CHEMISTRY

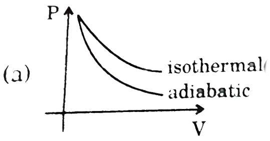
BOOKS - GRB CHEMISTRY (HINGLISH)

GRAPHICAL INTERPRETATION

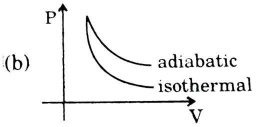
A. Thermodynamics

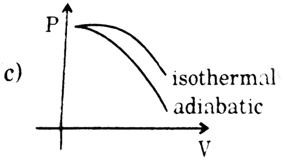
1. The correct figure representing isothermal and adiabatic expansion of an ideal gas from a particular initial state is:

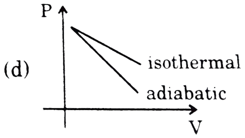
A.



B.



C. 

D. 

Answer: A

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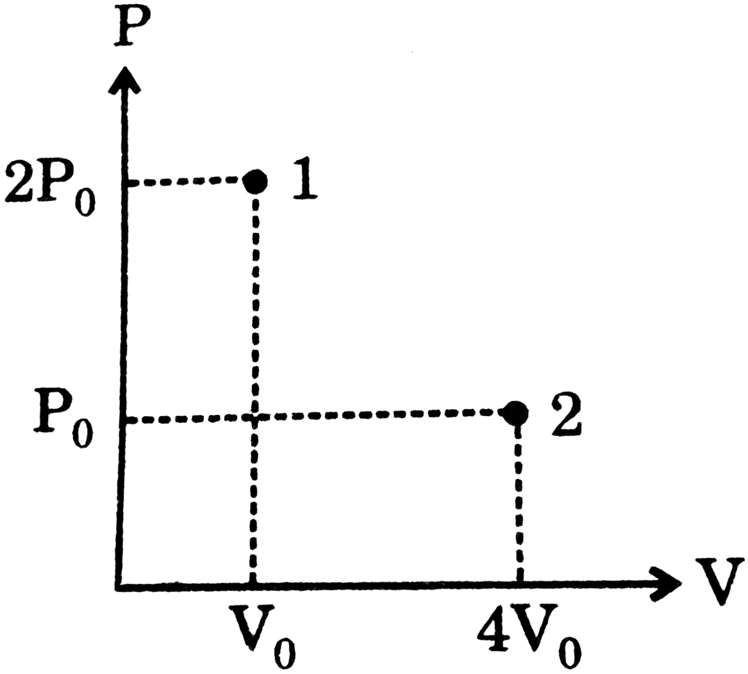
Thermodynamics

1. A liquid which is confined inside an adiabatic piston is suddenly taken from state 1 to state 2 by a single stage process. If the piston comes to rest at point 2 as shown. Then, the enthalpy change for the process will be:



A. $\Delta H = \frac{2\gamma P_0 V_0}{\gamma - 1}$

B. $\Delta H = \frac{3\gamma P_0 V_0}{\gamma - 1}$

C. $\Delta H = - P_0 V_0$

D. none of these

Answer: C

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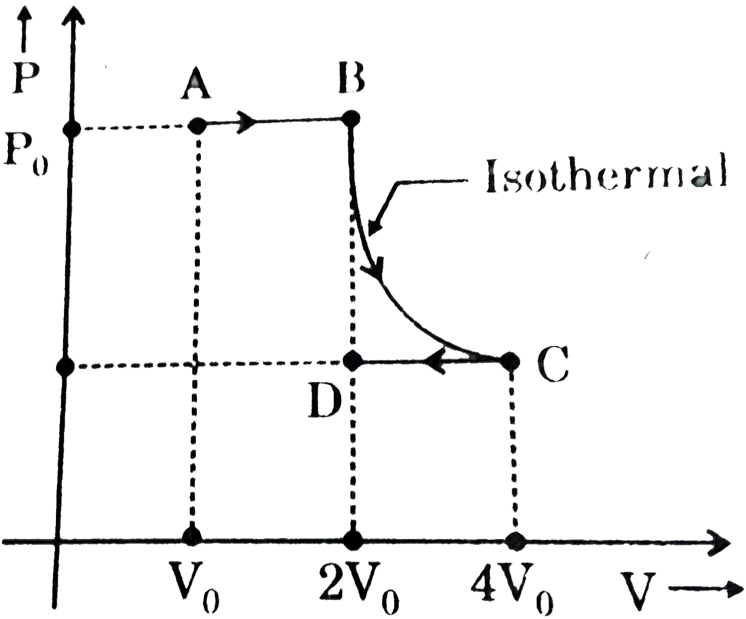
2. q.w, ΔE and ΔH for the following process ABCD on a monoatomic gas are:



A. $w = -2P_0V_0\ln 2$ $q = 2P_0V_0\ln 2$
$\Delta E = 0$ $\Delta H = 0$

B. $w = -2P_0V_0\ln 2$ $q = 2P_0V_0\ln$
$\Delta E = 0$ $\Delta H = 2P_0V_0\ln 2$

C. $w = -P_0V_0(1+\ln 2)$ $q = P_0V_0(1+\ln 2)$
$\Delta E = 0$ $\Delta H = 0$

D. $w = -P_0V_0\ln 2$ $q = P_0V_0\ln 2$
$\Delta E = 0$ $\Delta H = 0$

Answer: A

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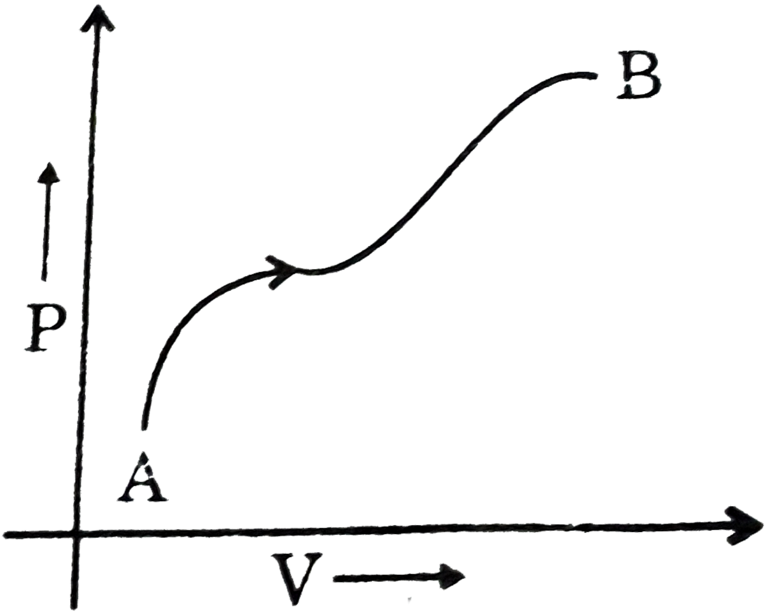
3. The graph given below shows the P-V plot for a process on an ideal gas.

Select the correct statement.



A. Enthalpy content of the gas is constantly increasing and the process is carried out slowly

B. Enthalpy content of the gas first increases then decreases and the process is quasistaticly

C. Enthalpy content of the gas is constant and the process taken infinite amount of time for completion

D. Enthalpy content first decreases then increases and the process is reversible

Answer: A

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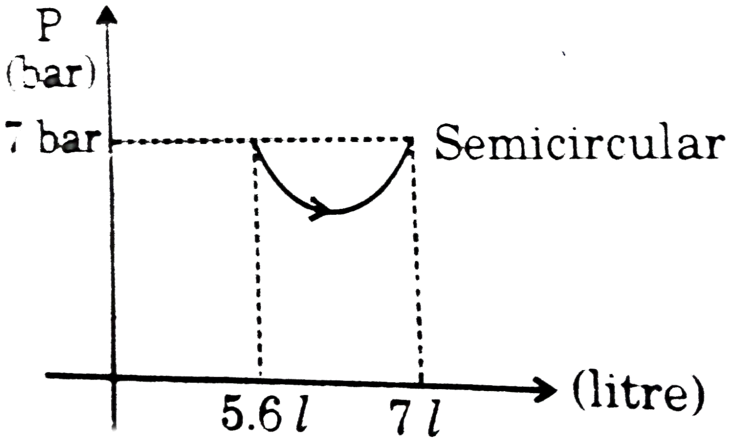
4. Calculate work done in given process (Take : $\pi = \frac{22}{7}$)



A. 9.03 bar .L

B. 9.8 bar. L

C. 0.77 bar.L

D. 10.04 bar.L

Answer: A

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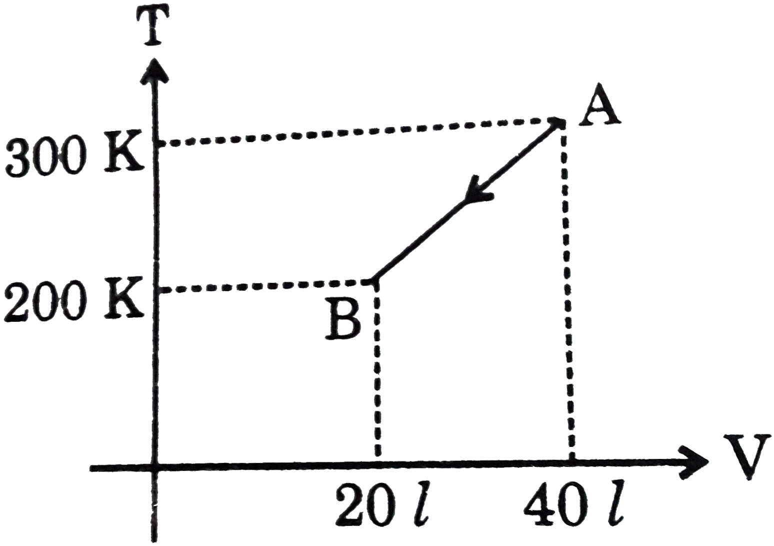
5. For 1 mol of an ideal gas work in process AB will be:



A. $100R$

B. $-100R$

C. $100R[1+\ln 2]$

D. $100R\ln 2$

Answer: C

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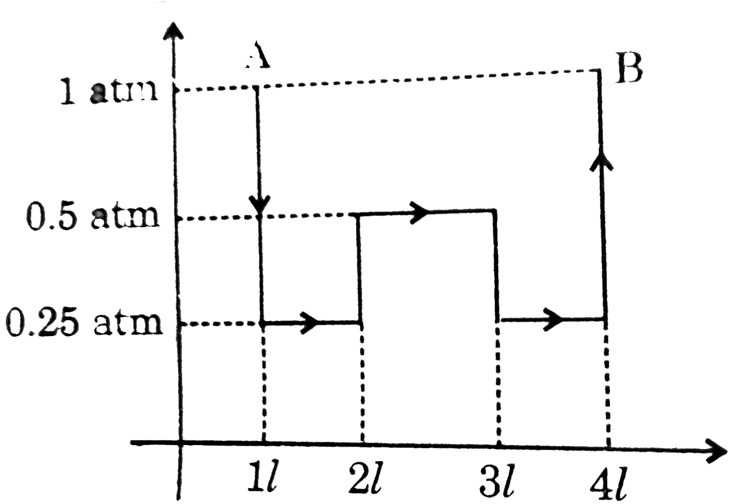
6. An ideal gas which has $\gamma = 4/3$ is taken from A to B according to the diagram then calculate enthalpy change for ideal gas:



A. 5 atm.litre

B. 6 atm. Litre

C. 10 atm.litre

D. 12 atm.litre

Answer: D

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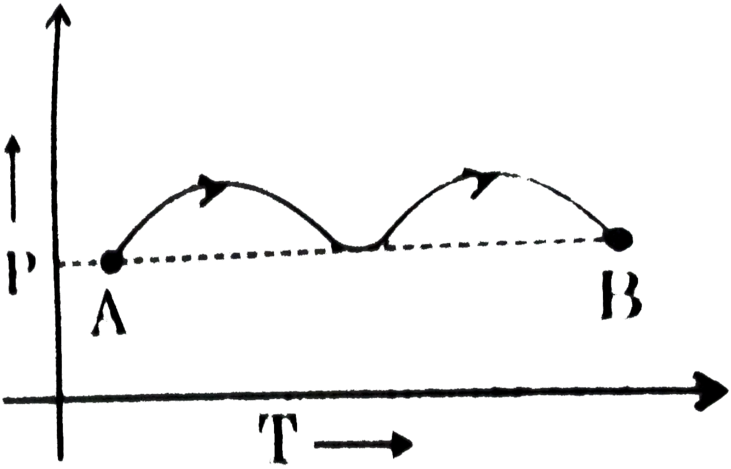
7. The P-T graph, as given below, was observed for a process on an ideal gas. Which of the statement is true ?



A. $w = +ve, \Delta H = (+)ve$

B. $w = (-)ve, \Delta H = (-)ve$

C. $w = (-)ve, \Delta H = (+)ve$

D. $w = (+)ve, \Delta H = (-)ve$

Answer: C

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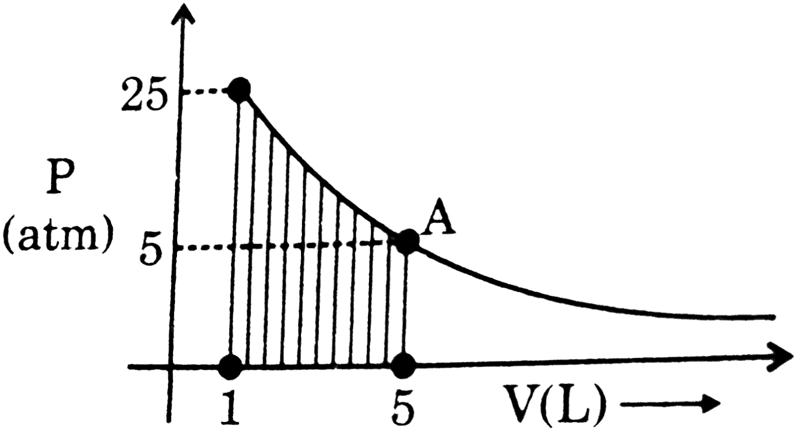
8. One mole of an ideal gas is undergoing process as shown in figure then what is the shaded area (atm-L) in the graph. (ln 5 = 1.5)



A. 8

B. 40

C. 20

D. 60

Answer: B

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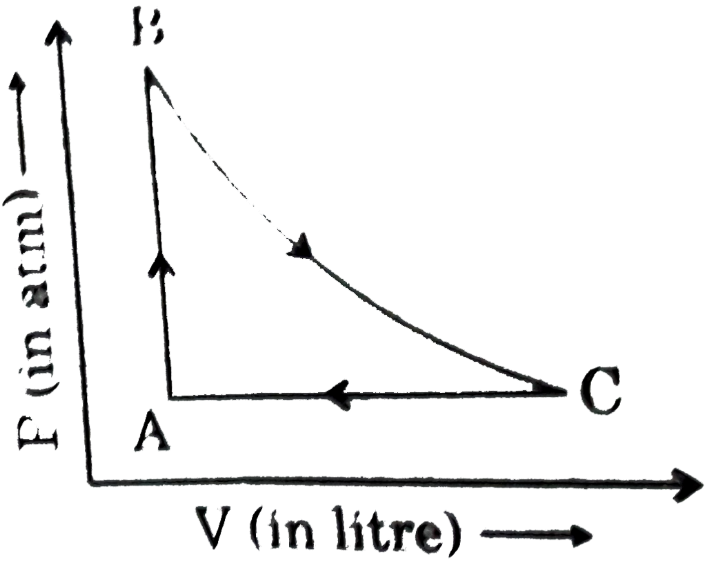
9. In given cyclic process for an ideal gas



Path $B \rightarrow C$ is isoentropic. Then select the correct options:

A. $\Delta S_{A_B} = \Delta S_{C \to A}$

B. $\Delta S_{A \to B} = \Delta S_{A \to C}$

C. $\Delta S_{\text{Cyclic} \neq 0}$

D. $\Delta S_{C \to A \to B \neq 0}$

Answer: B

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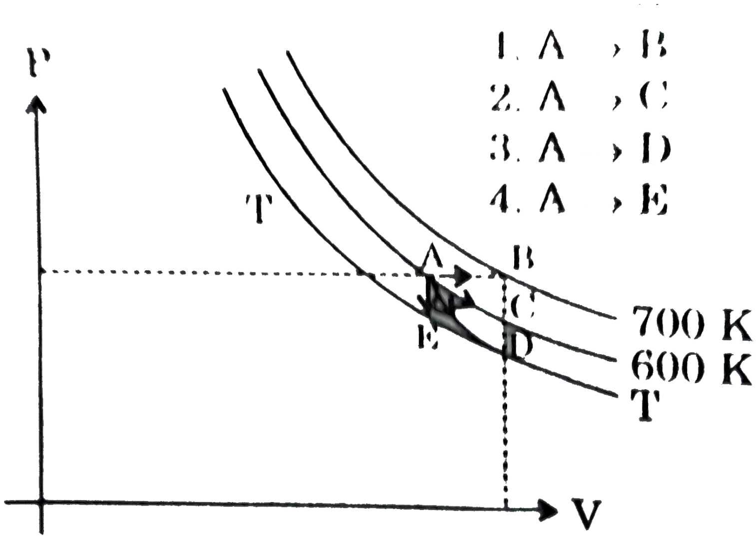
10. For an ideal gas four processes are marked as 1,2,3 and 4 on P-V diagram as shown in figure. The amount of heat supplied to the gas in the process 1,2,3 and 4 are Q_1, Q_2, Q_3 and Q_4 respectively, then correct order of heat supplied to the gas is:



A. $Q_1 > Q_2 > Q_3 > Q_4$

B. $Q_1 < Q_2 < Q_3 < Q_4$

C. $Q_1 > Q_2 > Q_4 > Q_3$

D. $Q_1 > Q_4 > Q_2 > Q_3$

Answer: A

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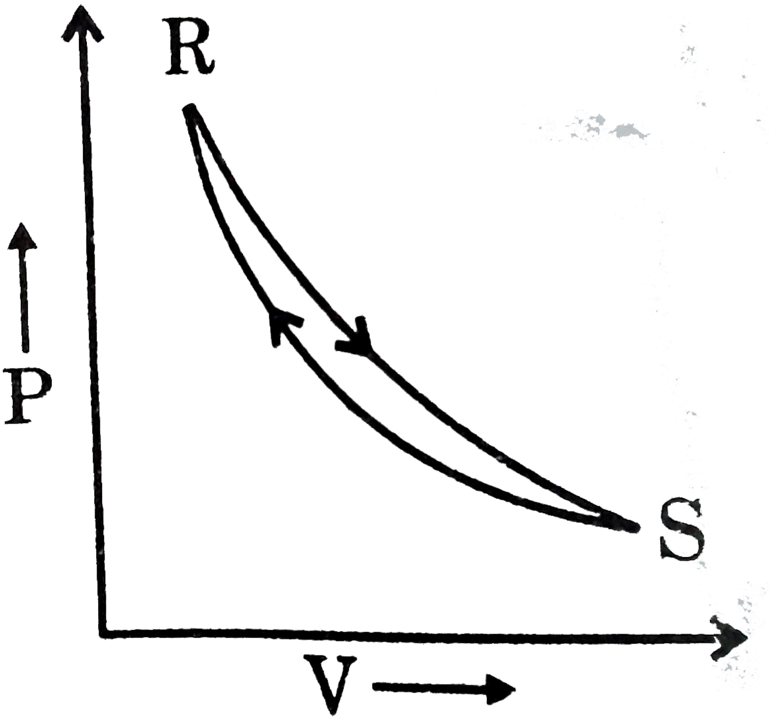
11. Consider the cyclic process $R \rightarrow S \rightarrow R$ as shown in the fig. You are told that one of the path is adiabatic and the other one isothermal. Which one of the following is (are) true ?



A. Process $R \rightarrow S$ is isothermal

B. Process $S \rightarrow R$ is adiabatic

C. Process $R \rightarrow S$ is adiabaic

D. Such a graph is not possible

Answer: D

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12. An ideal gas is taken from the same initial pressure P_1 to the same final pressure P_2 by three different processes. If it is known that point 1 corresponds to a reversible adiabatic and point 2 corrresponds to a single stage adiabatic then:

A. Point 3 may be a two stage adiabatic

B. The average K.E. of the gas is maximum at point 1

C. Work done by surrounding in reachingpoint number 3 will be maximum

D. If point 3 and point 4 lie along an isotherm, then $W_{4-3} > W_{4-2} > W_{4-1}$.

Answer: D

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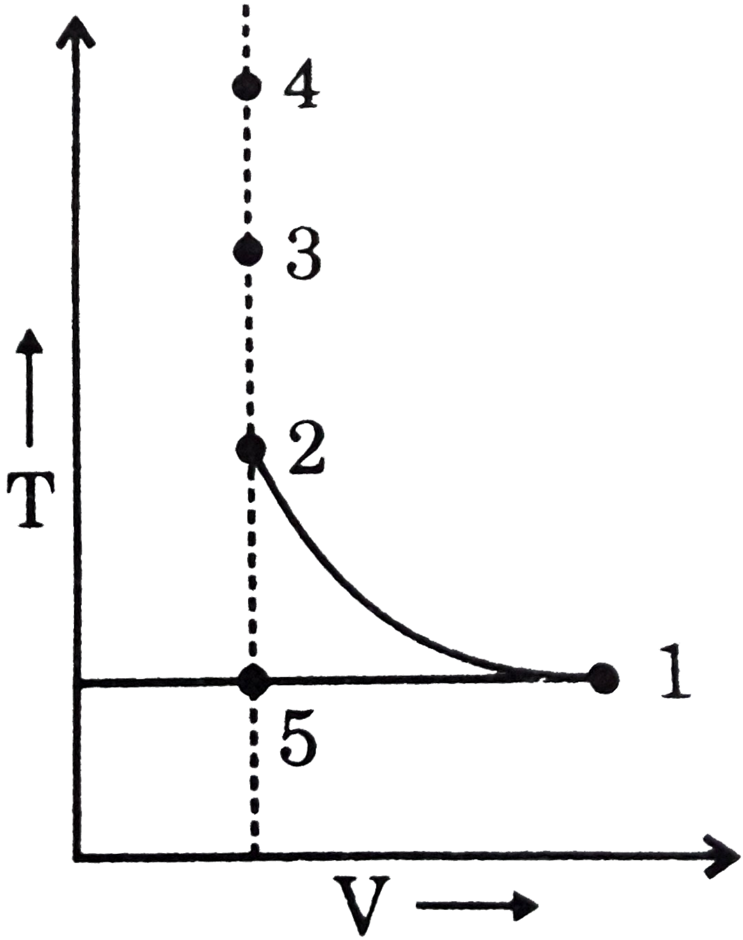
13. If the plot $1 \rightarrow 2$ represents an infinite stage adiabatic process and $1 \rightarrow 3$ represents a single stage adiabatic, then identify the correct statemet.



A. An intermediate state between point 3 and 4 can be reached by adiabatic process.

B. An intermediate state between 2 and 5 can be reached by an adiabatic process

C. An intermediate state between 3 and 2 can be reached by an adiabatic proces

D. Points 3,4 and 5 can not lie on may adiabatic process.

Answer: C

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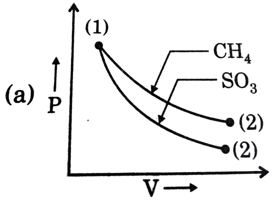
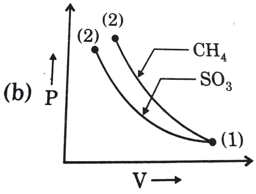
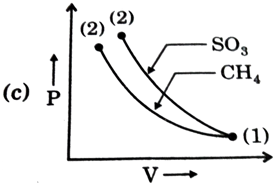
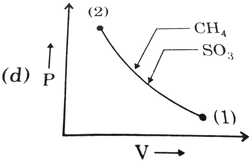
14. Which of the following graph correctly represents variation of P vs V for two gases CH_4 and SO_3 subjected to reversible adiabatic compression from same initial condition. (Assume that vibrational degrees of freedom are not active.)

A. 

B. 

C. 

D. 

Answer: D

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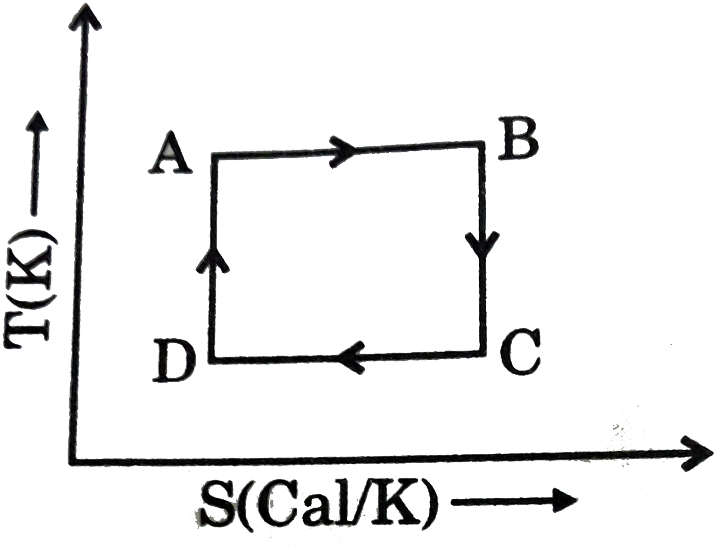
15. A substance is subjected to a four step reversible process ABCD as shown. Identify the correct statements out of the following.



A. Step A-B is a exothermic step

B. Step B-C is an endothermic step

C. Step C-D is an exothermic step

D. Step D-A is an endothermic step

Answer: C

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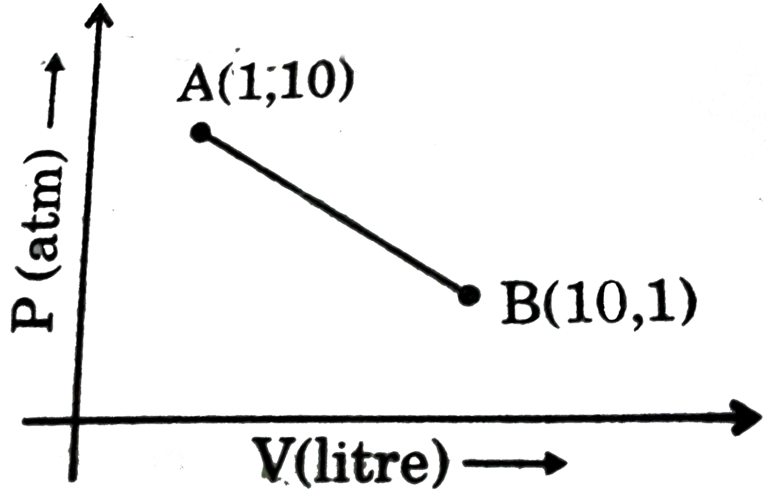
16. For 1 mole of an ideal gas, a graph of pressure vs volume is plotted as shown. Which of the following option is correct ?



A. AB process is isothermal.

B. Maximum temperature of the gas can be $\frac{10}{0.0821}K.$

C. Minimum temperature of the gas can be $\frac{11}{4\times 0.0821}K.$

D. None of the above

Answer: D

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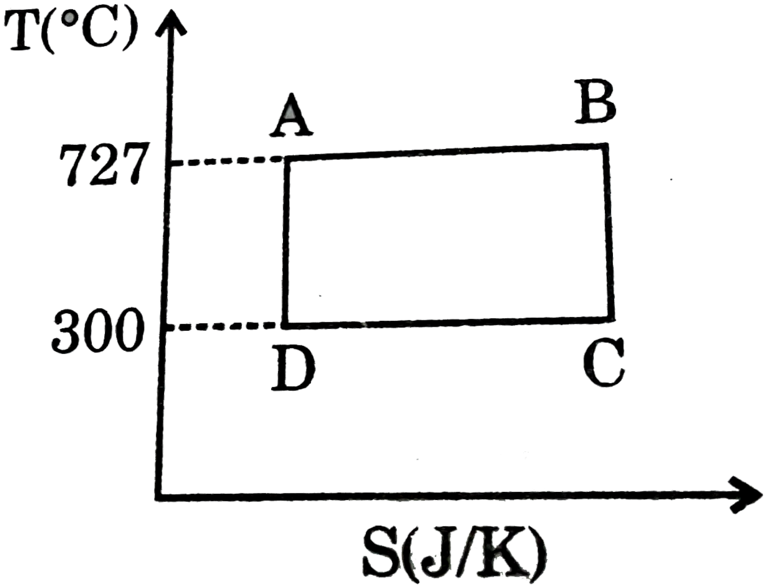
17. A reversible cyclic process is represented as shown. The efficiency of the process is :



A. $= 0.5$

B. > 0.5

C. < 0.5

D. $= 1$

Answer: C

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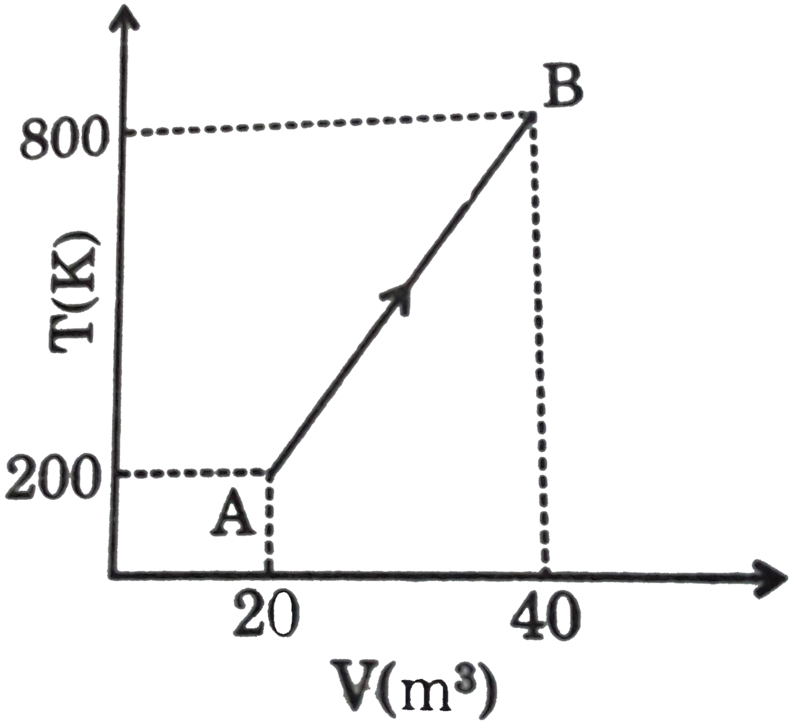
18. Calculate magnitude of work done in calorie for one mole of an ideal gas subjected to the process as shown in figure. [Use: $R = 2cal/mol - K$ and ln $2 = 0.7$]



A. 640 cal

B. 600 cal

C. 40 cal

D. 200 cal

Answer: A

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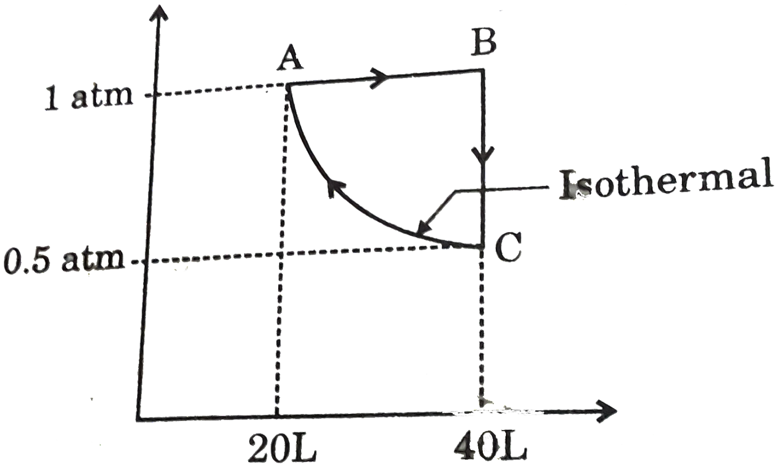
19. An ideal gas in subjected to a three step reversible process as shown. The amount of heat absorbed in the overall process will be: [In $2 = 0.693, 1L - atm = 101.325J$]



A. $6.13J$

B. $-6.13J$

C. $622.15J$

D. $-622.15J$

Answer: C

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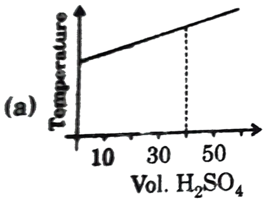
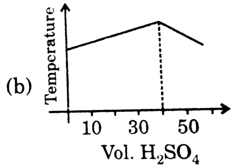
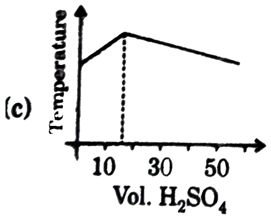
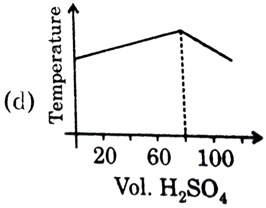
20. In an experiment to determine the enthalpy of neutralisation of sodium hydroxide with sulphuric acid, $50cm^3$ of $0.4M$ sodium hydroxide were titreated thermometrically with $0.25M$ sulphuric acid. Which of the following plots gives the correct representation ?

A. 

B. 

C. 

D. 

Answer: B

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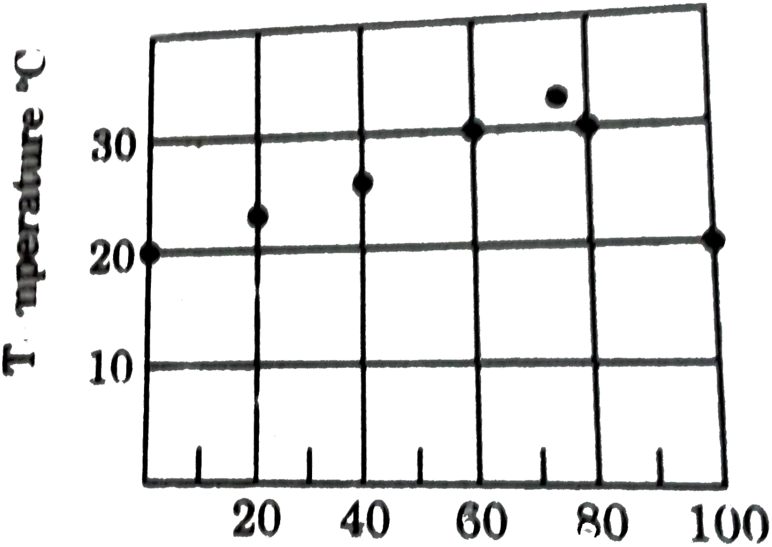
21. Chemicals A and B each initially at $20^\circ C$ react exothermically. A graph of the final temperature reached by mixing equimolar solutions of A and B to a total of $100mL$ is given below. According to this graph, in what mole ratio does A and B react ?



A. $2:1$

B. $3:1$

C. $4:1$

D. $3:2$

Answer: B

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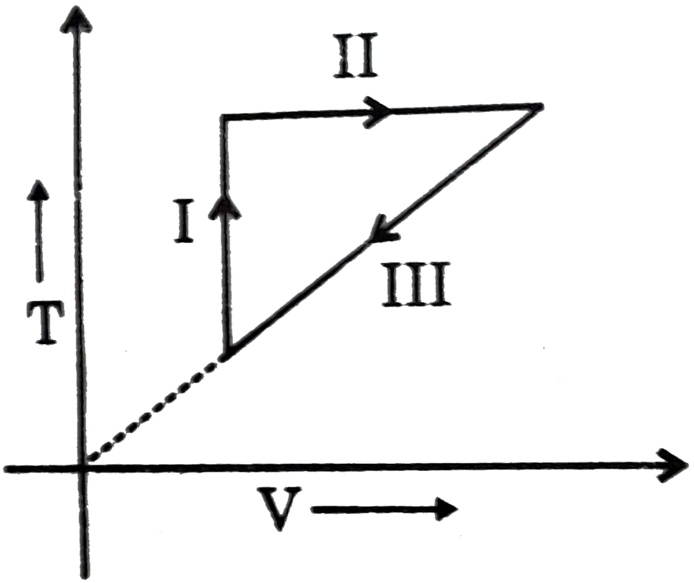
22. An ideal gas is subjected to various changes which are plotted as following: The correct order of process I, II and III respectively is :



A. isothermal, isochoric, isobaric

B. isobaric, isochoric, isothermal

C. isochoric, isothermal, isobaric

D. isochoric, isobaric, isothermal

Answer: C

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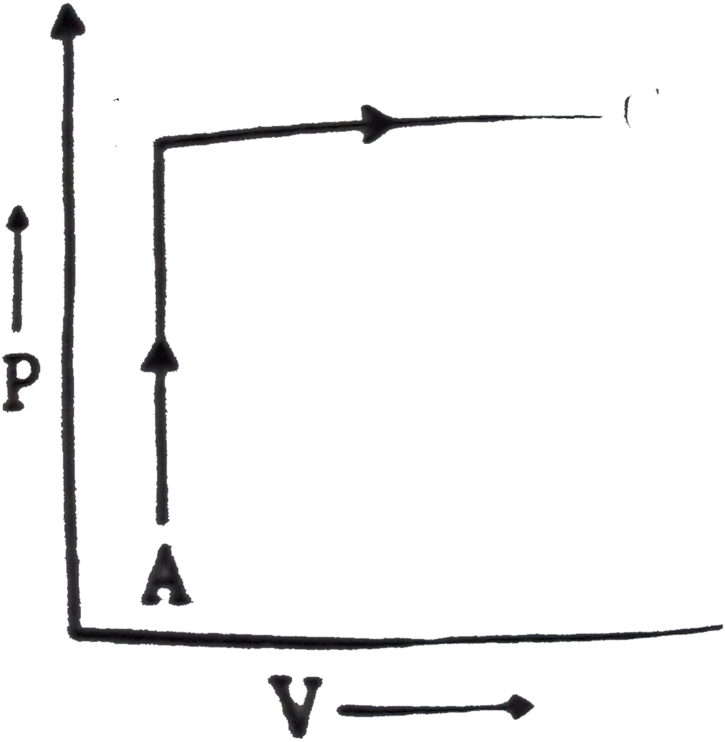
23. A thermodynamic process is shown in the following figure. In the process AB, 600 J of heat is added to the system and in BC, 200 J of heat is added to the system. The change in internal energy of the system in the process AC would be:

$P_A = 3 \times 10^4 Pa, V_A = 2 \times 10^{-3} m^3$

$P_B = 8 \times 10^4 Pa, V_C = 5 \times 10^{-3} m^3$



A. $560 J$

B. $800J$

C. $600J$

D. $640J$

Answer: A

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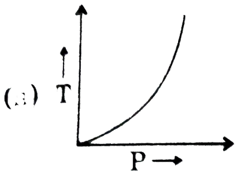
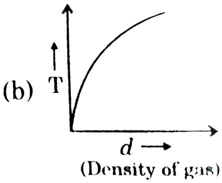
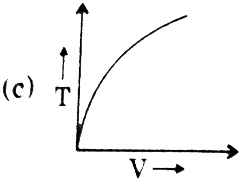
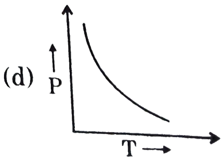
24. Which of the following graph is correct reversible adiabatic process for an ideal gas:

A. 

B. 

C. 

D. 

Answer: B

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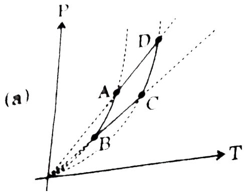
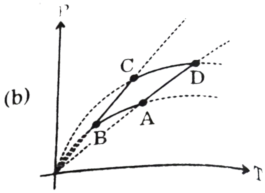
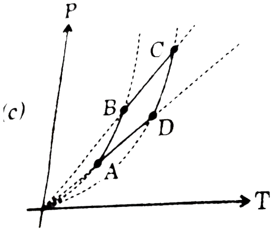
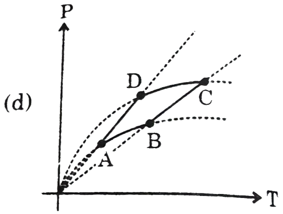
25. Which process is identical with the cyclic process shown below ? If AB and CD are adiabatic process.

A. 

B. 

C. 

D. 

Answer: C

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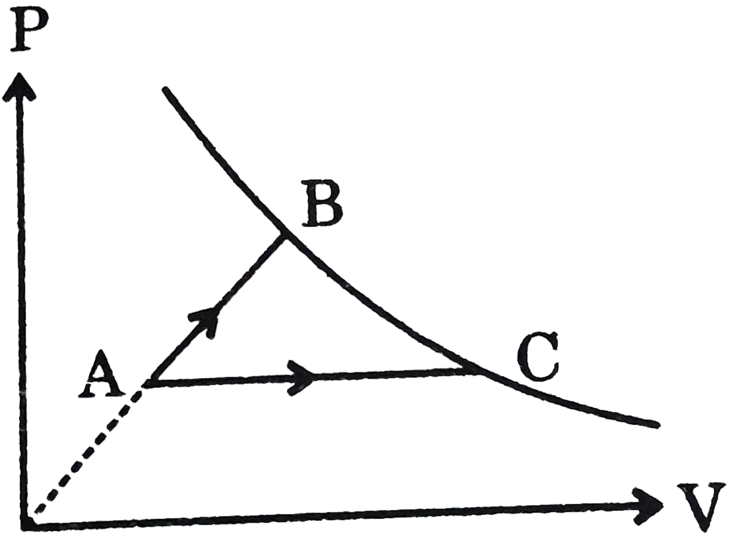
26. An ideal gas is subjected to two different process in which it is heated to same final temperature from same initial state (A) as shown in diagram, then :



A. heat absorbed by the system will be more in AB process.

B. heat absorbed by the system will be more in AC process

C. heat absorbed by the system will be same in AB and AC process

D. None of the above

Answer: B

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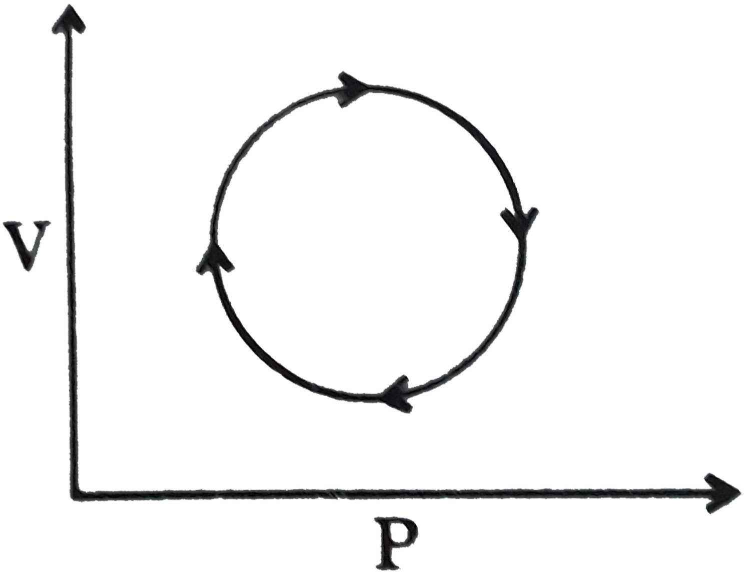
27. Which is correct for cyclic process as shown in figure ? Choose the correct statement.



A. Work is done by the system

B. Heat is liberated by the system

C. $w = 0$

D. Process is isoentropic as $\Delta S = 0$

Answer: B

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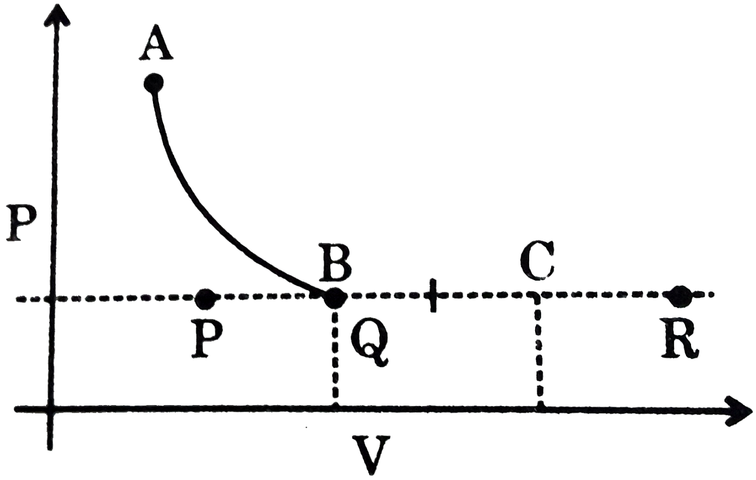
28. For an ideal gas three adiabatic processes are carried out upto same final pressure from same initial state. If adiabatic reversible process ends up at point B and adiabatic single step irreversible process ends up at point C then adiabatic free expansion upto same final pressure will end up at :



A. A

B. P

C. Q

D. R

Answer: D

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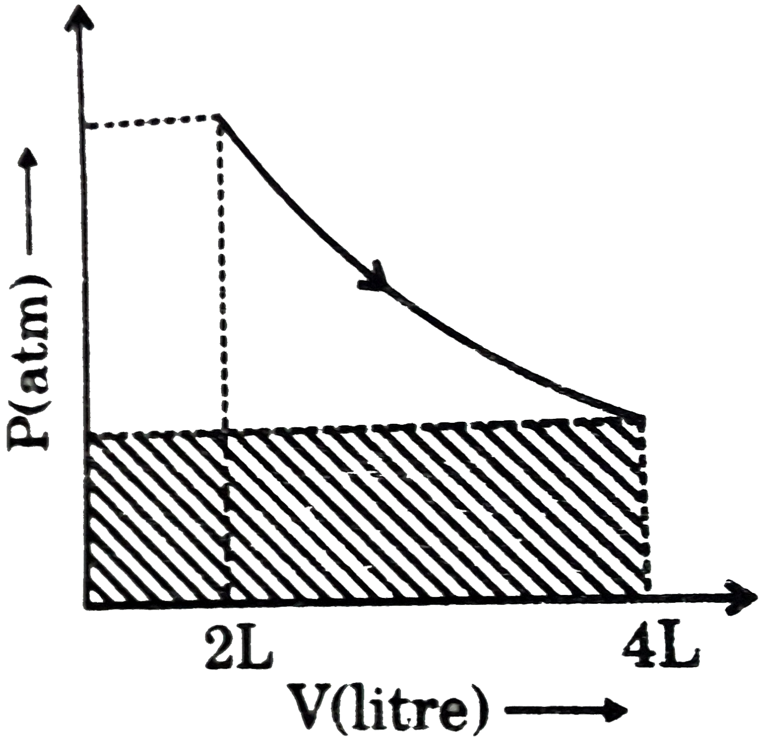
29. A student is calculating the work during a reversible isothermal process, shown by 2 moles of an ideal gas . By mistake he calculated the area as shown in PV graph (shaded area) equal to 49.26 L atm. Calculate the correct value of work (in L atm) during the process.



A. $-49.26 \ln 2$

B. $49.26 \ln 2$

C. $-24.63 \ln 2$

D. $24.63 \ln 2$

Answer: A

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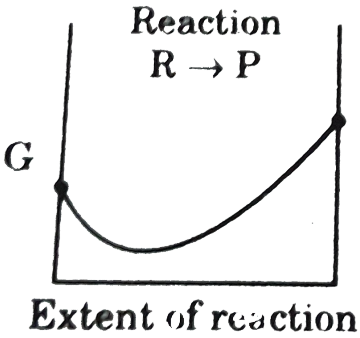
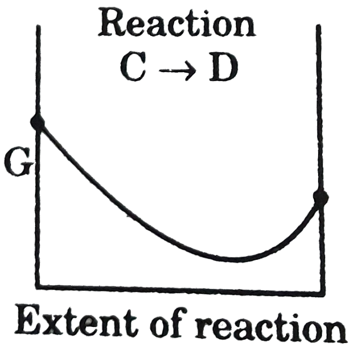
30. [At constant temperature and pressure]





Statement-I : C will partially convert into D.

Statement-II : R will not convert into P.

Statement-III : R will be completely converted into P.

Statement-IV : C will be completely converted in D.

With the help of given curves select the correct order of initials T (true) or F (false) for above statements.

A. TFTF

B. TFFF

C. FFTF

D. TTTF

Answer: B

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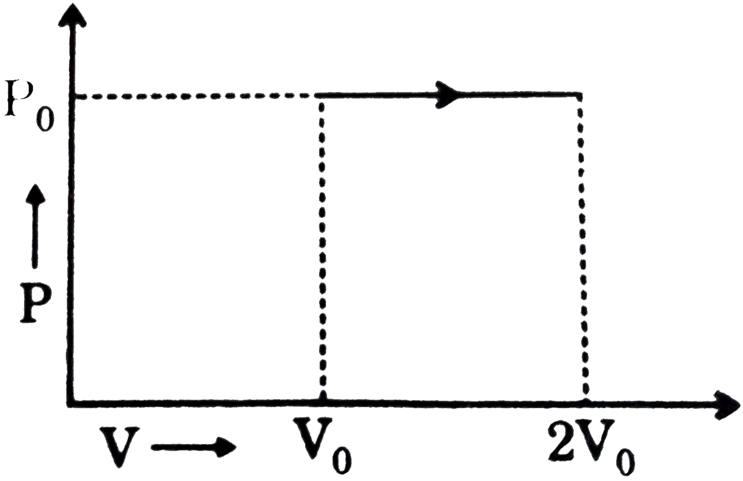
31. If the internal energy of an ideal gas varies as $U = 2PV$ and the gas undergoes an expansion as shown below, then heat absorbed in the process will be :



A. P_0V_0

B. $\frac{P_0V_0}{2}$

C. $3P_0V_0$

D. $\frac{3}{2}P_0V_0$

Answer: C

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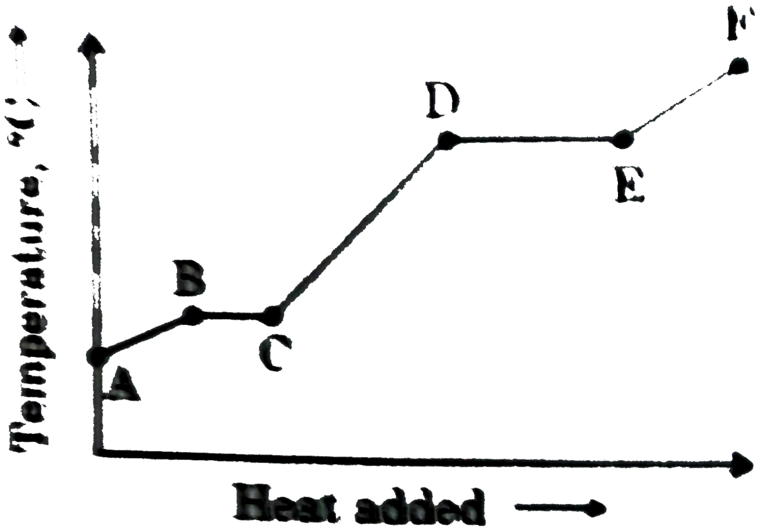
32. This curve is produced when a pure substance is heated. Which characteristic of this curve is related to the value for the enthalpy of fusion of the substance ?



A. Length of AB

B. Length of BC

C. Slope of AB

D. Sope of CD

Answer: B

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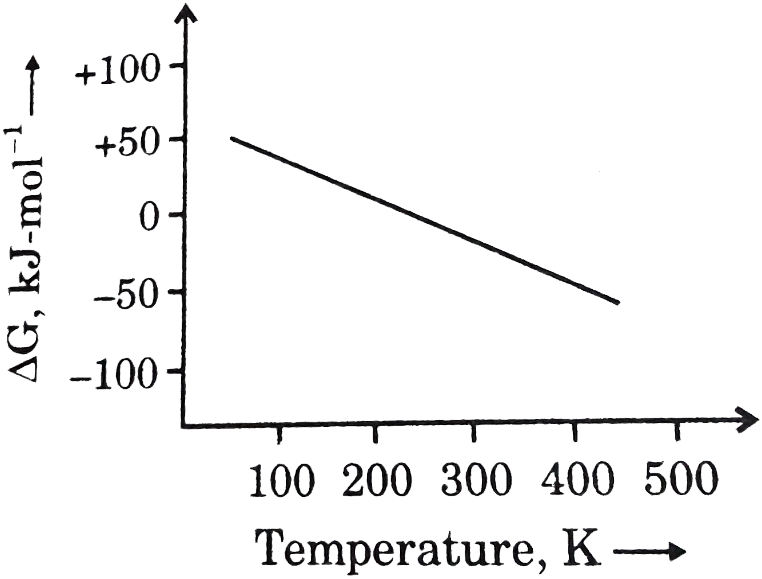
33. What can be concluded about the values of ΔH and ΔS from this graph ?



A. $\Delta H > 0, \Delta S > 0$

B. $\Delta H > 0, \Delta S < 0$

C. $\Delta H < 0, \Delta S > 0$

D. $\Delta H < 0, \Delta S < 0$

Answer: A

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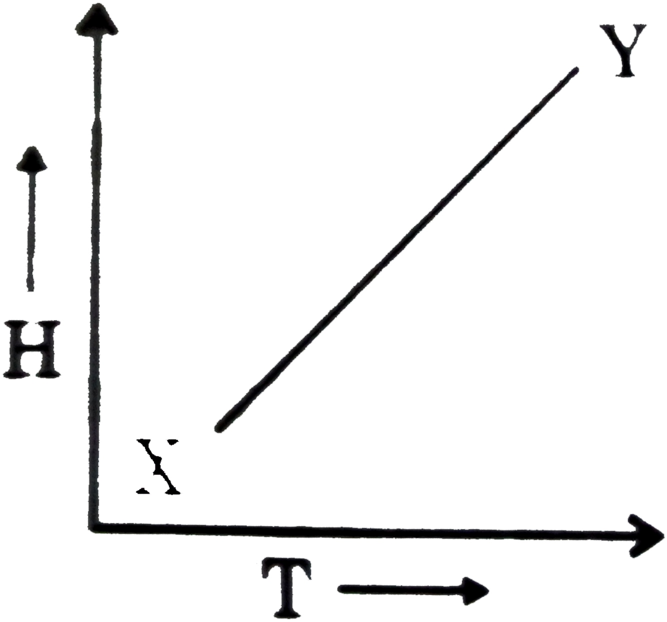
34. The process in which an ideal gas undergoes change from X to Y as shown in the figure diagram is :



A. isothermal compression

B. adiabatic compression

C. isothermal expansion

D. adiabatic expansion

Answer: B

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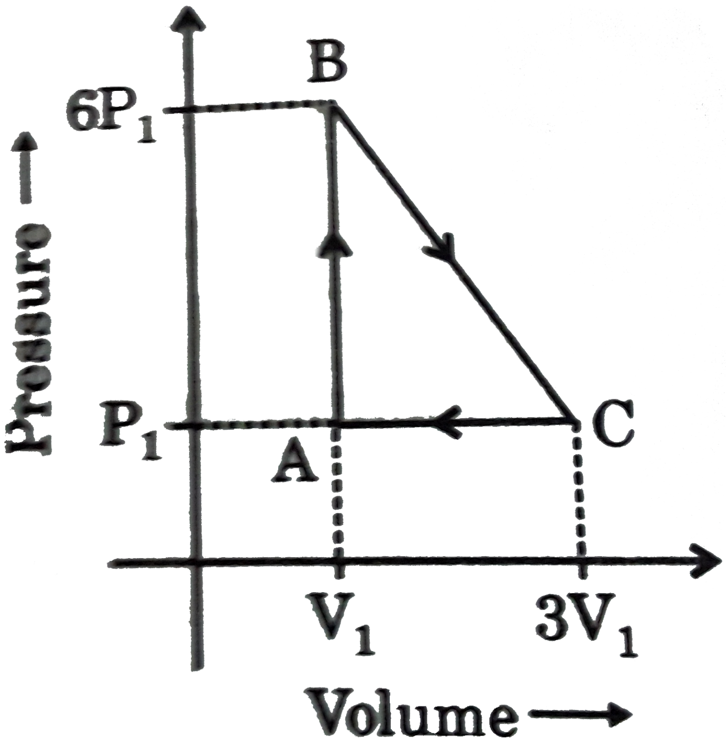
35. An ideal gas is taken around the cycle ABCA as shown in P-V diagram.

The net work done by the gas during the cycle is equal to :



A. $12P_1V_1$

B. $6P_1V_1$

C. $5P_1V_1$

D. P_1V_1

Answer: C

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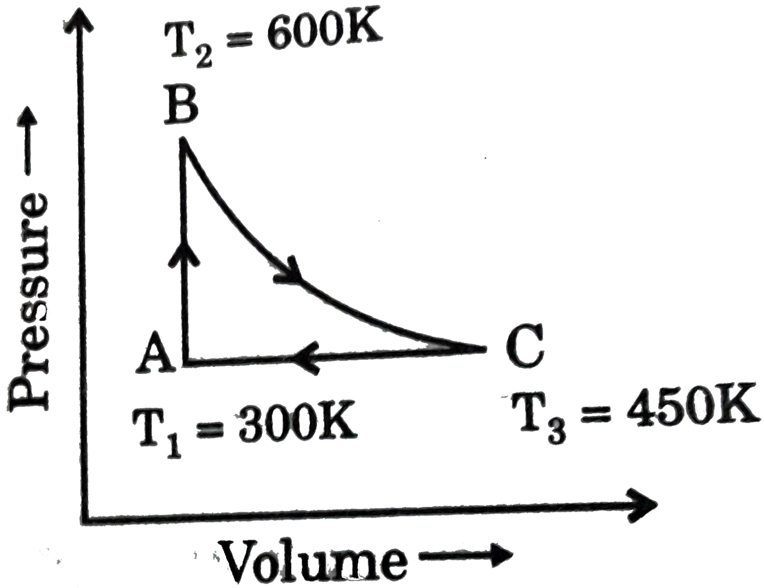
36. A heat engine carries one mole of an ideal monoatomic gas around the cycle as shown in the figure, the amount of heat added in the process

AB and heat removed in the process CA are :



A. $q_{AB} = 450R$ and $q_{CA} = -450R$

B. $q_{AB} = 450R$ and $q_{CA} = -225R$

C. $q_{AB} = 450R$ and $q_{CA} = -375R$

D. $q_{AB} = 375R$ and $q_{CA} = -450R$

Answer: C

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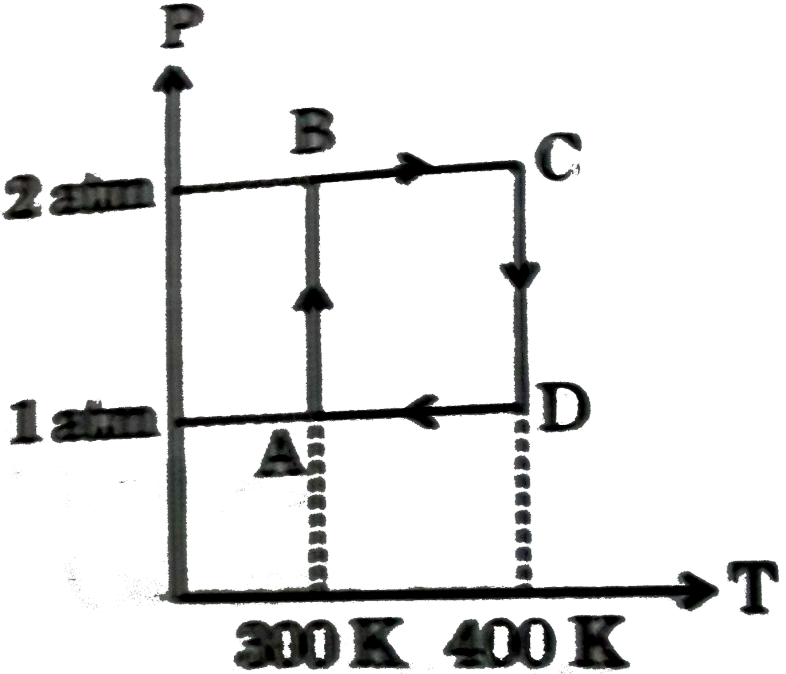
37. Two moles of Helium gas undergo a reversible cyclic process as shown in figure. Assuming gas to be ideal, what is the net work involved in the cyclic process ?



A. $-100R\ln 4$

B. $+100R\ln 4$

C. $+200R\ln 4$

D. $-200R\ln 4$

Answer: A

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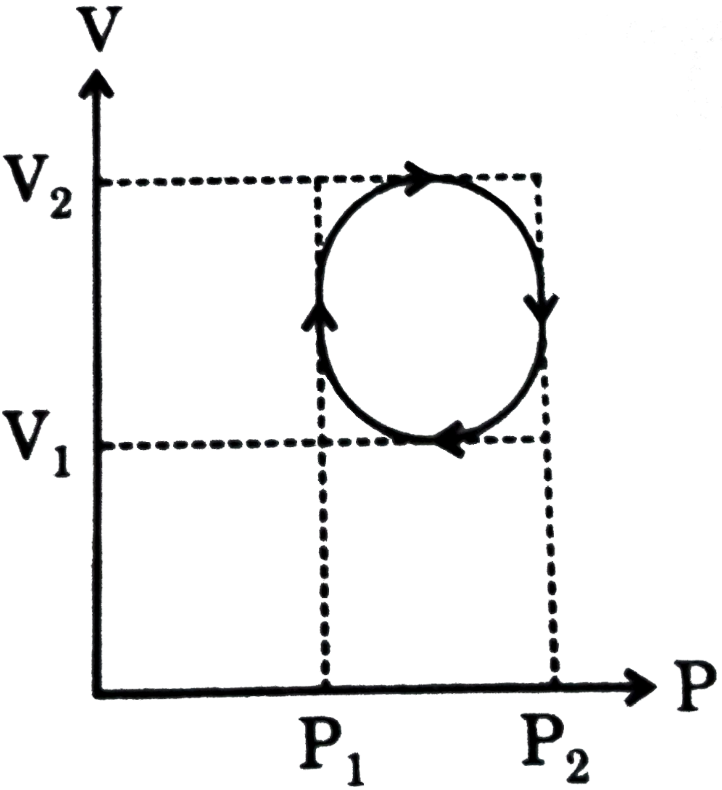
38. In the cyclic process shown in P-V diagram the magnitude of work done is :



A. $\pi\left(\frac{P_2 - P_1}{2}\right)^2$

B. $\pi\left(\frac{V_2 - V_1}{2}\right)^2$

C. $\frac{\pi}{4}(P_2 - P_1)(V_2 - V_1)$

D. $\pi(V_2 - V_1)^2$

Answer: C

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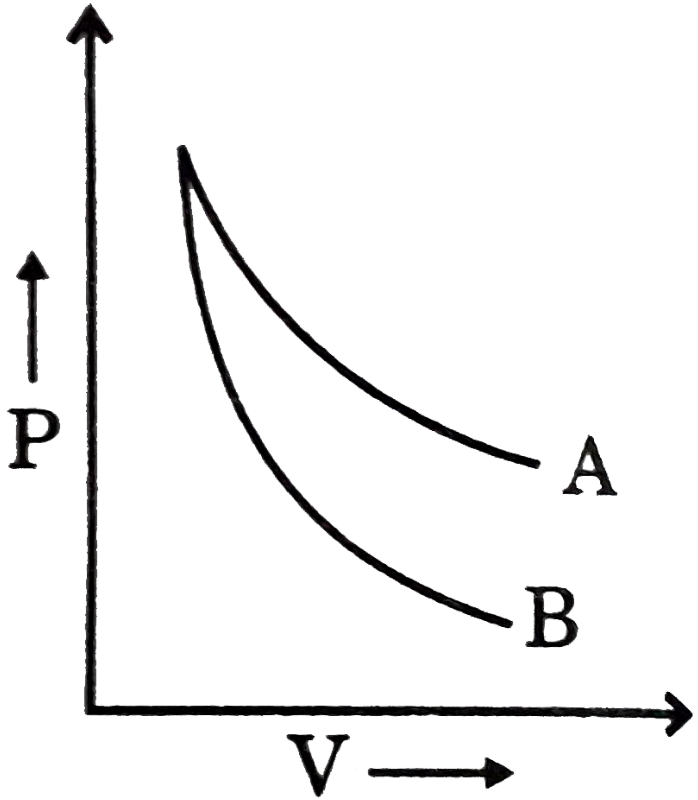
39. P-V plot for two gases (assuming ideal) during adiabatic processes are given in the figure. Plot A and plot B should correspond respectively to :



A. He and H_2

B. H_2 and He

C. He and Ne

D. H_2 and CI_2

Answer: B

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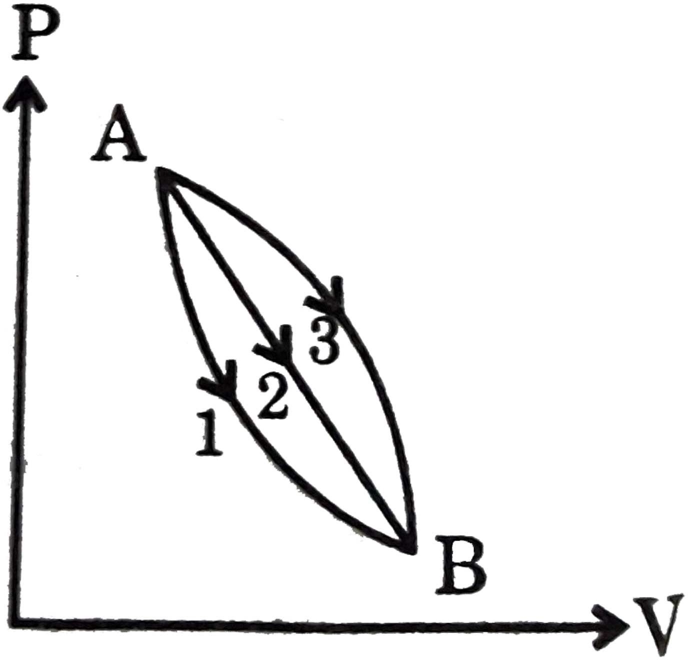
40. A given mass of gas expends from the state A to the state B by three paths 1,2 and 3 as shown in the figure. If w_1, w_2 and w_3 respectively be the magnitude of worl done by the gas along three paths then :



A. $w_1 > w_2 > w_3$

B. $w_1 < w_2 < w_3$

C. $w_1 = w_2 = w_3$

D. $w_2 < w_3 < w_1$

Answer: B

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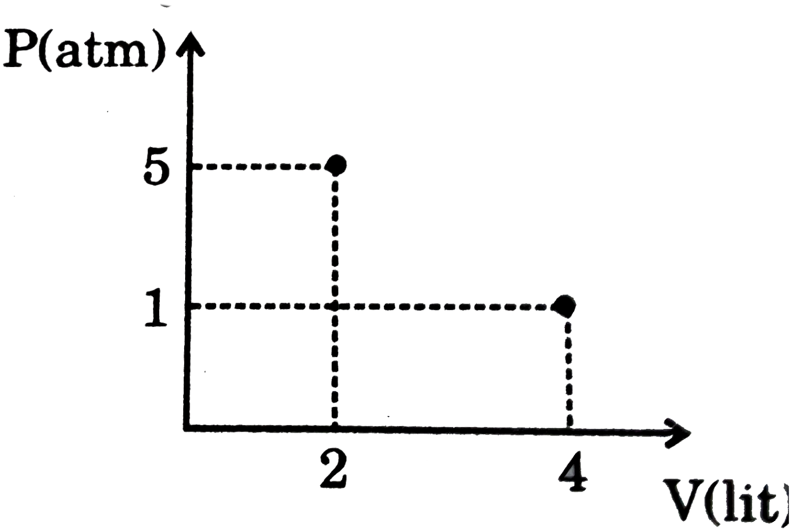
41. Following graph shows a single stage expansion, then work done by the system is:



A. $-9104J$

B. $-202.6J$

C. $-506J$

D. $-101.3J$

Answer: B

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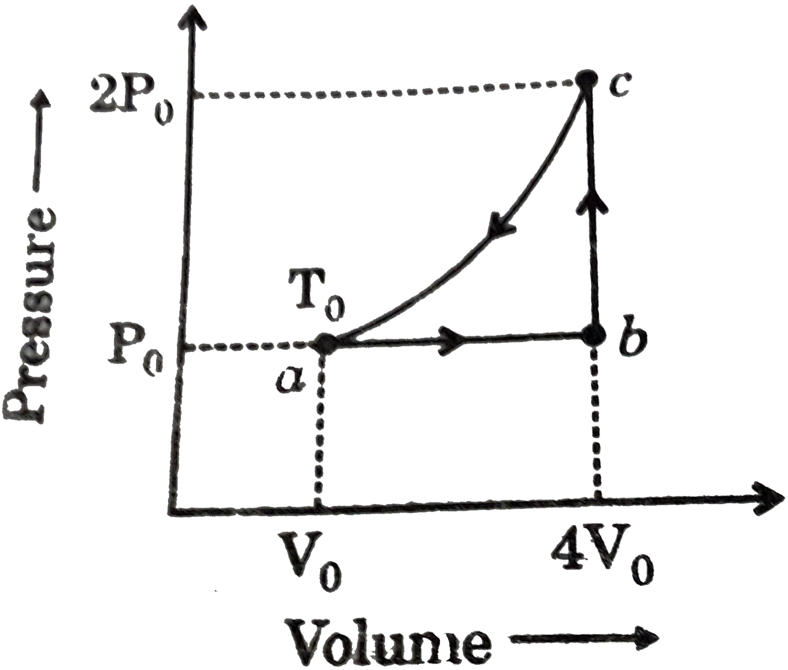
42. One mole of an ideal monoatomic gas undergoes a cyclic process as shown in figure. Then the change in the energy in expanding the gas from a to c along the path abc is:



A. $3P_0V_0$

B. $6RT_0$

C. $4.5RT_0$

D. $10.5RT_0$

Answer: D

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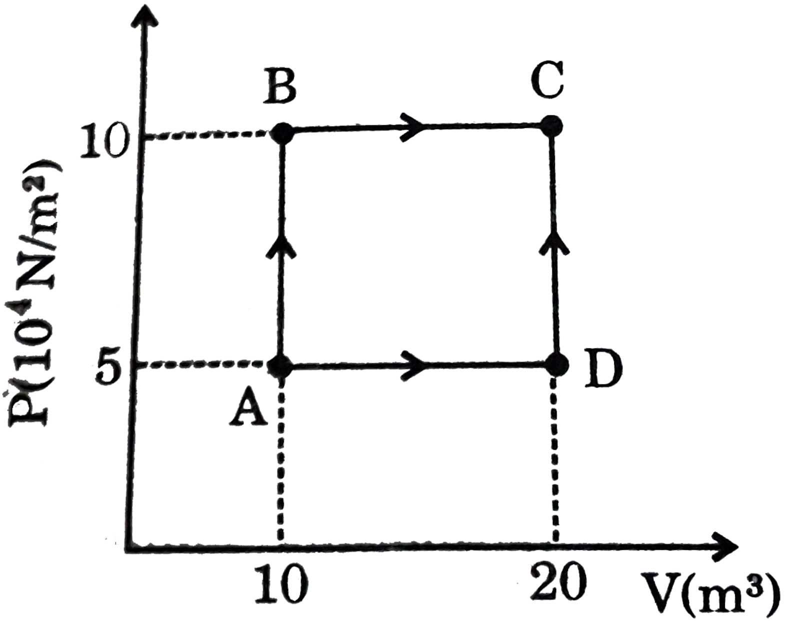
43. A sample of 2 kg of helium (assumed ideal) is taken through the process ABC and another sample of 2 kg of the same gas is taken through the process ADC. Then, the temperature of the states A and B are : (Given $R = 8.3J/\text{mol} - K$):



A. $T_A = 120.5K, T_B = 120.5K$

B. $T_A = 241K, T_B = 241K$

C. $T_A = 120.5K, T_B = 241K$

D. $T_A = 241K, T_B = 482K$

Answer: C

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44. Which of the following options regarding area under the graph is/are correct ?

A. The area under the V us P graph will give magnitude of work involved in the process

B. The area under T us S graph will give magnitude of heat exchange involved if the process occurs reversibly

C. The area under S us T graph will given magnitude of heat exchange involved in the process.

D. The area under P us V graph will give magnitude of free energy change in an isothermal process

Answer: B

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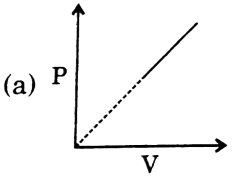
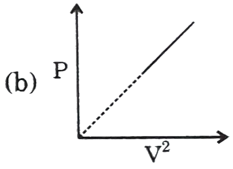
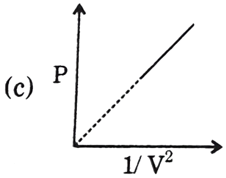
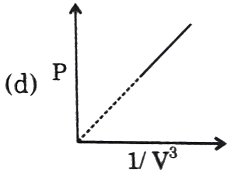
45. For an ideal gas subjected to different processes as shown by the graphs, select the graph which will involve greatest amount of heat exchange if initial and final temperature are same in all .

A. 

B. 

C. 

D. 

Answer: A

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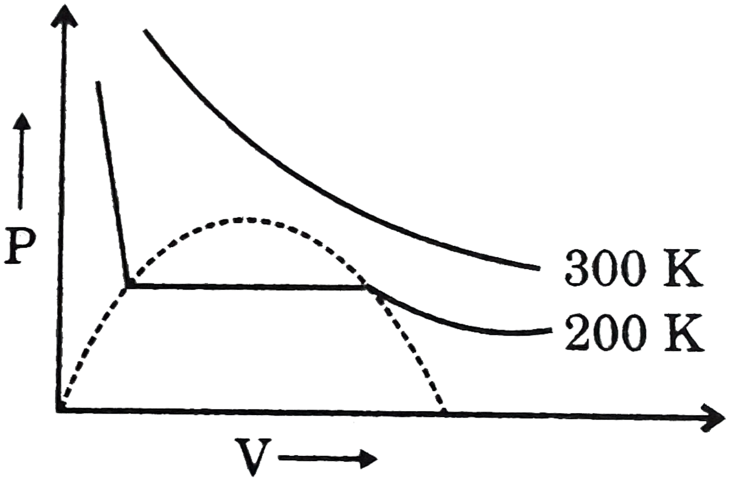
B. Gaseous State

1. P vs V graph is plotted for 1 mole of hypothetical gas. Range of a/b for this gas in (atm-L/mole). $[R = 0.08\text{atm-litre}/ - \text{mle} - K]$



A. $54 < \left(\frac{a}{b}\right) < 81$

B. $27 < \left(\frac{a}{b}\right) < 42$

C. $40 < \left(\frac{a}{b}\right) < 65$

D. $13.5 < \left(\frac{a}{b}\right) < 40.5$

Answer: A

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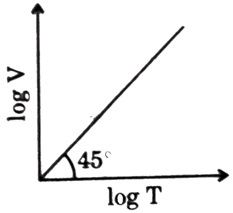
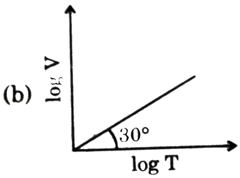
Gaseous State

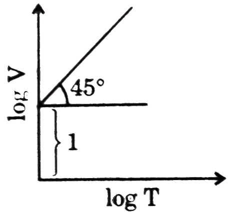
1. For a closed container containing 10 moles of an ideal gas, at constant pressure of 0.82 atm, which graph correctly represent, variation of log V us log T where volume is in litre and temp. in kelvin :

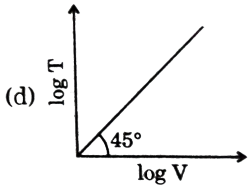


A.



B.

C. 

D. 

Answer: A

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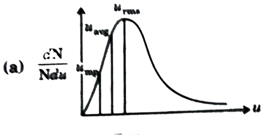
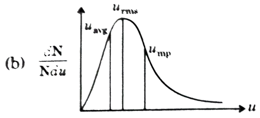
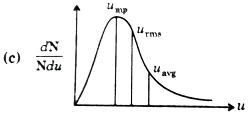
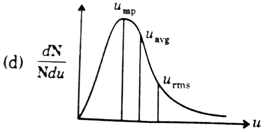
2. Which graph represents the correct relationship between various velocities for an idela gas ?

A. 

B. 

C. 

D. 

Answer: D

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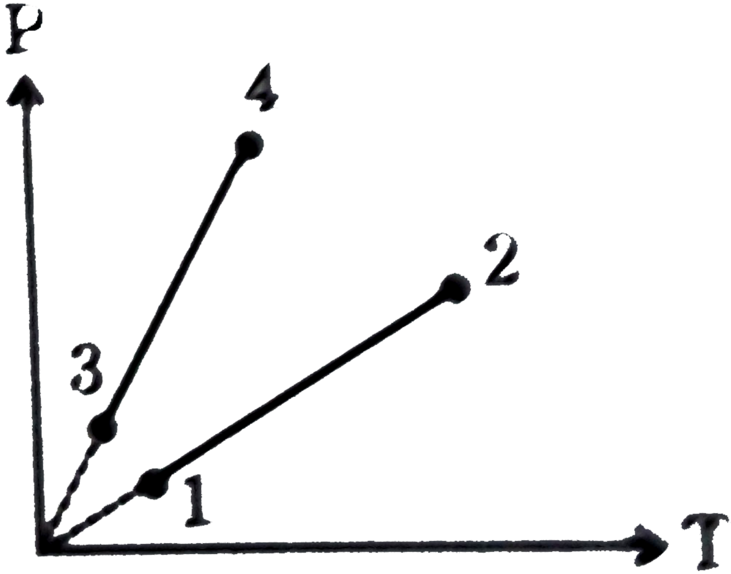
3. Pressure versus temperature graph of an ideal gas of equal number of moles of different volumes is plotted as shown in figure. Choose the correct alternatives.



A. $V_1 = V_2, V_3 = V_4$ and $V_2 > V_3$

B. $V_1 = V_2, V_3 = V_4$ and $V_2 < V_3$

C. $V_1 = V_2 = V_3 = V_4$

D. $V_4 > V_3 > V_2 > V_1$

Answer: A

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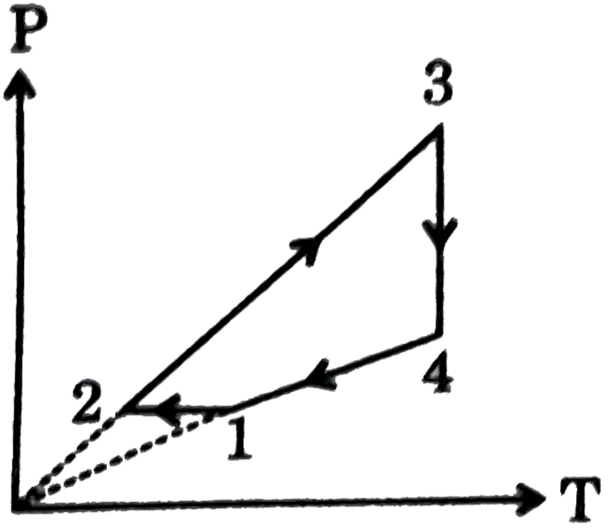
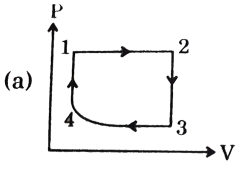
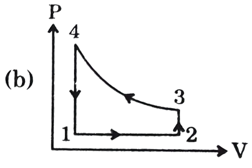
4. Consider the following (P-T) graph for a fixed mass of gas: Correct P-V graph as:



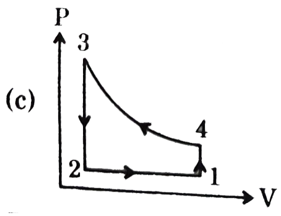
A.

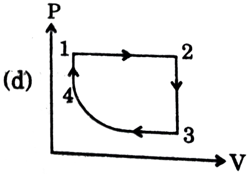


B.



C.



D. 

Answer: C

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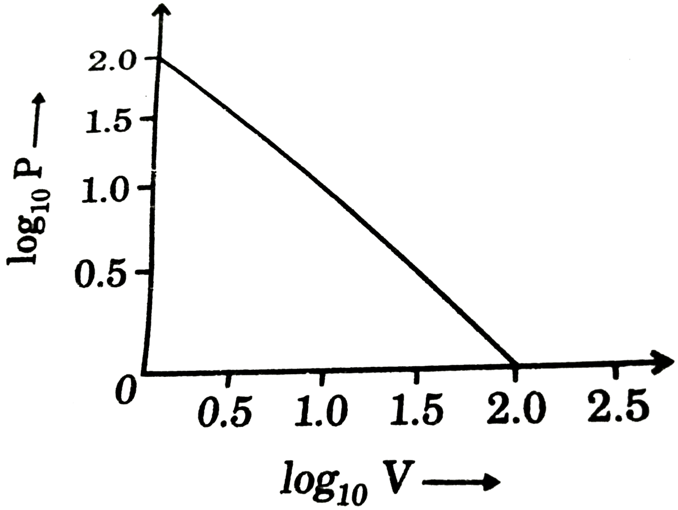
5. For the given isotherm (P in atm and V in L) for one mole of an ideal gas, which follows Boyle's law, what will be the approx value of temperature ? $(R = 0.0821 L\text{atm} / \text{mol} K)$



A. $8.2 \times 10^{-4} K$

B. $1220K$

C. $947K$

D. $48K$

Answer: B

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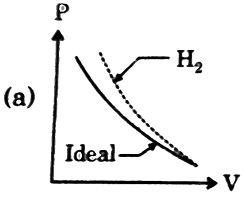
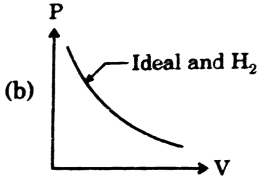
6. Graph depicting correct behaviour of ideal gas and H_2 gas will be (neglect a):

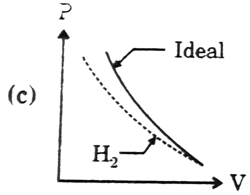


A.

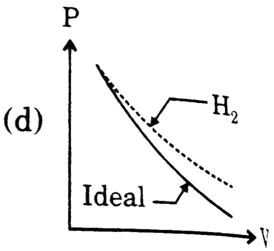


B.

C.



D.



Answer: A

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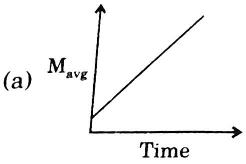
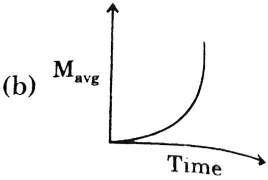
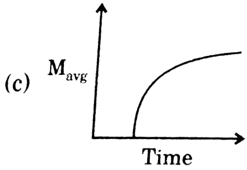
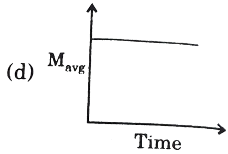
7. During decomposition of $NH_2COONH_2(s)$ reaction: $NH_2COONH_4(s) \rightarrow 2NH_3(s) + CO_2(g)$. Which graph correctly represents average molecular weight of gaseous with progress of reaction :

A.



B. 

C. 

D. 

Answer: D

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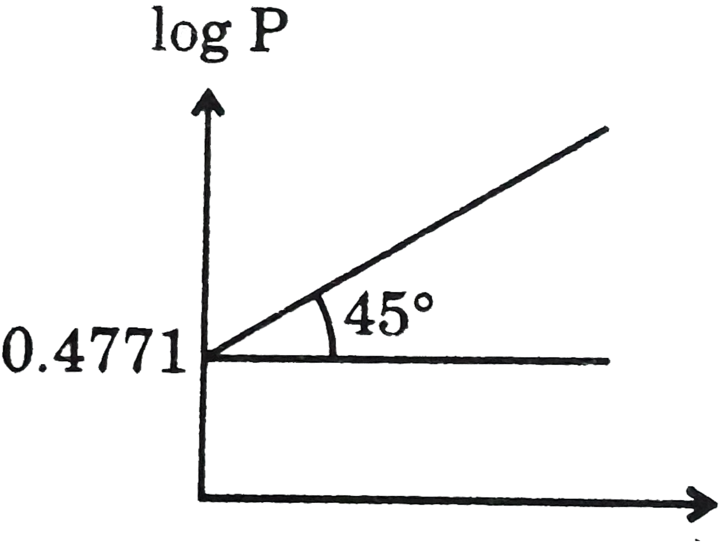
8. For an ideal gas kept in a container attached manometer as show. Find volume of container. For the given gas, lo P us log $(1/V)$ graph is given :



A. $3L$

B. $1.5L$

C. $4.5L$

D. $2L$

Answer: D

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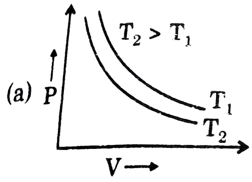
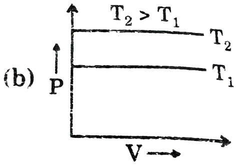
9. Which of the following graphs is inconsistent with ideal gas behaviour ? (Assume n = constant)

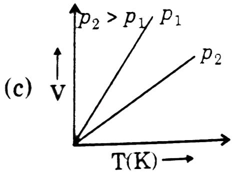
A.



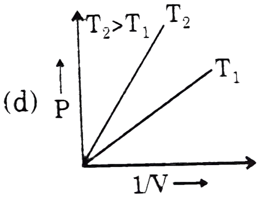
B.



C.



D.



Answer: A

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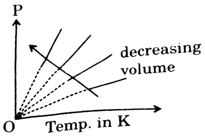
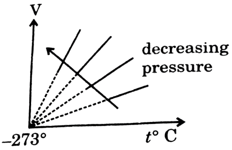
10. Which one of these graphs for an ideal gas havinga fixed amount, the arrow indication, is incorrectly marked ?

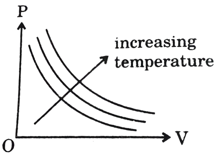
A. (a)



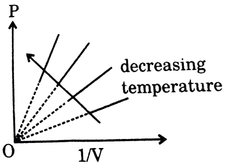
B. (b)



C. (c)



D. (d)



Answer: D

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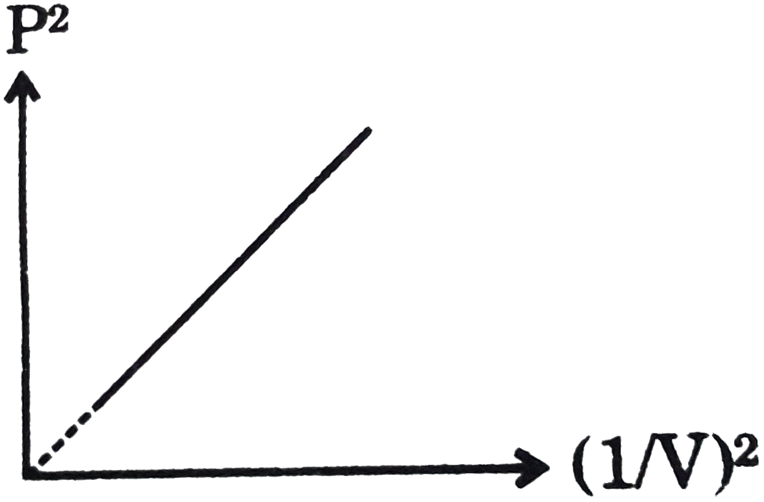
11. Consider the given graph: Graph is plotted for 1 mol of gas at 400K, find slope of curve [take: $R = 0.08 \frac{L - atm}{mol - K}$]



A. $(32)^2$

B. $(16)^2$

C. $(8)^2$

D. $(4)^2$

Answer: A

12. The pressure P of a gas is plotted against its absolute temperature T for two different constant volumes, V_1 and V_2 (for same no. of moles) where $V_1 > V_2$, the correct statement is:

A. Curves have the same slope and do not intersect

B. Curve must intersect at some point other than $T = 0$.

C. Curve for V_2 hasa greater slope than that for V_1

D. Curve for V_1 has a greater slope than that for V_2.

Answer: C

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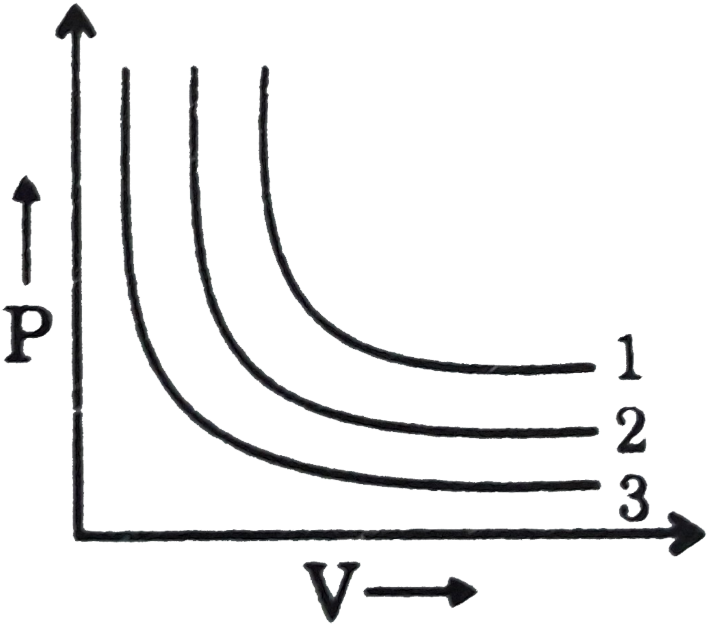
13. P us V curves were plotted for three different samples containing same masses of H_2, O_2 and N_2 at same temp. Mark out which graph is applicable for which sample.



A. $1 \rightarrow H_2, 2 \rightarrow N_2, 3 \rightarrow O_2$

B. $1 \rightarrow O_2, 2 \rightarrow N_2, 3 \rightarrow H_2$

C. $1 \rightarrow N_2, 2 \rightarrow H_2, 3 \rightarrow O_2$

D. Data insufficient

Answer: A

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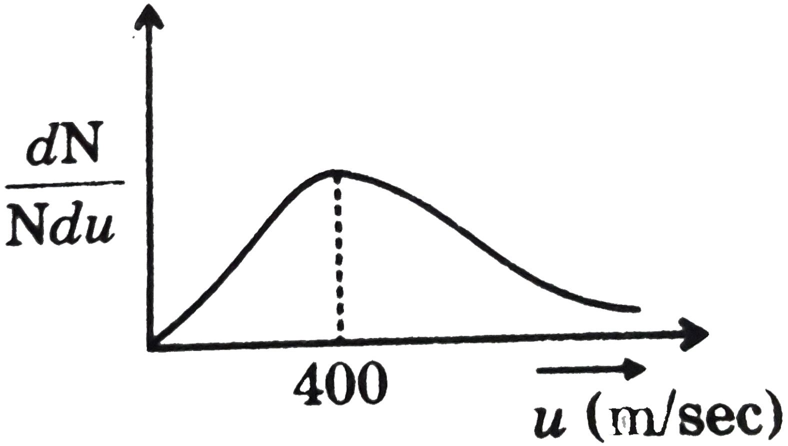
14. For ideal gas, observation as per Maxwell distribution



A. $U_{rms} = \sqrt{1.5} \times 100 m/s$

B. Fraction of molecules moving between 400 to 401 m/sec are equal with fraction of molecules moving between 452 to 453 m/sec.

C. $U_{rms} = \sqrt{20} \times 400 m/s$

D. $U_{avg} = 1.5 U_{mps}$

Answer: A

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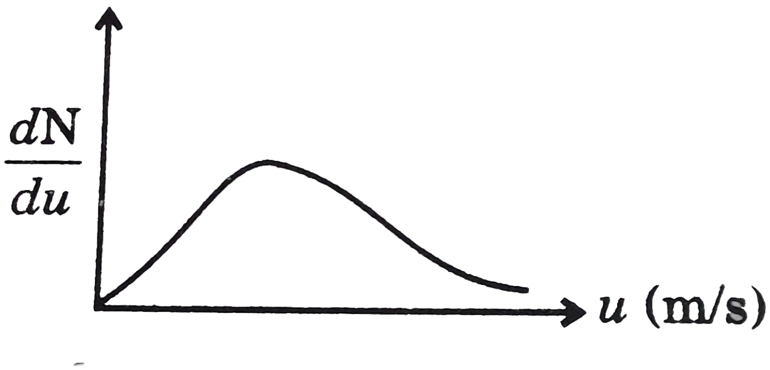
15. In the given curve total area under the graph represents:



A. Gives number of molecules moving with certain range of velocities

B. Gives fraction of molecules

C. Gives total number of molecules

D. Total frcation of molecules = unity

Answer: C

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16. Which graph is not a straight line for an ideal gas ?

A. P us $\frac{1}{V}$ (at constant T and n)

B. PV us V^2 (at constant T and n)

C. P us T^2 (at constant V and n)

D. log P us log (V^2) (at constant T and n)

Answer: C

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17. Consider the following statements.

(a) An oleum sample can be labelled as 127%

(b) Mole fraction is temperature dependent

(c) Slope of log V us log T graph is constant. (At constant P and n for ideal gas).

(d) 1 gm of $C_6H_{12}O_6$ contains more number of atoms than 1 gm of CH_3COOH.

(e) Intercept of log P vs log $(1/T)$ is always positive. (At constant V and n for ideal gas)

Select the correct code regarding true and false statement.

A. FFTFF

B. TFTFF

C. TFTTF

D. FFTFT

Answer: A

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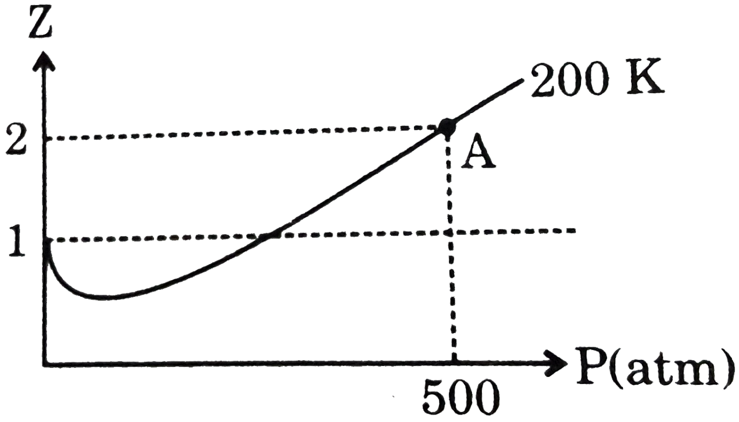
18. Z us P graph is plotted for 1 mole of hypothetical gas. Volume of gas at this point A is: $[R = 0.08 atm L / \text{mole} - K]$



A. $0.01L$

B. $0.09L$

C. $0.064L$

D. $0.64L$

Answer: C

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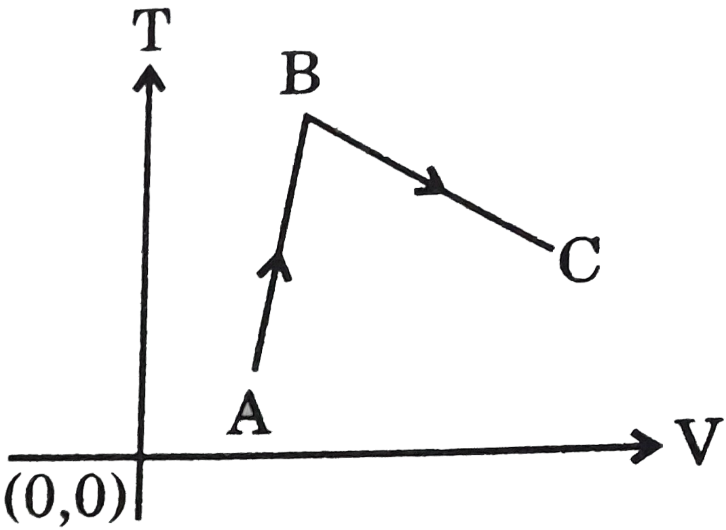
19. In the given isobaric process shown by graph between T and V.



A. Moles decreases throughout

B. Moles first increases then deceases

C. Moles first decreases then increases

D. Moles cannot be predicted form given data

Answer: C

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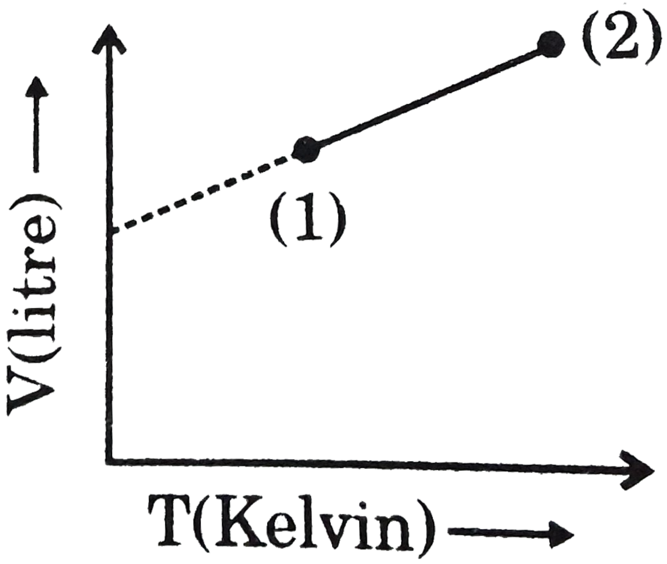
20. For the below graph which of the following combination is correct, (n represents mole and P represent pressure)

(I) If n is constant throughout then P at 2nd point must be greater than at 1st point.

(II) If n is doubled in moving from 1st point to 2nd point then P also doubles in the process.

(III) If n is constant then P is maximum at point (1).



A. I is true

B. II is true

C. Both II and III are true

D. I, II and III all are correct

Answer: A

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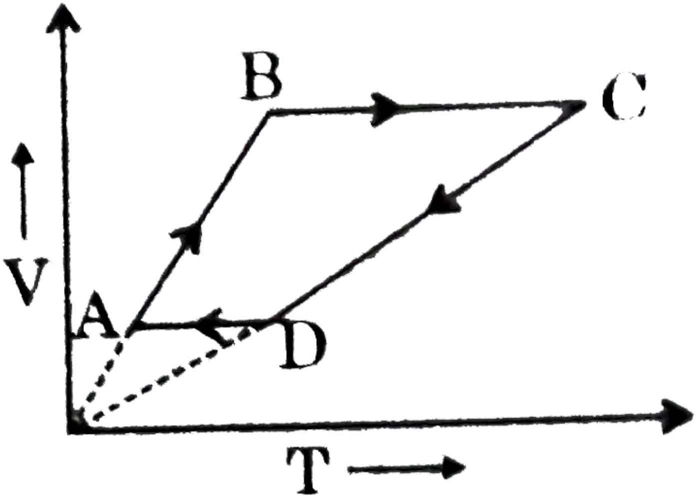
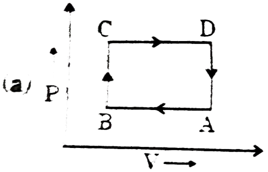
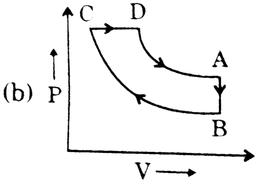
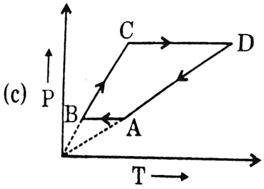
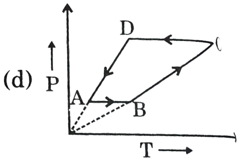
21. A cyclic process ABCD is shown in VT diagram for an ideal gas. Which of the following diagram represents the same process ?



A. 

B. 

C. 

D. 

Answer: D

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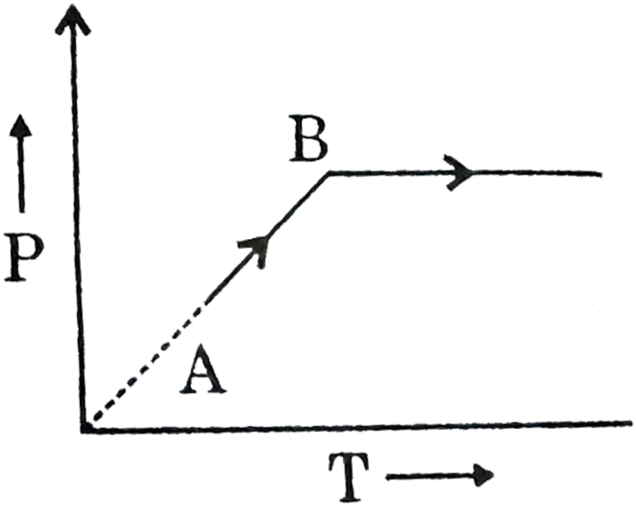
22. A gas is taken isochorically from state A to state C as shown in the graph. Choose the correct statement:



A. Moles of gas first remains constant and then increases

B. Moles of gas first increase and then remains constant

C. Moles of gas first remains constant and then decreases

D. Moles of gas first decreases and then remains constant.

Answer: C

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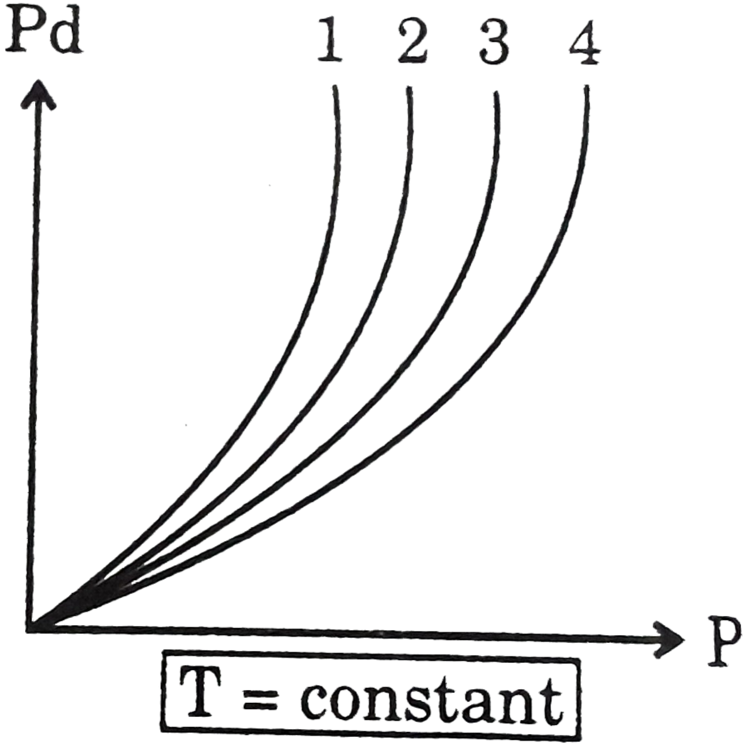
23. At 273 K, Pd vs P is plotted for various gases 1,2,3,4 assuming ideal behaviour for gases N_2, He, CO_2 and H_2. The correct combination is [P denotes combination in atmosphere and d denotes density in gm/L:



A. $2 - N_2, 1 - He, 3 - CO_2, 4 - H_2$

B. $4 - N_2, 1 - He, 2 - CO_2, 3 - H_2$

C. $4 - N_2, 3 - He, 2 - CO_2, 1 - H_2$

D. $2 - N_2, 3 - He, 1 - CO_2, 4 - H_2$

Answer: D

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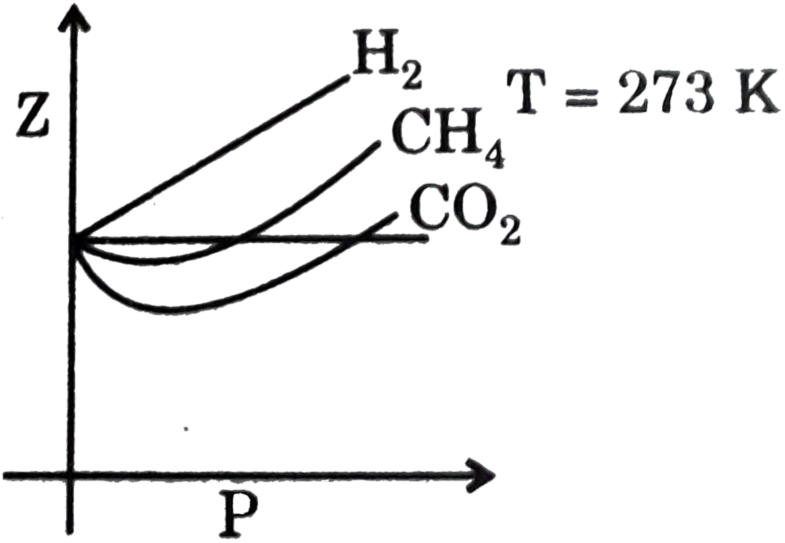
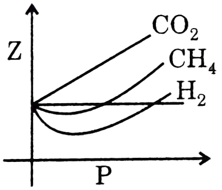
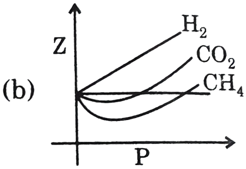


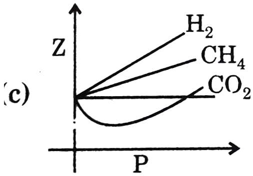
24.

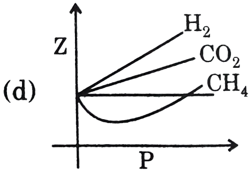
If the above plot is replotted at 373 K, then which of the following plots may show the correct behaviour at 373 K ?

A. (a)



B. 

C. 

D. 

Answer: C

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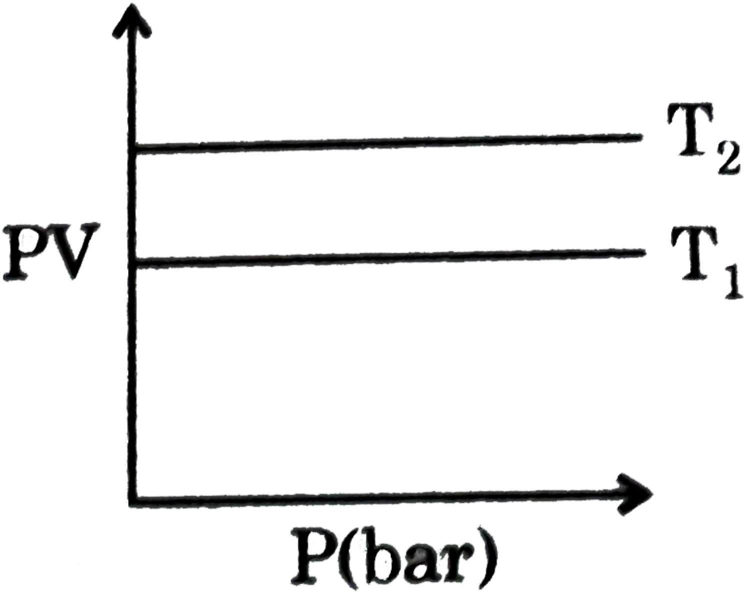
25. The product of PV is plotted against P at two temperatures T_1 and T_2 and the result is shown in figure. What is correct about T_1 and T_2?



A. $T_1 > T_2$

B. $T_2 > T_1$

C. $T_1 = T_2$

D. $T_1 + T_2 = 1$

Answer: B

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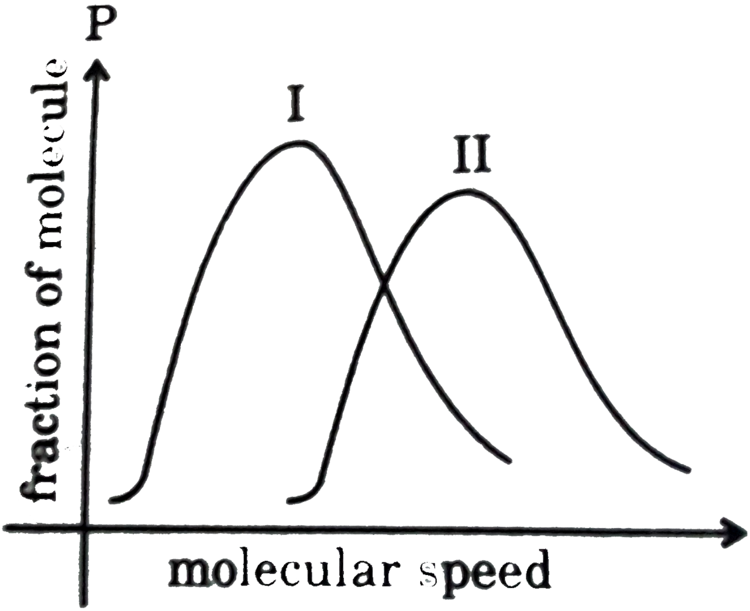
26. The graphs representing distribution of molecular speeds at 300 K for gases CI_2 and N_2 are as shown below (Atomic mass $N = 14, CI = 35.5)$

:



A. I graph is for N_2 and II is for CI_2

B. II graph is for N_2 and I is for CI_2

C. either graph can be taken for N_2 or CI_2

D. information is not sufficient

Answer: B

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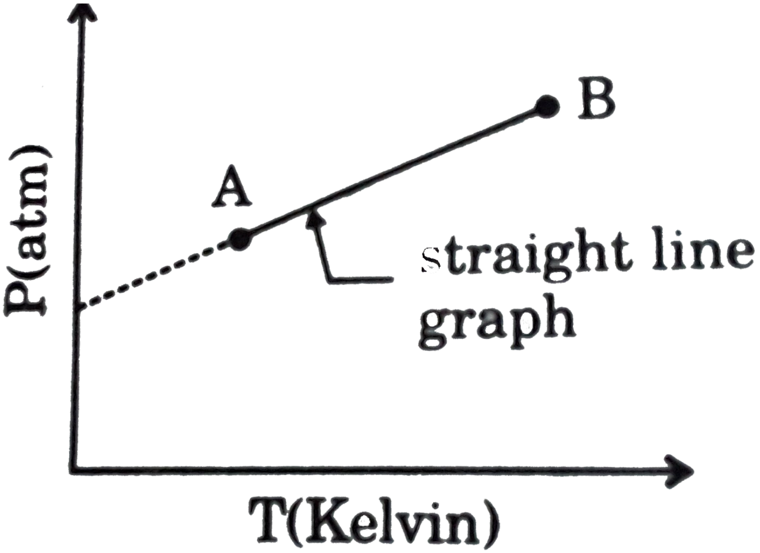
27. For a fixed amount of an ideal gas P us T plot is given as shown. Identify the correct option.



A. The change from A to B should be isochoric

B. Volume first increases reached maxima and then decreases

C. $PV = nRT$ is not applicable

D. None of the statements are correct

Answer: D

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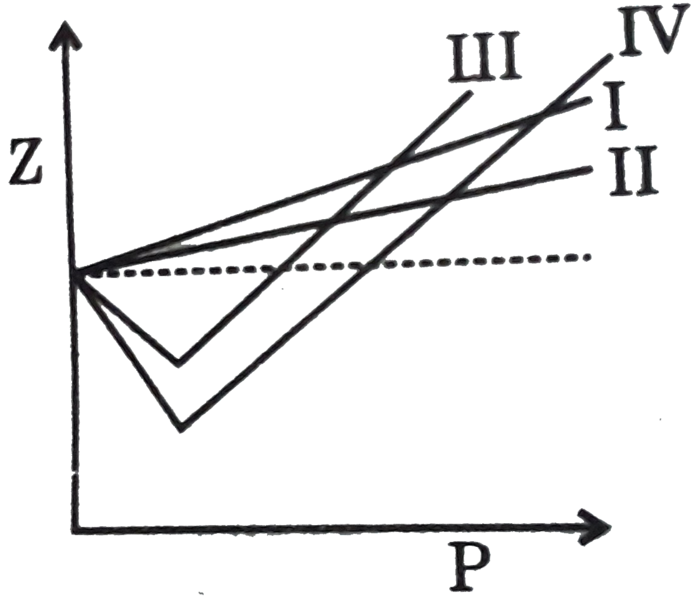
28. Which of the following options correctly match the graph of Z us P at normal temperature with gases ?



A. $I - H_2, II - He, III - CO_2, IV - NH_3$

B. $I - He, II - H_2, III - NH_3, IV - CO_2$

C. $I - H_2, II - He, III - NH_3, IV - CO_2$

D. $I - He, II - H_2, II - CO_2, IV - NH_3$

Answer: A

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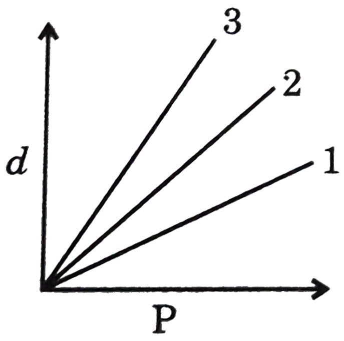
29. Following graphs are obtained when different gases are subjected to change in pressure at constant temperature. Identify the option which has correctly matched gas wth the graph.



d represents density

A. $1 \rightarrow O_2, 2 \rightarrow H_2, 3 \rightarrow He$

B. $1 \rightarrow CH_4, 2 \rightarrow N_2, 3 \rightarrow CO$

C. $1 \rightarrow H_2, 2 \rightarrow O_2, 3 \rightarrow SO_2$

D. $1 \rightarrow SO_3, 2 \rightarrow CO_2, 3 \rightarrow He$

Answer: C

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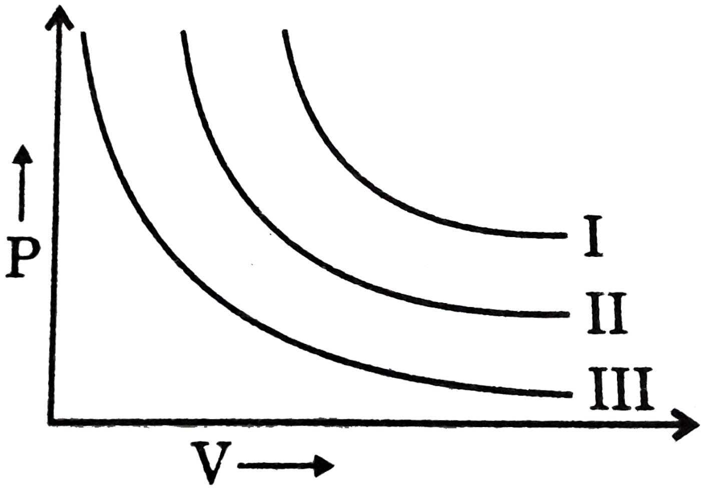
30. I,II,III are three isotherms respectively at T_1, T_2 and T_3 for a fixed mass of gas, as shown in graph. Temperature will be in order :



A. $T_1 = T_2 = T_3$

B. $T_1 < T_2 < T_3$

C. $T_1 > T_2 > T_3$

D. $T_1 > T_2 = T_3$

Answer: C

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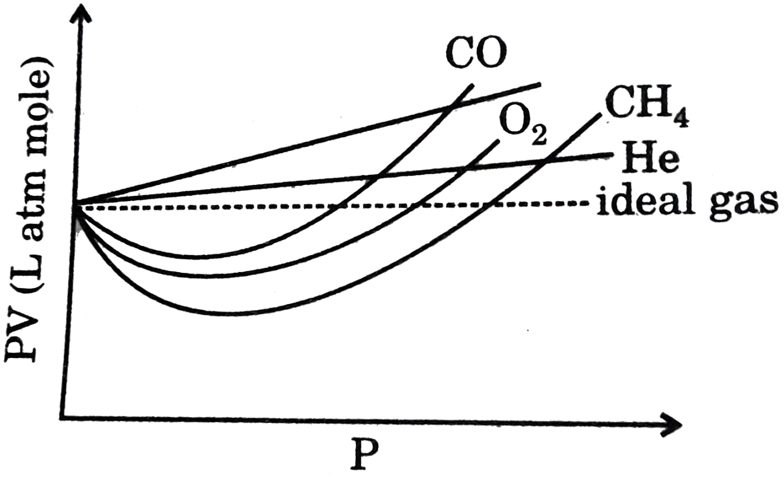
31. The curve of pressure volume (PV) against pressure (P) of the gas at a particular temperature is as shown, according to the graph. Which of the following is incorrect (in the low pressure region)?



A. H_2 and He shows +ve deviation from ideal gas equation

B. CO, CH_4 and O_2 show negative deviation from ideal gas equation.

C. H_2 and He show negative deviation while CO_2, CH_4 and O_2 show positive deviation

D. H_2 and He are less compressible than that of an ideal gas while CO_2, CH_4 and O_2 more compressible than that of ideal gas.

Answer: C

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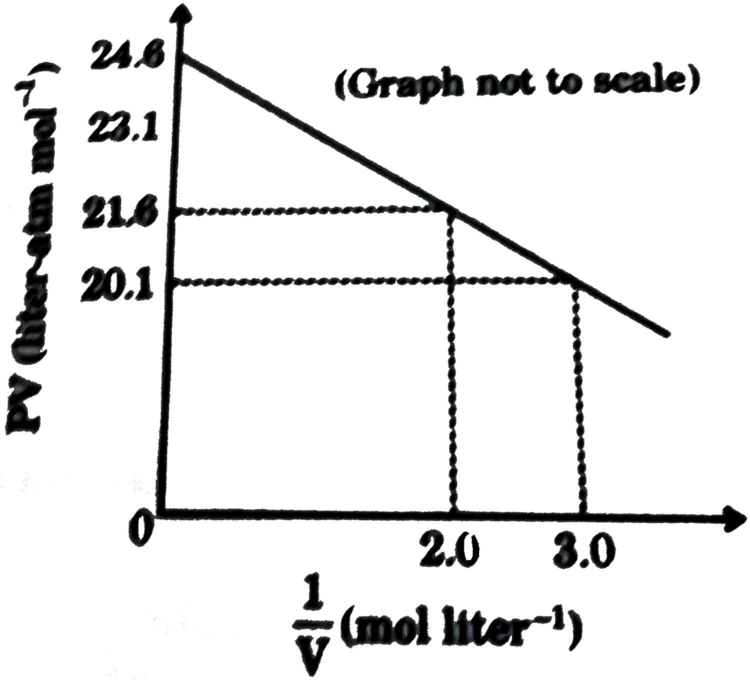
32. For one mole of a van der Waal's gas when $b=0$ and $T=300K$, the PV us $1/V$ plot is shown ahead. The value of the van der Waal's constant a$(\text{atm. litre}^2 mol^{-2})$ is:



A. 1.0

B. 4.5

C. 1.5

D. 3.0

Answer: C

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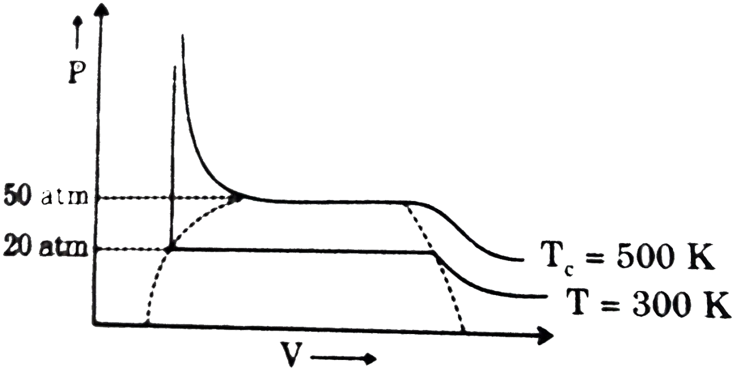
33. For a real gas the P-V curve was experimentally plotted and it had the following appearance. With respect to liquefaction, choose the correct statement.



A. at $T = 500K, P = 40$ atm, the state will be liquid

B. at $T = 300K, P = 50$ atm, the state will be gas

C. at $T < 300K, P > 20$ atm, the state will be gas

D. at $300K < T < 500K, P > 50$ atm, the state will be liquid

Answer: D

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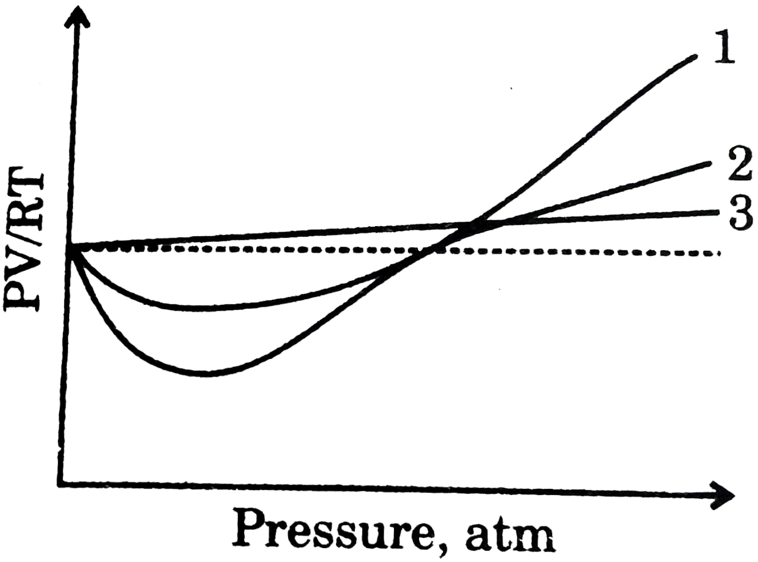
34. The curve in the accompanying diagram represent the PV/RT behaviour of the gases: He, CH_4 and C_3H_8. Which assignment of behavior for gas is correct ?



A. $1 = He, 2 = CH_4, 3 = C_3H_8$

B. $1 = C_3H_8, 2 = CH_4, 3 = He$

C. $1 = CH_3, 1 = C_3H_8, 3 = He$

D. $1 = C_3H_8, 2 = He, 3 = CH_4$

Answer: B

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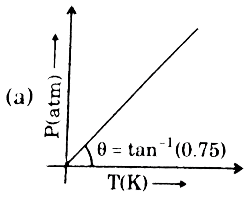
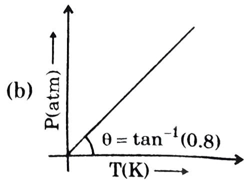
35. Gas A (1 mol) dissociates in a closed rigid container of volume 0.16 lit. as per following reaction.

$2A(g) \to 3B(g) + 2C(g)$ If degree of dissociation of A is 0.4 and remains constant in entire range of temperature then the correct P us T graph is: [Given $R = 0.08$ lit-atm/mol/K]

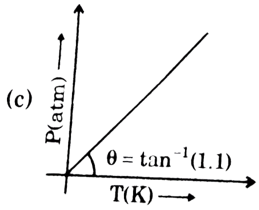
A.

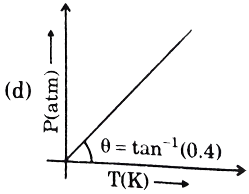


B.



C.



D. 

Answer: B

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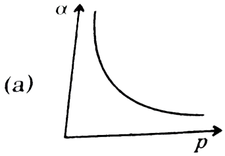
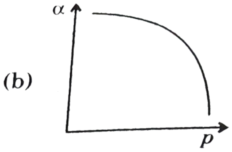
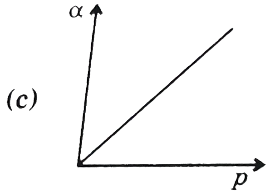
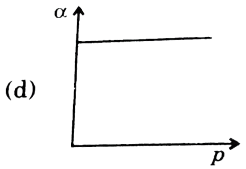
36. Which of following graphs correctly represent variation of $\alpha = \frac{-(dV/dP)_T}{V}$ with P for fixed amount of an ideal gas at constant temperature ?

A. 

B. 

C. 

D. 

Answer: A

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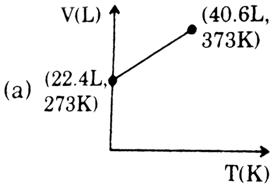
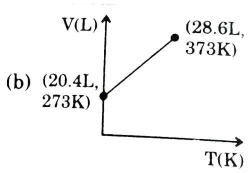
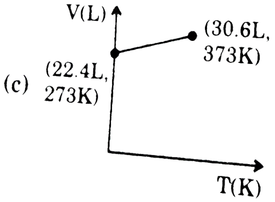
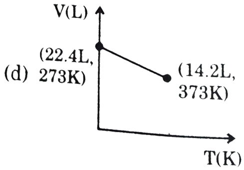
37. Which of the following volume-temperature $(V - I)$ plots represents the behaviour of 1mole of an ideal gas at the atmospheric pressure?

A. 

B. 



C.



D.

Answer: C

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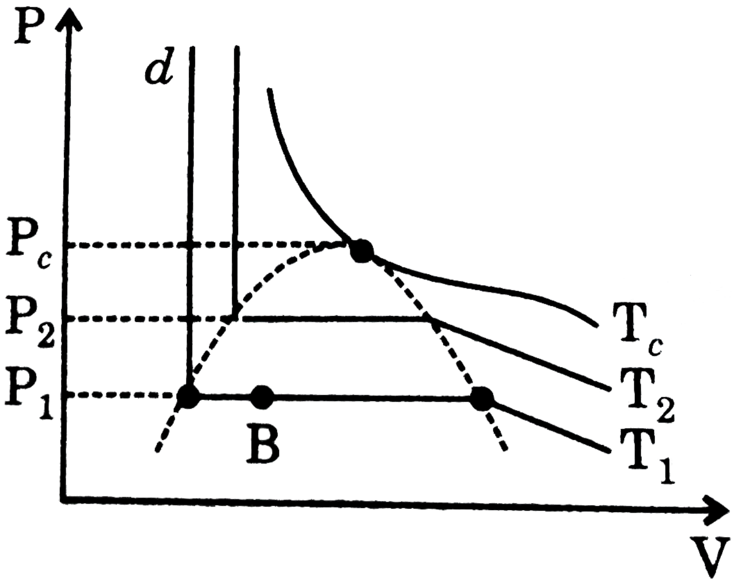
38. Select the incorrect statements on the basis of curve given below for real gas(A).



A. For 1 mol, $V_C = \frac{48}{3}\pi r^3 \times N_A$

B. Difference in densities of liquid and gas at T_2 and P_2 is less than that at T_1 and P_1.

C. At temperature T_C and pressure P_C density of gas and liquid becomes almost equal.

D. At point B, substance A exists in liquid state only.

Answer: D

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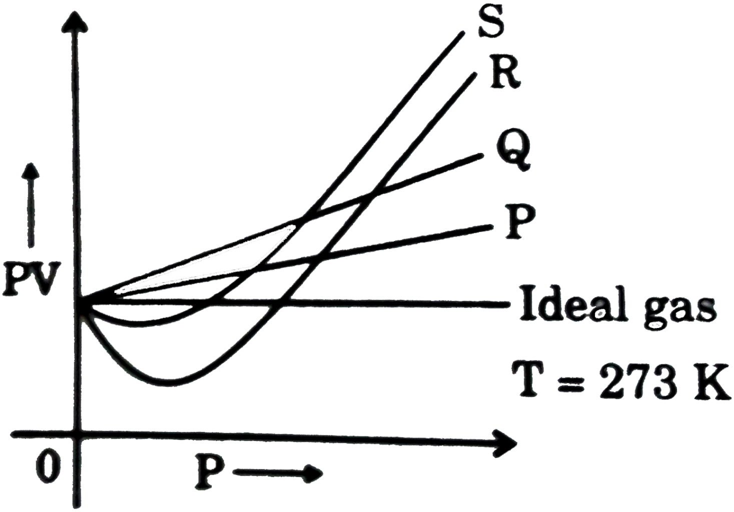
39. For the given plot, match the most appropriate graph for respective gases: (Among H_2, He, CO, CH_4)



A. $\begin{array}{cccc} P & Q & R & S \\ H_2 & He & CO & CH_4 \end{array}$

B. $\begin{array}{cccc} P & Q & R & S \\ He & H_2 & CH_4 & CO \end{array}$

C. $\begin{array}{cccc} P & Q & R & S \\ He & H_2 & CH_4 & CO \end{array}$

D. $\begin{array}{cccc} P & Q & R & S \\ CO & He & H_2 & CH_4 \end{array}$

Answer: C

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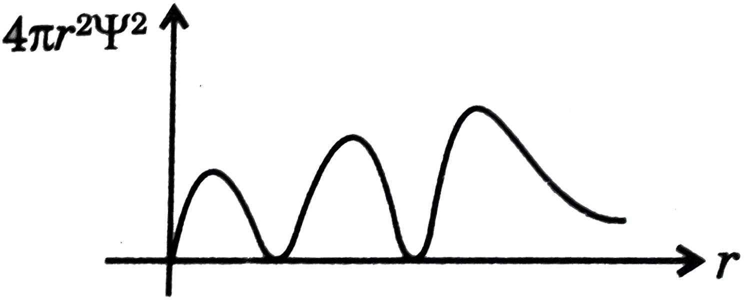
C. Atomic Sturcture

1.



The above graph cannot be of:

A. 3s

B. $4p_x$

C. $3p_x$

D. $5d_{xy}$

Answer: C

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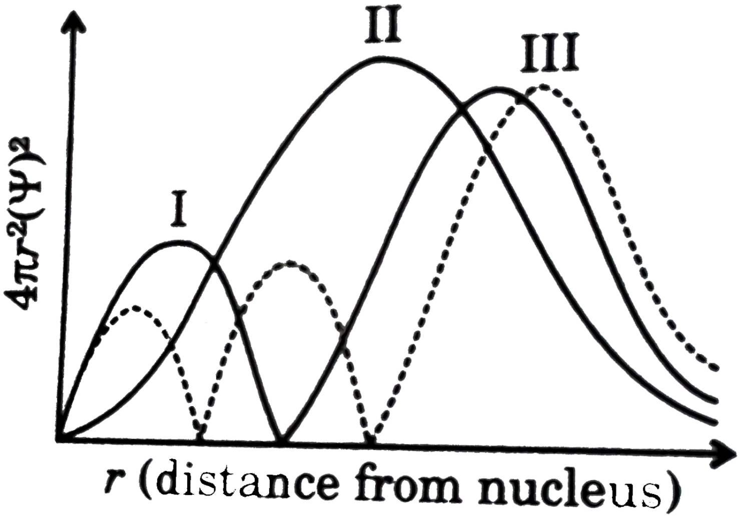
1. Consider the following radial distribution function diagrams. Which of the following has the correct matching of curve and orbital ?



A. $I(3s), II(3p), II(3d)$

B. $I(3d), II(3p), III(3s)$

C. $I(3p), II(3d), III(3s)$

D. $I(3s), II(3d), III(3p)$

Answer: C

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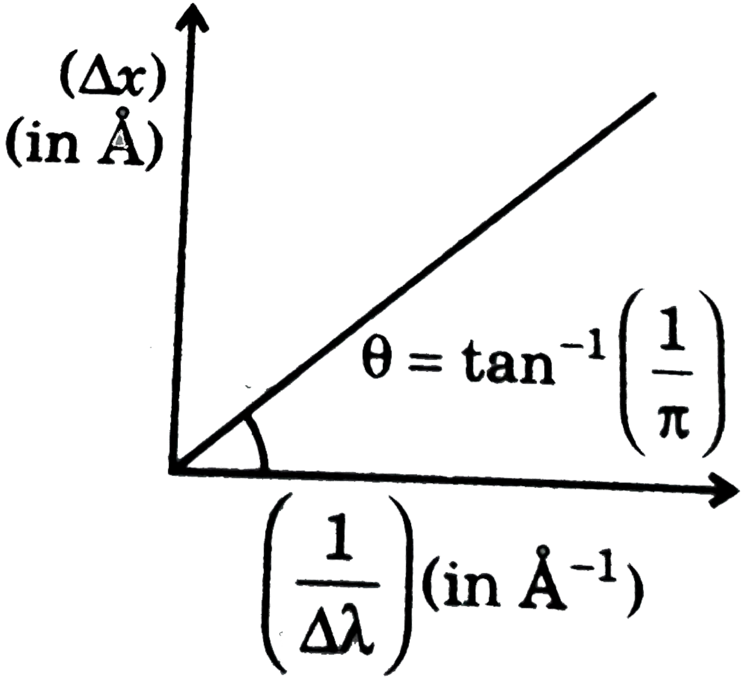
2. A graph is plotted between uncertainty in position and inverse of uncertainty in wavelength for an electron. We get a straight line passing through origin. Calculate voltage through which electron is accelerated with:



A. $150V$

B. $75V$

C. $37.5V$

D. $300V$

Answer: C

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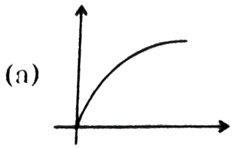
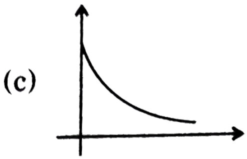
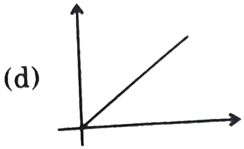
3. For a H-like species if area A_1 is of ground state orbit and area A_n is of nth orbit, then, the plot of $\frac{A_n}{A_1}$ us n^2 looks like:

A. 

B. 

C. 

D. 

Answer: B

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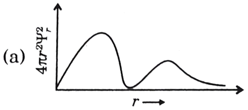
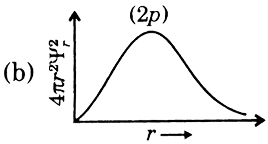
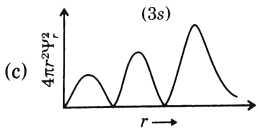
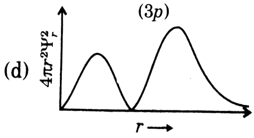
4. Which of the following plots of radical probability function $4\pi r^2 \Psi_r^2$ is incorrectly labelled ?

A. 

B. 

C. 

D. 

Answer: A

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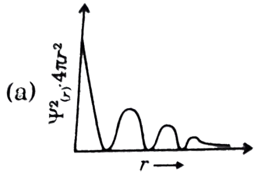
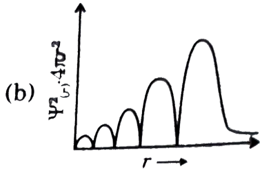
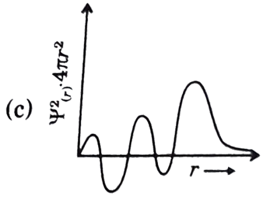
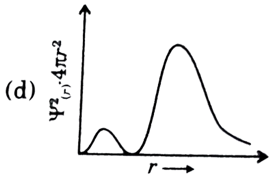
5. Which of the following radial probability distribution graph is correct for 5s orbital ?

A. 

B. 

C. 

D. 

Answer: B

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6. Which of the following graphs is correct with respect to phtotelectric effect ?

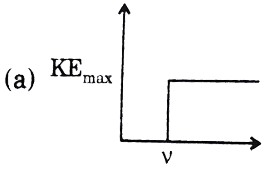
Where v $\rightarrow$ Frequency of EMR

$KE_{\max}$ $\rightarrow$ Maximum kinetic energy of photon-electron

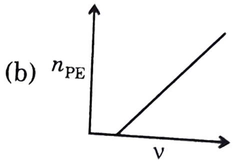
I $\rightarrow$ Intensity of EMR ltbr. $V_{S.P.}$ $\rightarrow$ Stopping potential

n_{PE} $\rightarrow$ Number of photon electron

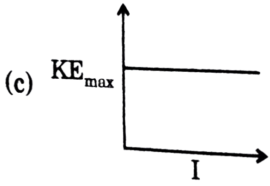
A.

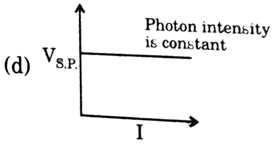


B.



C.



D. 

Answer: C

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7. The radial probability distribution curve for an orbitals comprises of 3 maxima. If the orbital has 3 angular nodes as well, then the orbital can be:

A. 5f

B. 7d

C. 6f

D. 7f

Answer: C

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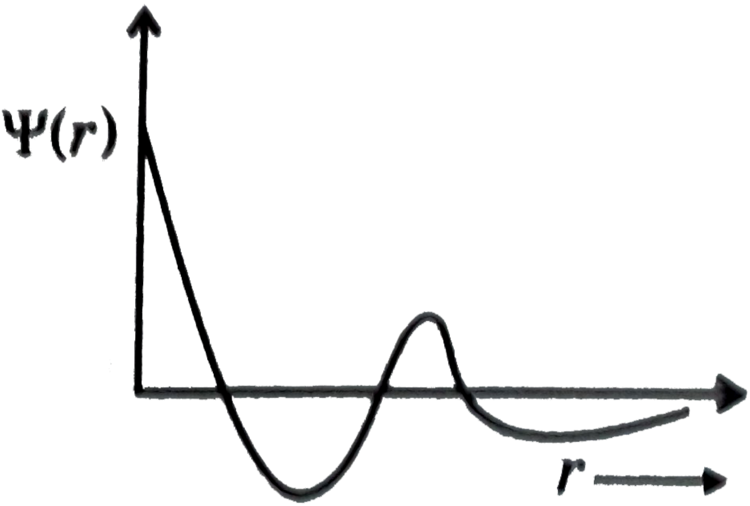
8. Given curve represents



A. 3s orbital

B. 4s orbital

C. 2s orbital

D. 2s orbital

Answer: B

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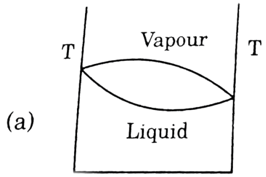
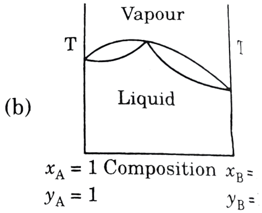
9. Which of the following will be correct graph for variation of boiling point with composition ?

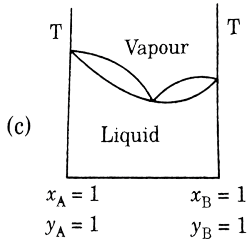
A.



B.



C.



D.

Answer: C

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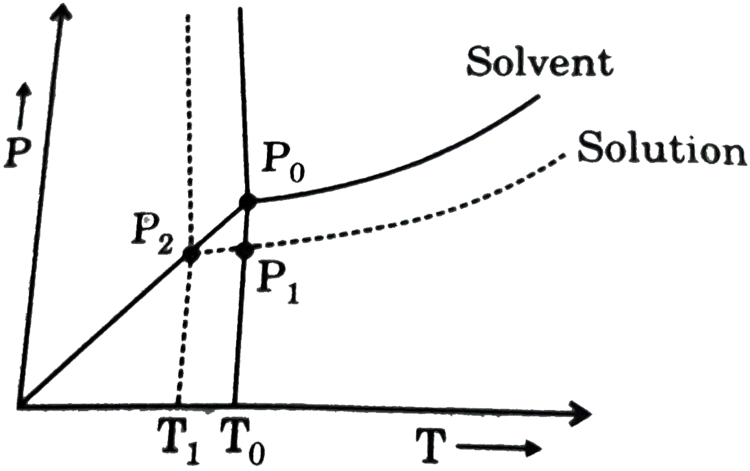
D. Liquid Solutions

1. From the phase diagram of water and an aqueous solution containing non-volatile solute, identify the incorrect option.



A. At temperature T_0, vapour pressure of solid and vapour pressure of liquid will be same .

B. Order of vapour pressure (P_0, P_1, P_2) are $P_0 > P_1 > P_2$.

C. $P_0 = P_2 e \frac{\Delta H_{\text{fusion}}[T_0 - T_1]}{T_0 T_1}$

D. $P_1 = P_2 e \frac{\Delta H_{vap}[T_0 - T_1]}{T_0 T_1}$

Answer: C

View Text Solution

Liquid Solutions

1. The plots of $\frac{1}{x_A}$ (on y-axis) $\frac{1}{y_A}$ (on x-axis) is linear with slope and intercept respectively.

$p^\circ A =$ vapour pressure of pure liquid A

$p^\circ B =$ vapour pressure of pure liquid B

A. $\frac{p_A^\circ}{p_B^\circ}$ and $\frac{(p_A^\circ - p_B^\circ)}{p_B^\circ}$

B. $\frac{P_a^\circ}{P_b^\circ}$ and $\frac{(P_B^\circ - P_A^\circ)}{p_B^\circ}$

C. $\frac{p_B^\circ}{p_A^\circ}$ and $\frac{(p_A^\circ - p_B^\circ)}{p_B^\circ}$

D. $\frac{p_B^\circ}{p_A^\circ}$ and $\frac{(p_B^\circ - p_A^\circ)}{p_B^\circ}$

Answer: B

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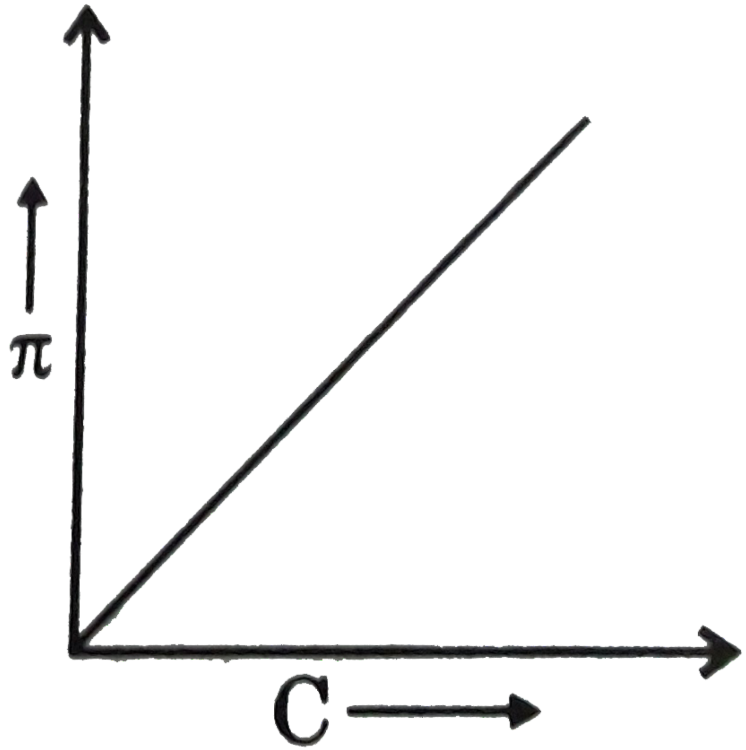
2. A graph showing variation of osmotic pressure (π) versus molar concentration. C of an aqueous solution at temperature T is given below. The slope of the line is equal to:



A. solution constant R

B. absolute temperature T

C. RT

D. degree of ionization of solute

Answer: C

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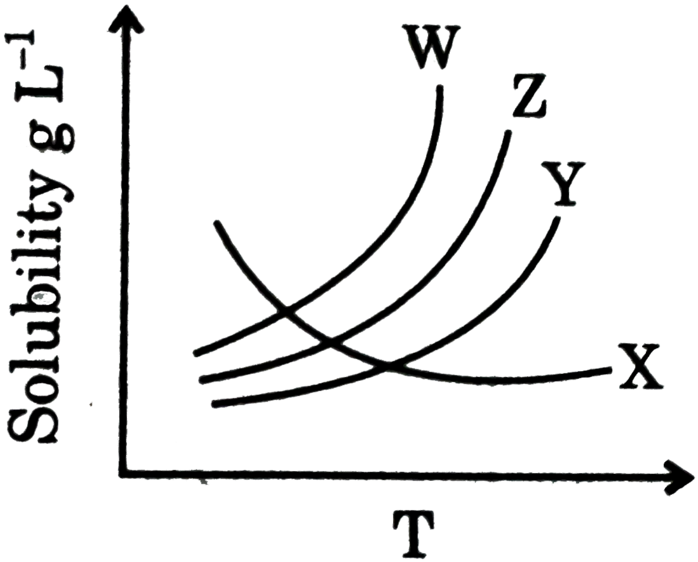
3. Solubility curves of four ionic salts X, Y, Z, W are given below. In which case the value of $\Delta H_{sol} < 0$?



A. X

B. Y

C. Z

D. W

Answer: A

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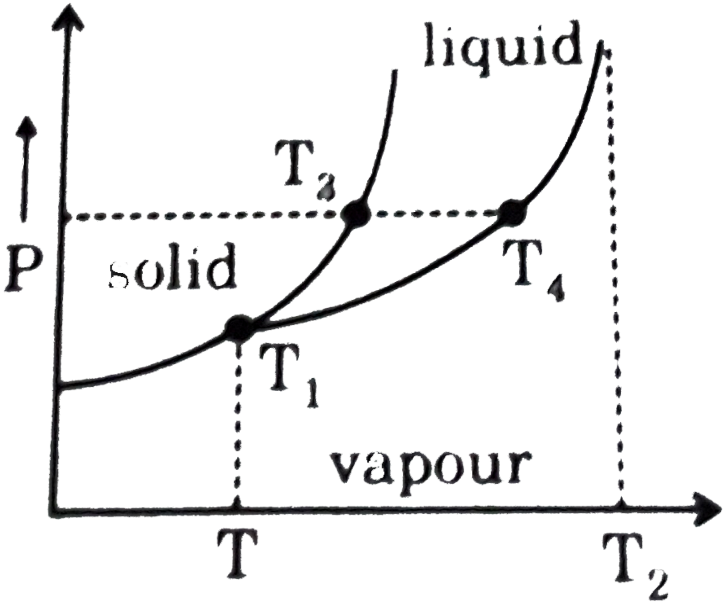
4. Observe the P-T phase diagram for a given substance A. Then melting point of $A(s)$, boiling point of $A(l)$, critical point of A and triple point of A (at their respective pressure) are respectively:



A. T_1, T_2, T_3, T_4

B. T_4, T_3, T_1, T_2

C. T_3, T_4, T_2, T_1

D. T_2, T_1, T_3, T_4

Answer: C

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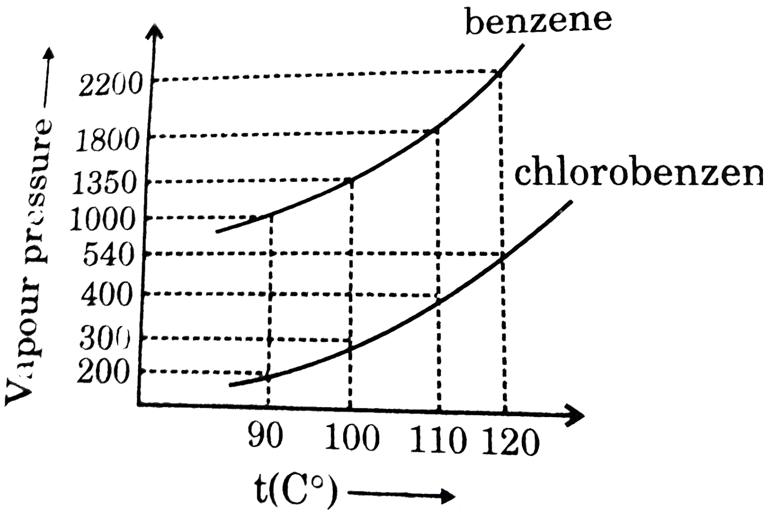
5. Assuming the formation of an ideal solution, determine the boiling point of a mixture containing 1560 g benzene (molar mass = 78) and 1125 g chlorobenzene (molar mass = 112.5) using the following against an external pressure of 1000 torr.



A. $90^\circ C$

B. $100^\circ C$

C. $110^\circ C$

D. $120^\circ C$

Answer: B

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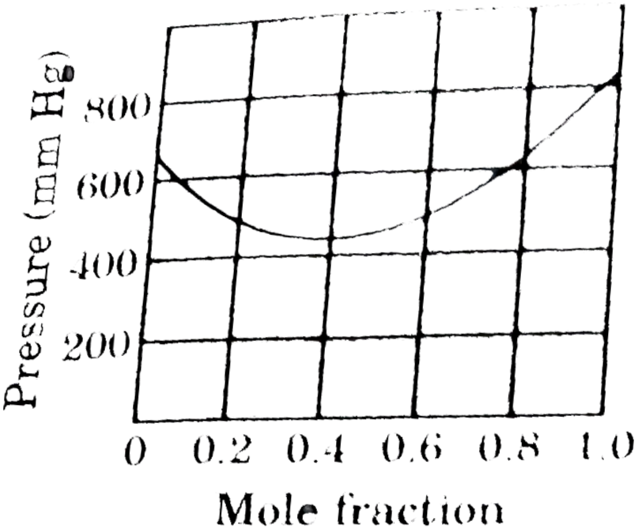
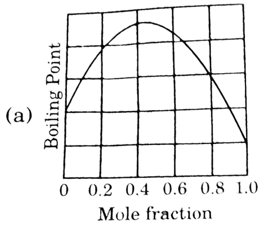
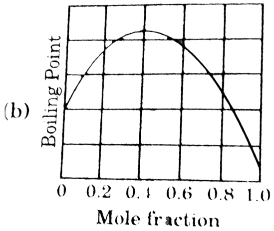
6. Given P-X curve for a non-ideal liquid mixture (fig). Identify the correct T-X curve for the same mixture.

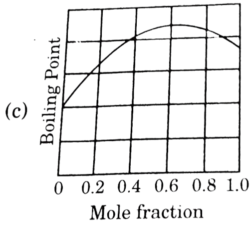


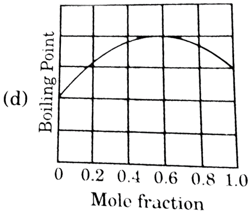
A.



B.



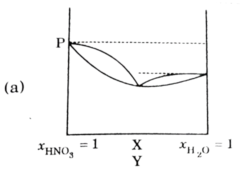
C. 

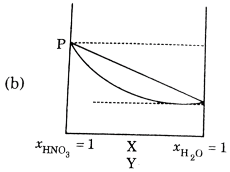
D. 

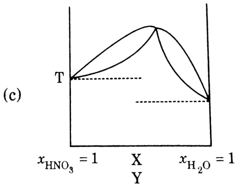
Answer: B

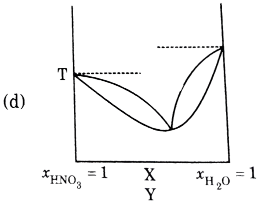
View Text Solution

7. HNO_3 is more volatile than water. If an aqueous solution of HNO_3 is taken then which of the following graph correctly represents variation of vapour pressure/boiling point with composition?

A. 

B. 

C. 

D. 

Answer: A

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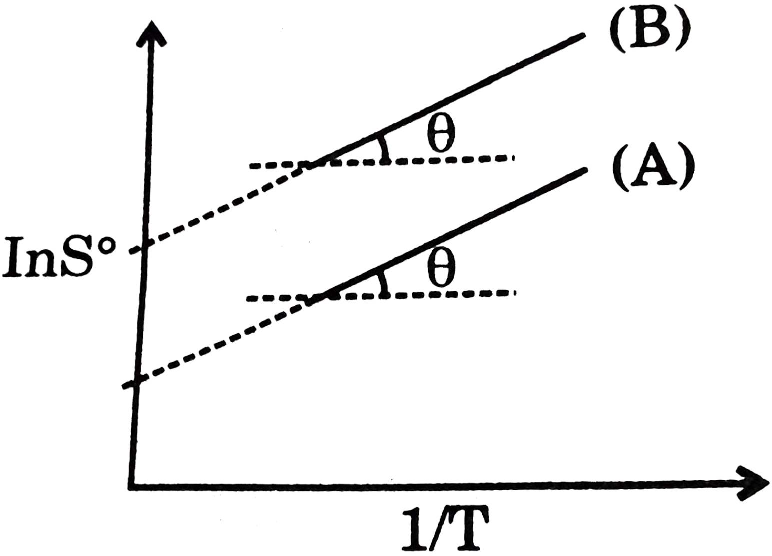
8. Graph of ln S° vs $\frac{1}{T}$ is plotted for two gases A and B $[S^{\circ}$ represents solubility in molarity and T is in Kelvin]. Compare Henry's constant K_H for the two gases at same temperature.



A. $K_{H,A} > K_{H,B}$

B. $K_{H,A} < K_{H,B}$

C. $K_{H,A} = K_{H,B}$

D. $K_{H,A}$ may be greater or less than $K_{H,B}$

Answer: A

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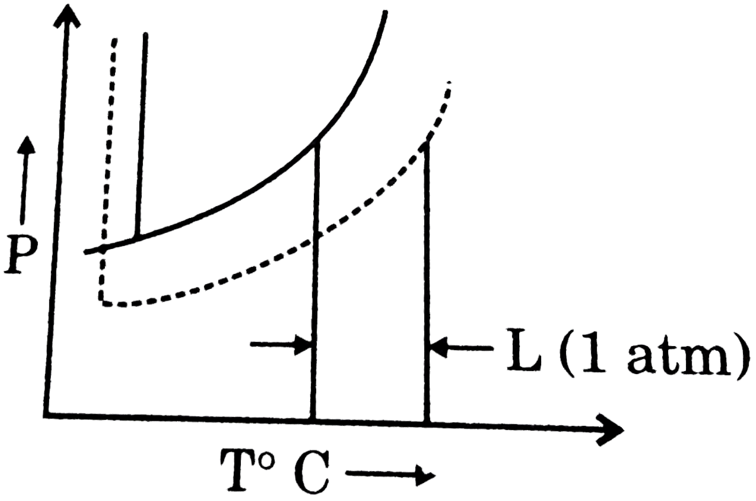
9. The phase diagrams for the pure solvent (solid lines) and the solution (non-volatile solute, dashed line) are recorded below. The quantity indicated by L in the figure is:



A. Δp

B. ΔT_f

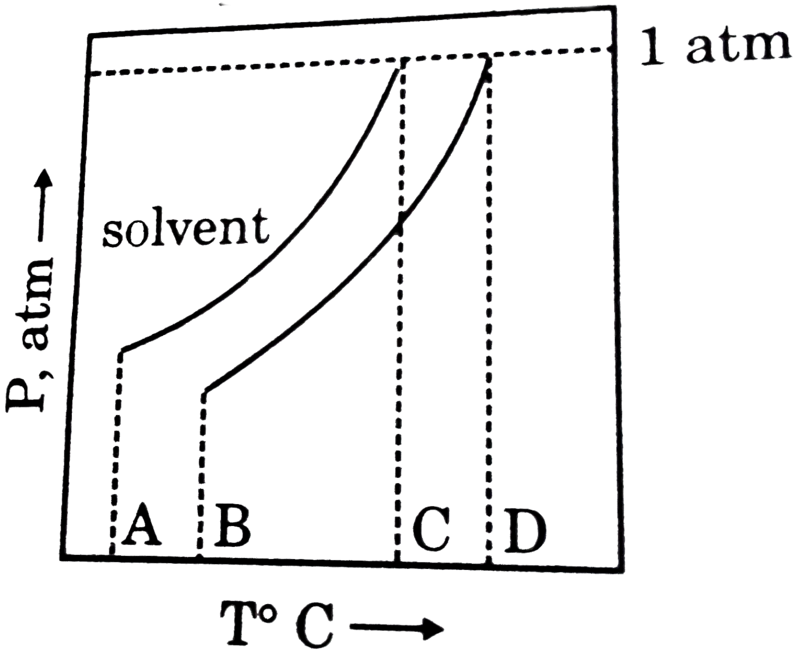
C. $K_b m$

D. $K_f m$

Answer: C

View Text Solution

10. What is the normal boiling point of the solution represented by the phase diagram ?



A. A

B. B

C. C

D. D

Answer: D

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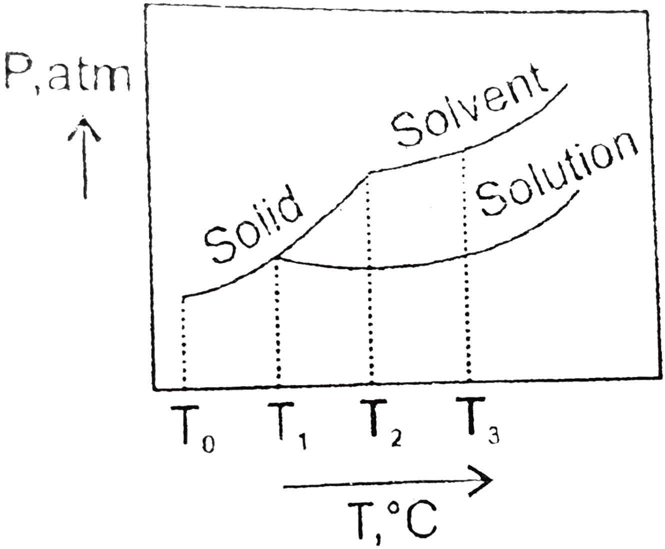
11. What is the normal freezing point of the solution represented by the phase diagram ?



A. T_1

B. T_2

C. T_3

D. T_0

Answer: A

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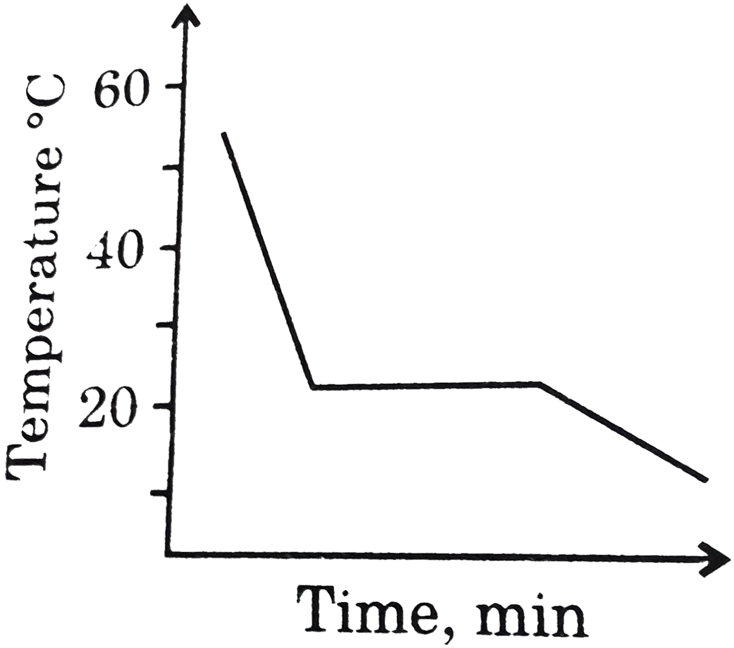
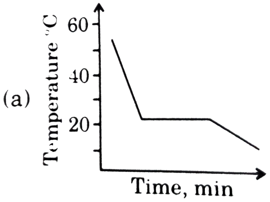
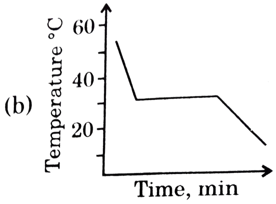
12. This diagram represents the behaviour of a pure solvent upon cooling. Which of the diagrams below best represents the cooling curve of a solution in that solvent upon cooling ? (Assume that all diagrams are drawn to the same scale.)



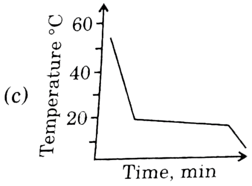
A.



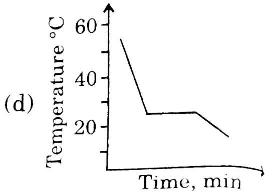
B.



C.



D.



Answer: C

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E. Surface Chemistry

1. The following graph is obtained for the adsorption of an ideal gas at charcoal surface, obeying Freundlich's isotherm. The value of $\frac{x}{m}$ at $P = 32$ atm, is:

`(#3GRB_PHY_CHM_P2_V03_QB_C13_E01_110_Q01.png" width="80%">

A. 10

B. 4

C. 1

D. 0.6

Answer: B

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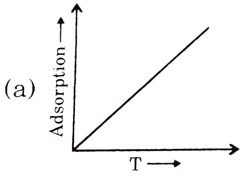
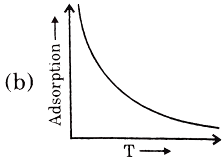
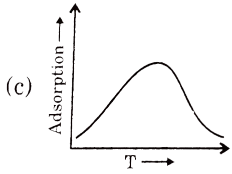
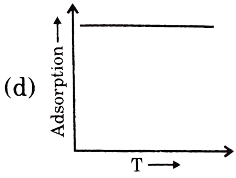
Surface Chemistry

1. Following is the variation of physical adsorption with temperature.

A. 

B. 

C. 

D. 

Answer: B

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2. Graph between $\log x / m$ and $\log p$ is a straight line inclined at an angle of 45° . When pressure is $0.5 atm$ and $1nk = 0.693$, the amount of solute adsorbed per gram of adsorbent will be:

A. 1

B. 1.5

C. 0.25

D. 2.5

Answer: A

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3. For adsorption of a gas on a solid, the plot of log (x/m) vs log P is linear with a slope equal to [n being a whole number]:

A. K

B. log K

C. n

D. $1/n$

Answer: D

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4. When a graph is plotted between log x/m and log p, it is striaght line with an angle 45° and intercept 0.3010 on y-axis. If initial pressure is 0.3 atm, what will be the amount of gas adsorbed per gm of adsorbent?

A. 0.4

B. 0.6

C. 0.8

D. 0.1

Answer: B

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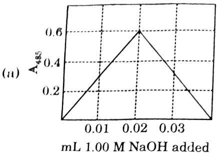
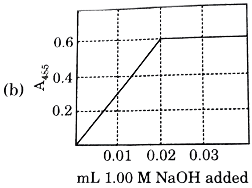
F. Ionic Equilibrium

1. Nitrophenol is a colorless weak monoprotic acid $(pK_a = 7.2)$ whose conjugate base is bright yellow. To $2.00mL$ of a solution of $0.0100M$ nitrophenol is added $1.00MNaOH$ in $0.01mL$ portions, and the adsorbance of the solution at 485 nm is monitored. what does the graph of A_{485} as a function of added volume of $NaOH$ look like ?

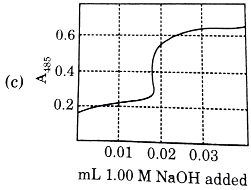
A.



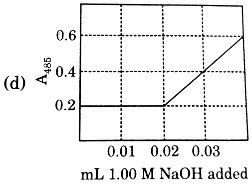
B.



C.



D.



Answer: B

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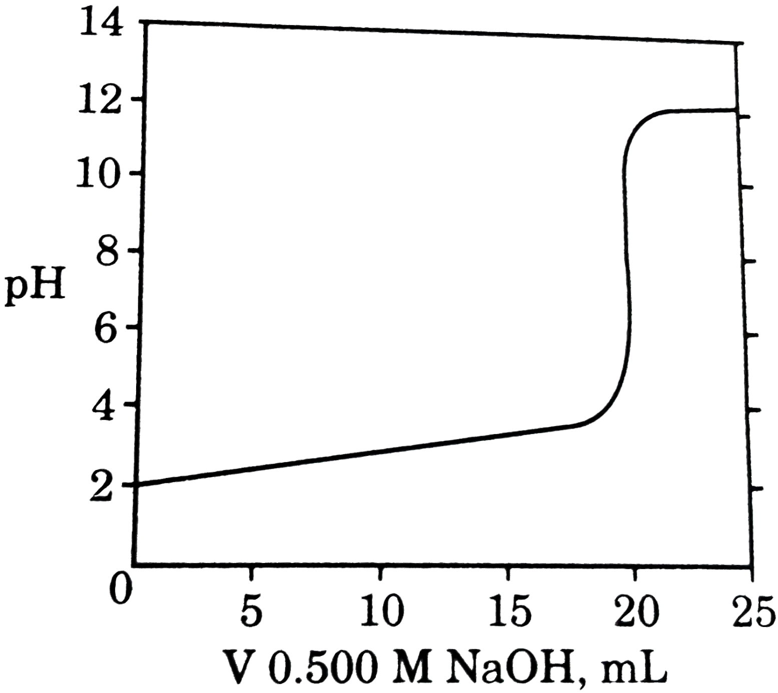
Ionic Equilibrium

1. A sample of 100 mL of a solution of a weak monoprotic acid of unknown concentration is titrated with $0.500 M NaOH$ to give the titration curve shown. All of the statements are correct except:



A. Phenolphthalein would be a suitable indicator for this titration

B. A buffer solution is formed when 15 mL of $NaOH$ is added

C. The pK_a of the acid is 4.0

D. The initial concentration of the acid is $0.10M$

Answer: C

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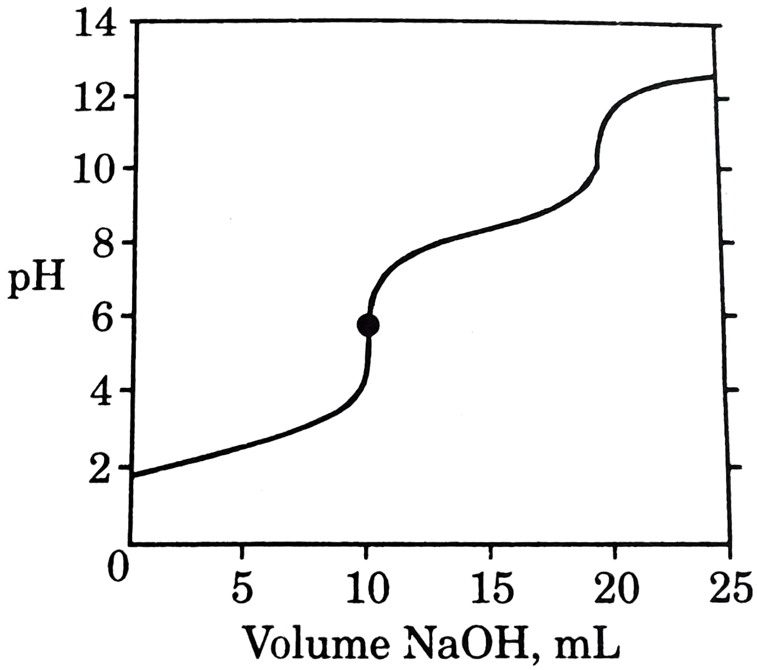
2. A $0.100M$ aqueous solution of H_2SeO_3 is titrated with $1.000MNaOH$ solution. At the point marked with a circle on the titration curve, which species represent at least 10 % of the total selenium in solution ?



A. H_2SeO_3 only

B. Both H_2SeO_3 and $HSeO_3^-$

C. $HseO_3^-$ only

D. Both $HSeO_3^-$ and SeO_3^{2-}

Answer: C

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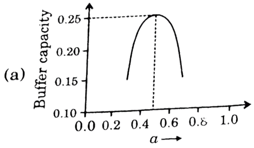
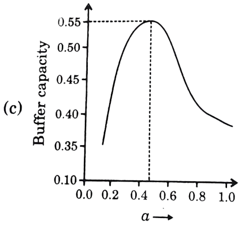
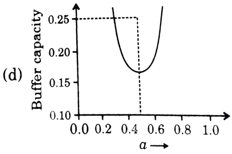
3. A buffer solution is prepared by mixing 'a' moles of CH_3COONa and 'b' moles of CH_3COOH such that $(a+b)=1$, into water to male 1L buffer solution. If the buffer capacity of this buffer solution is plotted against moles of salt CH_3COONa 'a' then the plot obtained will be (to the scale) approximately. (As shown in fig. in options)

A. 

B.

C. 

D. 

Answer: B

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4. Which is/are correct statements ?

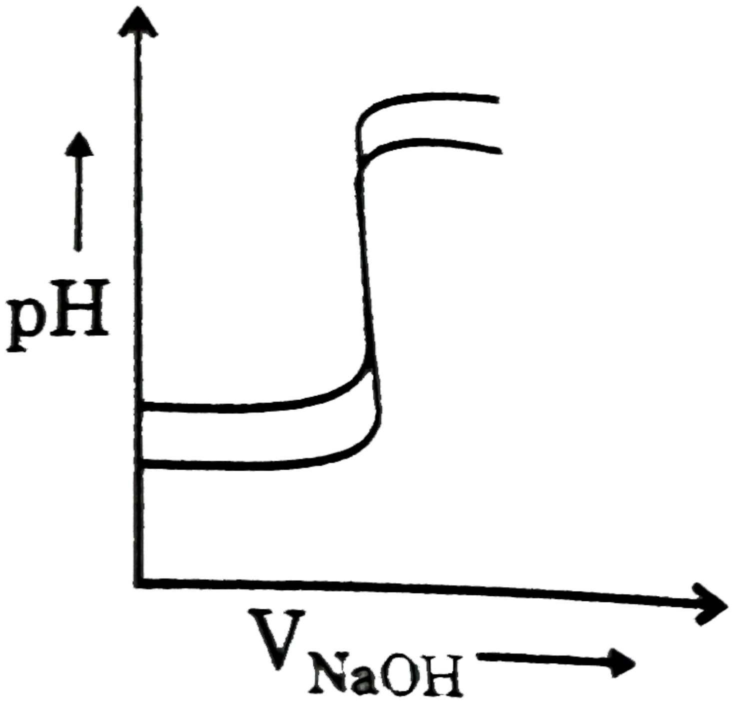
(P) In any strong acid's solution, the concentration of $\left[OH^{-}\right]$ will be zero.

(Q) If ΔG° of a reaction is positive, then the reaction will not proceed at all in the forward direction for any concentrations of reactants and products.

(R) Titration curves are drawn for (about the fig. shown)

(i) $1MHCI$ (50 mL) with $1MNaOH$ and

(ii) $0.01MHCI(50mL)$ with $0.01MNaOH$ on the same graph paper they look like:



A. P and Q

B. R only

C. Q only

D. P and R

Answer: B

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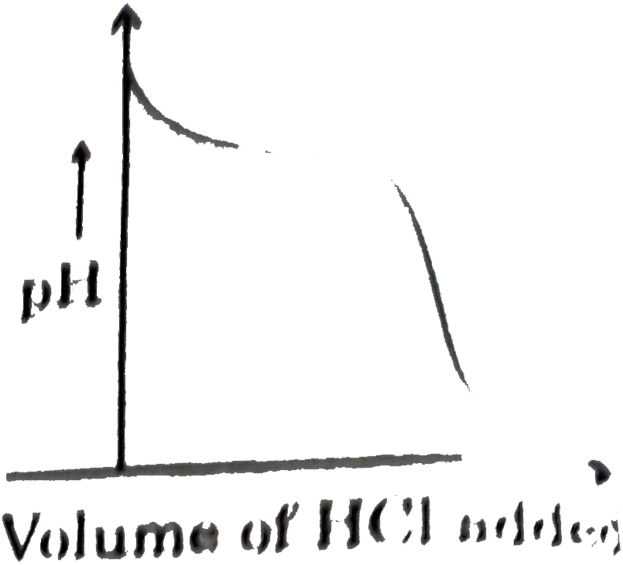
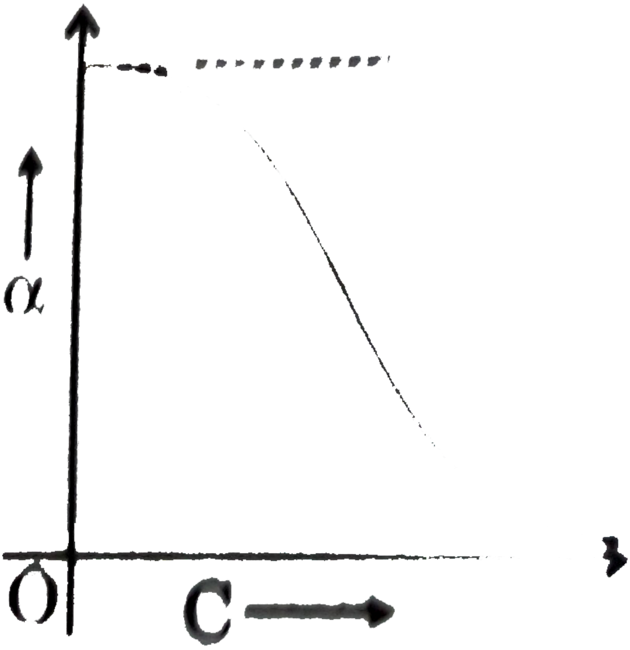
5. Which is/are correct statement ?

(P) When 100 mL of $0.1 M NaCN$ solution is titrated with $0.1 M HCI$ solution the variation of pH of solution with volume added will be (as shown in fig.)

(Q) Variation of degree of dissociation α with concentration for a weak electrolyte at a particular temperature is best represented by (as shown in fig.)

(R) $0.1 M$ acetic acid solution is titrated aganist $0.1 M NaOH$ solution. the difference in pH between $1/4$ and $3/4$ stages of neutralization of acid will be 2 log 3.





A. P and R

B. Q and R

C. P,Q and R

D. Q only

Answer: C

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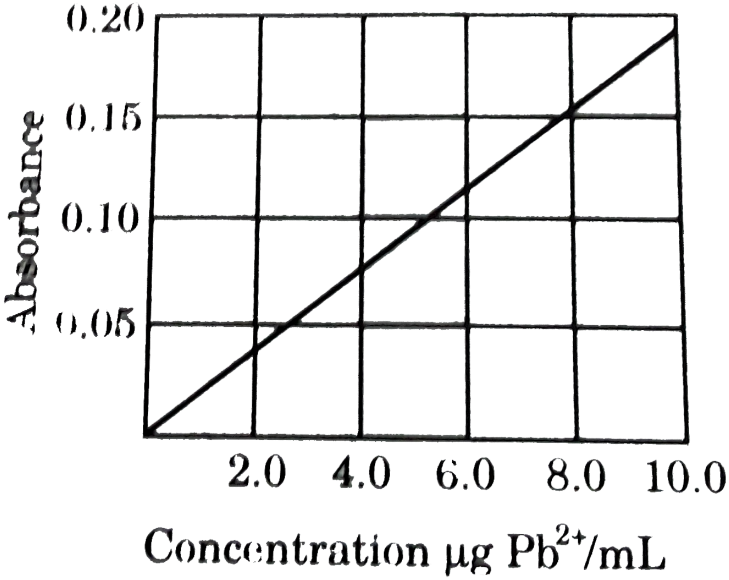
6. A $25.0mL$ sample of waste water is obtained to analyze for Pb^{2+} ions. This sample is evaporated to dryness and redissolved in $2.0mL$ of H_2O, mixed with $2.0mL$ of a buffer solution and $2.0mL$ of a solution of dithizone then diluted to $10.0mL$. The absorbance of the coloured Pb^{2+} dithizone complex is compared with the Beer-Lambert plot below. The absorbance of a proton of the final solution is 0.13. What is the concentration of Pb^{2+} ions in the waste water in ppm ?



A. 2.9

B. 7.2

C. 18

D. 36

Answer: A

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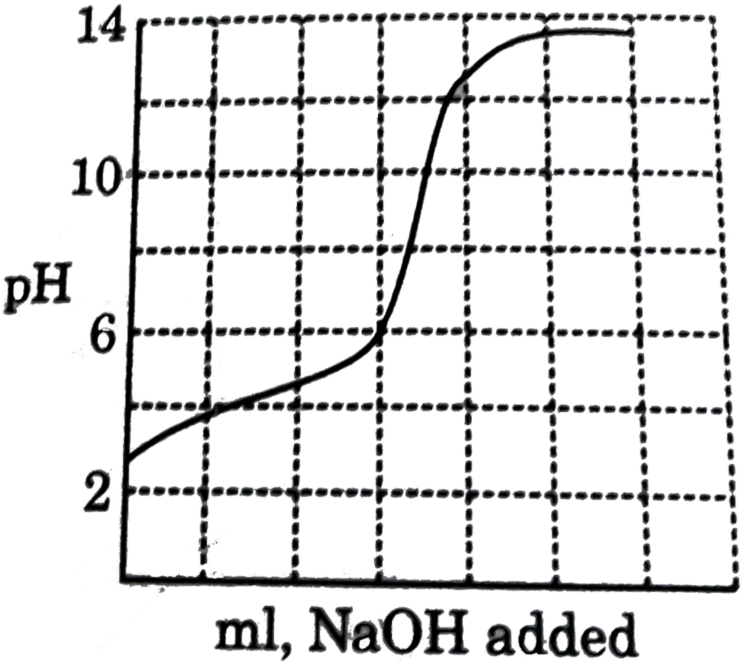
7. The curve represents the titration of a weak monoprotic acid. Ovar what pH range (s) will the acid being titrated, serve as a buffer when mixed with its salt ?



(P) $pH 4-6$

(Q) $pH 9-9$

(R) $pH 12-13$

A. P only

B. Q only

C. P and R only

D. P,Q and R

Answer: A

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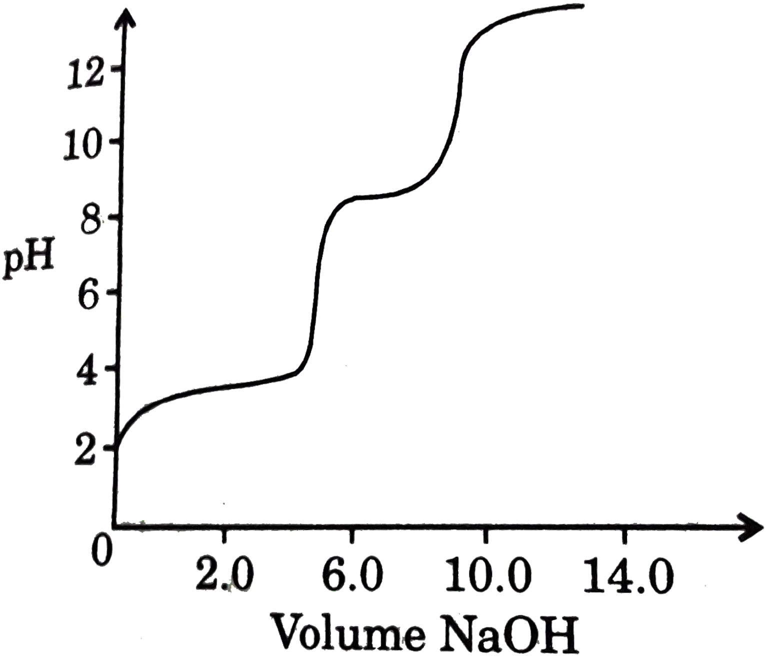
8. The curve represents the titration of :



A. a diprotic acid

B. two monoprotic acids with the same K_{a^s} but different concentrations.

C. two monoprotic acid with different K_{a^s} but the same concentrations

D. two monoprotic acids with different K_{a^s} and different concentrations.

Answer: D

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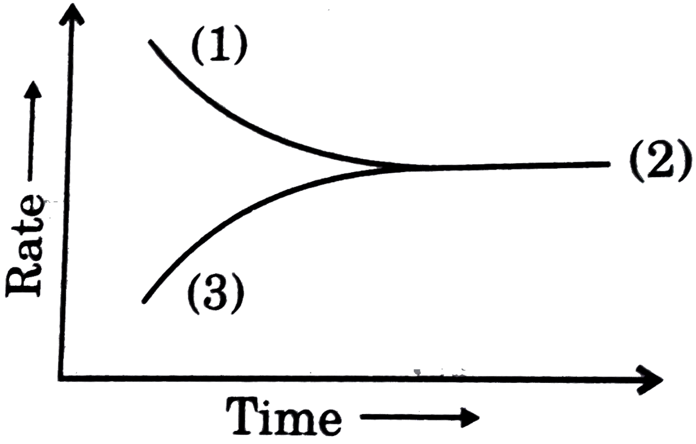
G. Chemical Equilibrium

1. In the reaction :

$NH_4CI(g) \Leftrightarrow NH_3(g) + HCI(g)$

A graph is plotted to show that the variation of the rate of forward and backward reaction against time. Which match is correct ?



A.

$Q > K$	$Q = K$	$Q < K$
3	2	1

B.

$Q > K$	$Q = K$	$Q < K$
2	3	1

C.

$Q > K$	$Q = K$	$Q < K$
1	2	3

D.

$Q > K$	$Q = K$	$Q < K$
2	1	3

Answer: A

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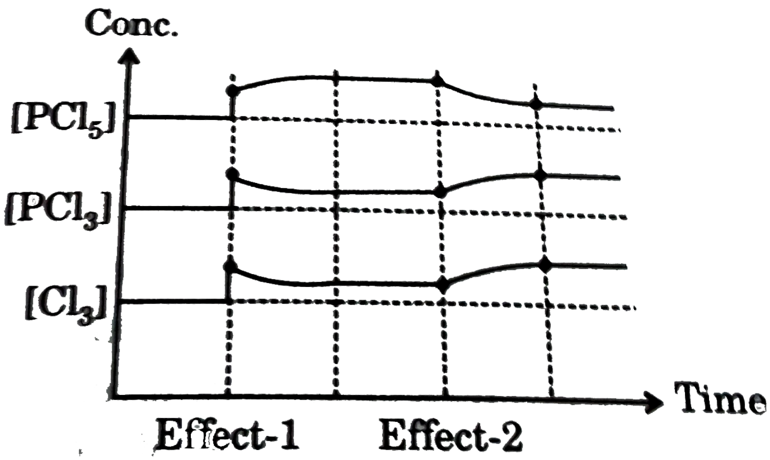
Chemical Equilibrium

1. Consider given endothermic reaction at equilibrium, $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$. A graph is ploted between concentration and time as shown. Effect-1 and Effect-2 is due to respectively are :



A. P increase, T increase

B. P increase, T decrease

C. Inert gas added at constant pressure, T increase

D. P decrease, T decrease

Answer: A

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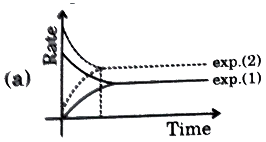
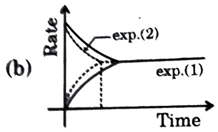
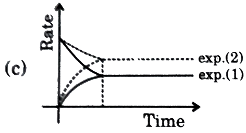
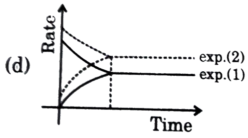
2. In two different experiments, equilibrium $A(g) \Leftrightarrow B(g)$ is established by initially taking reactant only. In first experiment, reaction is carried out in absence of catalyst and in second experiment reaction is carried out in presence of catalyst, then, which of the following curve of rate us time for forward and backward reaction hold true in these two experiments ?

A. 

B. 

C. 

D. 

Answer: A

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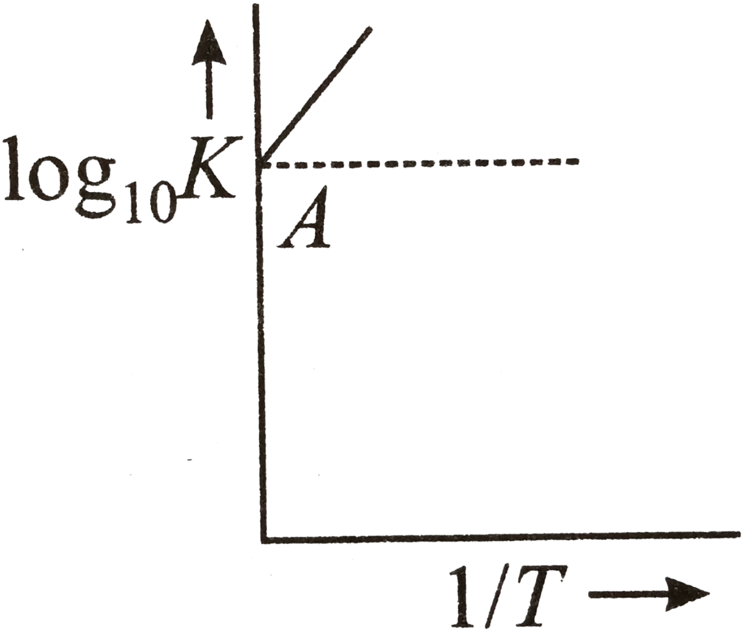
3. Variation of $\log_{10} K$ with $\frac{1}{T}$ is shown by the following graph in which straight line is at 45°, hence ΔH° is:



A. $+4.\ 606 cal$

B. $-4.606 cal$

C. $2 cal$

D. $-2 cal$

Answer: B

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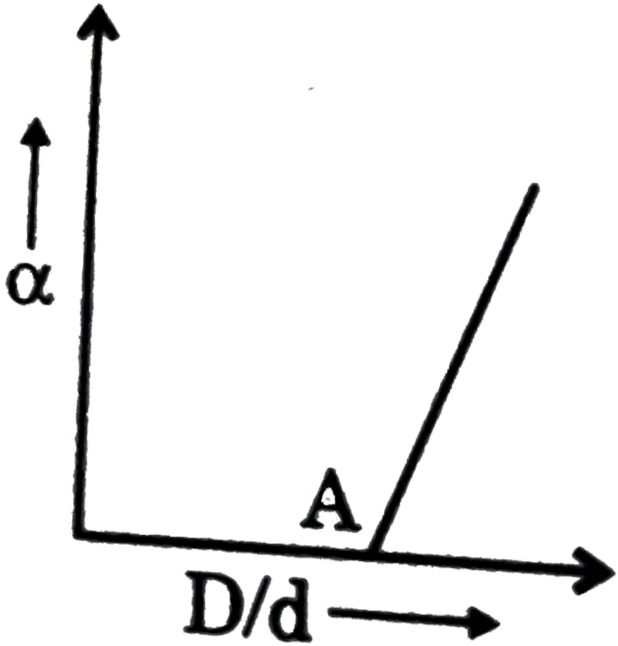
4. Before equilibrium is set-up the chemical reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$, vapour density d of the gaseous mixture was measured. If D is the theoretica value of vapour density, variation of α with D/d is given by the graph below. What is value D/d at point A` ?



A. 1

B. 0.5

C. 1

D. 1.5

Answer: C

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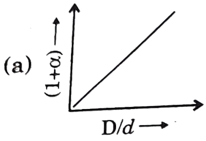
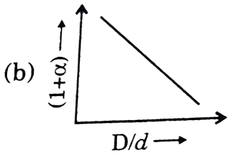
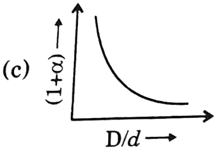
5. In the dissociation of N_2O_4 into NO_2. $(1+x)$ values with the vapour densities ratio $\left(\frac{D}{d}\right)$ is given by :

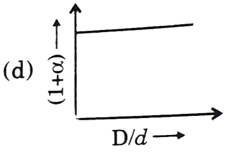


A.



B.

C. 

D. 

Answer: A

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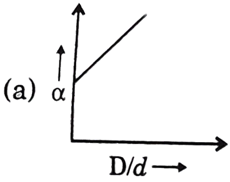
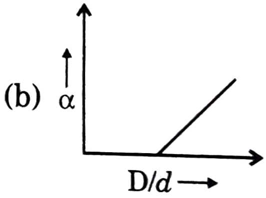
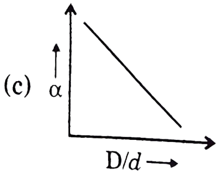
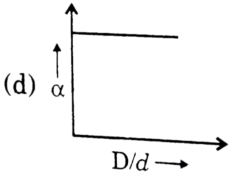
6. In the dissociation of N_2O_4 into NO_2O_4 into NO_2, α varies with $\left(\frac{D}{d}\right)$ according to: [α degree of dissociation, D-vapour density before dissociation, d-vapour density after dissociation]

A. 

B. 

C. 

D. 

Answer: B

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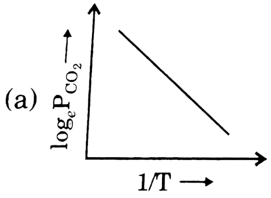
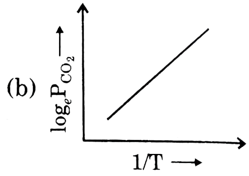
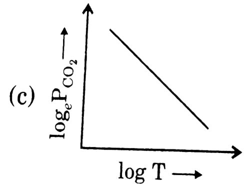
7. For the chemical equilibrium,

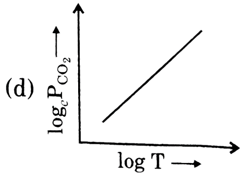
$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$\Delta_r H^{\ominus}$ can be determined from which one of the following plots?

A. 

B. 

C. 

D. 

Answer: A

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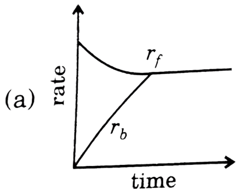
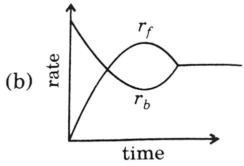
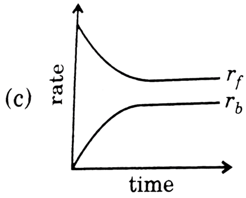
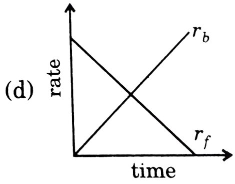
8. Rate of reaction curve for equilibrium can be like: $\left[r_f =\right.$ forward rate, $r_b =$ backward rate]

A. 

B. 

C. 

D. 

Answer: A

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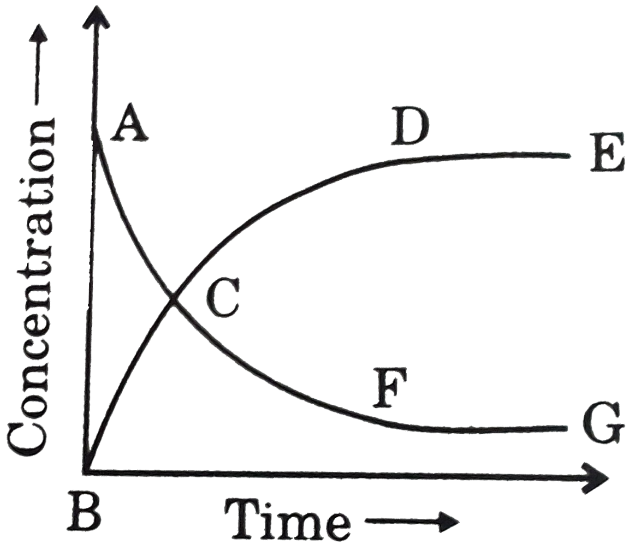
9. $N_2O_4(g) \Leftrightarrow 2NO_2(g), K_c = 4.$ This reversible reaction is studied graphically as shown in figure. Select the correct statements out of P,Q and R.

(P) Reaction quotient has maximum value at point A

(Q) Reaction proceeds left to right at a point when $[N_2O_4] = [NO_2] = 0.1M$

(R) $K_c = Q$ when point D or F is reached



A. P,Q

B. Q,R

C. P,R

D. P,Q,R

Answer: B

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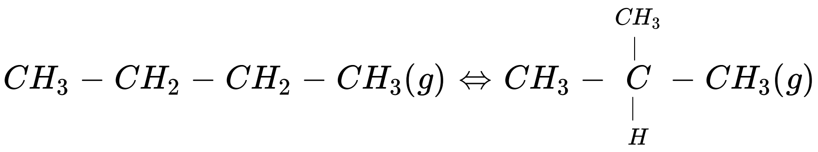
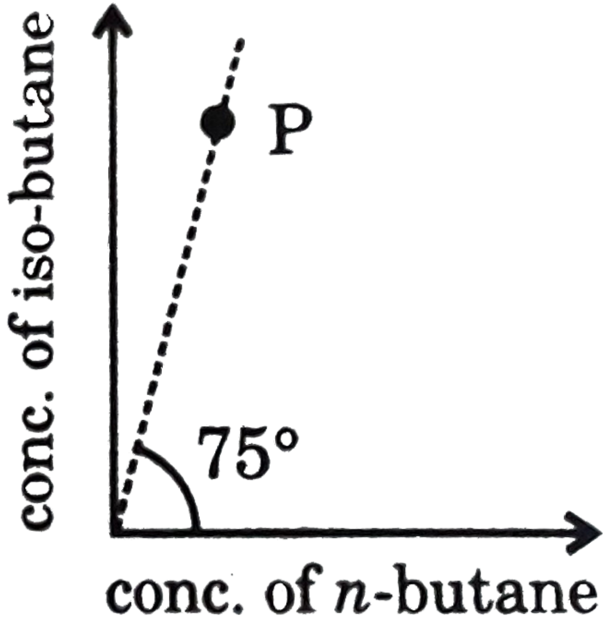
10. For the equilibrium,



$$CH_3-CH_2-CH_2-CH_3(g) \Leftrightarrow CH_3-\underset{H}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_3(g)$$

equilibrium constant is found to be 1.732 at 298 K. Now if in a vessel at 298K, a mixture of these two gases be taken as represented by the point P in the figure, predict what will happen:



A. immediately, above equilibrium will be setup

B. above reaction will go in the forward direction till it attains equilibrium

C. above reaction will go in the backward direction till it attains equilibrium

D. nothing can be said

Answer: C

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11. For the given endothermic reaction, $A(g) \Leftrightarrow 2B(g)$ The variation in concentration due to different changes is plotted. Neglect the slope of change in concentration. Changes are carried out very fast. Given the correct order of initials T (true) of F (false) for following statements.

(P) Effect-I is decrease in temperature at constant volume

(Q) Effect-II is decrease in total equilibrium pressure by changing volume.

(R) Effect-III is addition of B only at constant volume

A. FTT

B. TFT

C. TFF

D. TTT

Answer: D

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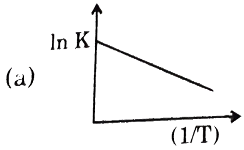
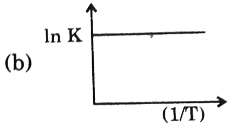
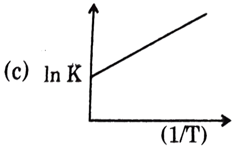
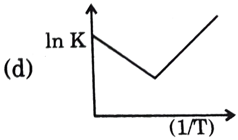
12. A particular reversible reaction shifts towards reactant side if temperature is increased. Which of the following is true for the reaction ?

A. 

B. 



C.



D.

Answer: C

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13. Which plot involving vapour pressure (VP) and absolute temperature results in a straight line ?

A. Vp us T

B. VP us T^{-1}

C. ln VP us T

D. ln VP us T^{-1}

Answer: D

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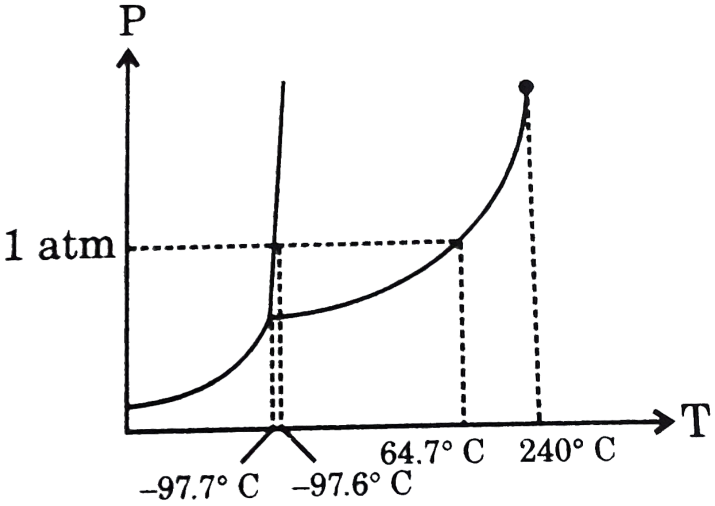
14. According to the phase diagram of methanol shown below, which statement is correct ?



A. Solid methanol has a greater density than liquid methanol

B. Solid methanol sublimes at atmospheric pressure

C. Solid, liquid and gaseous methanol can only coexist at pressure above 1 atm

D. At $200^\circ C$ and 1 atm pressure, methanol is a supercritical fluid

Answer: A

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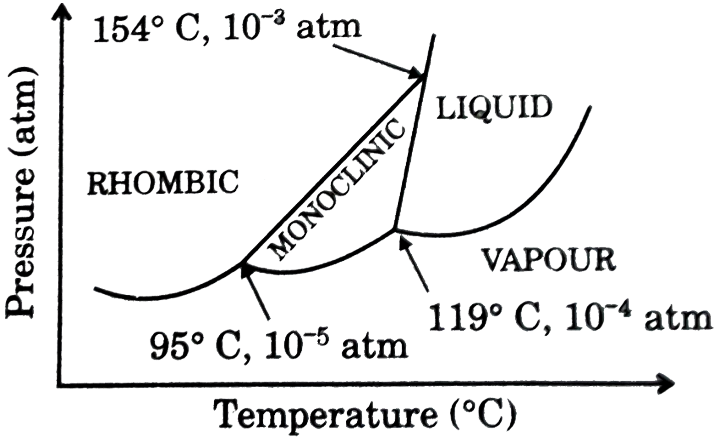
15. The phase diagram for sulphur is shown below. Which statement about this diagram is correct ?



A. The critical point is above $154^\circ C$ and 10^3 atm.

B. There are only two triple points in this diagram.

C. Monoclinic sulphur is more dense than rhombic sulphur at any temperature.

D. Monoclinic sulphur forms rhombic sulphur at higher pressure or lower temperature

Answer: D

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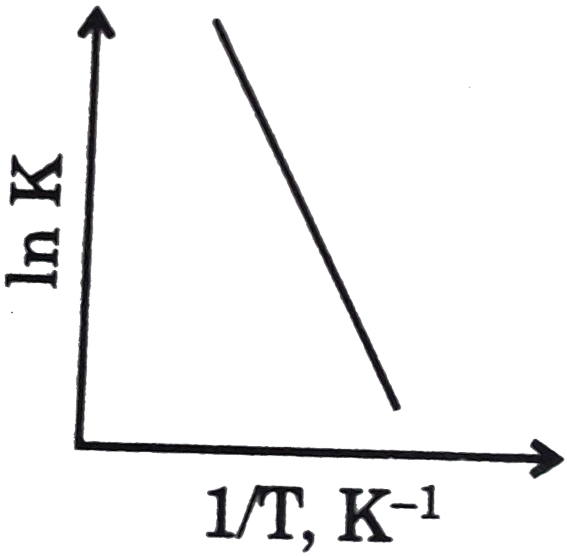
16. What quantity is represented by the slope of the line in this graph of the temperature dependence of the natural log of an equilibrium constant ?



A. $-\Delta G^{\circ}$

B. $-\Delta G^{\circ} / R$

C. $-\Delta H^{\circ}$

D. $-\Delta H^{\circ} / R$

Answer: D

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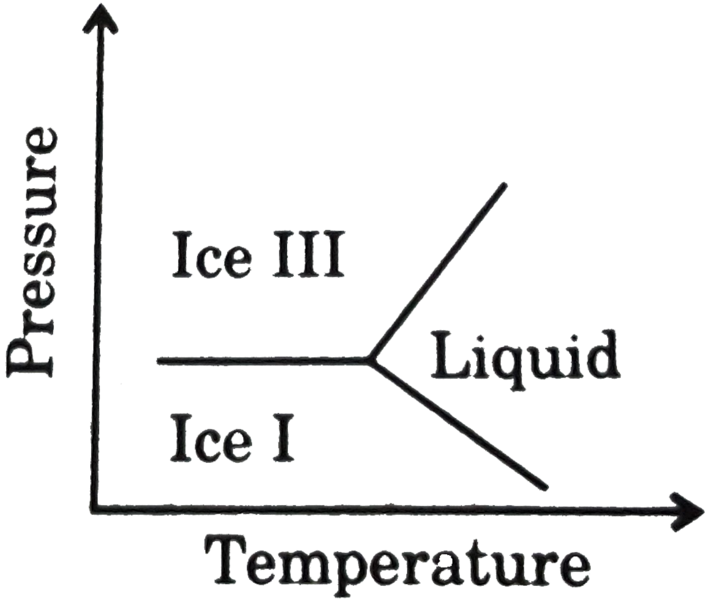
17. Water ice exists in several different form depending on the pressure and temperature. A proton of the phase diagram for ice I, ice III and liquid water is shown below. Which statement about the densities of these three phases is correct ?



A. The density of liquid water is greater than the densities of either ice I or ice III.

B. The density of ice I is greater than the densities of either ice III or liquid water.

C. The density of ice III is greater than the densities of either ice I or liquid water

D. The densities of ice I and ice III are equal and greater than the density of liquid water.

Answer: C

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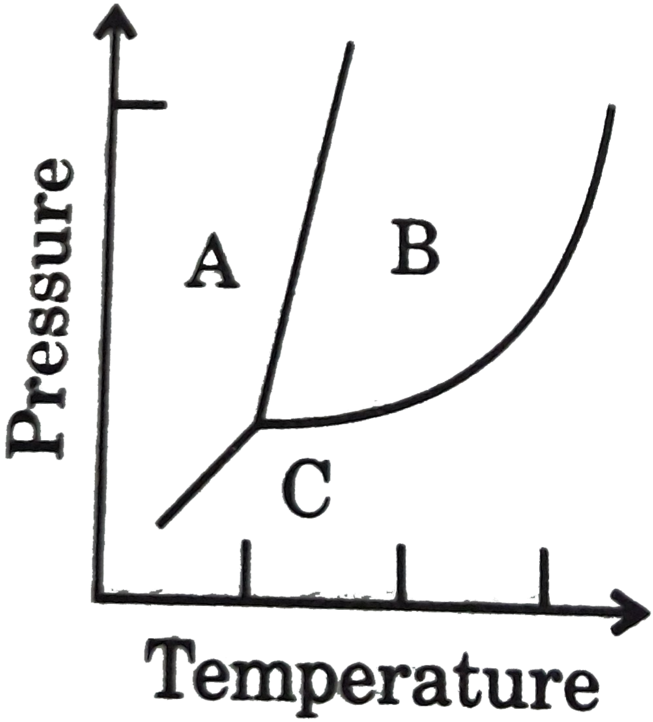
18. Under certain conditions, CO_2 melts rather than sublimes, CO_2 which transition in the phase diagram does this change correspond ?



A. $A \rightarrow B$

B. $A \rightarrow C$

C. $B \rightarrow C$

D. $C \rightarrow B$

Answer: A

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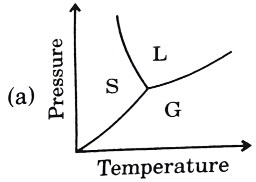
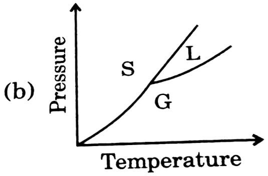
19. Which of the following graphs is the correct phase diagram of a substance whose melting point increases with pressure ?

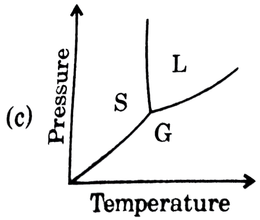
A.



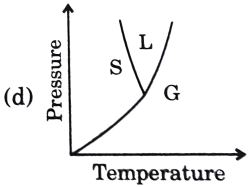
B.



C.



D.



Answer: B

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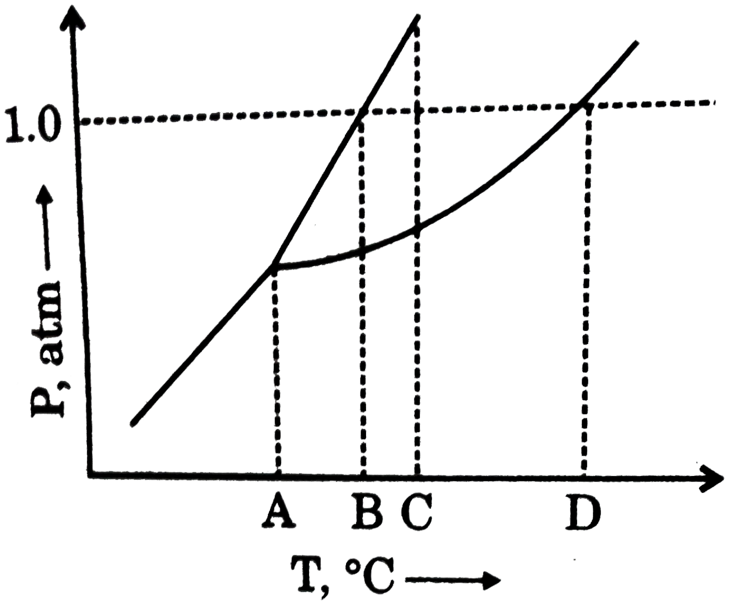
20. What is the normal melting point of the substance represented by the phase diagram ?



A. A

B. B

C. C

D. D

Answer: B

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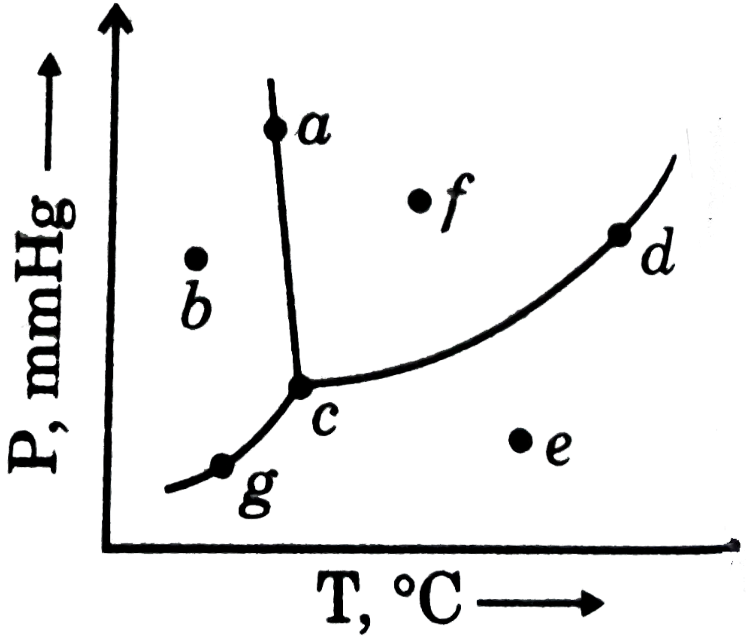
21. Which points in this phase diagram represent conditions of temperature and pressure where liquid will be present ?



A. a,b and g only

B. a,c,d and g only

C. a,c,d and f only

D. c,d,e and g only

Answer: C

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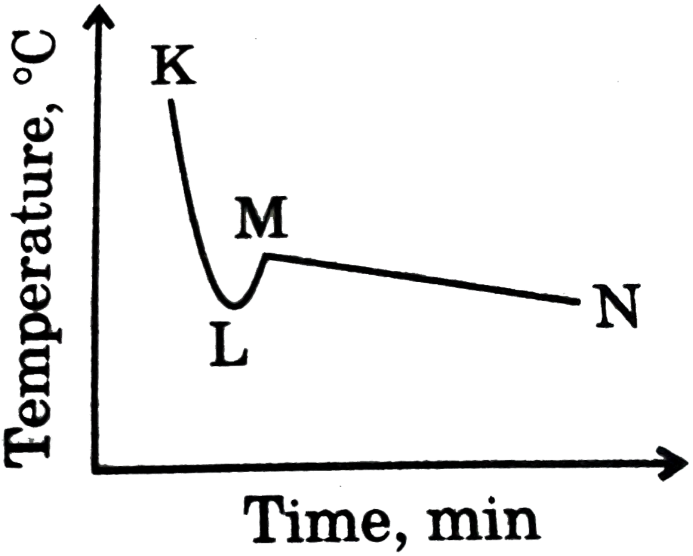
22. The curve shown results when a liquid is cooled. What temperature is closest to the freezing point of the liquid ?



A. L

B. M

C. $\dfrac{L+M}{2}$

D. $\frac{M+N}{2}$

Answer: B

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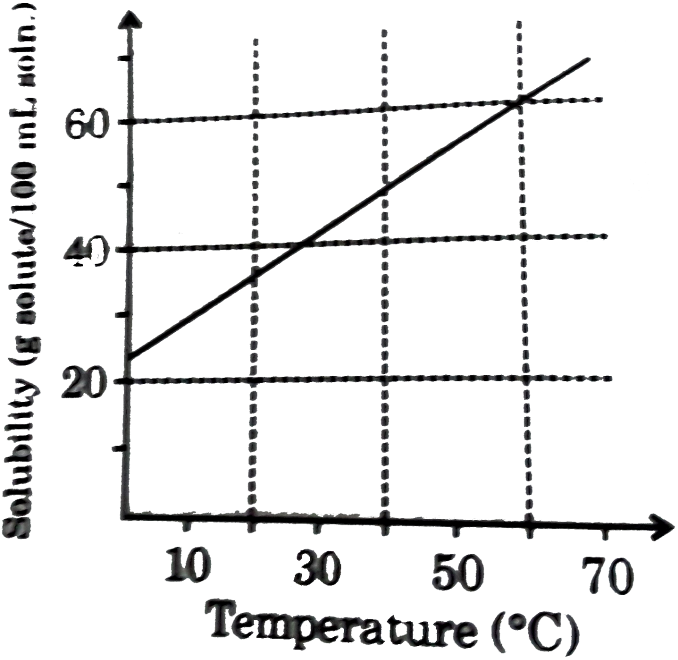
23. According to the solubility curve shown, how many grams of solute can be recrystallized when 20 mL of a saturated solution at $60^{\circ}C$ are cooled to $0^{\circ}C$?



A. 7.0

B. 12

C. 25

D. 35

Answer: A

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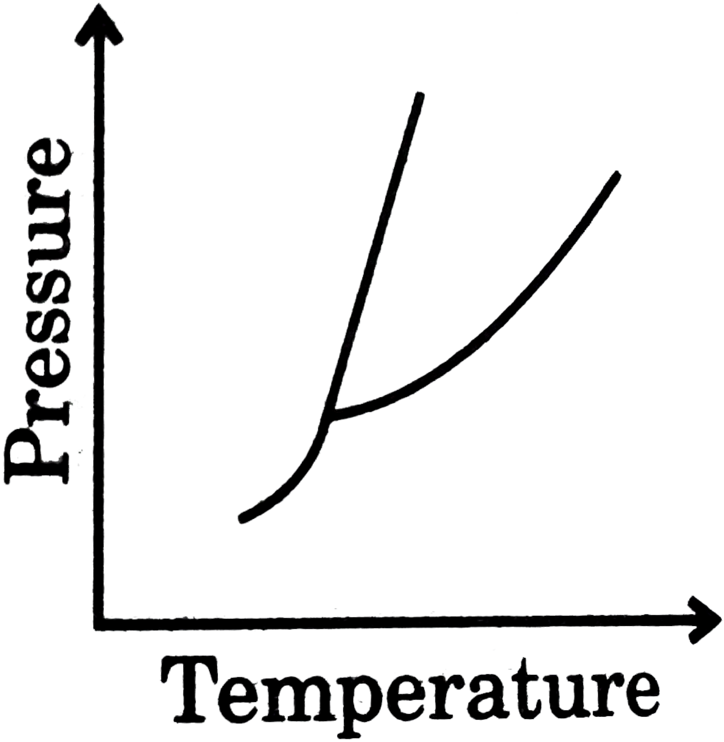
24. According to the phase diagram, what would be the effect of increasing the pressure on this substance ?



A. Decrease in both the melting and boiling points

B. Increase in both the melting and boiling points

C. Increase in the melting point and decrease in the boiling point

D. Decrease in the melting point and increase in the boiling point

Answer: B

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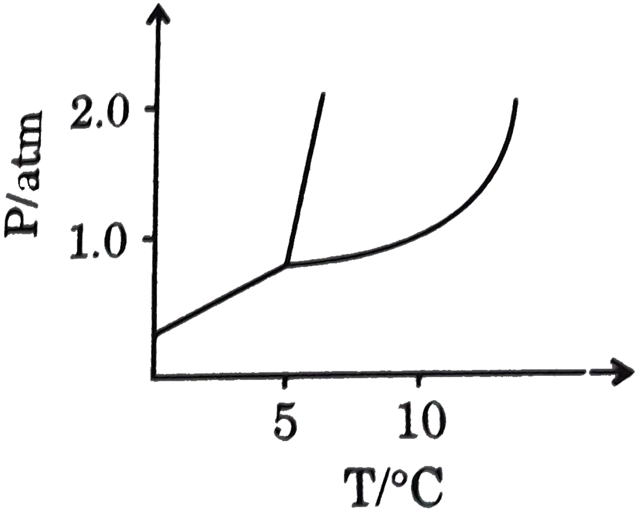
25. According to the phase diagram shown, in what state does not represented substance exist at 1.0 atm and $0.0^\circ C$?



A. Solid only

B. Liquid only

C. Gas only

D. Solid and liquid only

Answer: A

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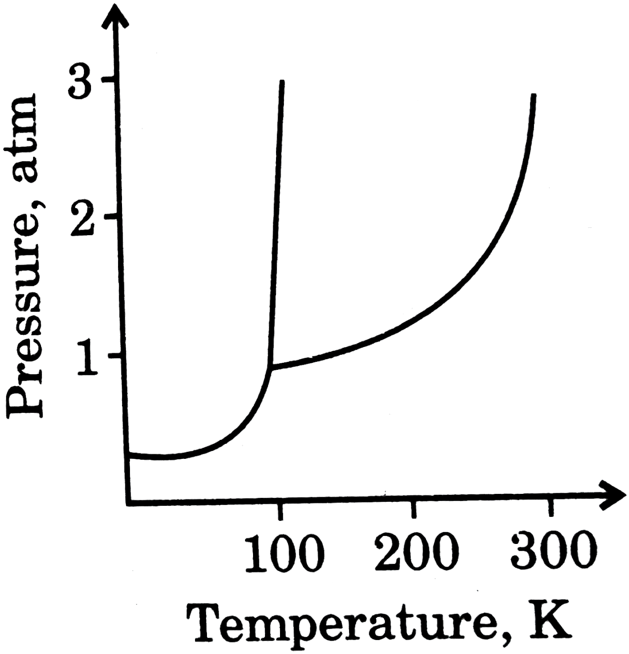
26. Which statement is correct about the substance represented by this phase diagram ?



A. The solid sublimes at 1 atm pressure

B. Its normal boiling point is above 300 K

C. It exists as a liquid at $25^\circ C$ and 1 atm pressure

D. The density of the solid is greater than that of the liquid

Answer: D

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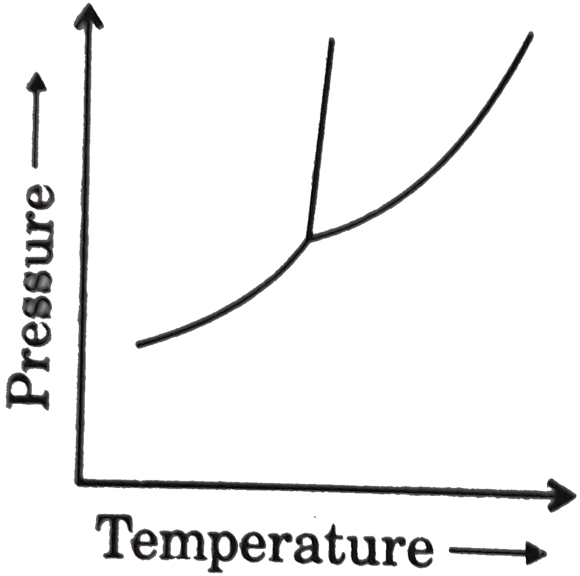
27. According to this phase diagram, which phases can exist at pressure lower than the triple point pressure ?



A. Gas only

B. Solid and gas only

C. Liquid only

D. Solid and liquid only

Answer: B

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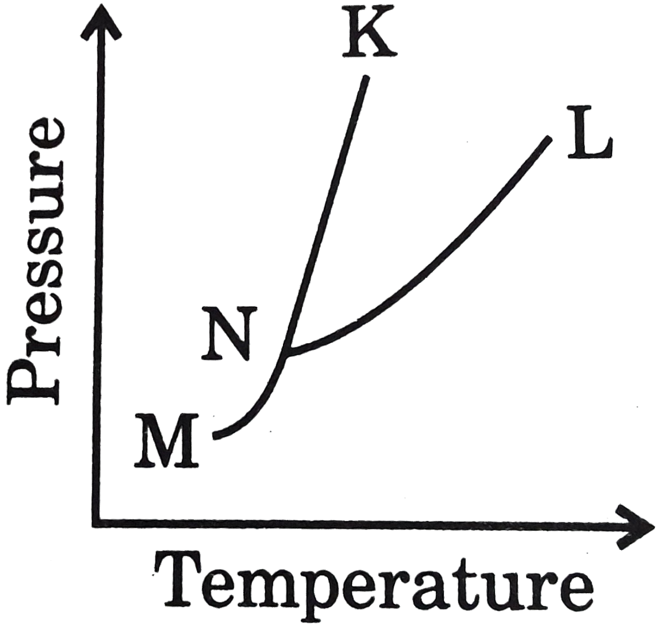
28. According to the phase diagram shown, where does a mixture of solid and liquid exist at equilibrium ?



A. Along line MN

B. Along line KN

C. Along line LN

D. In the region KNL

Answer: B

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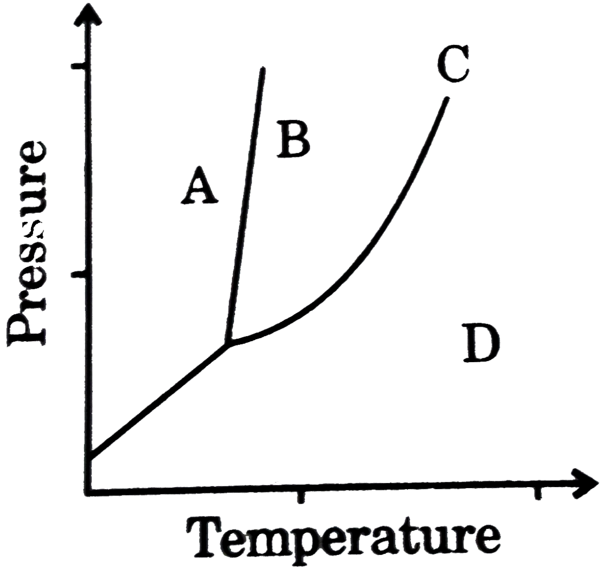
29. Supercritical carbon dioxide exists at which point on the accompanying phase diagram ?



A. A

B. B

C. C

D. D

Answer: C

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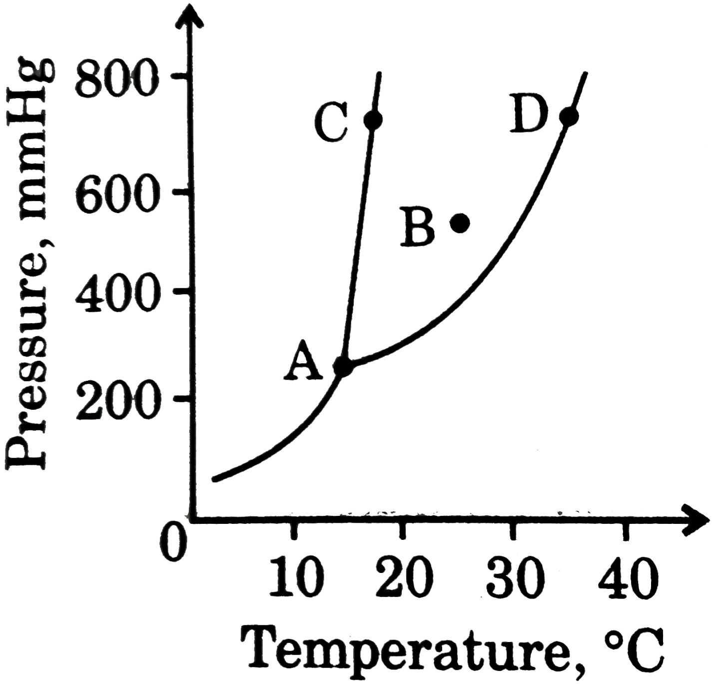
30. Which point on the phase diagram represents the normal boiling point?



A. Point A

B. Point B

C. Point C

D. Point D

Answer: D

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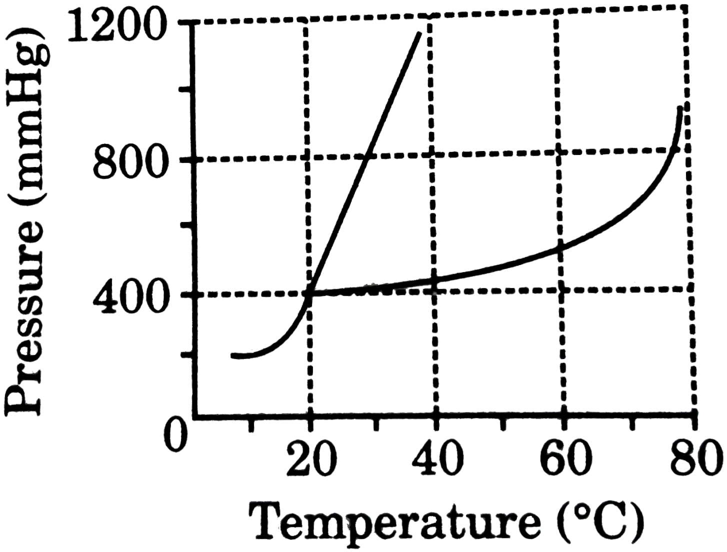
31. What can be concluded about the substance represented by this phase diagram ?



A. The normal boiling point of the liquid is $80^\circ C$

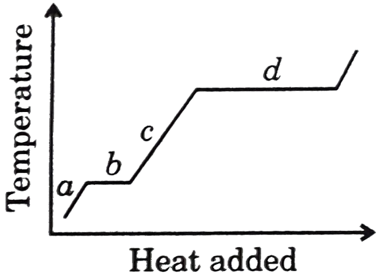
B. The solid is more dense than the liquid

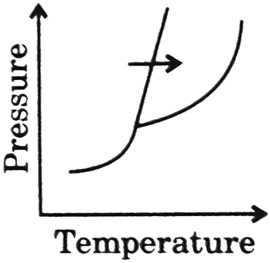
C. The solid sublimes at temperatures above $20^\circ C$.

D. The vapour can be converted to liquid by compressing it at temperatures below $20^\circ C$

Answer: B

32. Which segment of the heating curve obtained at constant pressure corresponds to the transition denoted by the arrow in the phase diagram ?





A. a

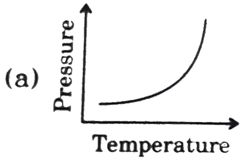
B. b

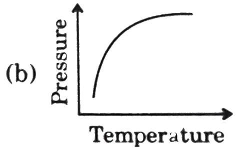
C. c

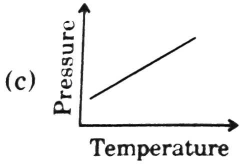
D. d

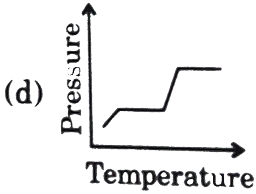
Answer: B

33. Which graph best represents the vapour pressure of water as a function of temperature from $0^{\circ} C$ to $100^{\circ} C$?

A. 

B. 

C. 

D. 

Answer: A

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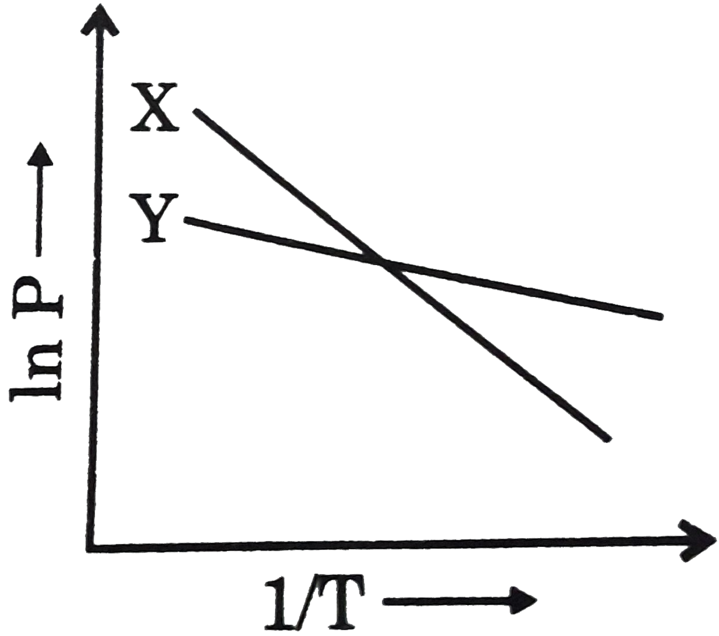
34. According to the graph (ln vapour pressure us $1/T$) what can be concluded about the enthalpies of vaporization (ΔH_{vap}) of liquids X and Y ?



A. $\Delta H_{vap}X > \Delta H_{vap}Y$

B. $\Delta H_{vap}X = \Delta H_{vap}Y$

C. $\Delta H_{vap}X < \Delta H_{vap}Y$

D. No conclusions can be drawn about the relative ΔH_{vap} values from this diagram.

Answer: A

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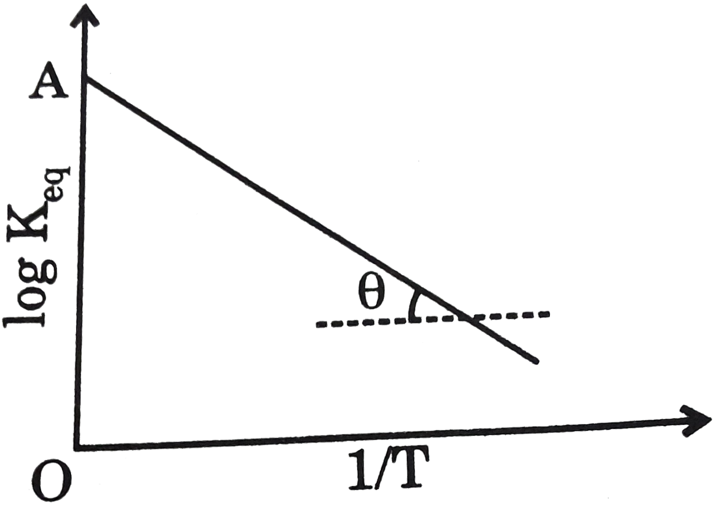
35. For a hypothetical reaction: $A(g)+B(g) \Leftrightarrow C(g)+D(g)$ a graph between log K_{eq} and T^{-} is striaght line as follows, where $\theta=\tan^{-1}0.5$ and $OA=1.0$ (S.I. units) Assuming ΔH° is independent of temperature, the equilibrium constant at 298 K will be:



A. 10.002×10^9

B. 3.79×10^8

C. 7.96×10^9

D. 9.96×10^9

Answer: D

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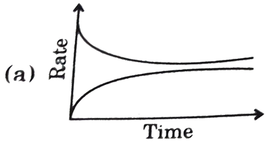
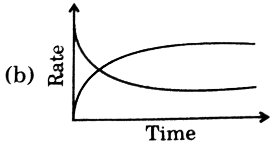
36. Which graph will show equilibrium, $R = P$?

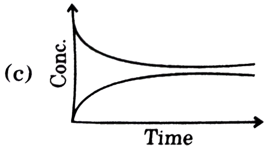
A.

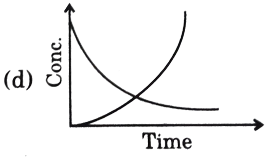


B.



C.



D. 

Answer: C

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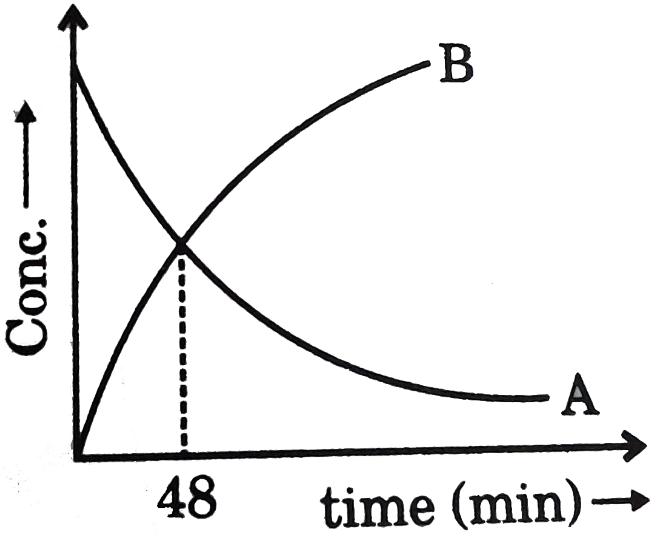
H. Chemical Kinetics

1. For a 1st order reaction, $nA \rightarrow B$ whose concentration vs time curve is shown ahead. If half life for the reaction is 24 minutes, the value of n is:



A. 1

B. 2

C. 3

D. 4

Answer: C

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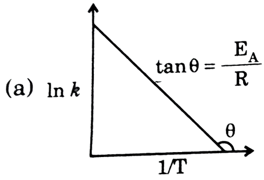
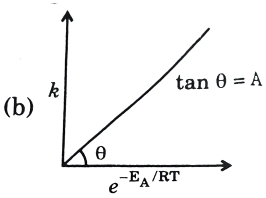
Chemical Kinetics

1. Which of the following graphs is incorrect regarding rate constant (k) and absolute temperature ? [Symbols have usual meaning]

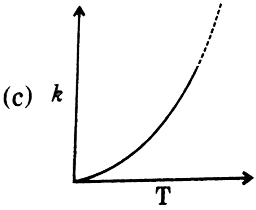
A.



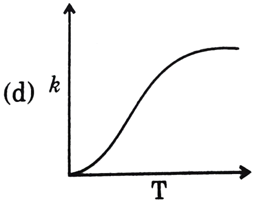
B.



C.



D.



Answer: C

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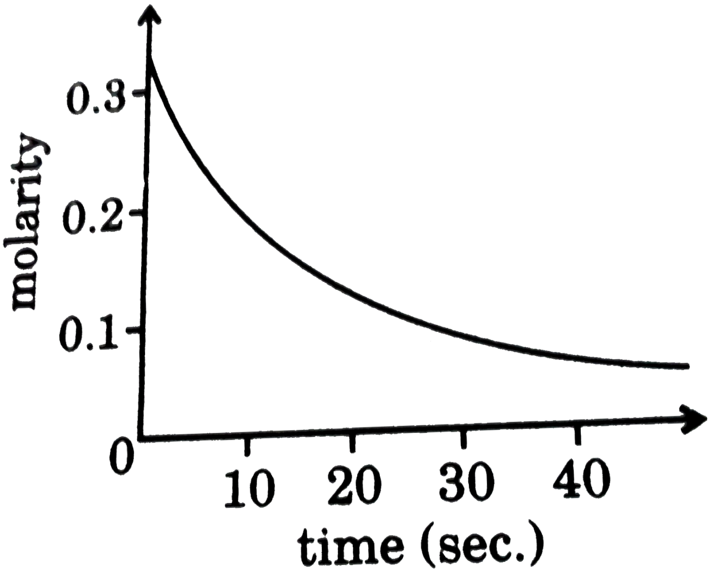
2. For the reaction represented by the accompanying diagram, which reaction rate is the greatest ?



A. Average rate

B. Final rate

C. Initial rate

D. Rate at 20 seconds

Answer: C

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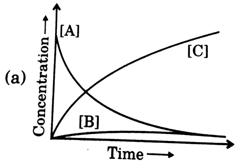
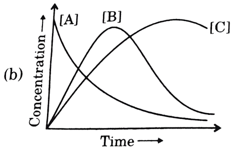
3. A substance A undergoes sequential reaction as shown

$A \xrightarrow{1000\,\text{sec}^{-1}} B \xrightarrow{10^8\,\text{sec}^{-1}} C$. Which of the following graph is correct regarding concentration of A,B and C ?

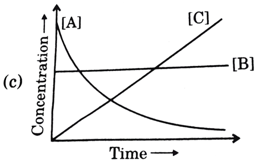
A.



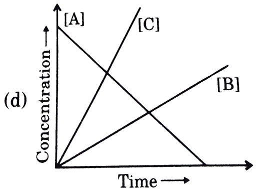
B.



C.



D.



Answer: A

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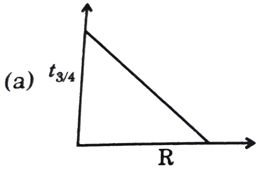
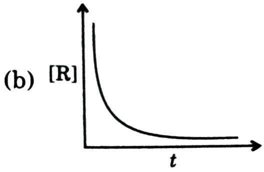
4. Which of the following graph is correct for a first order reaction of the type $R \rightarrow P$?

Where [] represents concentration.

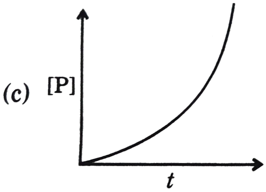
A.



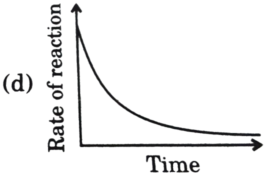
B.



C.



D.



Answer: D

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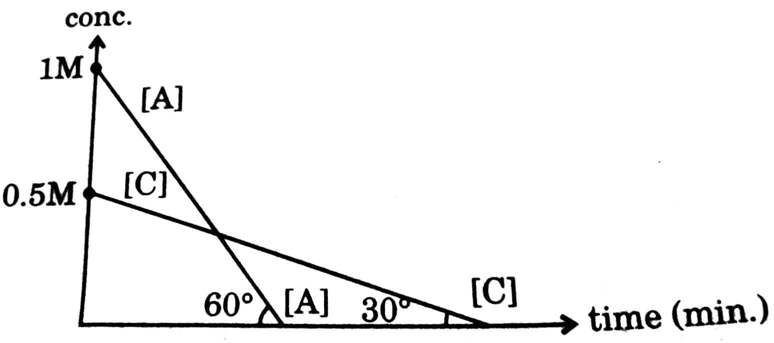
5. For the two reactions

Reaction I: $A \rightarrow B$

Reaction II: $C \rightarrow D$

following curves are plotted.



Which of the following is incorrect options ?

A. $(t_{100\,\%})_{\text{reaction I}} = \frac{2}{3}(t_{100\,\%})_{\text{reaction II}}$

B. $[A] = [C]$ at $t = \frac{\sqrt{3}}{4}$ minutes

C. When $[B] = [A]$ at the time $[C] = [D]$

D. If both $[A]_0$ and $[C]_0$ are 1M then $(t_{50\,\%})_I = \frac{1}{3}(t_{50\,\%})_{II}$

Answer: C

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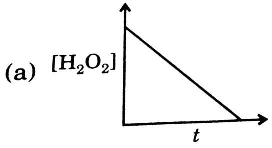
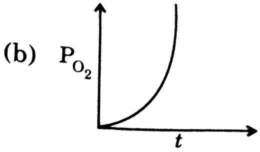
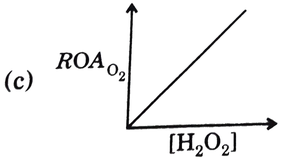
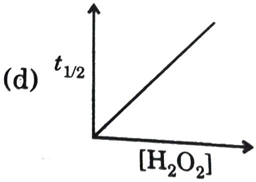
6. Which of the following graph is correct for disporportionation of H_2O_2 to given $H_2O(l)$ and $O_2(g)$?

Where [species] represents concentration of the species, P_{O_2} represents partial pressure of O_2 gas. ROA represents rate of appearance of O_2 and $t_{1/2}$ represents half life of H_2O_2.

A. 

B. 

C. 

D. 

Answer: C

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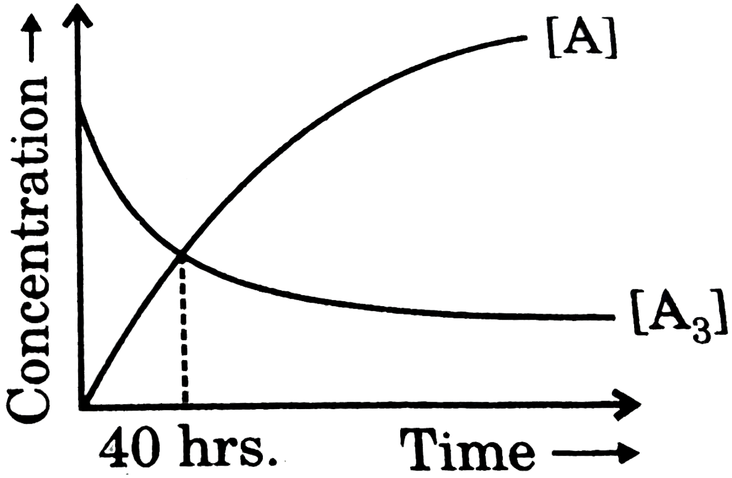
7. For a first order reaction: $A_3 \rightarrow 3A$, Following graph is observed when concentration vs. time graph is plotted. Identify the option which is correct.



A. Half life of the reaction will be 20 hrs

B. The coordinates of the point of interaction will remain same even if initial concentration is changed.

C. Concentration of A will be 3 times that of A_3 in 20 min.

D. If the reaction occurs in a rigid container at constant temperature pressure will decrease.

Answer: B

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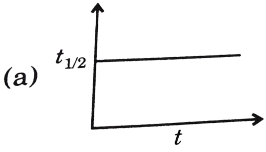
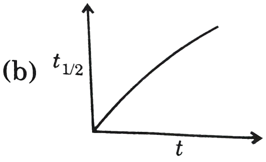
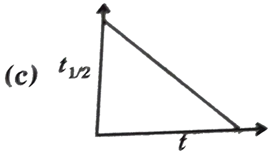
8. Which of the following graph is correct w.r.t half life for a zero order reaction at various stages of reaction ?

A.

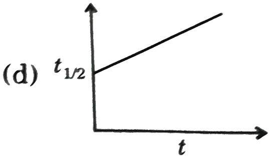




B.



C.



D.

Answer: C

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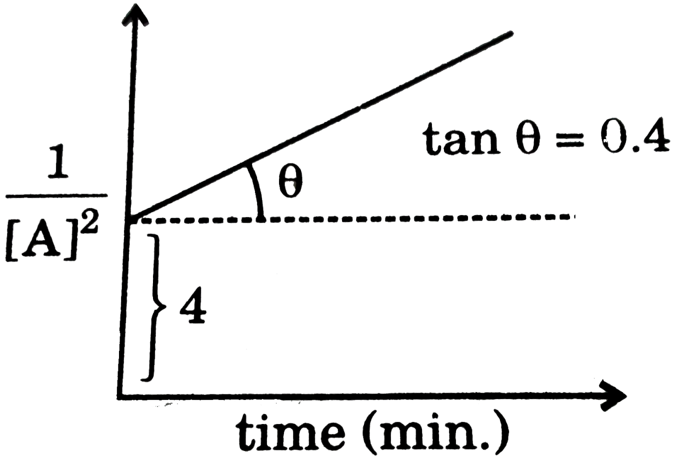
9. For a reaction $A \rightarrow$ Product, a graph plotted between $\frac{1}{[A]^2}$ vs time is found to be linear with slope = 0.4 and y intercept equal to 4 as shown. The rate of disapparance of A at the initial stages will be:



[A] is in terms of molarity

A. $0.025M/\text{sec}$

B. $4.16\times10^{-4}M/\text{sec}$

C. $8.33\times10^{-4}M/\text{sec}$

D. $0.05M/\text{sec}$

Answer: B

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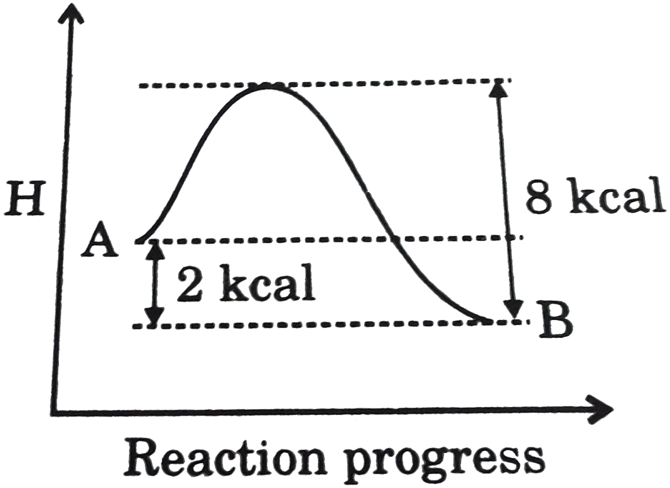
10. For a reversible factors in forward and backward direction are assumed to be equl. Select the incorrect option (s) on the basis of above graph. [take $R: = 2Cal/\text{mole} - K$]



A. $(E_a)_{\text{forward}} = 6Kcal/mol$

B. At 500K, fraction of molecules of A crossing energy barrier for backward reaction is e^{-8}.

C. At 500 K, fraction of molecules of B crossing energy barrier for backward reaction is e^{-8}.

D. Equilibrium constant for the reaction is e^{-2} at 500K temperature.

Answer: D

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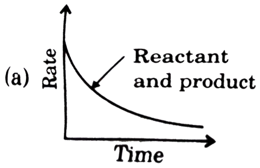
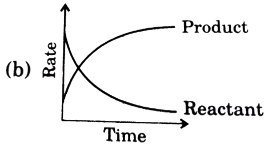
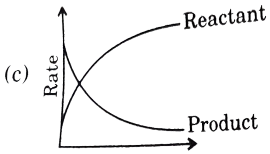
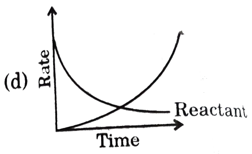
11. Consider the reaction : $A \rightarrow B$. The concentration of both reactant and product varies exponentially with time. Which of the following figure correctly describes the rate of reactant and product with time ?

A. 

B. 

C. 

D. 

Answer: A

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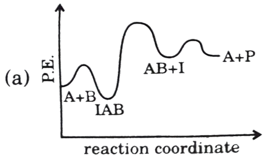
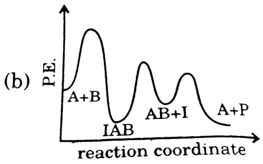
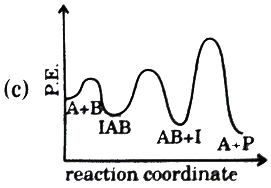
12. The following mechanism has been proposed for the exothermic catalyzed cmplex reaction:

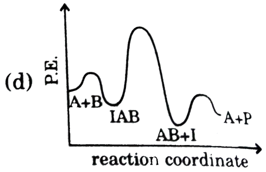
$$A+B\xrightarrow{\text{Fast}}IAB\xrightarrow{k_1}AB+I\xrightarrow{k_2}P+A$$

If k_1 is much smaller than k_2, the most suitable qualitative plot of potential energy (PE) versus reaction coordinates for the above reaction is

A. 

B. 

C. 

D. 

Answer: D

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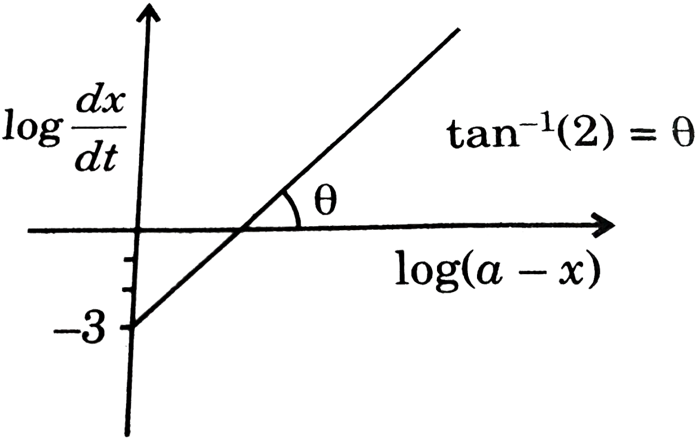
13. For an elementary reaction: $nA \rightarrow$ Product Find the value of n: [where a is initial] amount of A and x is amount reacted in tine t]



A. 2

B. -3

C. 3

D. 1

Answer: A

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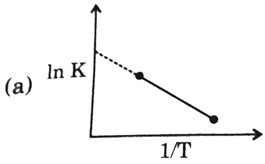
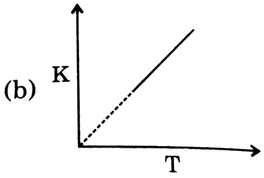
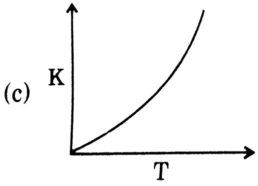
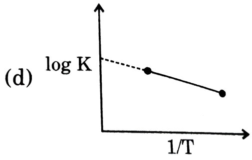
14. Which of the following graph is incorrect for variation of rate constant (K) with temperature for a reaction obeying Arrhenius equation ?

A. 

B. 

C. 

D. 

Answer: B

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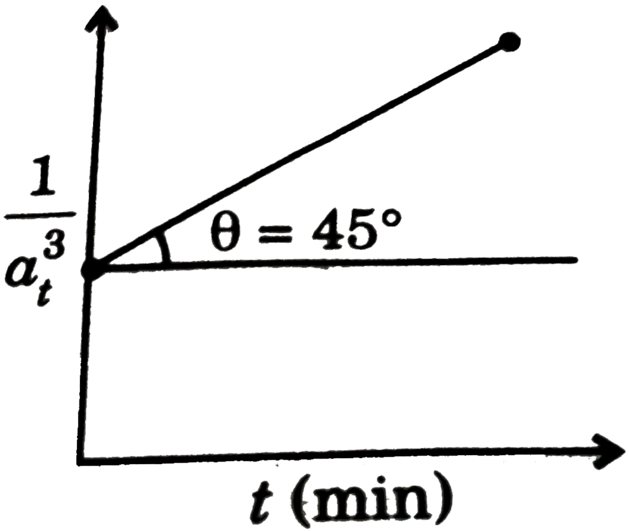
15. For a reaction $3A \rightarrow 2B$, following graph is obtained, calculate rate of reaction when concentration of A is $0.2M$.



A. $4 \times 10^{-4} M \text{ min} .^{-1}$

B. $\frac{16}{9} \times 10^{-4} M \text{ min }.^{-1}$

C. $1.6 \times 10^{-3} M \text{ min }.^{-1}$

D. $\frac{16}{3} \times 10^{-3} M \text{ min }.^{-1}$

Answer: B

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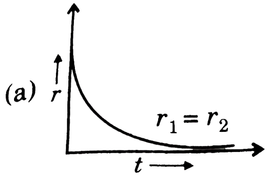
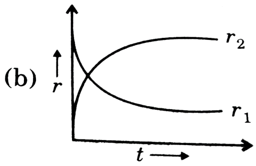
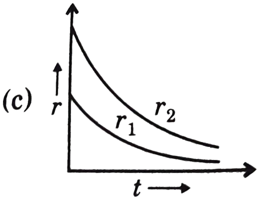
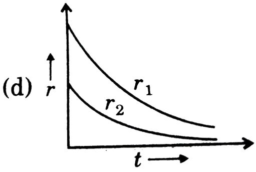
16. Consider the first order reaction: $A \rightarrow 2B$. Which of the following figure correctly describes the rate of disappearance of $A(r_1)$ and rate of appearance of $B(r_2)$ with time ?

A. 

B. 

C. 

D. 

Answer: C

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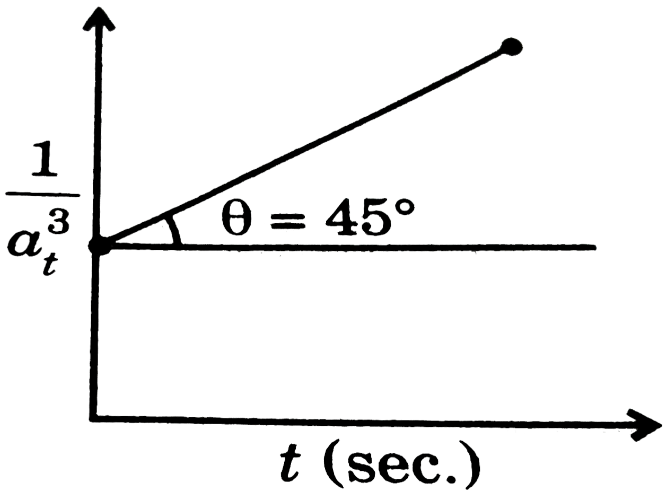
17. Which of the folloing characteristics are correct for a reaction in which the following graph is obtained ?



A. The order of the reaction will be 2nd.

B. The reaction will undergo 100% completion in finite time interval

C. Half life of the reactant will be inversely proportional of square to concentration of reactant

D. Rate of disappearance of reactant at 0.3M concentration is $2.7 \times 10^{-3} M \sec^{-1}$

Answer: D

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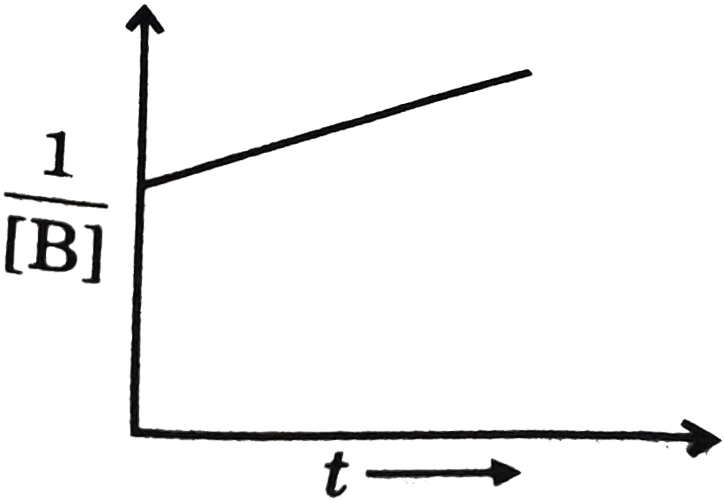
18. For a reaction $A + B \rightarrow C$, it is observed that half life of A (when B is taken in very large amount) is independent of concentration of A and the graph of $\frac{1}{[B]}$ us time is given below when $[A] = [B]$. What is order of reaction with respect to B ?



A. 4

B. 3

C. 2

D. 1

Answer: D

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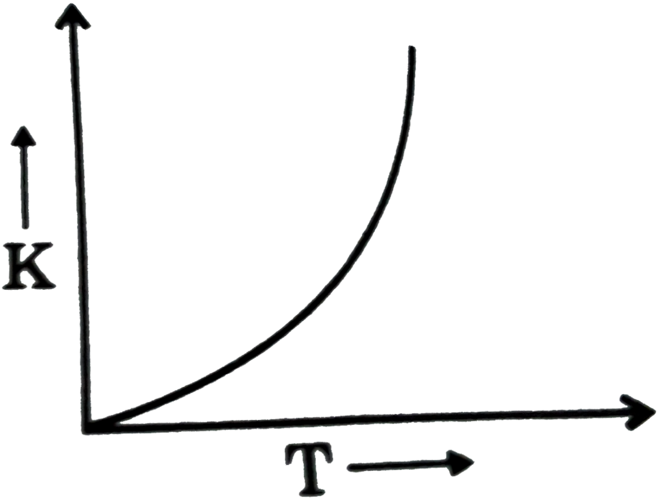
19. Rate constant vs temperature graph looks like: If the activation energy for the reaction is 100 kJ/mol, then what is the maximum temperature for this graph trend to be valid ? $\left(R=\frac{25}{3}J/mol/K\right)$



A. $10000K$

B. $12000K$

C. $120000K$

D. $1000K$

Answer: B

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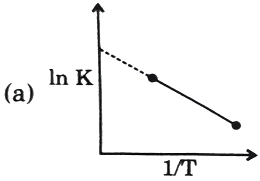
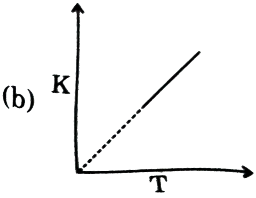
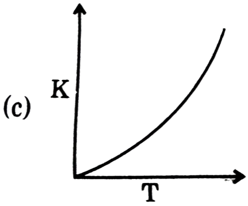
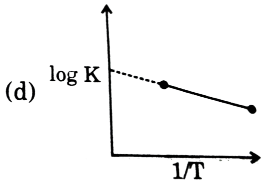
20. Which of the following graph is incorrect for variation of rate constant (K) with temperature for a reaction obeying Arrhenius equation ?

A. 

B. 

C. 

D. 

Answer: B

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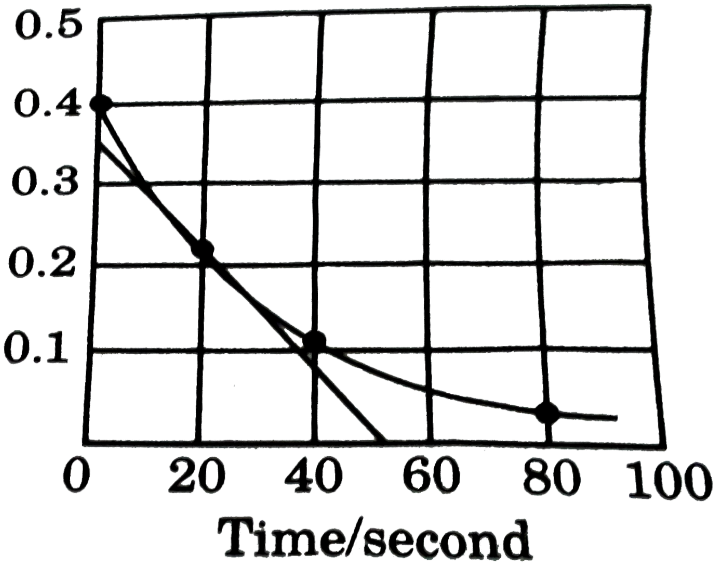
21. A reaction follows the given concentration (M) vs time graph. The rate for this reaction at 20 seconds will be :



A. $4 \times 10^{-3} M s^{-1}$

B. $8 \times 10^{-2} M s^{-1}$

C. $2 \times 10^{-2} M s^{-1}$

D. $7 \times 10^{-3} M s^{-1}$

Answer: D

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22. For a first order reaction, the reaction, the plot of $\log C$ against 't' (log C vs 't') gives a straight line with slope equal to:

A. $(k/2.303)$

B. $(-k/2.303)$

C. $(\ln k/2.303)$

D. $-k$

Answer: B

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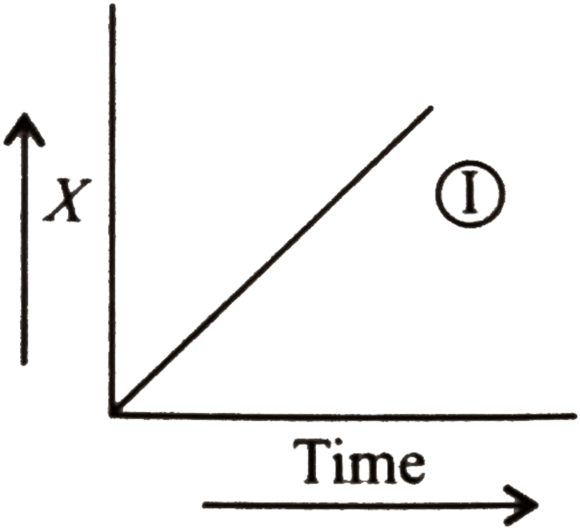
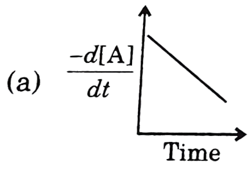
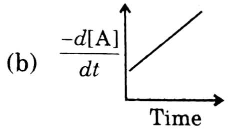
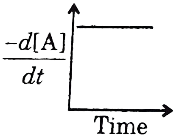
23. The graph between concentration (X) of the Product and time of the reaction $A \rightarrow B$ is of the type 1. Hence, graph between $-\frac{d[A]}{dt}$ and time will be of the type:



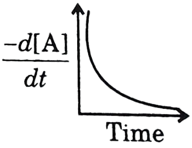
A. 

B. 

C. (c)



D. (d)



Answer: C

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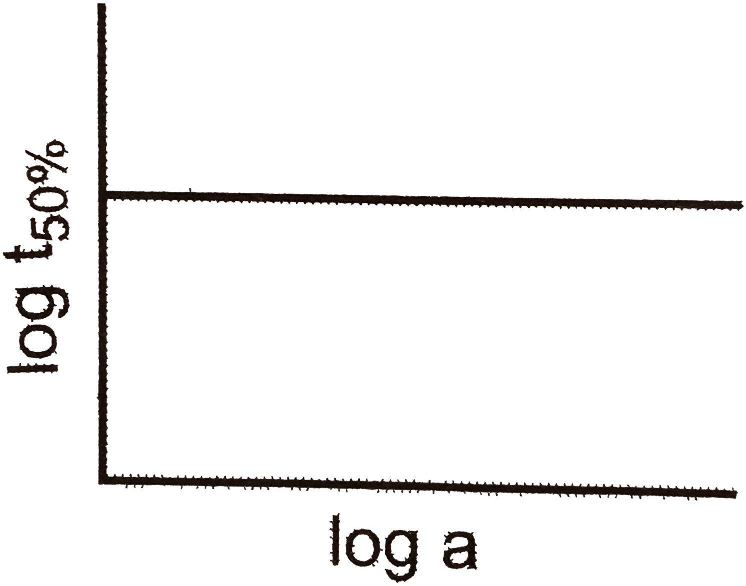
24. A graph plotted between log $t_{50\%}$ vs log concentration is a straight line. What conclusion can you draw from this graph?



A. $n = 1, t_{1/2} \propto a$

B. $n = 2, t_{1/2} \propto \frac{1}{a}$

C. $n = 1, t_{1/2} = (0.693/k)$

D. None of the above

Answer: C

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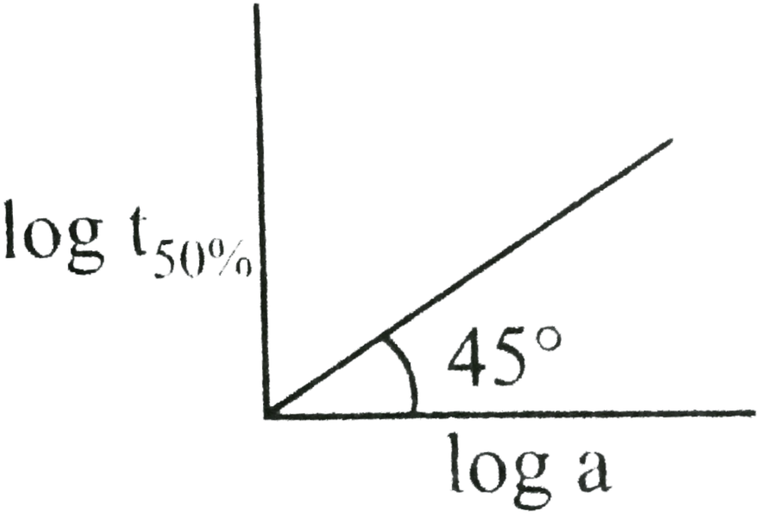
25. What will be the order of reaction and rate constant for a chemical change having $\log t_{50\%}$ versue log concentration of (a) curves as:



A. $0, 1/2$

B. $1, 1$

C. $2, 2$

D. $3, 1$

Answer: A

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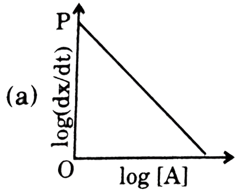
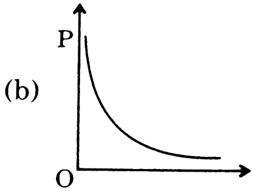
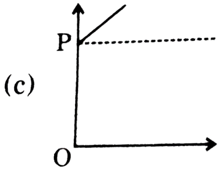
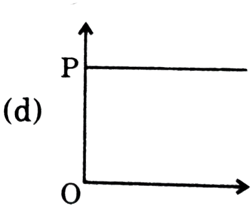
26. $A \rightarrow$ Product and $\left(\frac{dx}{dt}\right) = k[A]^2$. If log $\left(\frac{dx}{dt}\right)$ is plotted against log [A], then graph is of the type:

A. 

B. 

C. 

D. 

Answer: C

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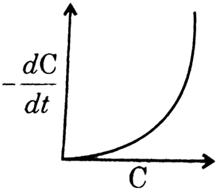
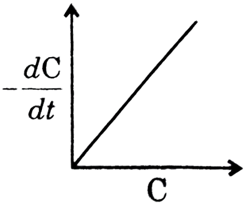
27. In the different reactions, involving a angle reactant in each case, a plot of rate of the reaction on the y-axis, versus concentratio of the reaction on the x-axis, yields three different curves shown below:

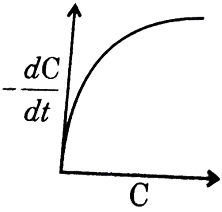
(P)



(Q)



(R)



What are the possible orders of the reactions (P), (Q),(R)?

A. 1,2,3

B. $2, 1, \frac{1}{2}$

C. 0,1,2

D. $0, 1, \frac{1}{2}$

Answer: B

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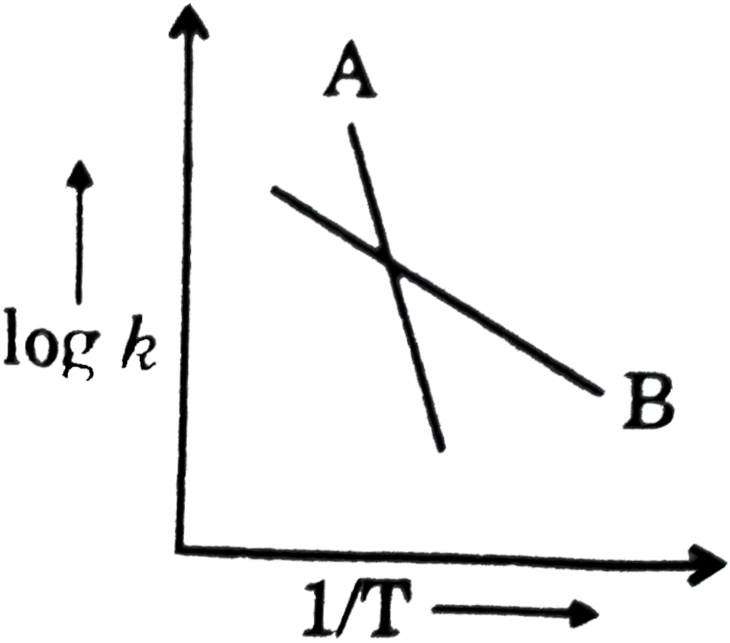
28. The Arrhenius relationship of two different reactions is shown below. Which reaction is faster at a lower temperature and which is more sensitive to changes of temperature ?



A. B faster, A more sensitive

B. B in both cases

C. A in both cases

D. A is faser, B more sensitive

Answer: A

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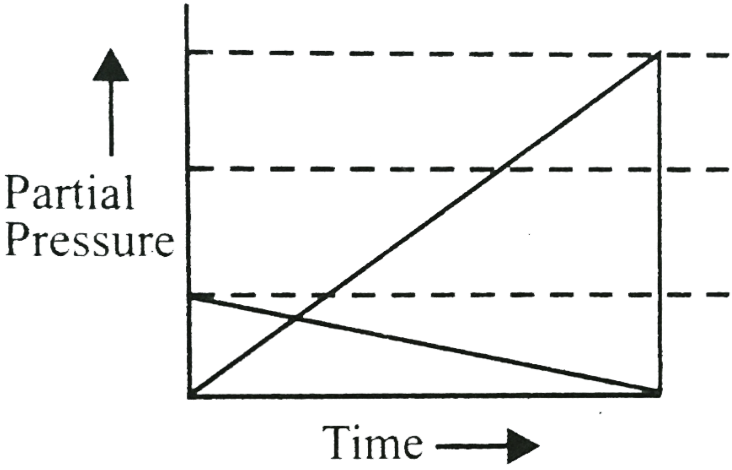
29. If for a reaction in which $A(g)$ converts to $B(g)$ the reaction carried out at const.

V & T results into the following grapg.



A. Then the reaction must be $A(g) \rightarrow 3B(g)$ and is first order reaction

B. Then the reaction must be $A(g) \to 3B(g)$ and is second order reaction

C. Then the reaction must be $A(g) \to 3(g)$ and is a zero order reaction

D. Then the reaction must be $A(g) \leftrightarrow 3B(g)$ and is a first order reaction

Answer: C

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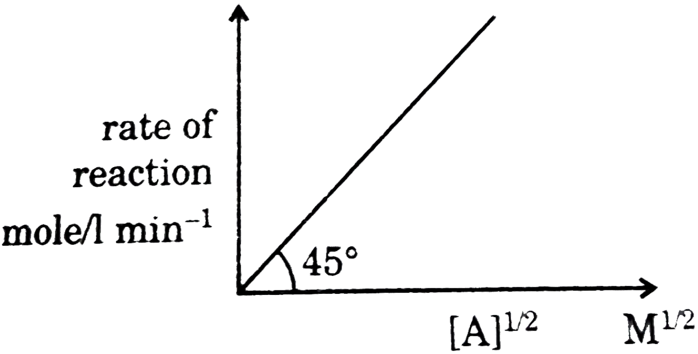
30. Rate of reaction $A \to B$ depends only on A and can be represented by below curve then:



A. molecularity of reaction must be one

B. reaction will be an elementary reaction

C. value of rate constant for reaction will be $1M^{-1/2}\sec^{-1}$

D. reaction will definitely be a complex reaction

Answer: D

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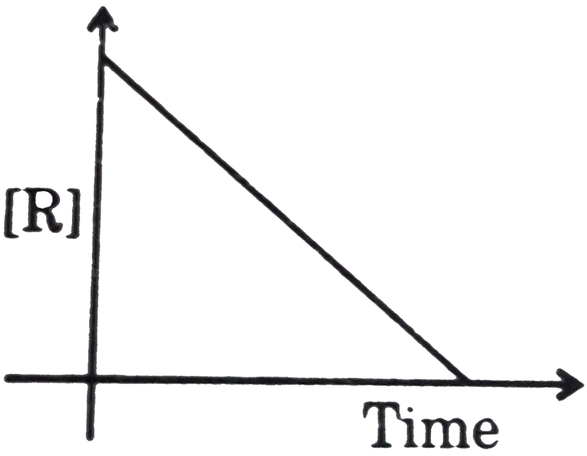
31. Adjoining graph is for a reaction which have only single reactant (R) and order of reactions depends only on that single reactant then possible order of reactions depends only on that single reactant then possible order of reaction may be:



A. first order reaction

B. 1/2 order reaction

C. -2 order reaction

D. zero order reaction

Answer: D

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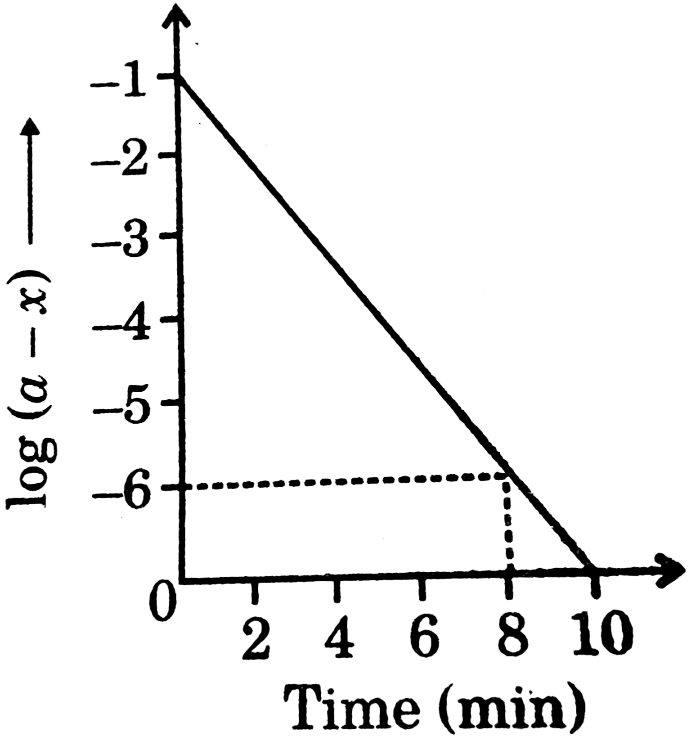
32. The conversion of vinyl allyl ether to pent-4-enol follows first-order kinetics. The following plot is obtained for such a reaction. The rate constant for the reaction is:



A. $4.6 \times 10^{-2} s^{-1}$

B. $1.2 \times 10^{-2} s^{-1}$

C. $2.3 \times 10^{-2} s^{-1}$

D. $8.4 \times 10^{-2} s^{-1}$

Answer: C

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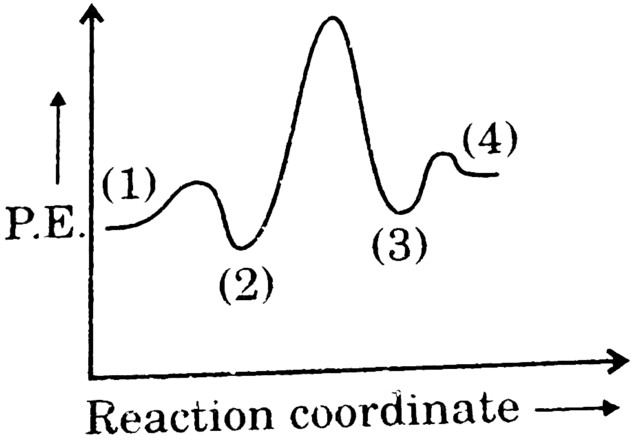
33. A simple mechanism for enzyme-catalysed reaction is given by the following set of equations

$$\underset{(\text{enzyme})}{E} + \underset{(\text{reactant})}{S} \longrightarrow \underset{(\text{intermediate-1})}{ES}$$

$$\underset{(\text{intermediat-1})}{ES} \longrightarrow \underset{(\text{intermediat-2})}{EP}$$

$$\underset{(\text{intermediate-2})}{EP} \longrightarrow \underset{(\text{enzyme})}{E} + \underset{(\text{product})}{P}$$



This is known as the Michaelis-Menten mechanism. The potential energy diagram is shown in the fig. Which of the following set of identifications is correct? (Assume that the temperature and pressure are constant).

A. $\begin{array}{cccc}(1) & (2) & (3) & (4). \\ E+P & EP & ES & E+S\end{array}$

B. $\begin{array}{cccc}(1) & (2) & (3) & (4). \\ ES & \text{Activated complex} & EP & \text{Activated complex}\end{array}$

C. $\begin{array}{cccc}(1) & (2) & (3) & (4). \\ EP & \text{Activated complex} & ES & \text{Activated complex}\end{array}$

D. $\begin{array}{cccc}(1) & (2) & (3) & (4). \\ E+S & ES & EP & E+P\end{array}$

Answer: D

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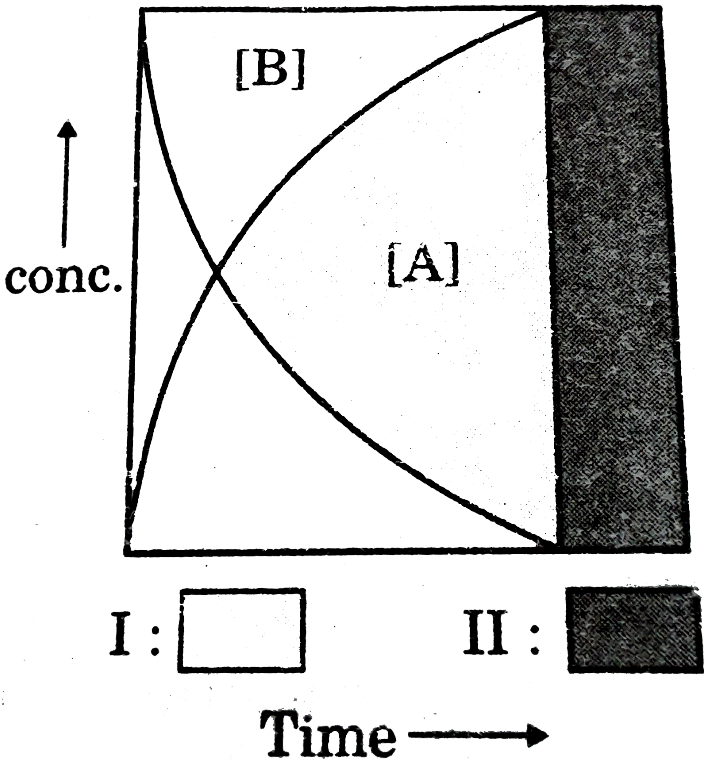
34. In the following graphical representation for the reaction $A \rightarrow B$ there are two types of regions :



A. I and II both represents kinetic region at different interval

B. I and II both represents equilibrium regions at different time interval

C. I represents kinetic while II represents equilibrium region

D. I represents equilibrium while II represents kinetic regions

Answer: C

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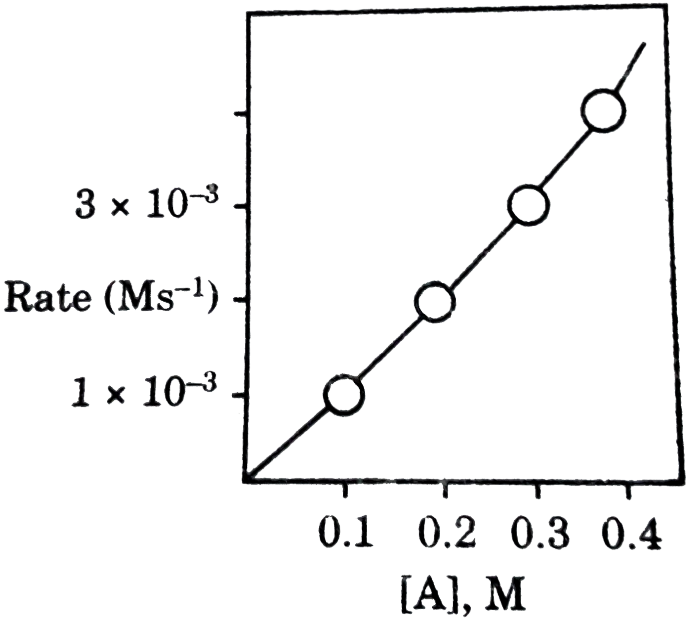
35. Rate law of the reaction $A \rightarrow$ Product is, rate $= k[A]$. Graphically it is represented as:



Hence, rate constant is:

A. $3 \times 10^{-4} s^{-1}$

B. $1 \times 10^{-2} s^{-1}$

C. $3 \times 10^{-2} s^{-1}$

D. $1 \times 10^{-4} s^{-1}$

Answer: B

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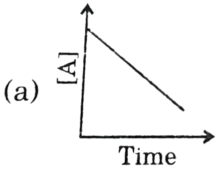
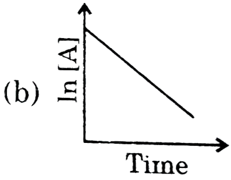
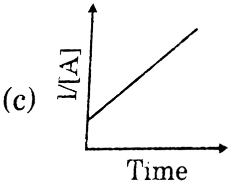
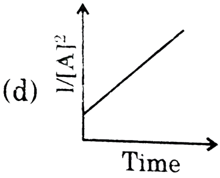
36. Which graph is diagnostic of an irreversible second order reaction $A \rightarrow B$?

A. 

B. 

C. 

D. 

Answer: C

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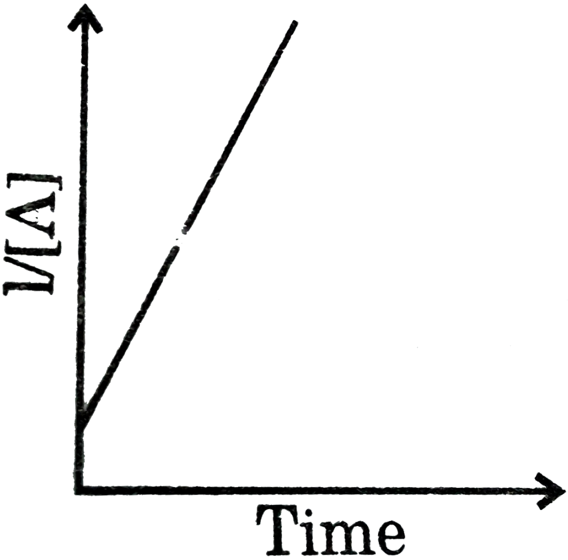
37. For the reaction $A \rightarrow B$, what is the order with respect to A that gives this graph ?



A. Zero

B. First

C. Second

D. Third

Answer: C

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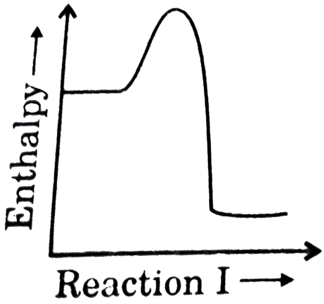
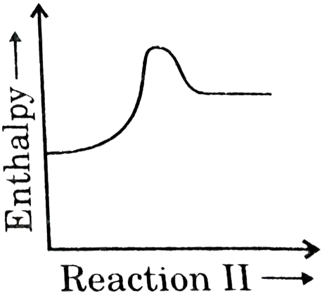
38. Which of the reactions represented in these diagrams will show the greatest increase in rate for the same increase in temperature ?





A. Reaction I forward

B. Reaction I reversed

C. Reaction II forward

D. Reaction II revesed

Answer: B

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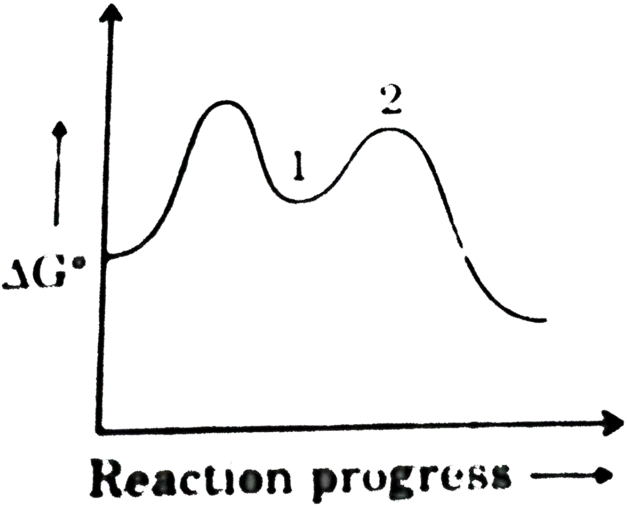
39. What names apply to chemical species corresponding to locations 1 and 2 on this reaction coordiante diagram ?



A.

Location 1	Location 2
activated complex	activated complex

B.

Location 1	Location 2
reaction intermediate	activated complex

C.

Location 1	Location 2
activated complex	reaction intermediate

D.

Location 1	Location 2
reaction intermediate	reaction intermediate

Answer: B

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40. How can be rate of reaction at a specific in the be determined from a graph of concentration against time ?

A. Concentration at that time divided by the time

B. Logarithm of the concentration divided by the time

C. Absolute value of the slope of the graph at that time

D. Logarithm of the slope divided by the time

Answer: C

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41. If a reaction $A \rightarrow B$ has the rate low k[A],which graph produced a straight line?

A. $1/[A]$ us time

B. ln [A] us time

C. $[A]^2$ us time

D. $1/\ln[A]$ us time

Answer: B

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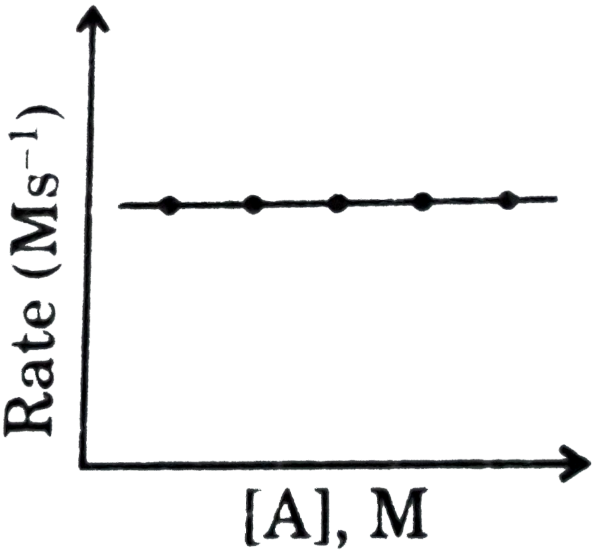
42. Following reaction can take place in both direction $A \underset{k_2}{\overset{k_1}{\Longleftrightarrow}} B$. Graph is given for the forward reaction. And for the beackward reaction, following data is obtained:



$[B]$	$Rate$
$0.01M$	$1 \times 10^{-2} Ms^{-1}$
$0.02M$	$2 \times 10^{-2} Ms^{-1}$

Hence, net reaction rate of B is:

A. $= k_1[A] - k_2[B]$

B. $= k_1 - k_2[B]$

C. $= k_1[A] - k_2$

D. $= k_1 - k_2$

Answer: B

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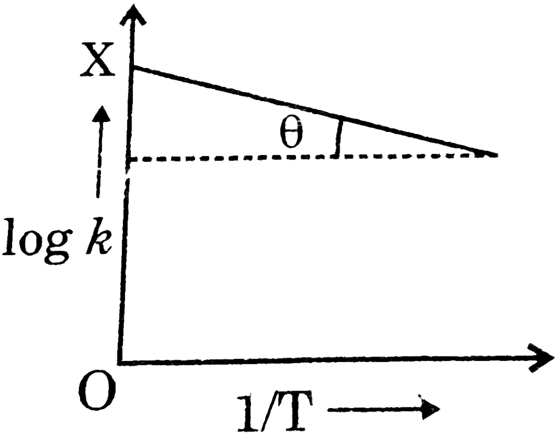
43. Graph between log k and $\frac{1}{T}$ (k is rate constant in s^{-1} and T is the temperature in K) is a straight line. As shown in figure if OX = 5 and slope of the line $= -\frac{1}{2.303}$ then E_a is :



A. $2.303 \times 2cal$

B. $\frac{2}{2.303}cal$

C. 2 cal

D. none of these

Answer: C

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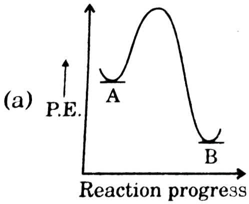
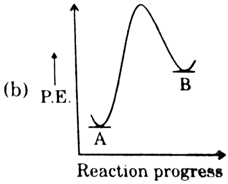
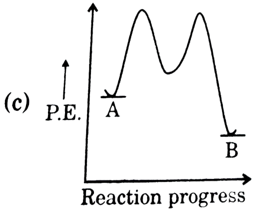
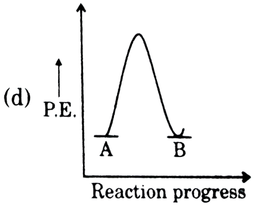
44. For a reaction $A \rightarrow B, E_a = 10kJmol^{-1}, \Delta H = 5kJmol^{-1}$. Thus, potential energy profile for this reaction is:

A. 

B. 

C. 

D. 

Answer: B

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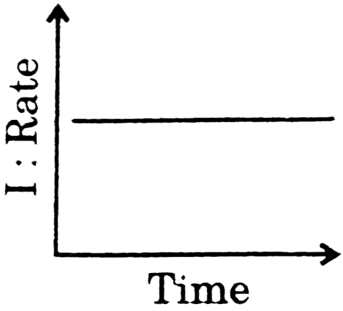
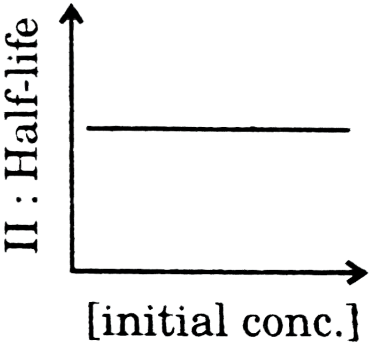
45. Match the graphical study with the order of the reaction:

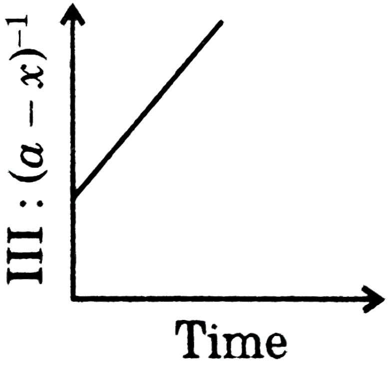
(P) Rate



(Q) Half -life



(R) $(a-x)^{-1}$



A: First, B: Second, C = Zero

A. $\begin{matrix} P & Q & R \\ A & B & C \end{matrix}$

B. $\begin{matrix} P & Q & R \\ B & C & A \end{matrix}$

C. $\begin{matrix} P & Q & R \\ C & B & A \end{matrix}$

D. $\begin{matrix} P & Q & R \\ C & A & B \end{matrix}$

Answer: D

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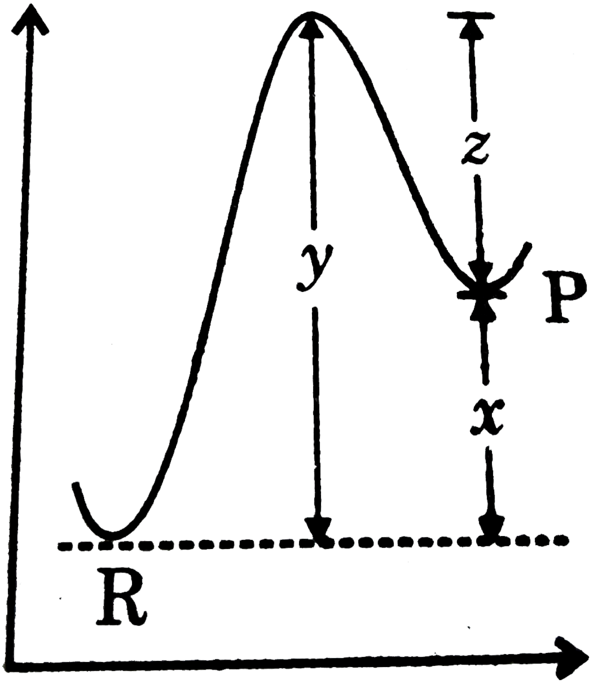
46. The potential energy diagram for a reaction $R \rightarrow P$ is given ΔH° of the reaction corresponds to the energy :



A. x

B. y

C. z

D. (x+y)

Answer: A

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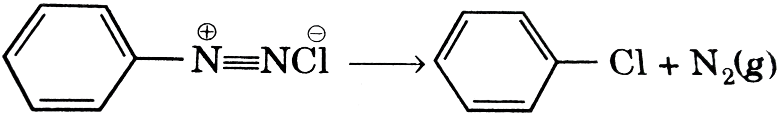
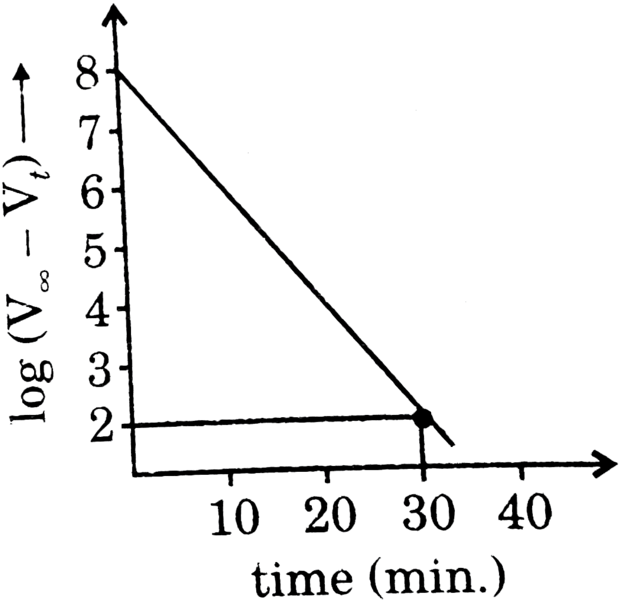
47. For the first order reaction



Following observation is made: where V_t (in ml) is volume of N_2 collected at time t and V_∞ (in ml) is volume of N_2 collected after a long time. what is the time taken (in minutes) for 75% reaction completion? (log $2 = 0.3$)



A. 2.5

B. 0.5

C. 3

D. 10

Answer: C

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48. When a graph between log K and $1/T$ is drawn a straight line is obtained. The point at which line cuts y-axis and x-axis respectively correspond to the temperature :

A. $0, \frac{E_n}{2.303}R\log A$

B. $\infty, E_a/(R\ln A)$

C. $0, \log A$

D. none of these

Answer: B

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49. The slope of straight line graph between ln k us $\frac{1}{T}$ is equal to $2.4 \times 10^4 K$. Calculate the activation energy of the reaction at 400 K. (K represents rate constant)

A. 24 kJ

B. 48 kcal

C. 9600 kcal

D. 48 kJ

Answer: B

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50. For a reaction represented by $A \rightarrow B$, which of the following options do not given the value of order of the reaction.

$$\begin{array}{lll} A & ROR = \text{Rate of reaction} & C = \text{Concentration of reactant} \\ & C_0 = \text{Concentration of reactant} & P = \text{Concentration of product} \\ B & t_{1/2} = \text{Half life of} A & \end{array}$$

A. $\dfrac{\log(ROR)_2 - \log(ROR)_1}{\log C_2 - \log C_1}$

B. $1 + \left[\dfrac{\log t'_{1/2} - \log t_{1/2}}{\log C'_0 - \log C_0}\right]$

C. Slope of In ROR us ln C graph

D. y-intercept of log ROR us log C graph

Answer: D

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51. For a certain reaction, a plot of $\dfrac{[C_0 - C]}{C}$ against time t, yields a straight line. C_0 and C are concentrations of reaction at $t = 0$ and $t = t$ respectively. The order of reaction is:

A. 3

B. Zero

C. 1

D. 2

Answer: B

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52. Consider the following chart.

Now with the following, select the correct code.

(P) Arrow corresponding to $.{}_{1}^{1}p$ emission

(Q) Arrow corresponding to $.{}_{1}^{1}H$ fusion

(R) Arro corresponding to $.{}_{1}^{2}H$ fusion

(S) Arrow corresponding to $.{}_{2}^{4}He$ fusion

A. $\begin{array}{cccc} A & B & C & D \\ P & Q & R & S \end{array}$

B. $\begin{array}{cccc} A & B & C & D \\ S & R & P & Q \end{array}$

C. $\begin{array}{cccc} A & B & C & D \\ R & Q & P & S \end{array}$

D. $\begin{array}{cccc} A & B & C & D \\ R & S & P & Q \end{array}$

Answer: B

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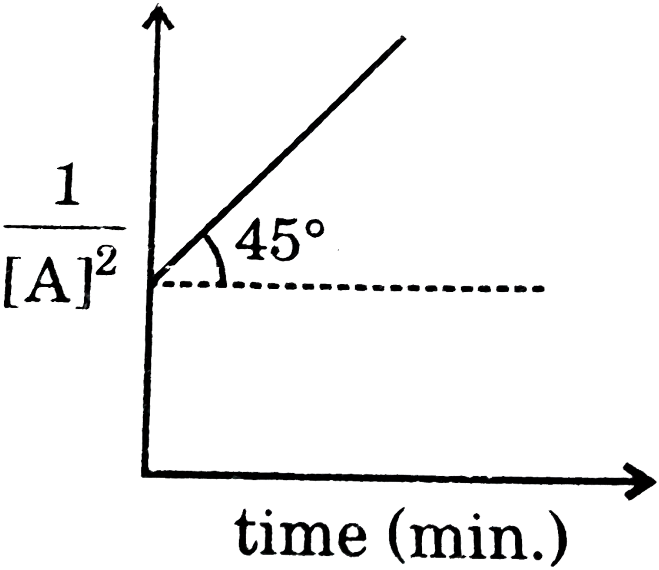
53. Based on the following graph, mark the correct option for the reaction: $A \rightarrow P$



A. II order reaction

B. Rate constant is $0.5(mol/L)^{1-n}\sec^{-1}$

C. $[A]_0 = 0.5M$

D. Reaction complete in finite time

Answer: C

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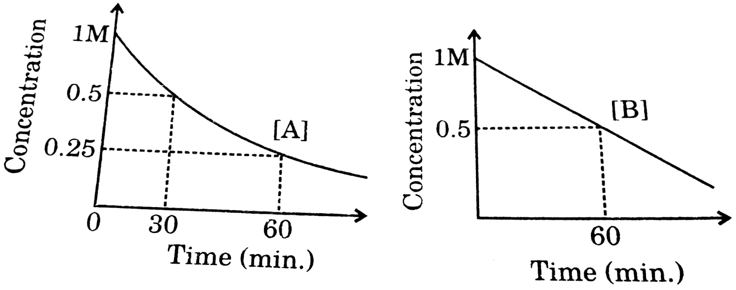
54. For the reactions (i) $A \xrightarrow{K_I} P$ and (ii) $B \xrightarrow{K_{II}} Q$, following observation is made.



Calculate $\frac{K_I}{K_{II}}$ where K_I and K_{II} are rate constants for the respective reaction.

A. 2.772

B. 1

C. 0.36

D. None of these

Answer: A

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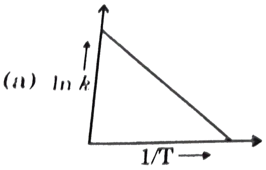
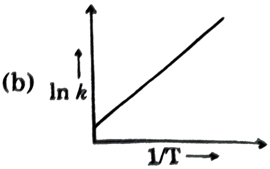
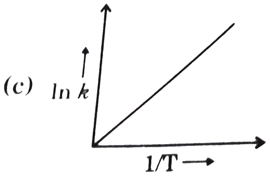
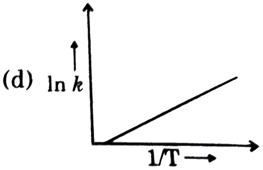
55. According to Arrhenius equation rate constant k is equal to $Ae^{-E_a/RT}$. Which of the following option. Represents the graph of ln k us $\frac{1}{T}$?

A. 

B. 

C. 

D. 

Answer: A

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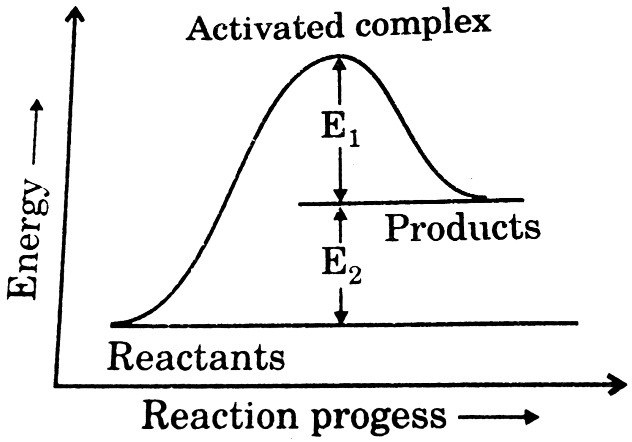
56. Consider the figure and mark the correct option.



A. Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.

B. Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

C. Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

D. Activation energy of backward reaction if E_1 and product is more stable than reactant.

Answer: A

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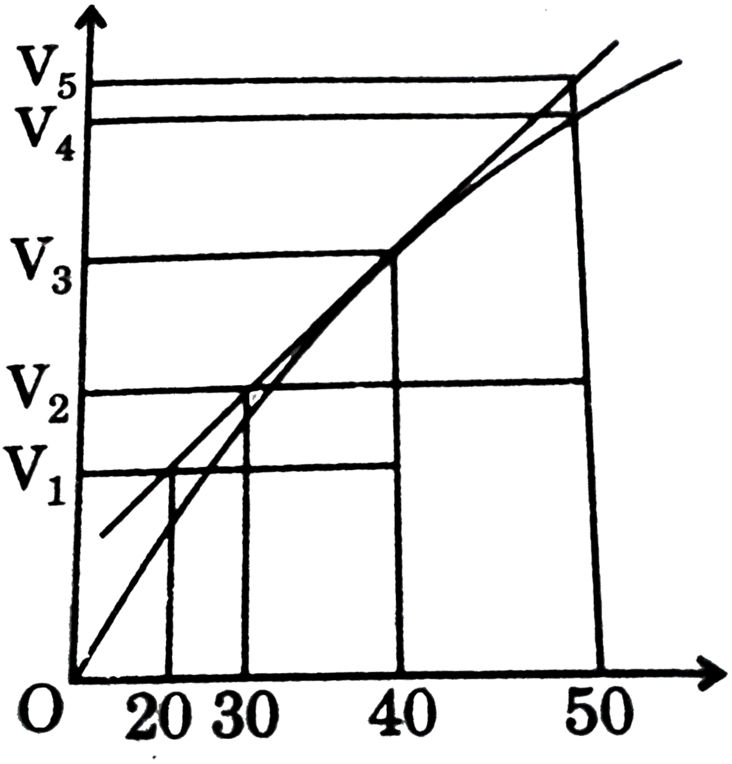
57. A graph of volume of hydrogen released us. Time for the reaction between zinc and dil. HCI is given in figure below On the basis of this, mark the correct option.



A. Average rate upto 40 seconds is $\frac{V_3 - V_2}{40}$

B. Avergae rate upto 40 seconds is $\frac{V_3 - V_2}{40 - 30}$

C. Average rate upto 40 seconds is $\frac{V_3}{30}$

D. Average rate upto 40 seconds is $\frac{V_3 - V_1}{40 - 20}$

Answer: C

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58. Consider the graph given in the above questions. Which of the following options does not show instanetaneous rate of reaction at 40 th second ?

A. $\frac{V_5 - V_2}{50 - 30}$

B. $\frac{V_4 - V_2}{50 - 30}$

C. $\frac{V_3 - V_2}{40 - 30}$

D. $\frac{V_3 - V_1}{40 - 20}$

Answer: B

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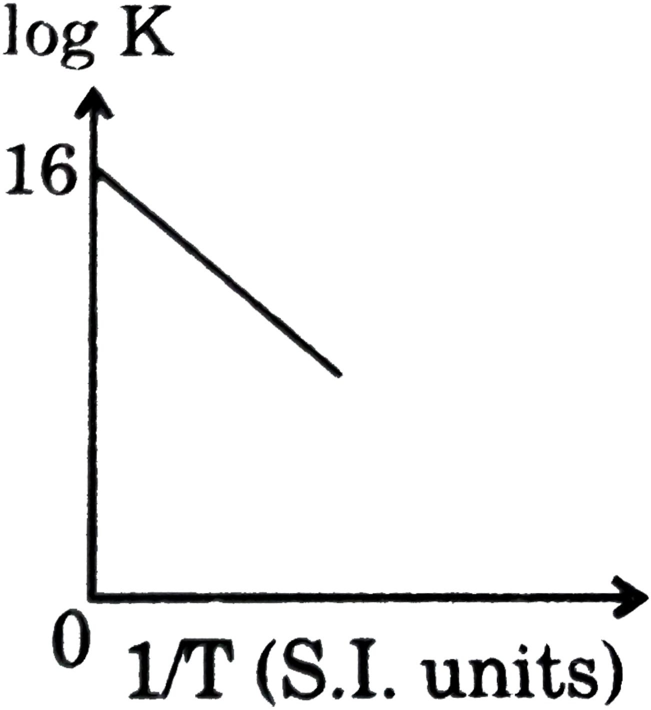
59. For any first order reaction following observation is made. If at temperature (T) half life of the reaction is 6930 sec. and at temperature (T') half life of the reaction is 0.693μ sec. then, calculate $\frac{T'}{T}$.



A. 2

B. 4

C. 6

D. 8

Answer: A

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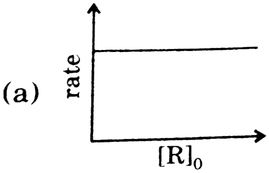
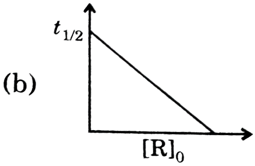
60. Which of the following graphs is correct for a first order reaction ?

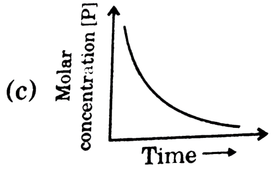
$(R \rightarrow P)$

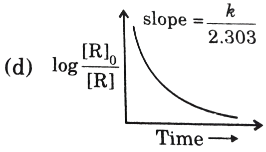
A.



B.



C. 

D. 

Answer: D

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61. $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$ For the reaction above, a straight line for which plot indicates a second order reaction ?

A. $[NO_2]$ us time

B. $[NO_2]^2$ us time

C. $\frac{1}{[NO_2]}$ us time

D. $\frac{1}{[NO_2]^2}$ us time

Answer: C

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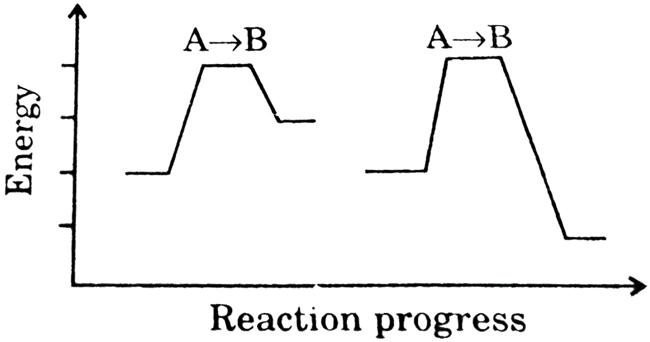
62. From the energy profiles for the two untimolecular reactions below, how will the rates of the two reactions compare if the temperature of each reaction is increased from $25^{\circ} C$ to $75^{\circ} C$?



A. The rate of reaction $A \rightarrow B$ will increase more than the rate of reaction $C \rightarrow D$.

B. The rate of reaction $C \rightarrow D$ will increase more than the rate of reaction $A \rightarrow B$

C. The rates of the reactions will increase by the same amount.

D. The rate of reaction $A \rightarrow B$ will increase but the rate of reaction $C \rightarrow D$ will decrease.

Answer: C

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63. In a second order reaction, the plot of $1/(a-x)$ versus t is a straight line.

A. Zero order

B. First order

C. Second order

D. Third order

Answer: C

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64. This is the rate law for a reaction that consumes X Rate $= k[X]^2$

Which plot gives a straight line ?

A. [X] us time

B. ln [X] us time

C. $1/[X]$ us time

D. $1/\ln[X]^2$ us time

Answer: C

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65. Which graph is linear for a reaction that is third order in [A] ?

A. [A] us time

B. ln [A] us time

C. $[A]^3$ us time

D. $1/[A]^2$ us time

Answer: D

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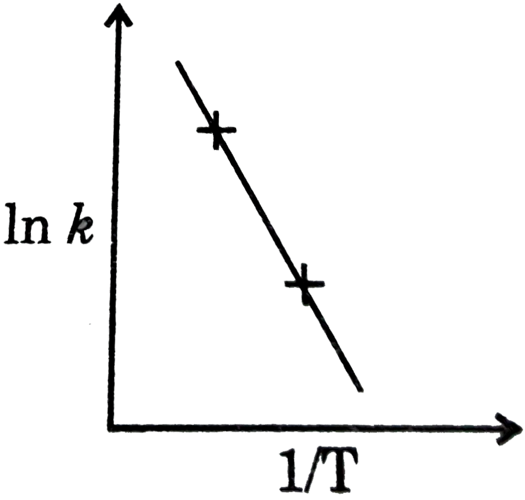
66. The value of the specific rate constant, k, for a reaction is determined at two different temperatures and plotted in the accompanying graph. What is the relationship between the slope of the graph and the activation energy, E_a?



A. slope $= E_A$

B. slope $= -E_a$

C. slope $= -E_a / R$

D. slope $= E_a \times R$

Answer: C

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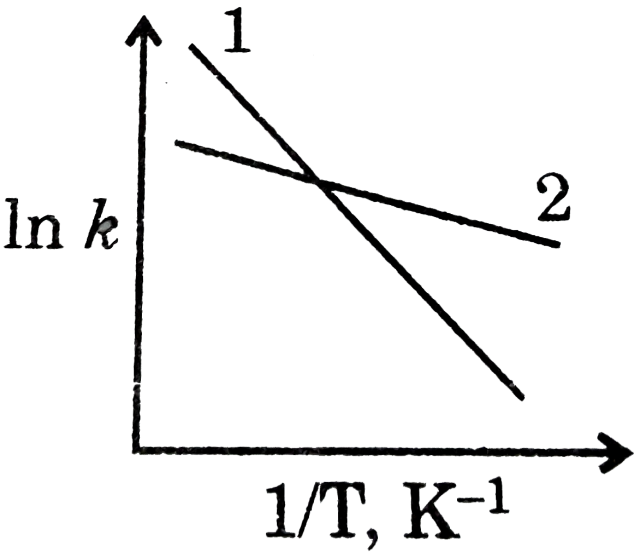
67. In adjoining diagram depicts the temperature behaviour of the rate constant k, for two reactions,1 and 2. Which statement about the k values at low temperature and the activation energies, E_a, for these reactions is correct ?



A. $\begin{array}{ll} k\text{values at low}T & E_a\text{values} \\ krxn1 < krxn2 & E_arxn1 < E_arxn2 \end{array}$

B. $\begin{array}{ll} k\text{values at low}T & E_a\text{values} \\ krxn1 < krxn2 & E_arxn1 > E_arxn2 \end{array}$

C. $\begin{array}{ll} k\text{values at low}T & E_a\text{values} \\ krxn1 > krxn2 & E_arxn1 < E_arxn2 \end{array}$

D. $\begin{array}{ll} k\text{values at low}T & E_a\text{values} \\ krxn1 > krxn2 & E_arxn1 > E_arxn2 \end{array}$

Answer: B

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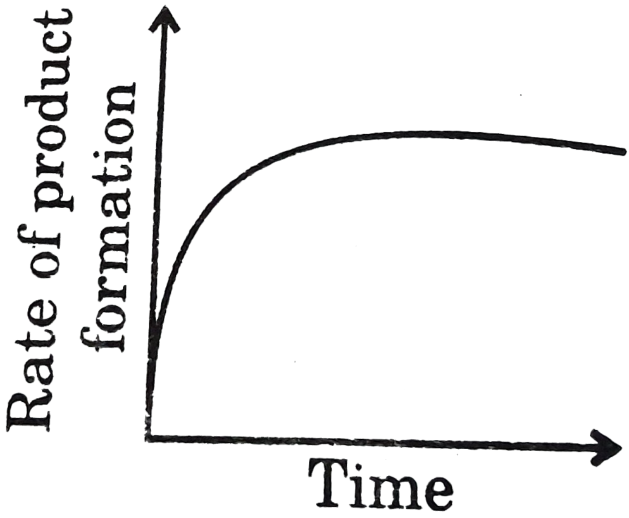
68. The rates of many substrate reaction catalyzed by enzymes vary with time as account(s) for the constant reaction rate after a certain time ?

(P) The enzyme's active sites are filled.

(Q) The amount of substrate is constant.



A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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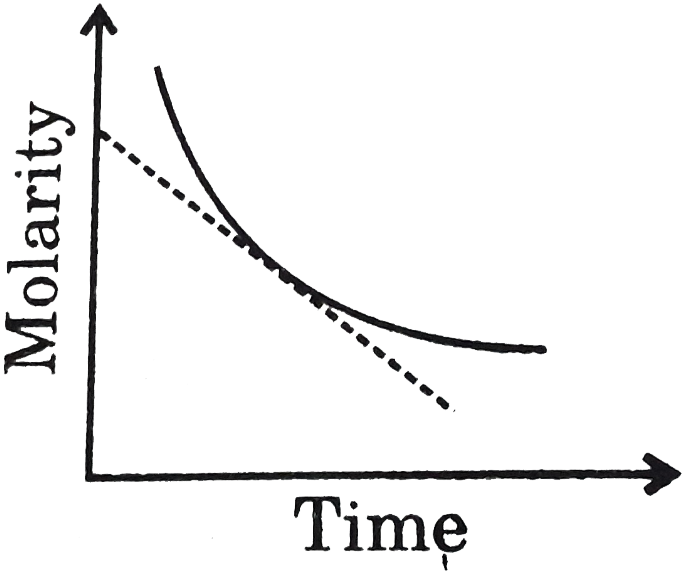
69. What quantity is represented by the slope of the dashed line in the accompanying diagram for the concentration change in a reaction ?



A. Instantaneous reaction rate

B. Rate constant

C. Reaction order for that reactant

D. Activation energy

Answer: A

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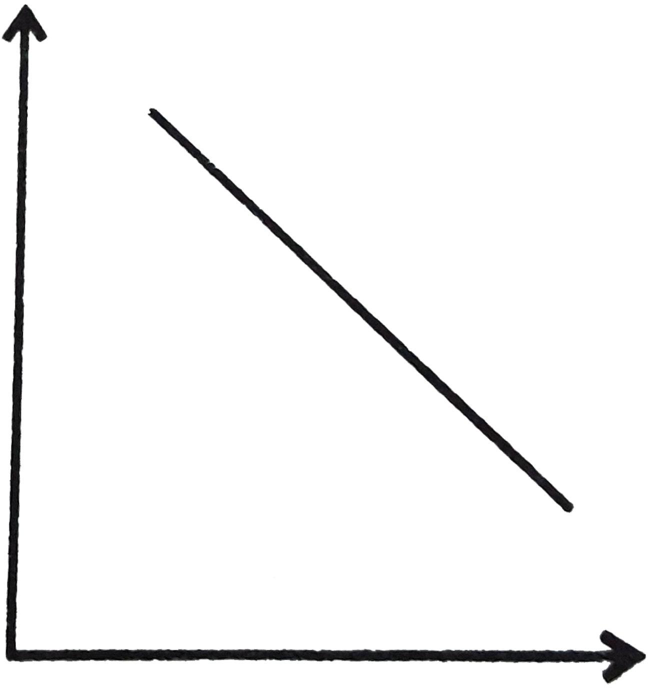
70. A student analyzed tha data from a zero order reaction and obtained the graph shown. What labels should be attached to the X and Y axes, respectively ?



A. Time, concentration

B. Time, $1/$concentration

C. Time, ln (concentration)

D. $1/\text{time}$, concentration

Answer: A

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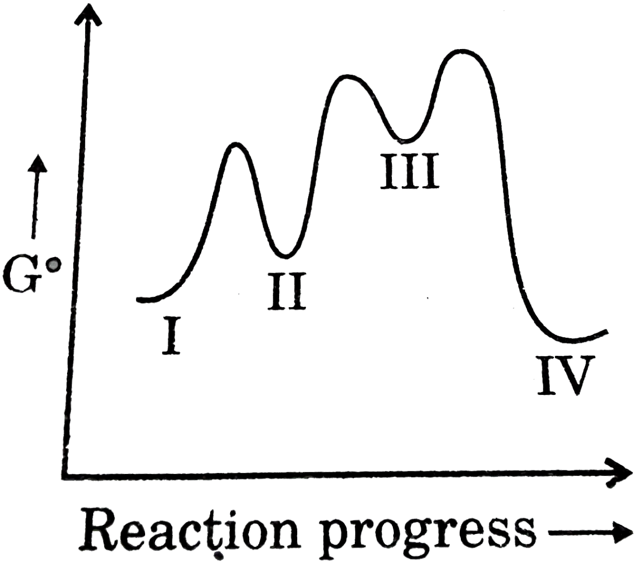
71. Acccording to the reaction profile given, which reaction step is rate-determining in the forward direction ?



A. $I \rightarrow II$

B. $II \rightarrow III$

C. $III \rightarrow II$

D. $III \rightarrow IV$

Answer: D

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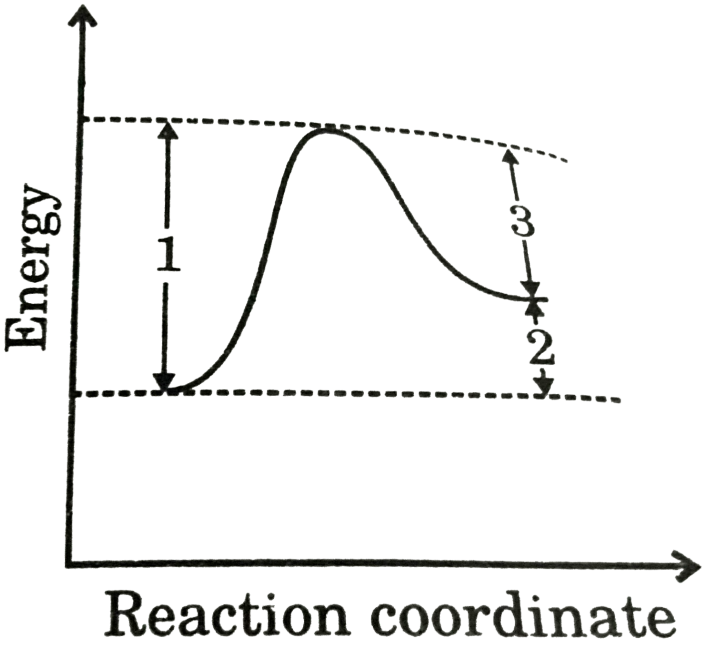
72. Which dimensions in the diagram can be charged.



A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1,2,3

Answer: B

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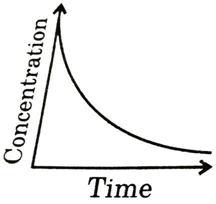
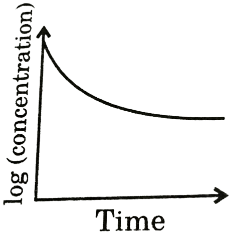
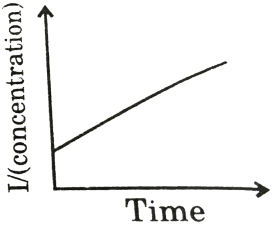
73. What is the order of a reaction that produces the graphs shown ?







A. Zero order

B. First order

C. Second order

D. Some other order

Answer: C

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74. According to the Arrhenius equation $k = Ae^{-E_a/RT}$ a plot of ln k against $1/T$ yields:

A. E_a as the slope and A as the intercept

B. E_a / R as the slope and A as the inercept

C. E_a / R as the slope and ln A as the intercept

D. $-E_a / R$ as the slope and ln A as the intercept

Answer: D

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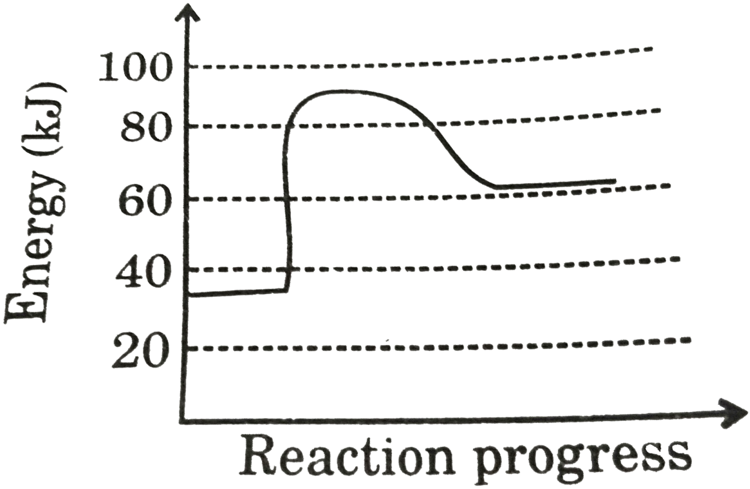
75. Adjoining diagram, represents the energy profile for the reaction : $A+B \rightarrow C+D$. What is the valye of the activation energy for the reaction ? $C+D \rightarrow A+B$?



A. 25 kJ

B. 55 kJ

C. 85 kJ

D. $-30kJ$s

Answer: A

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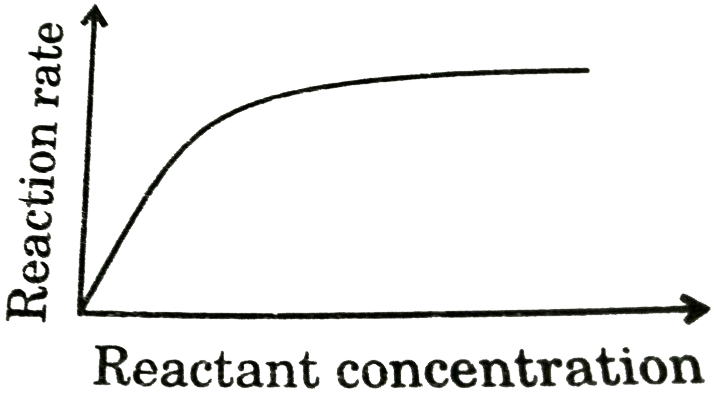
76. Curves with the shape shown are often observed for reactions involving catalysts. The level portion of the curve is best attributed to the fact that:



A. product is no longer being formed

B. the reaction has reached equilibrium

C. all the catalytic sites are occupied

D. all the reactant has been consumed

Answer: C

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77. Which straight line gives the activation energy for a reaction?

A. Rate constant vs T

B. In (rate constant) vs T

C. Rate constant vs T^{-1}

D. In (rate constant) vs T^{-1}

Answer: D

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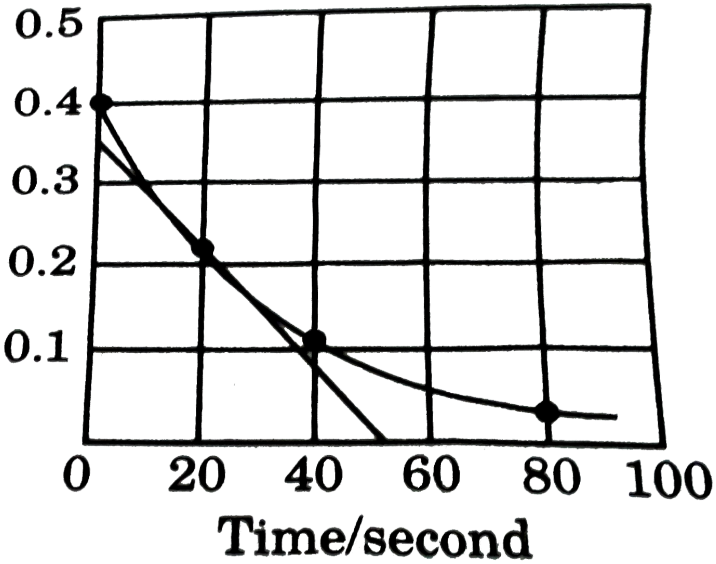
78. A reaction follows the given concentration (M) vs time graph. The rate for this reaction at 20 seconds will be :



A. $6 \times 10^{-3} M. \sec^{1}$

B. $8 \times 10^{-3}. L^{-1}. \sec^{-1}$

C. $2 \times 10^{-2} M \cdot \sec^{-1}$

D. $1 \times 10^{-1} M \cdot \sec^{-1}$

Answer: A

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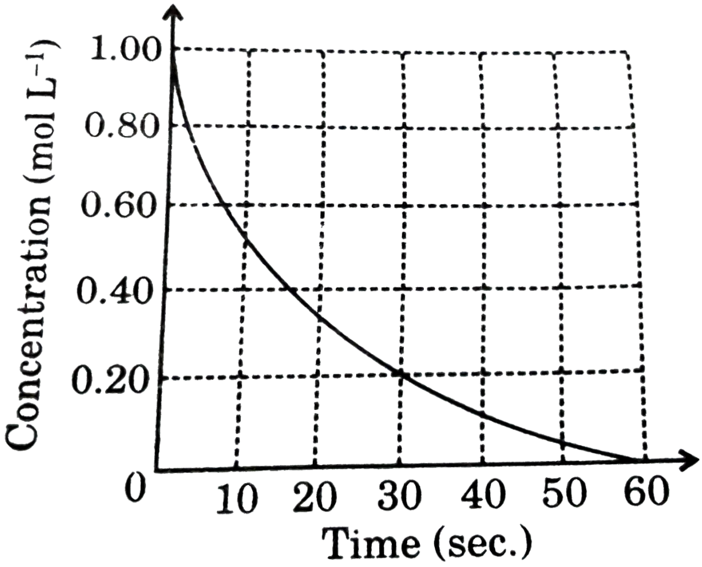
79. According to the graph what is the rate of disappearance of the reactant at 10 seconds ?



A. $0.025 mol \cdot L^{-1} \cdot \sec^{-1}$

B. $0.050 mol \cdot L^{-1}. \sec^{-1}$

C. $0.40 mol \cdot L^{-1} \cdot \sec^{-1}$

D. $0.80 mol \cdot L^{-1} \cdot \sec^{-1}$

Answer: B

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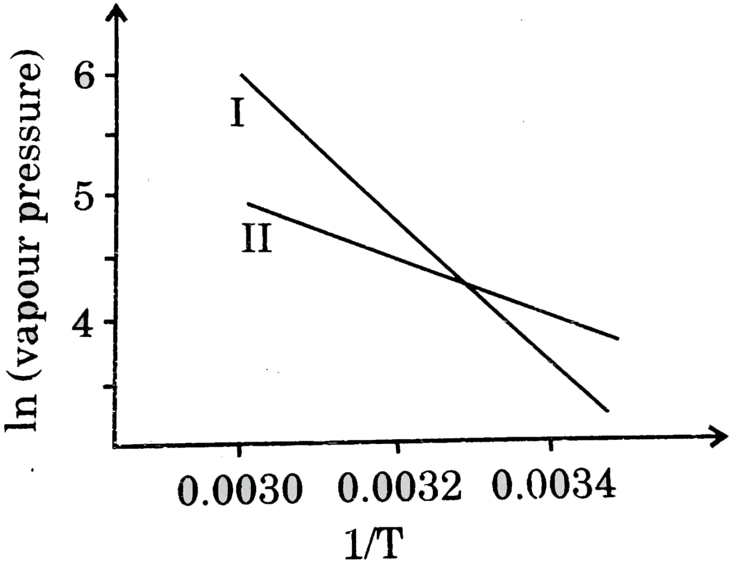
80. In the graph the natural log of the vapour pressures of two substances are plotted vs 1/T. what can be concluded about the relative the 1/T enthalpies of vaporization (ΔH_{vap}) of these substances?



A. ΔH_{vap} of I is greater than ΔH_{vap} of II

B. ΔH_{vap} of I is less than ΔH_{vap} of II

C. ΔH_{vap} of I is equal to ΔH_{vap} of II

D. No conclusion can be drawn from this information alone.

Answer: A

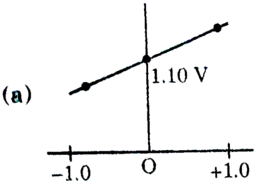
Watch Video Solution

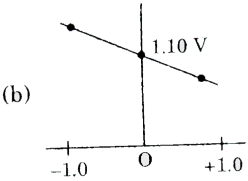
I.Electrochemistry

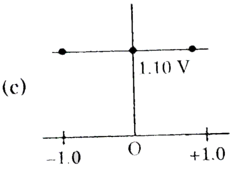
1. You are given the following cell at 298 K with $E^{\circ}_{cell} = 1.10V$

$Zn(s)|Zn^{2+}(C_1)||Cu^{++}(C_2)|Cu(s)$

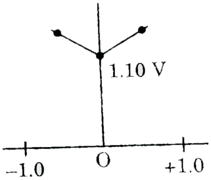
where C_1 and C_2 are the concentration in mol/lit then which of the following figures correctly correlates E_{cell} as a function of concentrations x-axis $\log\left(\frac{C_1}{C_2}\right)$ and y-axis E_{cell}

A. 

B. 

C. 

D. (d)



Answer: B

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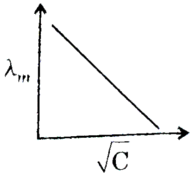
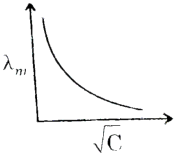
Electrochemistry

1. Which of the following curve represents the variation of λ_m with $\sqrt{C}$ for $AgNO_3$?

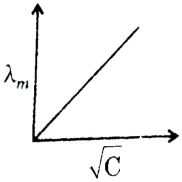
A. (a)



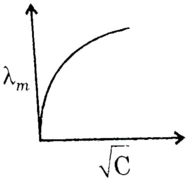
B. (b)



C. (c)



D. (d)



Answer: A

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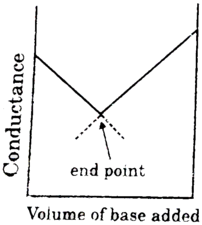
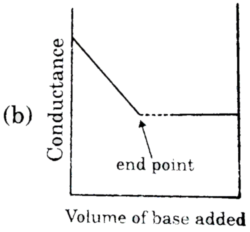
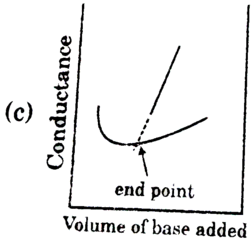
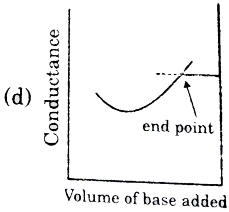
2. Conductance measurements and be used to detect the end point of acid-base titrations. Which of the following plots correctly represents the end point of the titration of strong acid and a strong base?

A. (a)



B. 

C. 

D. 

Answer: A

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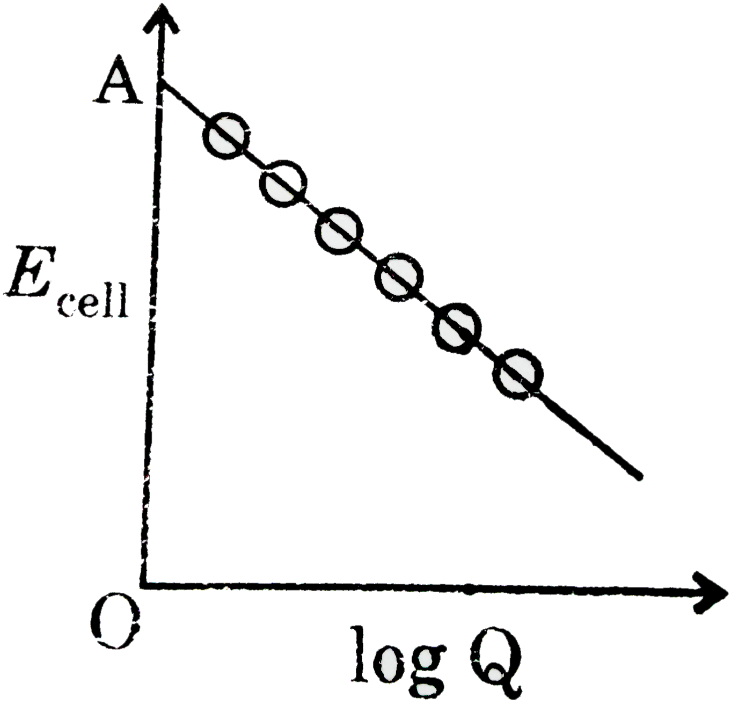
3. $Zn + Cu^{2+}(aq) \rightarrow Cu + Zn^{2+}(aq)$.

Reaction quotient is $Q = \frac{[Zn^{2+}]}{[Cu^{2+}]} \cdot E^{\circ}_{cell} = 1.10V$ ltb rgt E_{cell} will be

1.1591 V when :



A. $[Cu^{2+}/[Zn^{2+}]=0.01$

B. $[Zn^{2+}]/[Cu^{2+}]=0.01$

C. $[Zn^{2+}]/[Cu^{2+}]=0.1$

D. $[Zn^{2+}]/[Cu^{2+}]=1$

Answer: B

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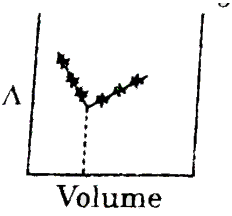
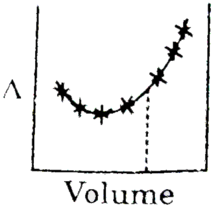
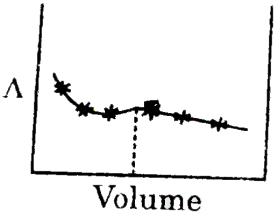
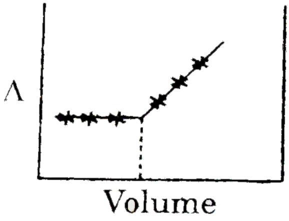
4. $AgNO_3$ (aq) was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance $(\wedge)$ versus the value of $AgNO_3$ is

(P)


(Q)


(R)


(S)


A. P

B. Q

C. R

D. S

Answer: D

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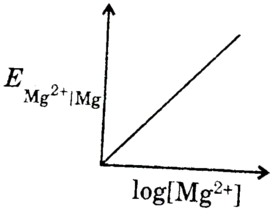
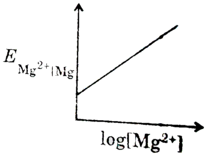
5. Electrode potential for Mg electrode varies according to the graph.

A.

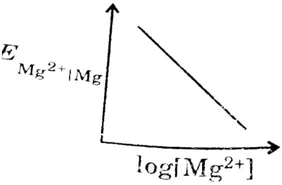


B.

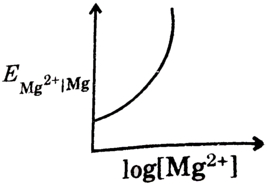
(b)



C.



D.



Answer: B

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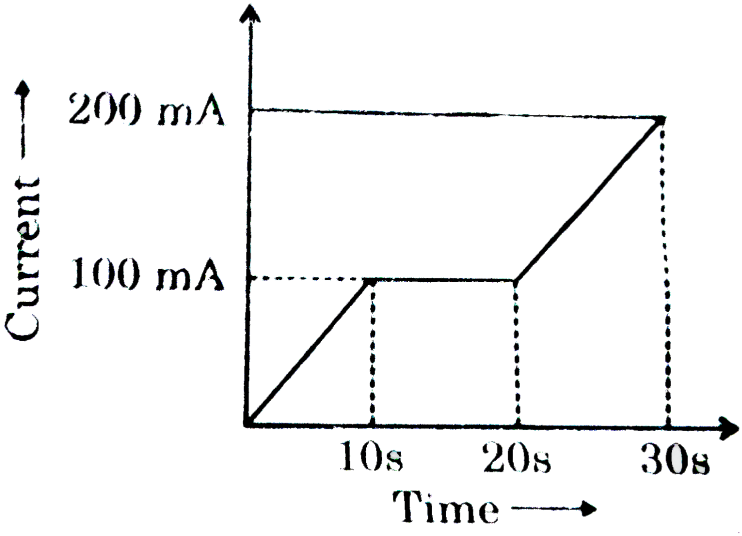
6. In a Cu-voltameter, mass deposited in 30s is m gm. If the time-current graph is shown in the following figure. What is the electrochemical equivalent of Cu?



A. $\frac{m}{2}$

B. $\frac{m}{3}$

C. $\frac{m}{4}$

D. $\frac{m}{63.5}$

Answer: B

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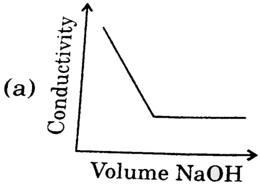
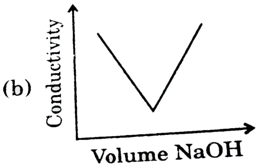
7. Which diagram best represents the change in electrical conductivity of a solution of acetic acid as a solution of sodium hydroxide is added?

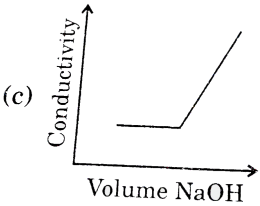
A.



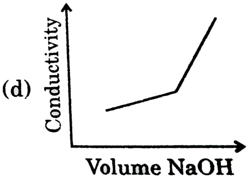
B.



C.



D.



Answer: D

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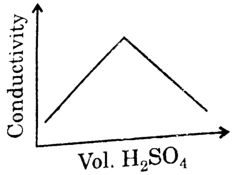
8. Which of the graphs shown below would best represent the changes when 0.10 M barium hydroxide was titrated with 0.10 M sulphuric acid?

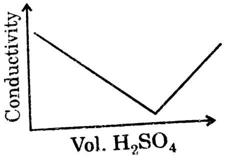
A.

(a)



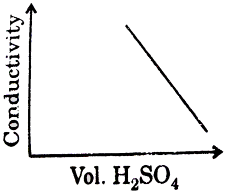
B.

(b)

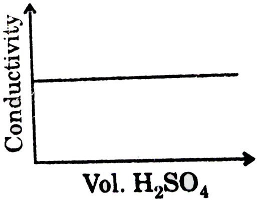


C.

(c)



D.



Answer: B

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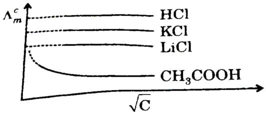
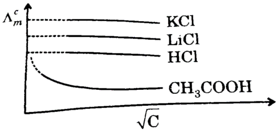
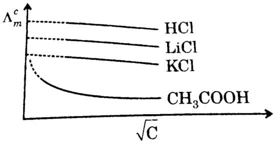
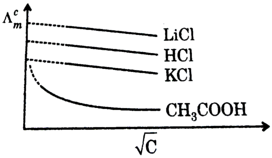
9. Select the correct option for following aqueous solution.

A. 

B. 

C. 

D. 

Answer: A

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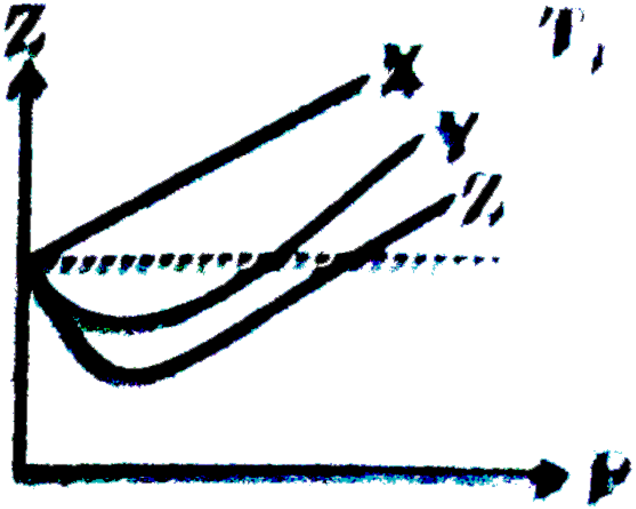
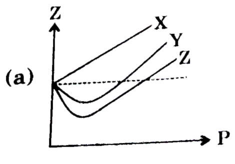
Multiple Objective Type

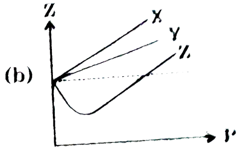
1. Z vs P is plotted for 1 mole of three different gases X,Y and Z at temperature T_1. Then which of the following may be correct if the above plot is made for 1 mole of each gas at $T_2 (T_2 > T_1)$?

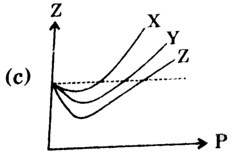


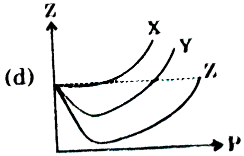
A.



B.



C. 

D. 

Answer: A::C::D

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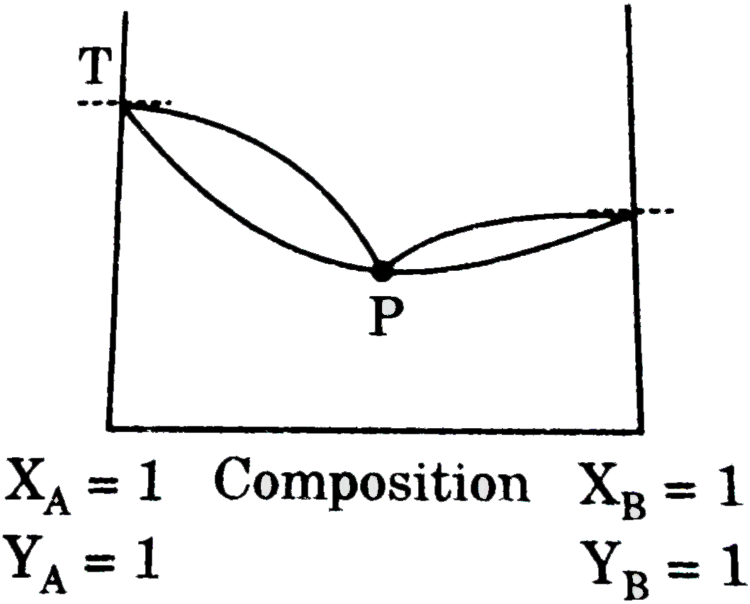
2. A liqud mixture of two volatile liquids has composition corresponding to point P in the temperature vs composition graph and is subjected to distillation from the composition P. Which of the following statements is incorrect?



A. The composition of distillate will be different

B. the boiling point of the solution will keep on increasing.

C. The mixture will have highest vapour pressure at the composition.

D. The composition of P will change if external pressure changes.

Answer: A::B

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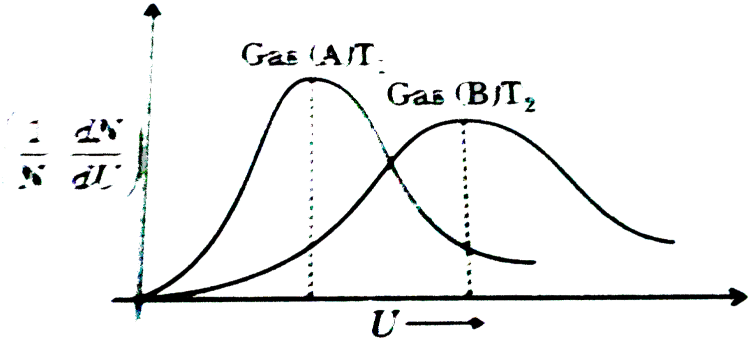
3. For the following graph, drawn from two different samples of gases at two different temperatures T_1 and T_2, which of the following statements is/are necessarily true?



A. if $T_2 > T_1$, M_B is necessarily greater than M_A

B. if $T_1 > T_2$, M_A is necessarily greater than M_B

C. $\frac{T_2}{M_B} > \frac{T_1}{M_A}$

D. Nothing can be predicted.

Answer: B::C

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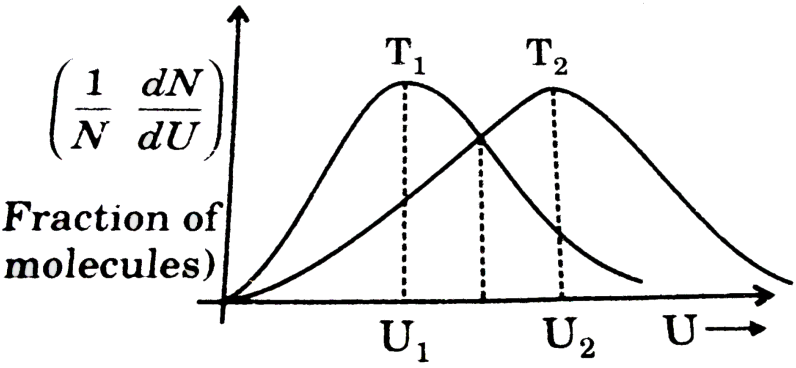
4. In the above Maxwellian plot at two different temperatures which of the following statements may be true?



A. Area under the two plots is the same

B. Fraction of molecules with speed $U_1 > U_2$

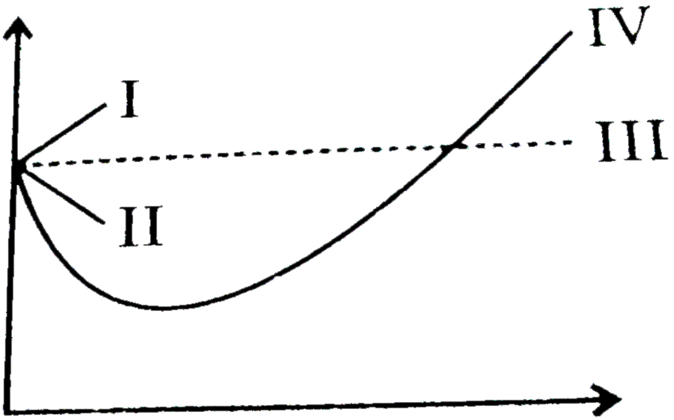
C. $U_2 > U_1$ and $T_2 > T_1$

D. U_{MPS} at $T_1 < U_{RMS}$ at T_2, U_{RMS} at $T_1 < U_{RMS}$ at T_2

Answer: A::B::C::D

View Text Solution

5. Figure displays the plot of the compression factor Z versus P for a few gases which of the following statements is/are correct for a van der Waals' gas?



A. The plot I is applicable provided the van der Waals' constant a is negligible

B. The plot II is applicable provided the van der waals' constant b is negligible

C. The plot III is applicable provided the van der waals' constant a and b are negligible

D. the plot IV is applicable provided the temperature of theh gas is must higher than its critical temperature.

Answer: A::B::C

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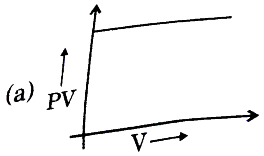
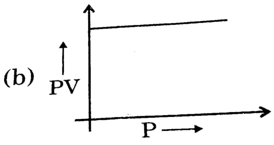
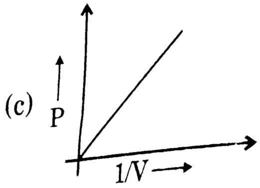
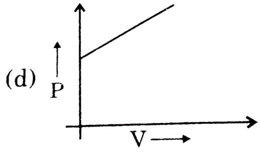
6. For gaseous state at constant temperature which of the following plot is correct?

A. 

B. 

C. 

D. 

Answer: A::B::C

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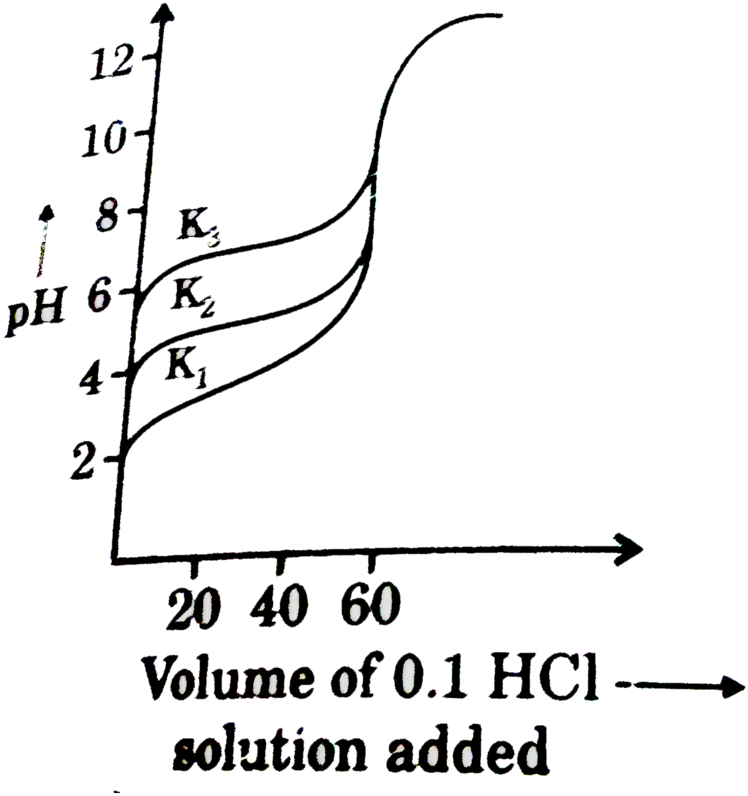
7. Titration curves for 0.1 M solutions of three weak acids HA_1, HA_2 and HA_3 with ionization constant K_1, K_2, K_3 respectively are plotted as shown in the following figure. Which of the following is/are true.?



A. $K_2 = \frac{(K_1 + K_3)}{2}$

B. $K_1 < K_3$

C. $K_1 > K_2$

D. $K_2 > K_3$

Answer: C::D

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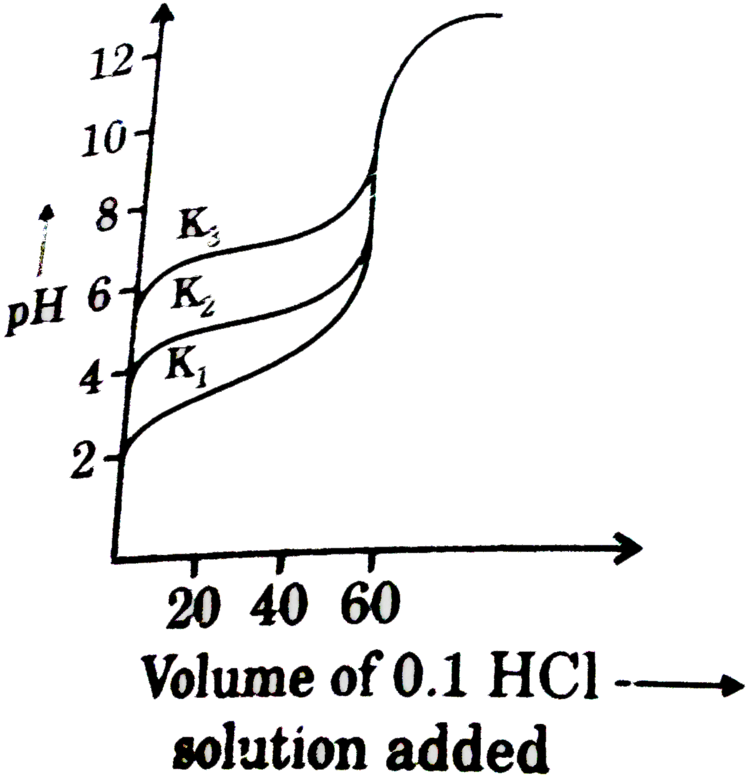
8. When weak base solution (50 ml of 0.1 NH_4OH) is titrated with strong acid 0.1 N HCl, the pH of solution initially decreases fast and then decreases slowly till near equivalence point (as shown in the fig.) which of the following is true?



A. The slow decrease of pH is due to formation of an acidic buffer solution after additio on some HCl.

B. The slope of shown pH graph will be minimum when 25 ml of 0.1 N HCl is added.

C. the slow decrease of pH is due to formation of a basic buffer solution.

D. The initial fast decreament in pH is due to fast consumption of free OH^- ions by HCl

Answer: B::C::D

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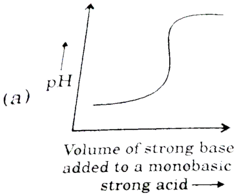
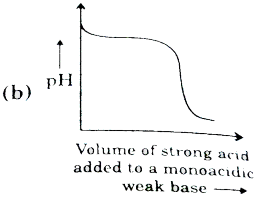
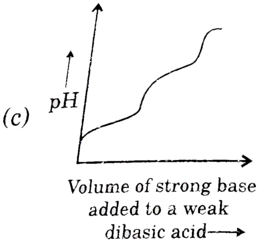
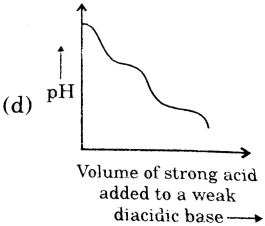
9. Which one is the correct graph (fig.) for the corresponding acid base titration?

A. 

B. 

C. 

D. 

Answer: A::B::C::D

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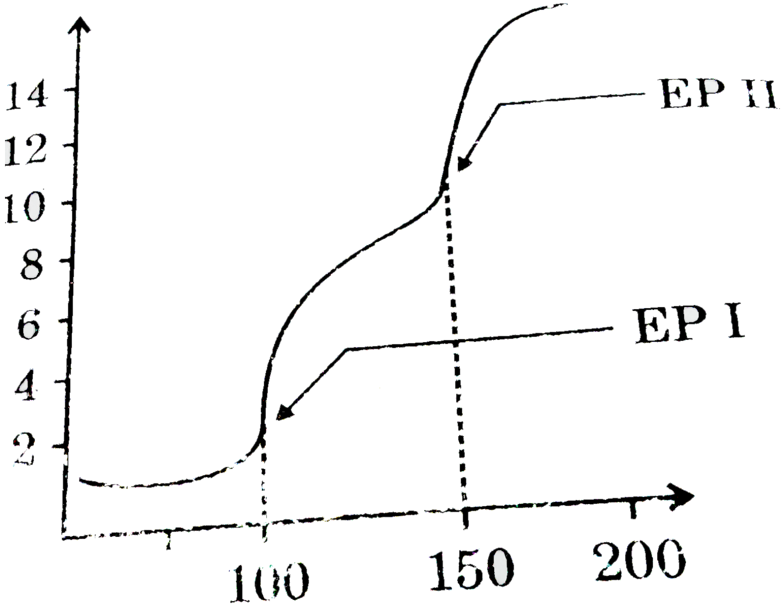
10. A weak acid (or base) is titrated against a strong base (or acid), volume V of strong base (or acid) is plotted against pH of the solution (as shown in fig).The weak electrolyte (i.e., acid or base) could be:



A. Na_2CO_3

B. $Na_2C_2O_4$

C. $H_2C_2O_4$

D. $CH_4(COOH)_2$

Answer: C::D

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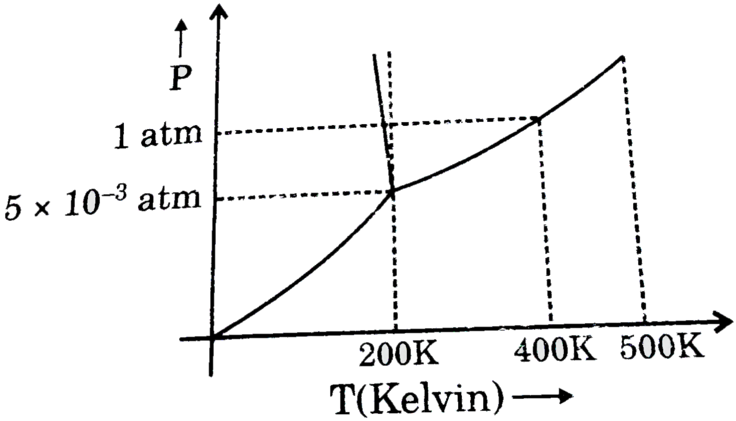
11. For a general substance A the phase diagram is represented as shown.

Identify the option (s) which is/are correct.



A. Triple point of the substance is 200 K and 3.8 mm of Hg.

B. Standard boiling point of the substances should be slightly less than 400 K

C. Above 500 K, gas-liquid transition cannot occur without change in temperature

D. Melting point of the substance will increase with increase in pressure.

Answer: A::B::C

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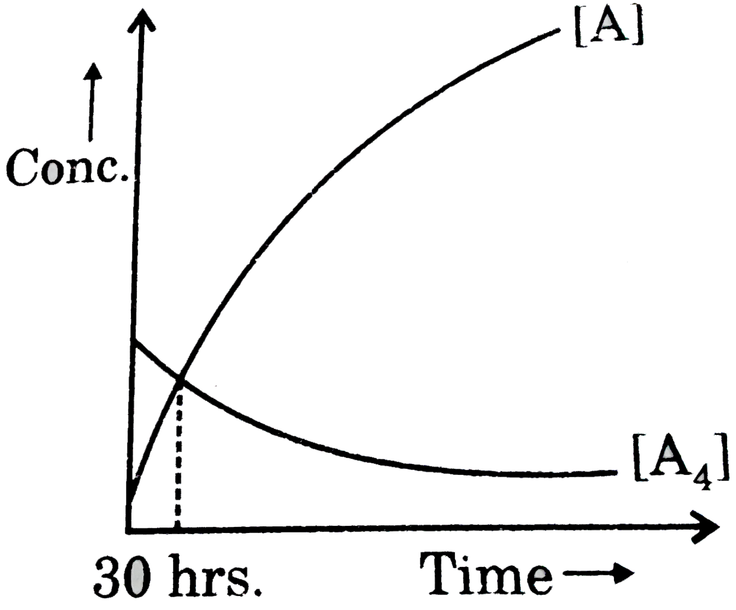
12. Consider the following first order decomposition and the accompanying concentration-time plot. Which of the following statements regarding the decomposition reaction is/are true?

$$A_4(g) \longrightarrow 4A(g)$$



A. At 30 hrs, only 20% reaction is complete

B. Half-life of the reaction is 90 hrs (approximately)

C. Rate of decomposition decreasing linearly with time

D. Changing initial concentration will changethe time at which the two curves are intersecting

Answer: A::B

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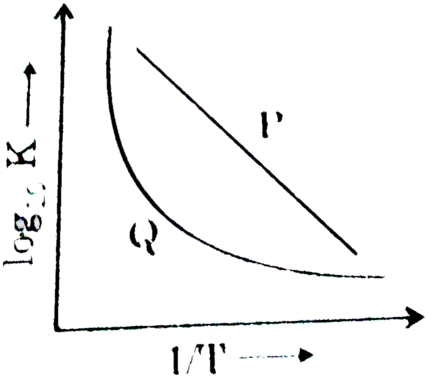
13. Which of the following statement are true regarding the log K vs $1/T$. Plot shown in the given diagram?



$$K = Ae^{-E_a/RT}$$

A. Plot P shows that the energy of activation is independent of temperature

B. Plot Q describes the behaviour of temperature dependence of energy of activation

C. Arrhenius behaviour is described by P

D. The slope of curve P gives the value $-\frac{E_a}{R}$

Answer: A::B::C::D

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14. For a second order reaction, plots are made for $\frac{1}{[A]}$ us time for the reaction, $2A \rightarrow$ Product. Pick up the correct sentences.

A. The graph will show straight line with slope $K(2 \times$ rate constant.)

B. The graph will show straight line with intercept $[A]_0$

C. The graph will show straight line with slope $[A]_0$

D. The graph will show straight line with intercept $\frac{1}{[A]_0}$

Answer: A::D

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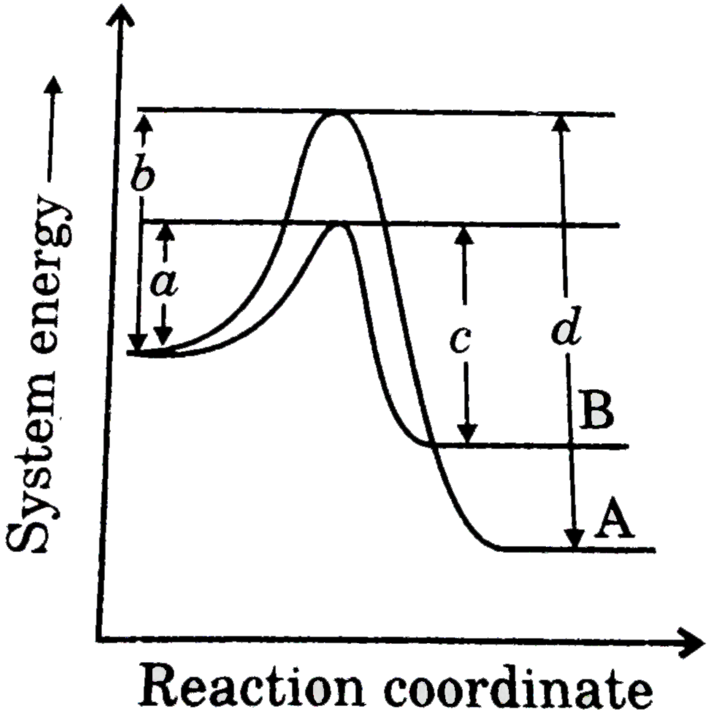
15. Consider the decay of P to A and B by two parallel first order reactions as shown in Fig. Given Which of the following is (are) true ?



A. $a = E_B$

B. $b = E_A$

C. $\Delta H_A = b - d$

D. $\Delta H_B = c - a$

Answer: A::B::C

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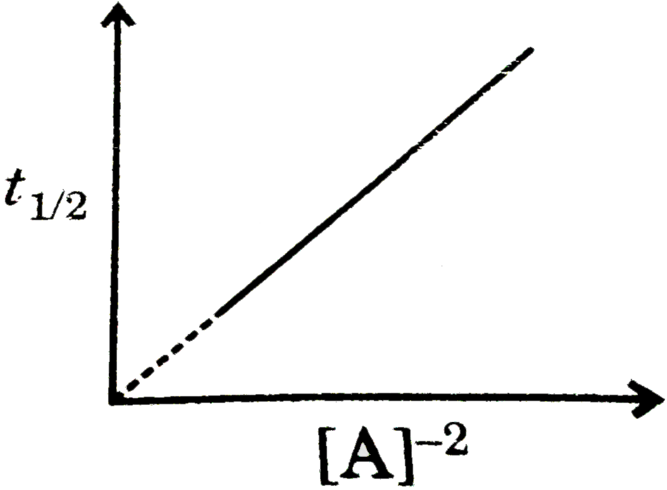
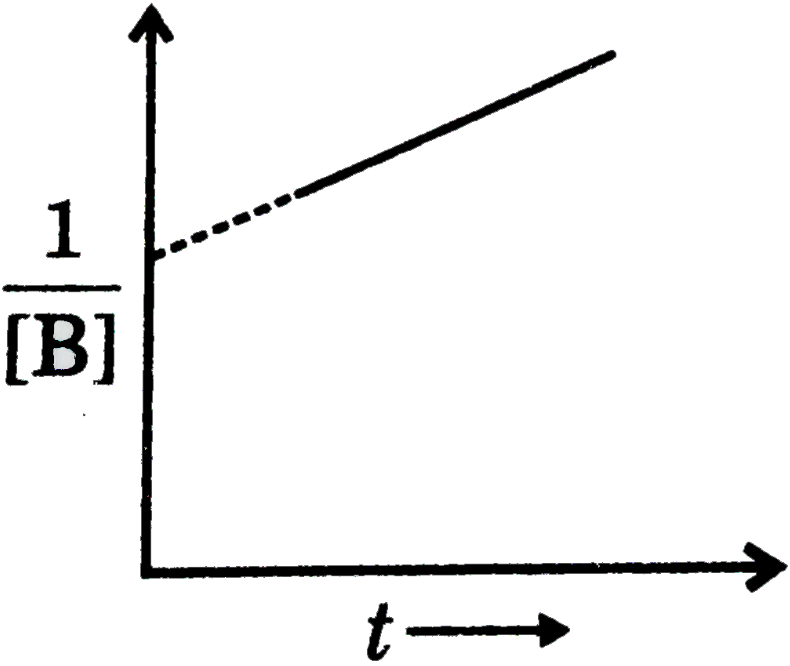
16. For a reaction $2A + B \rightarrow C$ following information is known. Identify the options which is/are correct ?

Information-1: When B is taken in very larger amount following graph was obtained.



Information-2: When $B = 1M$ and $A = 2M$ are mixed and graph of $\frac{1}{[B]}$ us time is plotted adjoining graph is obtained.



A. order with respect to A is 2

B. Order with respect to B is 2

C. Overall order is 2

D. Order with respect to one of the reactant will be negative.

Answer: C::D

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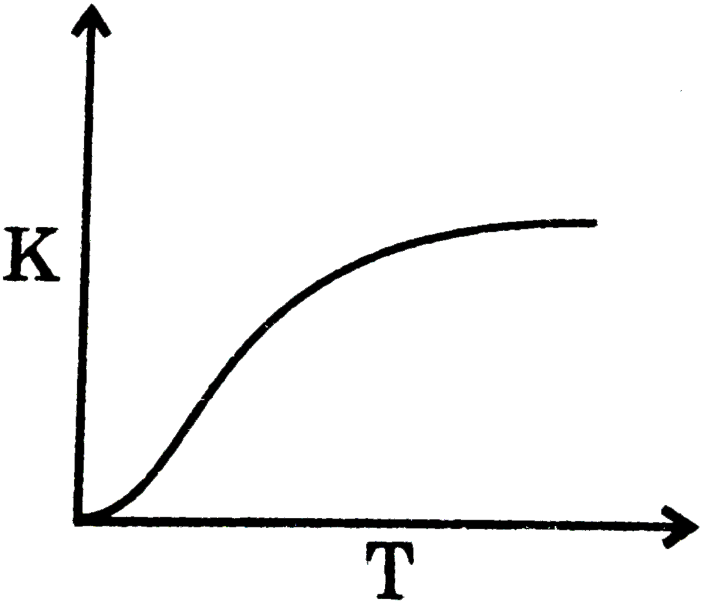
17. Identify the correct statement (s).



A. free neutron can be a β emitter

B. For an endothermic reaction equilibrium constant increases with increase in temperature

C. If ΔH°_{Rxn} does not vary with temperature then ΔS°_{Rxn} will also be temperature independent

D. The correct graph of rate constant us temperature as per Arrhenius equation is given by

Answer: A::B::C::D

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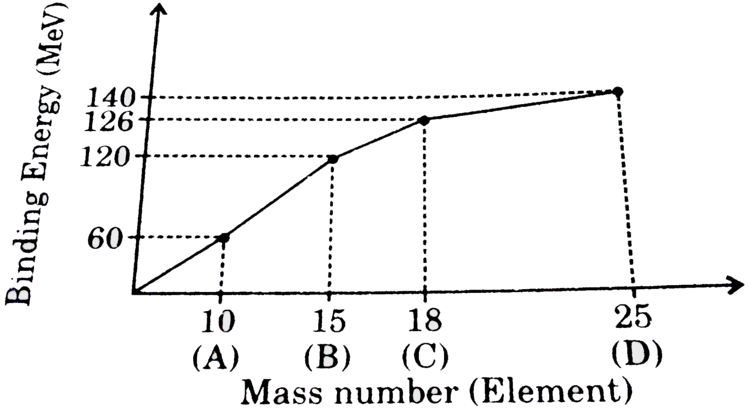
18. From the graph of binding energy (B.E.) usmass number plotted as shown, identify the correct option (s). (All the graphs are straight line)



A. Order of stability of nucleus is $D < A < C < B$

B. If D undergoes breakage to give C and another nucleus then energy will be released

C. If A and B combine to form D then energy must be supplied

D. If C undergo breakage into two fragements of equal mass number then energy will be released

Answer: A::B::C

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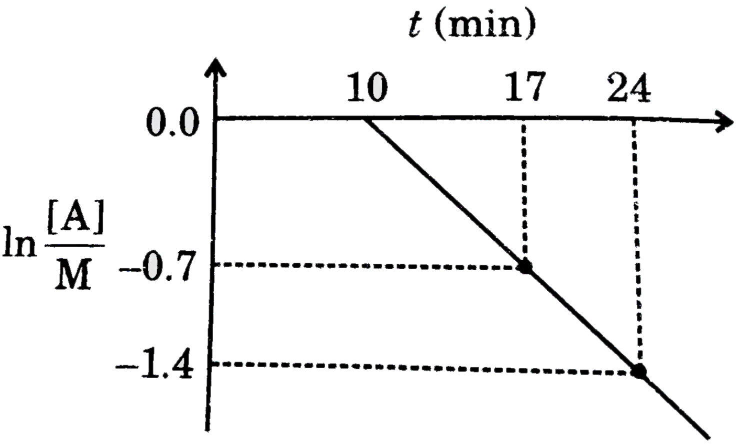
19. The following graph is experimentally obtained for the reaction : $A \to 2B$, at $25^\circ C$. The correct statement (s) for the reaction is/are (Given : ln 2 = 0.7)



A. Time for 87.5% reaction of A is 21 min

B. The initial concentration of A was eM

C. The time at which the concentration of A and B becomes equal is 7 min

D. The rate of appearance of B is $\frac{d[B]}{Dt} = \left(0.2 \text{ min}^{-1}\right)[A]$

Answer: A::B::D

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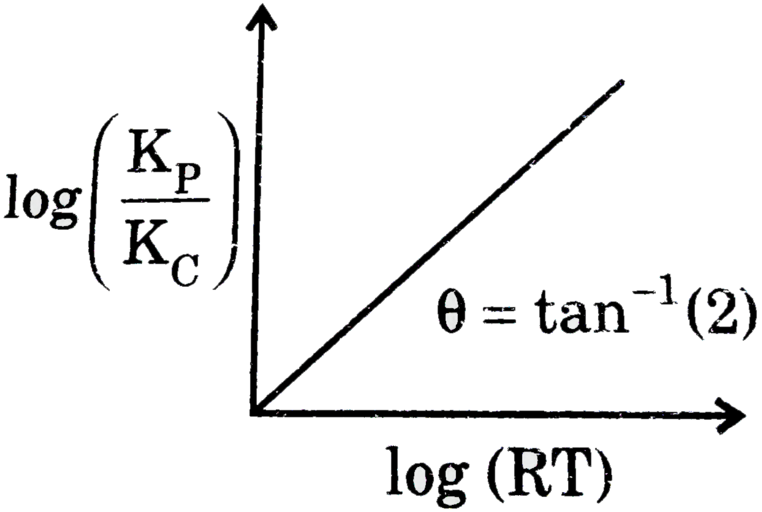
20. Given plot is valied, for which of the following reaction ?



A. $2NH_3(g) \Leftrightarrow N_2(g) + 3H_2(g)$

B. $NH_4HS(s) \Leftrightarrow NH_3(g) + H_2S(g)$

C. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

D. $CuSO_4.5H_2O(s) \Leftrightarrow CuSO_4.3H_2O(s) + 2H_2O(g)$

Answer: A::B::D

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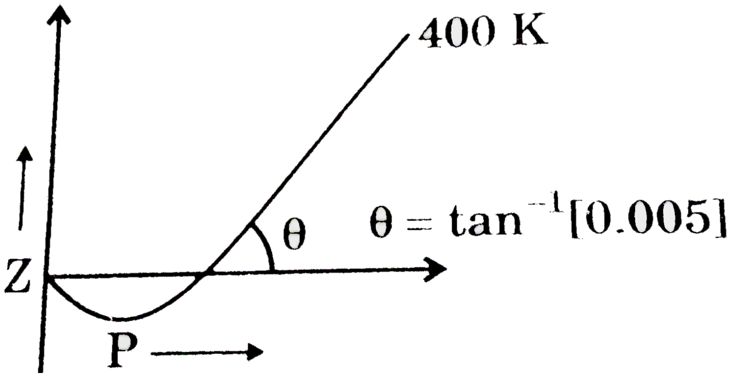
21. If critical temperature for the real gas is 500 K then the value of :



A. Boyle's temperature is 1687.5K

B. van der Waals' constant a for the gas is 21.6 atm-L^2/mol^2

C. Gas will show ideal behaviour at high temperature and low pressure

D. At Boyle's temperature behaviour of gas is always ideal

Answer: A::C

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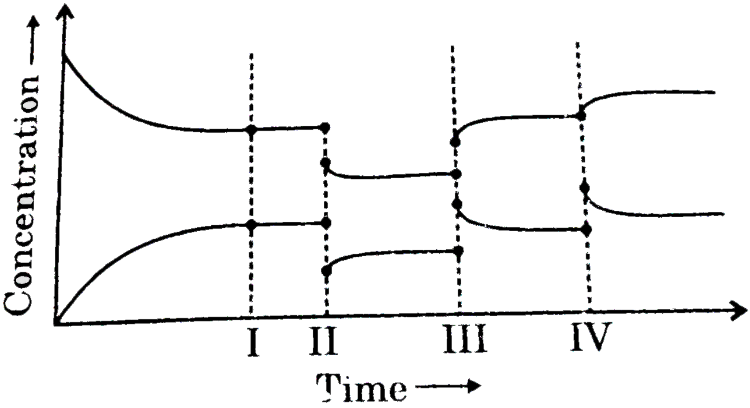
22. Consider the following equilibrium $A(g) \Leftrightarrow 2B(g)$ and the following graph : Select the correct statements.



A. Effect (I) represent the insertion of inert gas at constant volume

B. Effect (II) represent the insertion of inert gas at constant pressure

C. Effect (III) represent the decrease in volume of container

D. Effect (IV) represent the addition of moles of gas B

Answer: A::B::C::D

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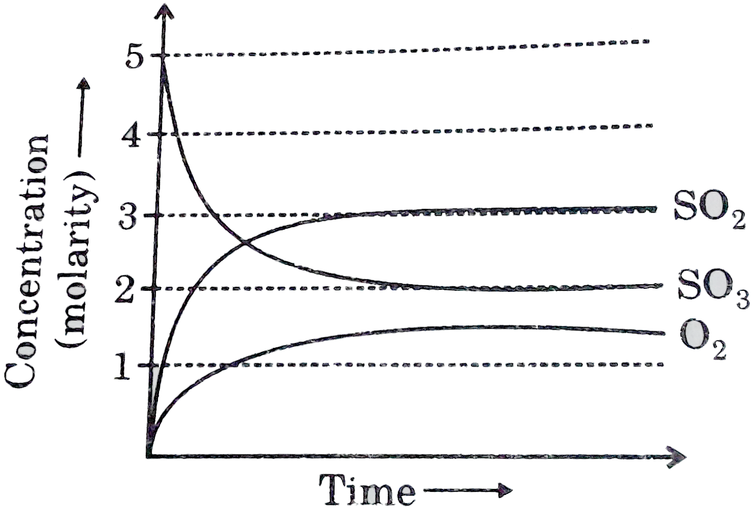
23. The dissociation of $SO_3(g)$ into $SO_2(g)$ and $O_2(g)$ is carried out in a closed container at a constant temperature $T.2SO_3 \Leftrightarrow 2SO_2(g) + O_2(g)$ Variation of concentration with time is shown Choose the correct statement



A. K_C for the dissociation of $SO_3(g)$ is $\frac{27}{8}$

B. Addition of inert gas at constant pressure promotes the degree of dissociation of $SO_3(g)$

C. K_p for the dissociation of $SO_3(g)$ increases with increase in pressure

D. K for the dissociation of $SO_3(g)$ increases with increase in temperature

Answer: A::B::D

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24. Which of the following statement (s) is/are correct with respect to $\Psi(r)$ (y-axis) us r (x-axis) graph for H-atom ?

A. For a 3d orbital, the graph will not intersect the x-axis at any finite, non-zero value

B. For a 4s orbital, the graph will intersect exactly three distinct, non-zero finite points

C. For 1s orbital, the sign of $\Psi_{(r)}$ will not change at any radial distance

D. For 3p orbital the graph will intersect x-axis at two non-zero distinct points.

Answer: A::B::C

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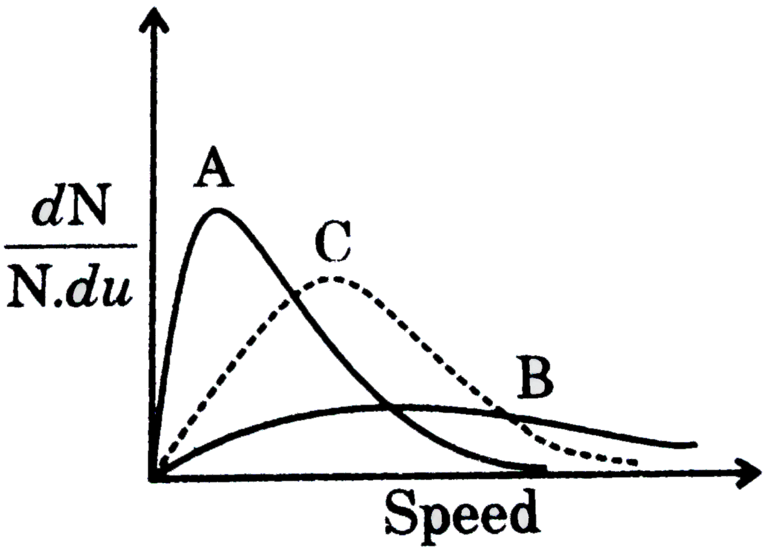
25. The curve C is for the gas X at 273 K.Choose the correct statement (s).



A. Curve A may be of a heavier gas but at same temperature

B. Curve B may be of the same gas but at 373 K

C. Curve A may be of the same gas but at 373 K

D. Curve B may be of the lighter gas but at same temperature.

Answer: A::B::D

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26. For fixed amount of ideal gas In P (y-axis) us In B (x-axis) curve is plotted at constant T Select correct statements.

A. Slope of curve for any ideal gases would be same

B. Slope of curve for ideal gases would depend on amount of gas and temperaure

C. Intercept on y-axis for any ideal gases would be same

D. Intercept on y-axis for ideal gases would depend on amount of gas and temperature

Answer: A::D

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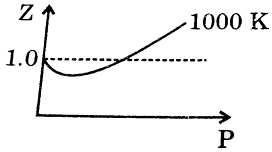
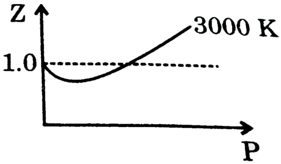
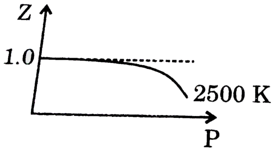
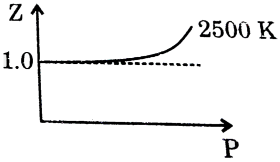
27. For a van der Waals' gas, $a = 4atm - l^2 / \text{mol}^2$ and $b = 0.02l / \text{mol}$. Select the correct possible graph (s). [Given: $R = 0.08L - atm / mol' - L$]

A. 

B. 

C. 

D. 

Answer: A::D

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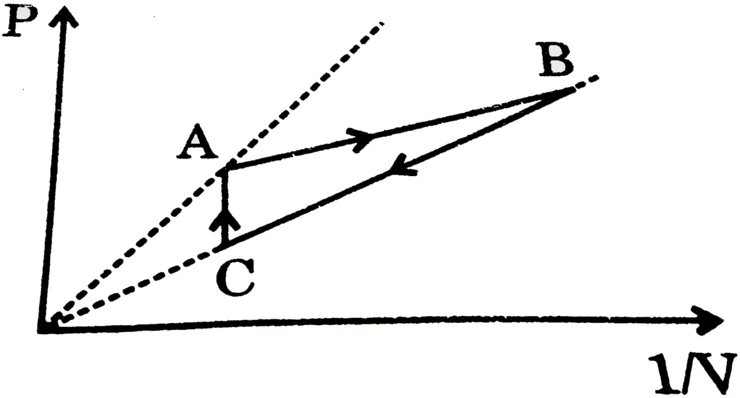
28. For the following process involving fixed moles of an ideal gas, select the correct statement (s). (d is density of gas)



A. $T_A > T_B = T_C$

B. $T_A < T_B = T_C$

C. $d_A \neq d_B \neq d_C$

D. $d_A = d_C < d_B$

Answer: A::D

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29. Which of the following graph is parabolic for fixed mass of an ideal gas at constant temperature in closed container ?

A. $\frac{1}{V^2}$ us P

B. $\frac{P}{V}$ us P

C. $\frac{P}{V}$ us V

D. $\frac{P}{V}$ us log V

Answer: A::B

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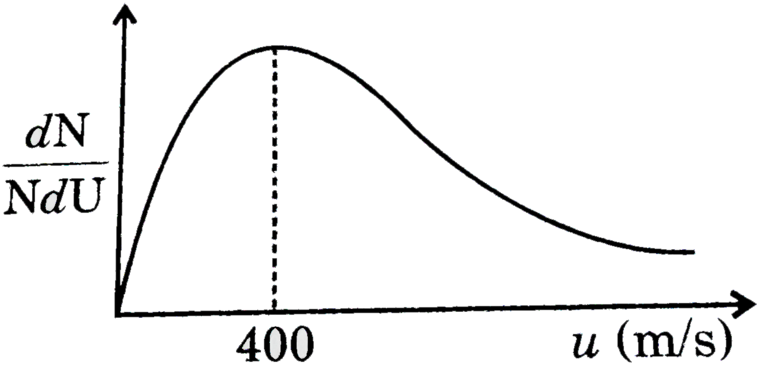
30. For an ideal gas, following observation is made as per Maxwell-Boltzmann distrbution. Choose the correct options.



A. $\mu_{rms} = \sqrt{1.5} \times 400m/s$

B. $\mu_{avg} = \sqrt{\frac{4}{\pi}} \times 400m/s$

C. Fraction of molecules moving between 400 to 401 m/s are more than fraction of molecules moving between 452 to 453 m/s

D. Fraction of molecules moving between 400 to 401 m//s are equal with fraction of molecules moving between 452 to 453 m/s

Answer: A::B::C

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31. Which of the following statements is (are) true ?

A. Graph between $\frac{1}{V(L)}$ us P (atm) for 1 mole of gas at 300 K has a slope between 0 and 1

B. Isobar between log V us log T has varying slope depending upon the values of n and P

C. Isobars between log V us log T has varying intercepts on y and x axis depending upon the values of n and P.

D. Isochore between PT us P for constant n is a straight line

Answer: A::C

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32. For a fixed mass of gas at constant volume, which of the following statements is/are (not) correct ?

A. Plot of pressure vs celsius temperature is linear with intercept zero

B. Plot of pressure us kelvin temperature is linear with a nonzero intercept

C. Plot of p us T is linear with a positive slope

D. Plot of p us T is linear with a negative slope

Answer: A::B::D

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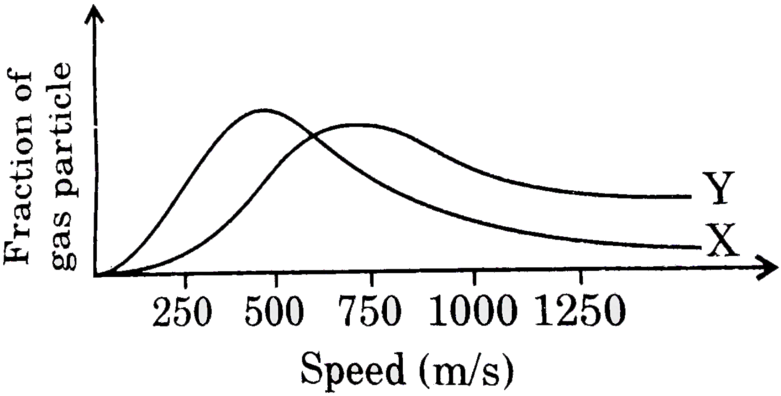
33. The graph below shows the distribution of molecular speeds of two ideal gases X and Y at 200 K . On the basis of the below graph, identify the correct statements .



A. If gas X is methane, then gas Y can be CO_2

B. Fraction of molecules of X must be grater then Y in a particular range of speed a 200K

C. Under identical conditions rate of effusion of Y is greater than that of X

D. The molar kinetic energy of gas X at 200K is equa to the molar kinetic energy of Y at 200 K

Answer: C::D

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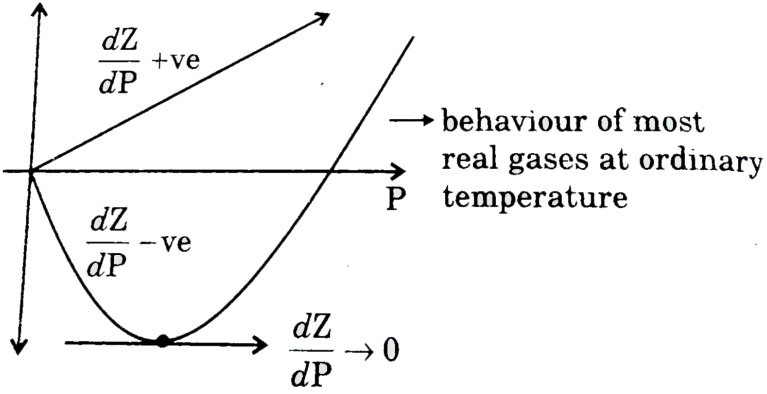
34. Which of the following statement(s) are true about Z us P graph for a real gas at a given temperature.



A. $\frac{dZ}{dP} \rightarrow 0$ as $P \rightarrow 0$ for must real gases

B. $\frac{dZ}{dP} = -$ ive as $P \rightarrow 0$ for most real gases

C. $\frac{dZ}{dP} \rightarrow 0$ at a pressure where repulsibe and attractive forces are comparable

D. $\frac{dZ}{dP} = +$ ive for real gases at extermely high pressure.

Answer: B::D

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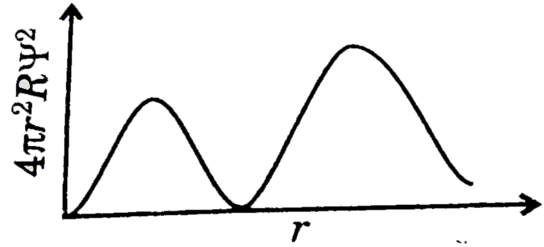
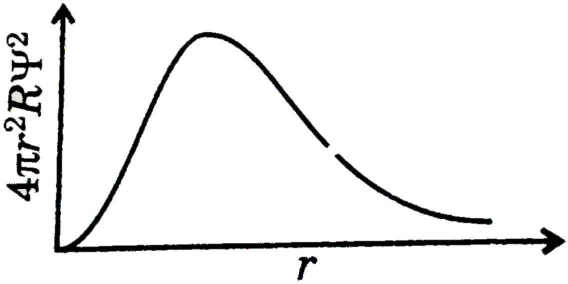
35. Which of following has correct matching of curve and orbital ?

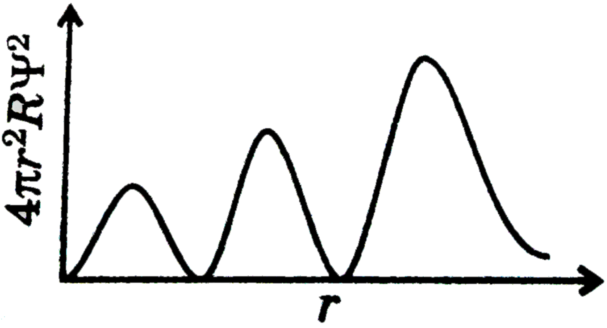
(P)



(Q)



(R)



A. $P(2p)Q(!s)R(4p)$

B. $P(3p)Q(3d)R(3s)$

C. $P(4d)Q(2p)R(5d)$

D. $P(2s)Q(4f)R(3d)$

Answer: B::C

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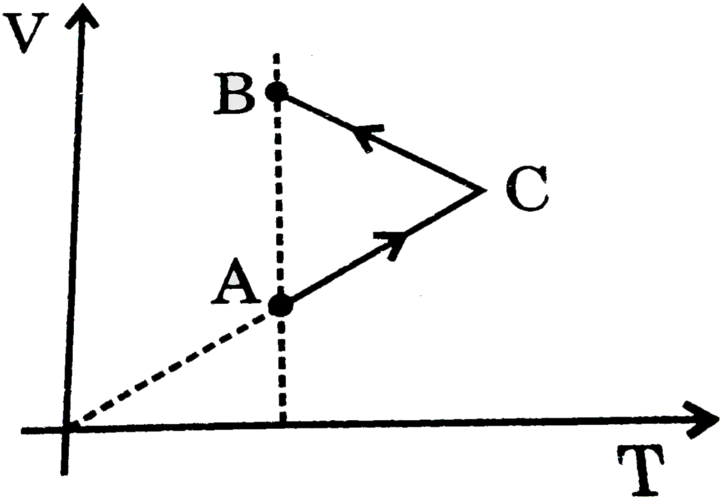
36. 

With refernce to above graph, which of the following is/are incorrect ?

A. $P_A = P_B = P_C$

B. Pressure first increases then decreases

C. $P_C > P_A$

D. $P_B < P_A$

Answer: A::B::C

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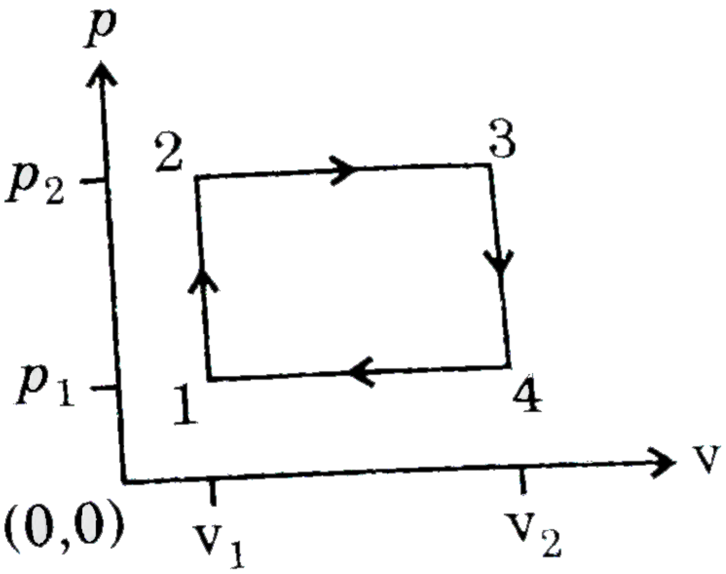
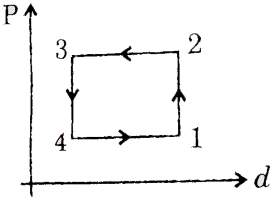
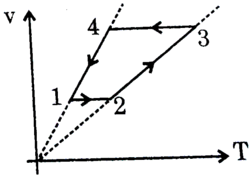
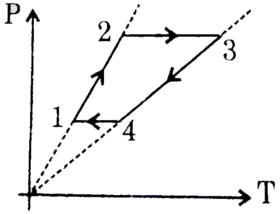
37. A gas has been subjected to an isochoric and isobaric cycle. Plot of the graph of this cycle in the pressure-density, V-T and P-T co-ordinates are given below. Choose the correct plots.



A. 

B. 

C. 

D. None of these

Answer: A::B::C

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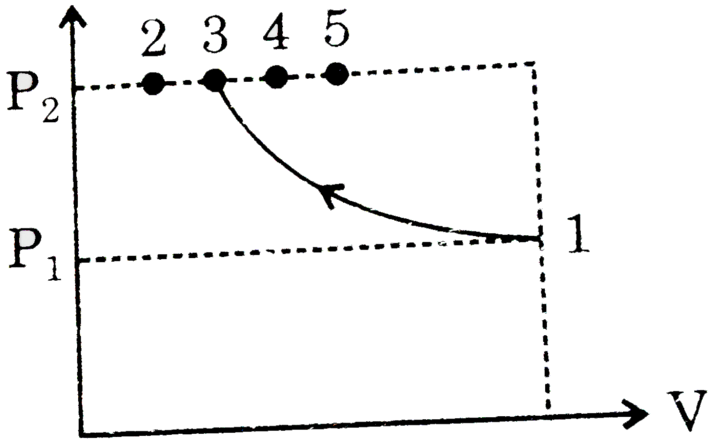
38. An ideal gas is taken from the same initial pressure P_1 to the same final pressure P_2 by four different process. If it is known that point 3 corresponds to a reversible adiabatic, point 4 corresponds to a single step adiabatic and point 2 corresponds to reversible isothermal. Select the incorrect option (s).



A. Point 5 may be achieved by two step adiabatic process

B. Temperature of the gas is more at point 3 than at point 4

C. Temperature of the gas is more at point 3 than at point 2

D. Work done in process "1-3" is more than work done in process "1-2".

Answer: A::B

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39. In the graph showing Maxwell Boltzmann distribution of energy ....

A. area under the curve increases with increase in temperature

B. area under the curve decreases with increase in temperature

C. with increase in temperature curve broadens and shifts to the right hand side.

D. as a gas cools to a lower temperature, the peak of the graph shifts to the left

Answer: A::D

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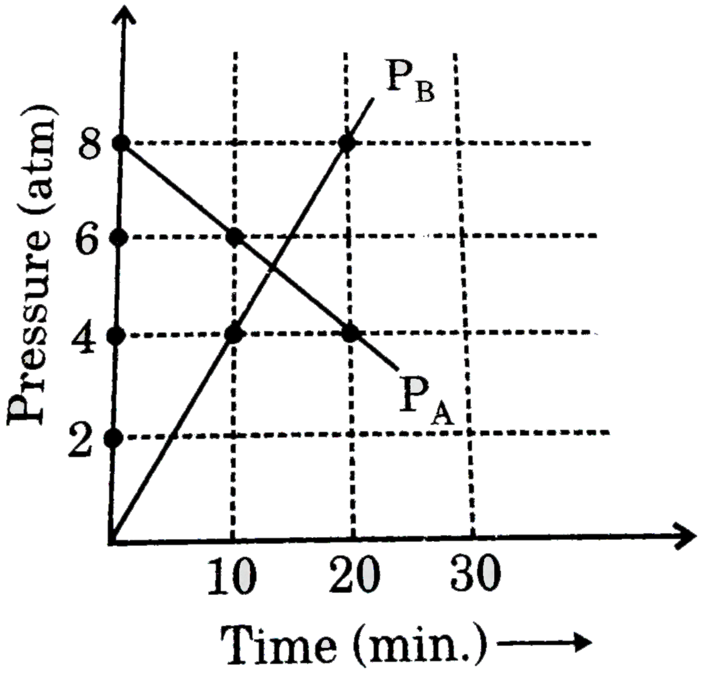
40. In a chemical reaction $A(g)$ is converted to $B(g)$ following observation is made. Identify the correct statement (s).



A. Chemical reaction can be $\frac{1}{2}A(g) \rightarrow B(g)$

B. $t_{1/2}$ of the reaction in independent of initial partial pressure of A.

C. Recation must be complex reaction

D. Time of complettion for the reaction is 40 minutes.

Answer: A::C::D

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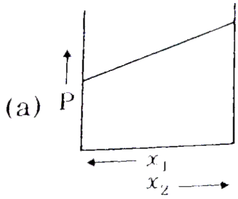
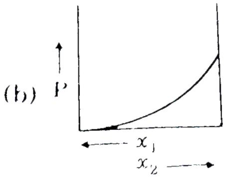
41. For a binary ideal liquid solution, the variation in total vapour pressure us composition of solution is given by which of the curves ?

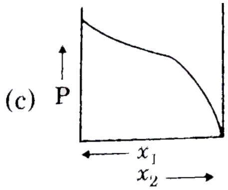
A.



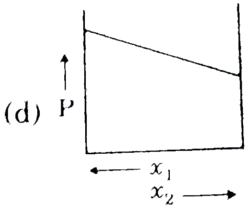
B.



C.



D.



Answer: A::D

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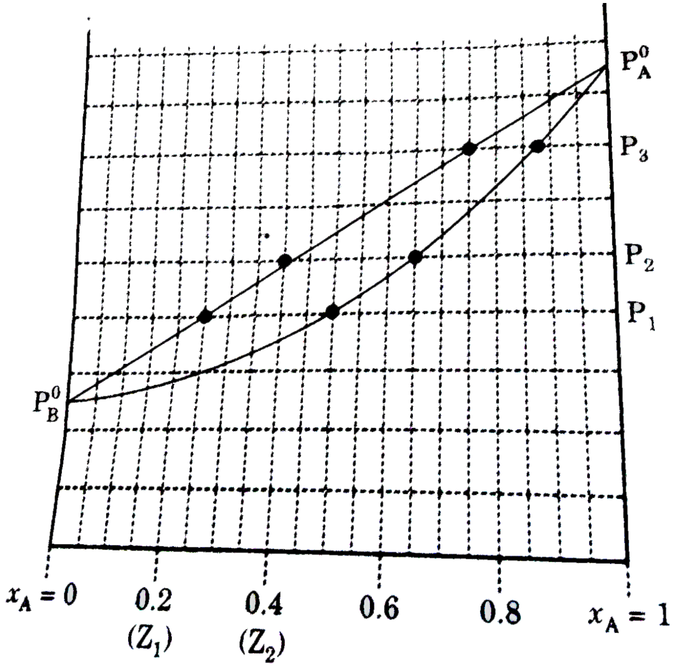
42. With the help of following phase diagram, select the correct statements.



A. Mole fraction of B in vapour at pressure P_1 for solution Z_2 is 0.5

B. Mole fraction of A in liquid at presure P_3 for solution Z_2 is 0.4

C. Mole fraction of B in liquid at pressure P_1 for solution Z_2 is 0.75

D. Mole fraction of B in liquid at pressure P_2 for solution Z_1 is 0.4

Answer: A::B::C

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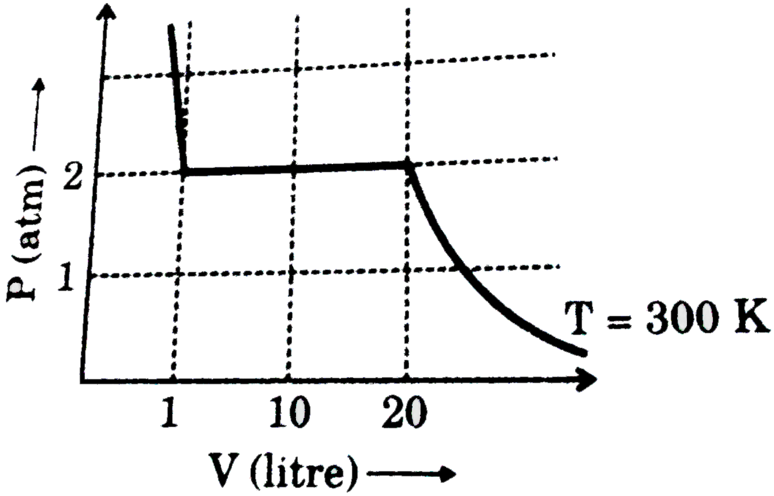
43. A 1kg real gas is liquified at temperature 300 K as shown in diagram. Select the correct statement.



A. 2 atm is vapour pressure of liquid at 300 K

B. Density of gas when V equals to 20 litre, $0.1 gm / ml$

C. Density of gas when V equals to 10 litre, $0.05 gm / ml$

D. Density of liquid when V equals to 1 litre, $1 gm / ml$

Answer: A::C::D

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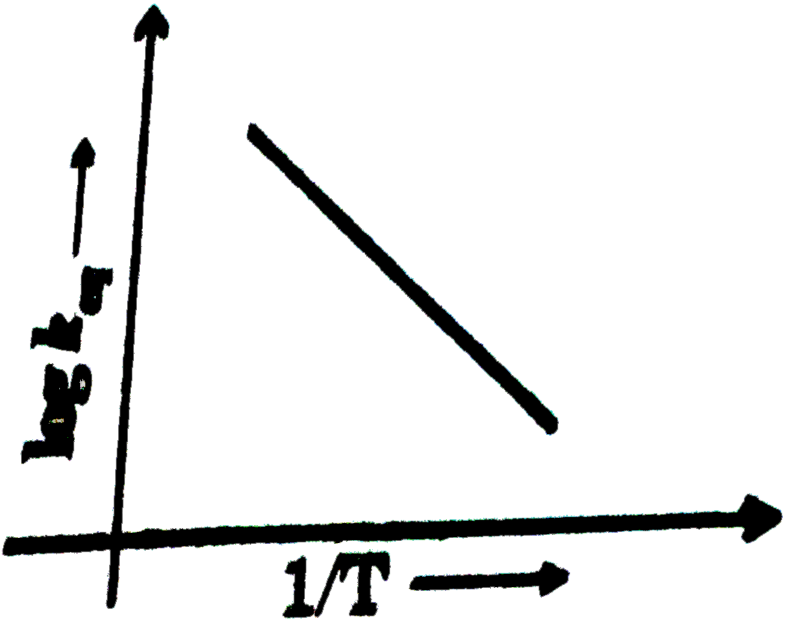
44. For the reaction

$2CIF_3(g) \leftrightarrow CI_2(g) + 3F_2(g) \log K_{eq} vs \frac{1}{T}$ (where temperature is in K) curve is obtained as given. Which of the following change will increase the concentration of CI_2 in an equilibrium mixture of CI_2, F_2 and CIF_3?



A. Addition of inert gas at constant pressure

B. Increase in temperature at constant volume

C. Addition of catalyst at equilibrium

D. Removal of $F_2(g)$ at equilibrium

Answer: B::D

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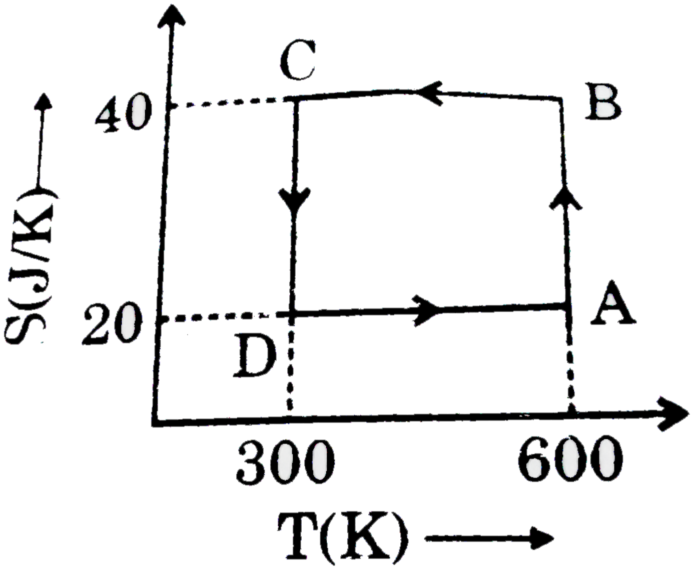
45. For the process,



A. The efficiency of the cyclic process $= 50\%$

B. Net work done $= -6kJ$

C. Heat supplied during the process $= +12kJ$

D. More work is done (magnitude wise) in BC than DA

Answer: A::B::C

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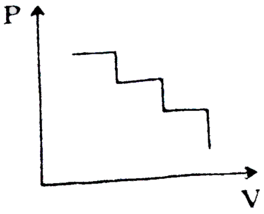
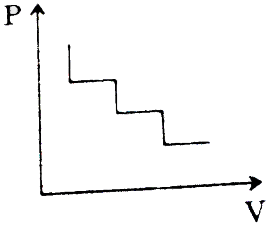
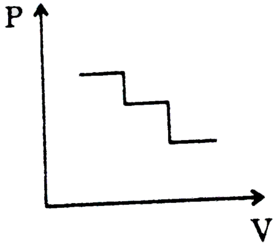
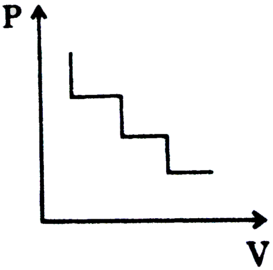
46. For an irreversible process, if P-V graphs are plotted simply to represents the work involved in the process as the area under the P-V curve. Then which of the following options has/have the correct P-V curve for the mentioned process on an ideal gas placed in a cylinder fitted with a piston.

A. 

B. 

C. 

D. 

Answer: A::D

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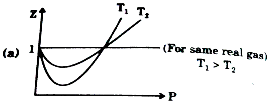
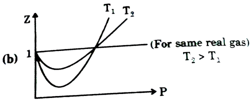
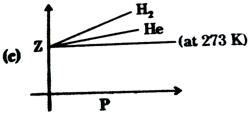
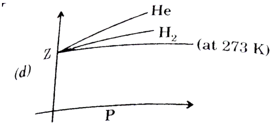
47. Which of the following graphs are correct ?

A. 

B. 

C. 

D. 

Answer: B::C

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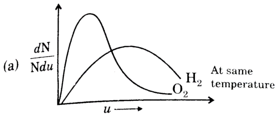
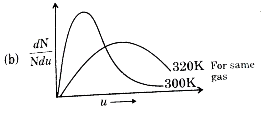
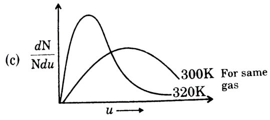
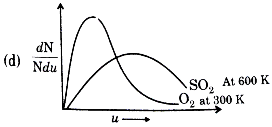
48. Which of the following graphs regarding Maxwell distribution of speed are correct for ideal gases ?

A. 

B. 

C. 

D. 

Answer: A::B

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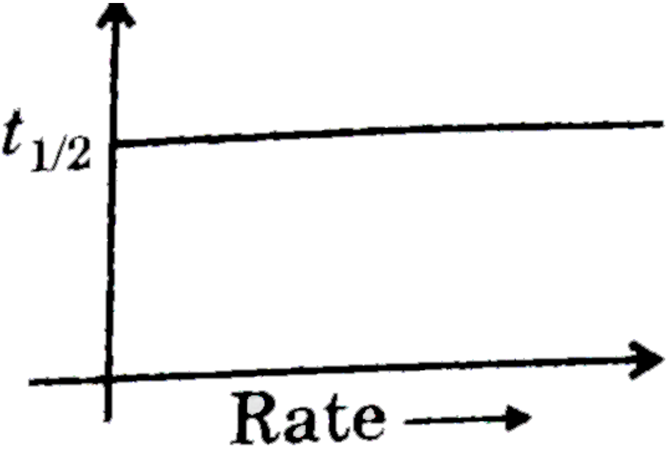
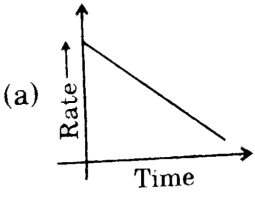
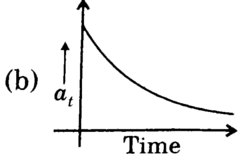
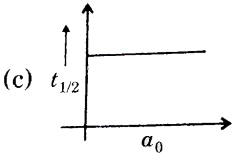
49. For the reaction, $A(g) \to B(g) + C(g)$

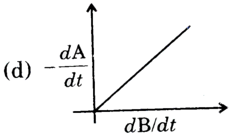


Select the correct graph.

A. 

B. 

C. 

D. 

Answer: B::C::D

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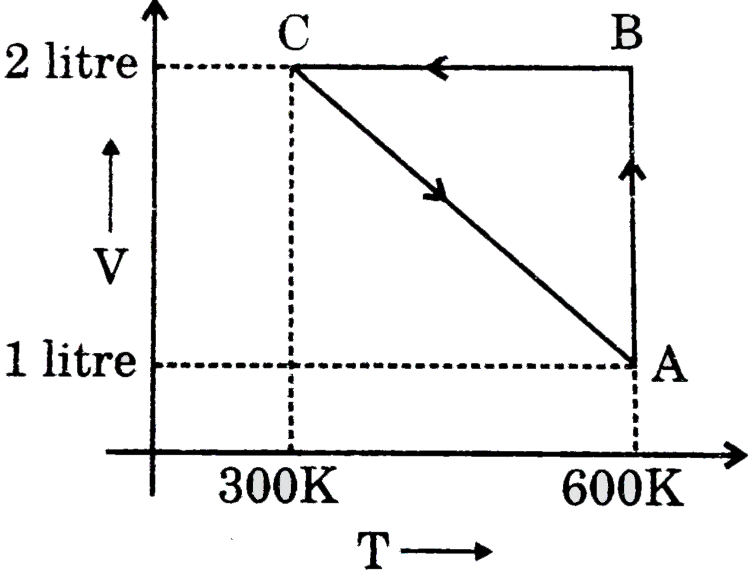
50. 1 mole $N_2(g)$ undergoes followingcyclic process : Which option(s) is/are correct ? [Use: $R = 2Cal/K - \text{mole}$, ln $2 = 0.7$]



A. $W_{\text{overall}} = -180cal$

B. $\Delta H_{AB} = 300cal$

C. $\Delta U_{CA} = 1500cal$

D. $q_{BC} = -600cal$

Answer: A::C

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51. Which of the following is false regarding reversible adiabatic expansion of an ideal gas ?

A. Plot of T us V is a straight line with slope equal to γ

B. Plot of ln T us ln V is a striaght line with slope equal to γ

C. Plot of ln T us ln V is a straight line with slope equal to $-\gamma$

D. Plot of ln T us ln V is a straight line with slope equal to $1-\gamma$

Answer: A::B::C

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52. Which of the following are correct ?

A. When 2 moles of an ideal gas $\left(C_V = \frac{3R}{2}\right)$ is heated from 300 K to 600 K at constant pressure, change in entropy of gas is 5R ln 2

B. An ideal gas is undergoing in process as shown in figure. Work done for process 1-2 and 1-3 will be equal .

C. Entropy change when an ideal gas exapnds isothermally is positive

D. Entropy change is positive for an adiabatic free expansion of an ideal gas

Answer: A::B::C::D

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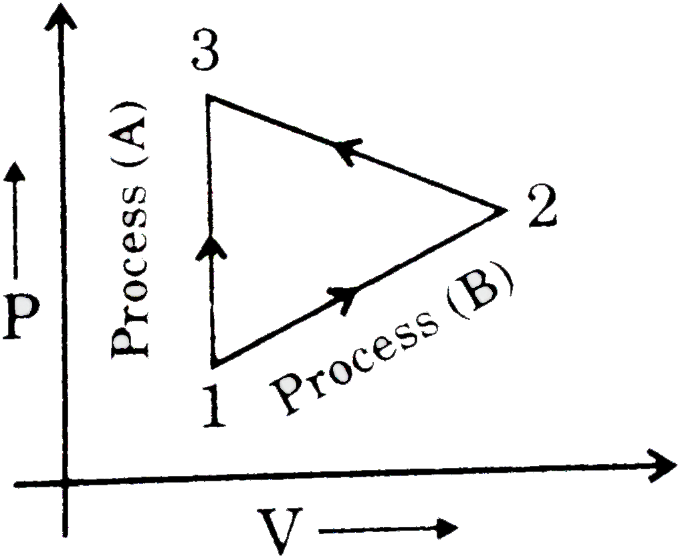
53. Two process are shown such that an ideal gas is taken from state 1 to state 3. Compare the following and choose the correct option(s).



A. $W_A > W_B$

B. $\Delta U_A = \Delta U_B$

C. $\Delta S_A = \Delta S_B$

D. $q_A = q_B$

Answer: B::C::D

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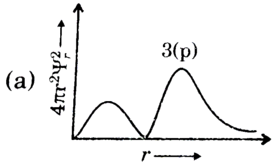
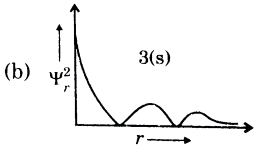
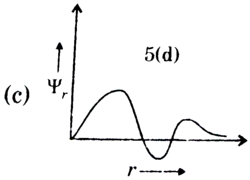
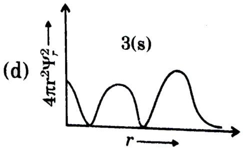
54. Which of the following plots is/are correctly labelled ?

A. 

B. 

C. 

D. 

Answer: A::B::C

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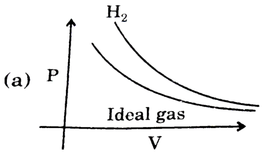
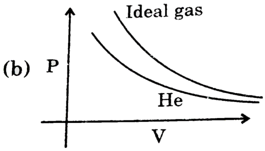
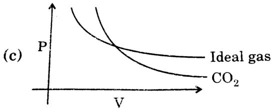
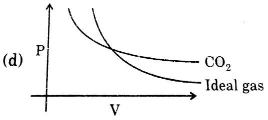
55. Which of the following are correct near room temperature ?

A. 

B. 

C. 

D. 

Answer: A::C

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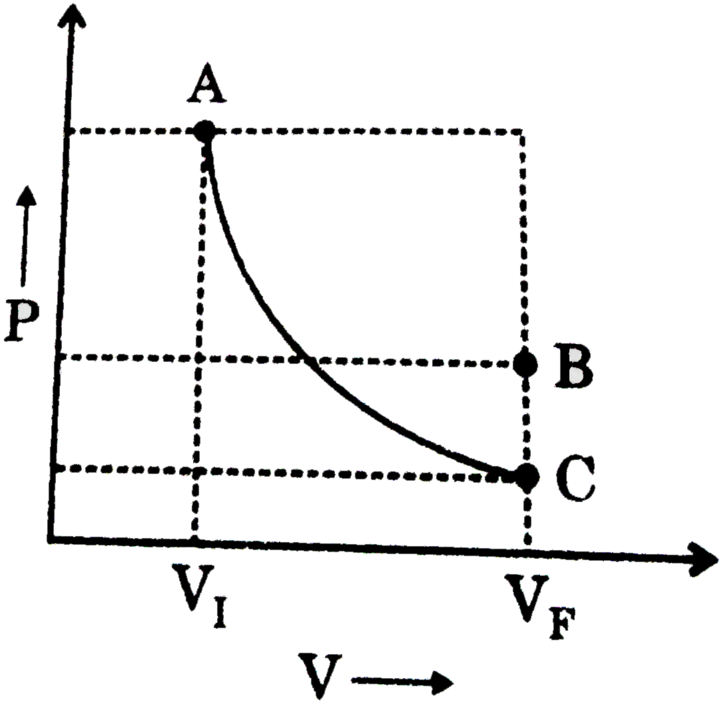
56. An ideal gas from same initial state participates in two different thermodynamic processes (AC -Reversible, AB-Irreversible) as shown in figure. If the entropy of surroundings remain constant in these processes, then which of the following are correct ?



A. $\left(\Delta S_{gas}\right)_{AB} > \left(\Delta S_{gas}\right)_{AC}$

B. $\left|\left(\Delta H_{gas}\right)_{AB}\right| < \left|\left(\Delta H_{gas}\right)_{AC}\right|$

C. $\left|\left(\Delta U_{gas}\right)_{AB}\right| < \left|\left(\Delta U_{gas}\right)_{AC}\right|$

D. $\left(\Delta S_{gas}\right)_{AC} > \left(\Delta S_{gas}\right)_{AB}$

Answer: A::B::C

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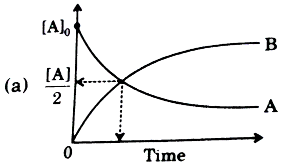
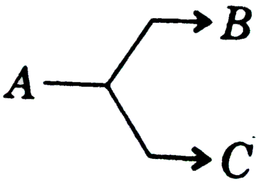
57. Which of the following is/are correct ?

A. 

For an elementary reaction $A \rightarrow B$ shown in the figure the sum of slopes for curve A and B at the intersection point is zero.

B. The half lives of two parallel first order reactions



are 4 hrs. and 12 hrs. respectively the average half life for decay of A is 8 hrs.

C. In general $\Delta G, \Delta H, \Delta S$ all have negative values in physical adsorption

D. In CsCl type structure, $8 Cs^{+}$ ions occupy the second nearest neighbour locations of Cs^{+} ion

Answer: A::C

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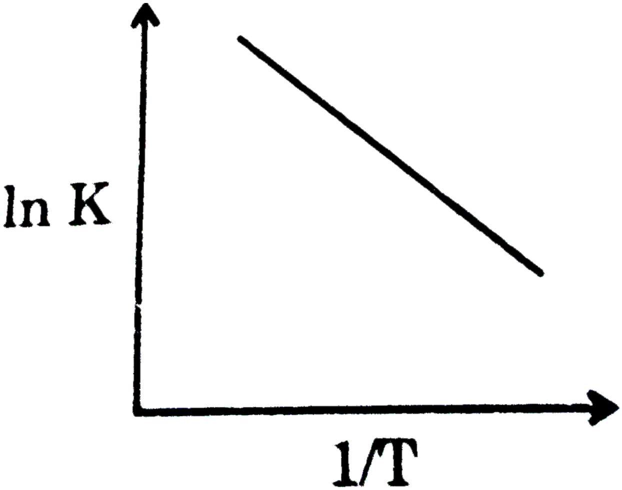
58. Consider the following reaction :

$2A(s) + 3B(g) \Leftrightarrow 2C(g) + 2D(g)$

For given reaction, graph which is followed between ln k and $1/T$ is:



Which of the following statement(s) is/are incorrect ?

A. Above reaction is exothermic

B. On increasing temperature reaction moves forward.

C. Addition of inert gas at constant volume shifts reaction in forward direction

D. On increasing volume at constant temperature reaction moves backward

Answer: A::C::D

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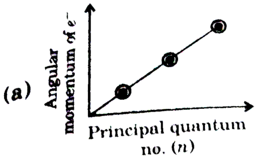
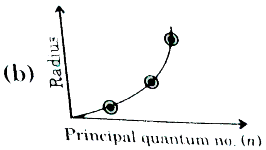
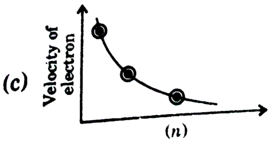
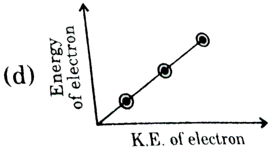
59. Select the correct graph for Bohr atom:

A. 

B. 

C. 

D. 

Answer: A::B::C

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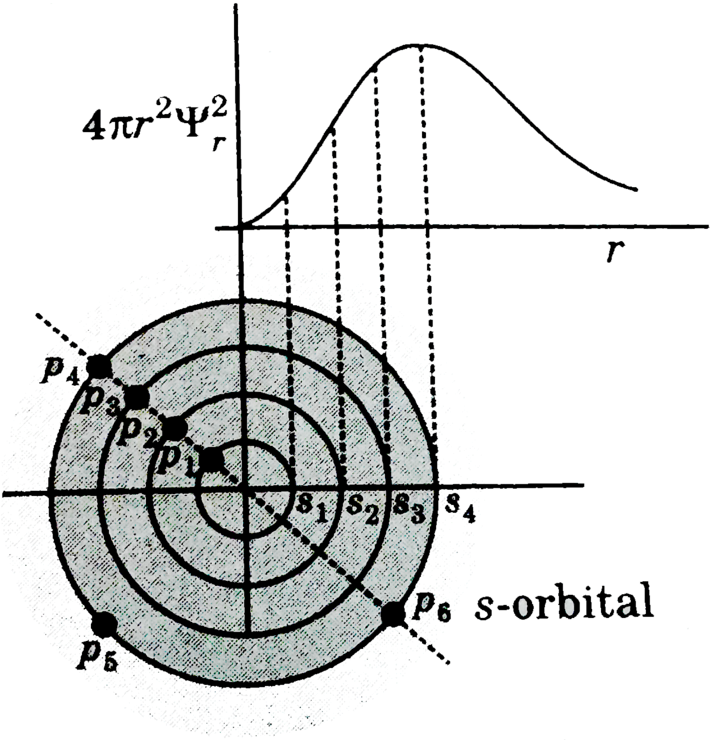
60. For s-orbital, $4\pi r^2 \Psi_r^2$ us r is plotted. Select correct statement (s).

Note: S = spherical surface at given distance. P = Point (very small volume) at given distance.



A. Order of probability of finding an electron at points is

$P_4 > P_3 > P_2 > P_1$.

B. Order of probability of finding an electron at spherical surface is

$S_4 > S_3 > S_2 > S_1$

C. Order of probability of finding an electron at points is $P_6 = P_5$.

D. Order of probability of finding an electron at points is $P_6 > P_3 > P_2 > P_1$.

Answer: B::C

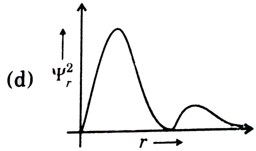
View Text Solution

61. Which of the following are correct ?

A. For van der Waal's gas, the pressure at which gas may behave ideally is $\frac{a}{V_m b}$ in low pressure range.

B. For chemical reaction at state of chemical equilibrium $(\Delta G)_{TP}$ must be zero

C. The expansion of van der Waal's gas in isothermal process occurs with increase in internal energy.

D. 

The orbital represented by the above graph will have on radial node and Ψ_{angular} depends on θ.

Answer: A::B::C::D

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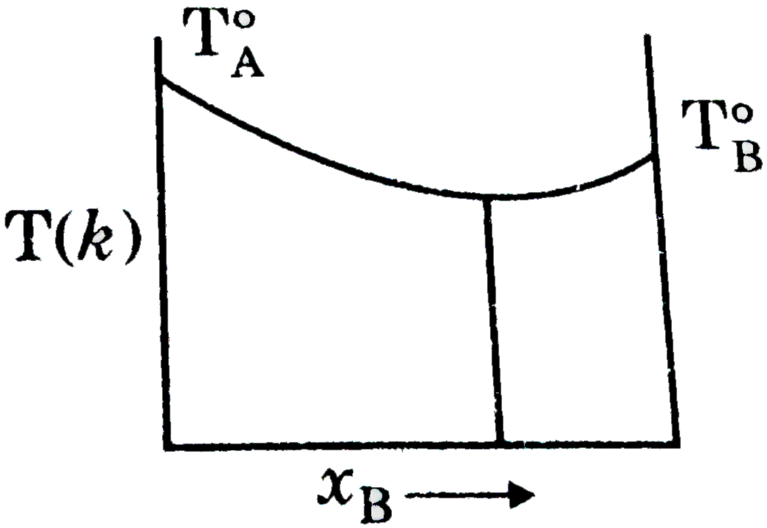
62. The diagram given below represents boiling point composition diagram of solution of component A and B. Which is/are incorrect among the following ?



A. The solution shows negative deviation.

B. A-B interaction are stronger than A-A and B-B

C. The solution is ideal solution

D. The solution shows positive deviation

Answer: A::B::C

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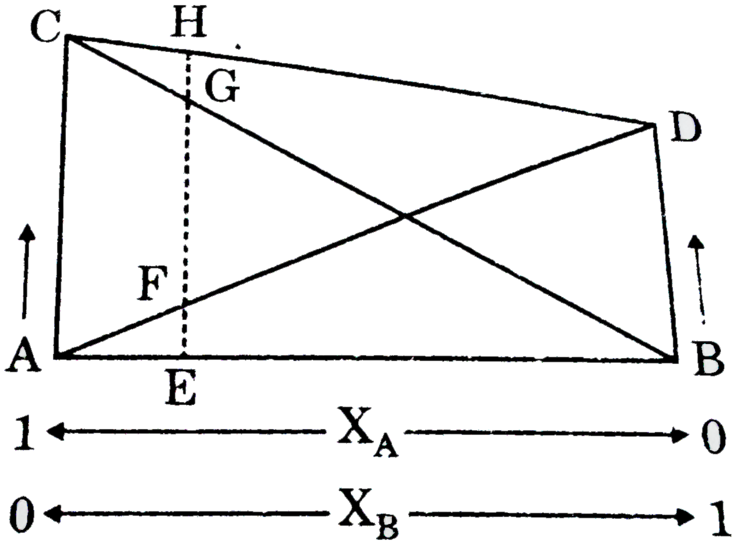
63. Based on the given diagram, which of the following statements regarding the solutions of two miscible volatile liquids are correct ?



A. Plots AD and BC show that Raoult's law is obeyed for the solution in which B is a solvent and A is the solute and as well as as for that in which A is solvent and B is solute.

B. Plots CD shows that Dalton's law of partial pressure is obeyed by the binary solutions of components A and B.

C. $EF + EG = EH$ and AC and BD correspond to the vapour pressure of the pure solvent A and B respectively.

D. As B is added to the component A, vapour pressure of A as well as of B changes.

Answer: A::B::C::D

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64. Freundlich adsorption isotherm is given by the expression $\frac{x}{m} = kp^{1/n}$. Which of the following conclusions can be drawn from this expression ?

A. When $\frac{1}{n} = 0$, the adsorption is independent of pressure.

B. When $\frac{1}{n} = 1$, the adsorption is directly proportional to pressure.

C. When $\frac{1}{n} = 0$, $\frac{x}{m}$ us p graph is a line parallel to x-axis.

D. When $\frac{1}{n} = 0$, plot of $\frac{x}{m}$ us p is a curve

Answer: A::B::C

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65. Which of the following statements is/are correct with respect to surface phenomenon ?

A. Potassium ferrocyanide can cause greater coagulation in a basic dye as compared to Na_2HPO_3

B. A starch aqua-sol can act as protective colloid for $Fe(OH)_3$ sol

C. The slope of the Freundlich isotherm (log $\frac{x}{m}$ us log P) keeps on changing for a long range of pressure and is constant over a limited range of pressure.

D. On mixing $AgNO_3$ with large amount of KI and subjecting the colloidal state to electrophoresis, coagulation is obtained at cathode.

Answer: A::B::C

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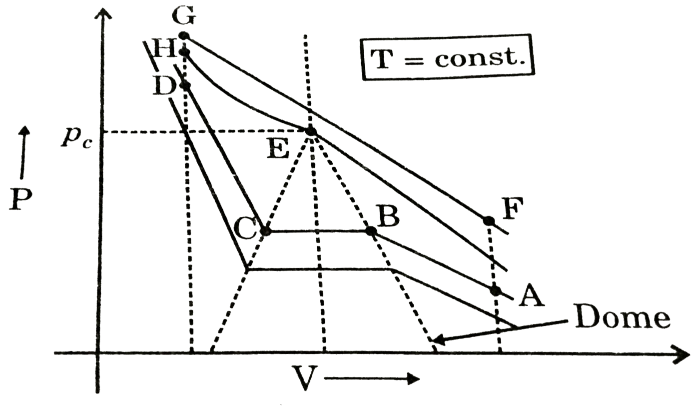
66. For the given graph of real gas: What should be the pathto change a gas into a liquid or vice-versa in which always a single phase is present ?



A. $A \rightarrow F$ vertically then $F \rightarrow G$ (isothermally) then $G \rightarrow D$

B. $A \rightarrow B$ (isothermally) then $F \rightarrow G$ (isobarically), then $C \rightarrow D$ (isothermally)

C. $D \rightarrow H \rightarrow G$ then $G \rightarrow F$ (isothermally) then $F \rightarrow A$ vertically

D. None of the above

Answer: A::C

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67. In the graph of , if we use the term fluid for either a gas or a liquid, then which of the following can be true statement(s)?

A. Liquid can be viewed as a very dense gas

B. Liquid and gas can be distingusihed only when the fluid is below its critical temperature and its pressure and volume lie under the done of graph

C. Under the dome, liquid $\Leftrightarrow$ gas (equilibrium) and a surface separating the two phases is visible.

D. In the absence of surface, there is no fundamental way of distinguishing between two states.

Answer: A::B::C::D

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68. 1 mole of real gas changes its state from state -A (bar, 3L, 100K) to state-B (2bar, 5L, 200K) at constant pressure and finally to state-C (3 bar, 10 L, 300K). If $\Delta U_{BC} = 110 J$ and C_{P_m} of gas $= 3R = 3x8.3 JK^{-1} mol^{-1}$ then choose the correct option (s).

A. $W_{AB} = 830 J$

B. $\Delta H_{AC} = 4600 J$

C. $\Delta U_{AC} = 2200 J$

D. $\Delta U_{AC} = 1770 J$

Answer: B::C

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Comprehension 1

1. Every reaction whether started by taking only reactants or by taking only products or any other combination always has a tendency to move towards equilibrium. Hence, equilibrium state can be considered as the one with most stable composition. In case of isomers, based on stability data position of equilibrium can als be decided.

Which of the following options correctly represent ΔG_f° of cis but-2-ene, trans but-2-ene and but-1-ene in kJ/mole?

A. 63,66,72

B. 66,63,72

C. 72,63,66

D. 66,72,63

Answer: B

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Comprehension

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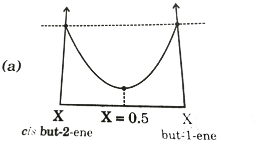
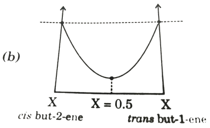
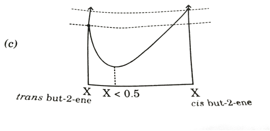
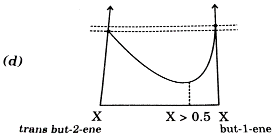
Which of the following graphs are correct for the isomeric conversions at 1 bar and 298 K?

A. 

B. 

C. 

D. 

Answer: C

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2. One mole of an ideal gas undergoes a process (10L, 4atm) to (4L, 10 atm). The process may be represented by straight line in P-V diagram

The only incorrect statement is :

(R = 0.08 L-atm/K-mol)

A. The maximum temperature of the gas during the process is $612.5^\circ C$

B. The temperature of gas is maximum when its volume is 7 L

C. The temperature of gas is maximum when its pressure is 7 atm

D. The mimimum temperature of gas during the process is 500 K

Answer: A

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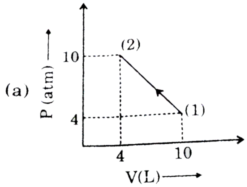
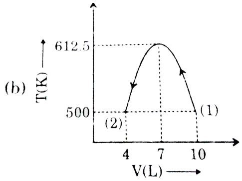
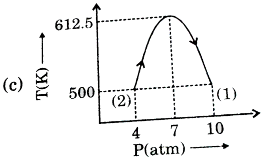
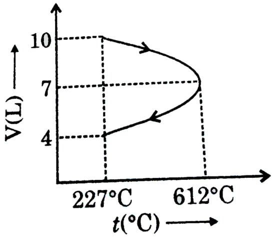
3. One mole of an ideal gas undergoes a process (10L, 4atm) to (4L, 10 atm). The process may be represented by straight line in P-V diagram

The incorrect graph regarding the process is ltbgt

A. 

B. 

C. 

D. 

Answer: D

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4. In order to perdict variation of Gibbs free energy with progress of reaction at constant temperature and 1 bar pressure, it is important to know realtive stability of the components involved in chemical reaction at standard useful work then the change in Gibbs free energy should be calculated

In the thermite reaction used obtaining energy, aluminium oxide. From the given data identify the option 9s) which is (are) correct.

[Given : $\Delta H_f^\circ Al-(2)O_3 = -390kj/mol$,

$\Delta H_f^\circ Fe_2O_3 = -176kj/mol$,

Density of aluminimum = 2/7 gm/ml, Density of $Fe_2O_3 = 3.2gm/ml$

A. Maximum calorific value of the fuel can be 1000 J/gm

B. Maximum calorific value of the fuel can be $\frac{21.4}{7}$ kj/ml

C. 2.14 kg of the mixture can be produce 2500 kj of heat

D. 140 ml of the mixture can be produce 280 kj of heat

Answer: A::B::D

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5. One of the important approach of the study of real gases involves the analysis of a parameter Z called the compressibility factor $Z = \frac{PV_m}{RT}$ where P is pressure, V_m is molar volume ,T is absolute temperature and R is the universal gas constant .Such a relation can also be expressed as $Z = \left(\frac{V_{\text{m real}}}{V_{\text{m ideal}}}\right)$ (where $V_{\text{m ideal}}$ and V_("m real") $arethemo \leq rvolumef$ or $ideal$ and $realgasrespectivelytendenciesamo$ $\in creasedthevalueofZapproachesidealbehaviourF$ or $arealgas'G'$, Zgt1` at STP, then for 'G' which of the following is true ?

A. 1mole of the gas occupies 22.7 L at STP

B. 1 mole of the gas occupies 22.7 L at pressure higher then that at STP (Keeping temperature constant)

C. 1 Mole of the gas occupies 22.7 L at pressure lower then that at STP (keeping temperature constant)

D. None of the above

Answer: B

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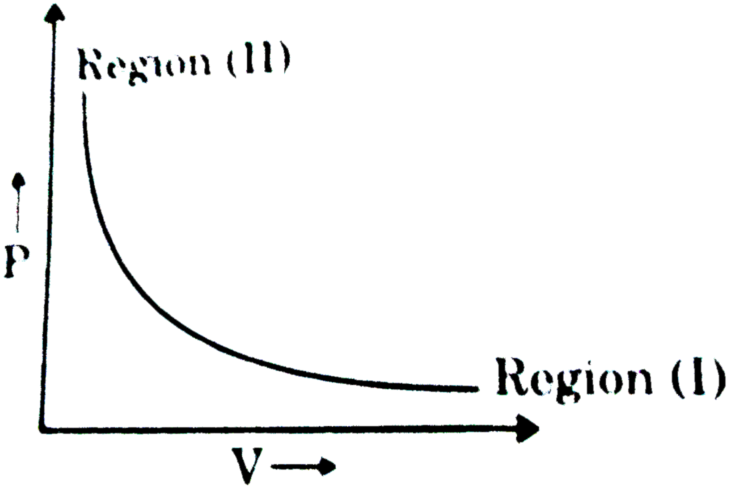
6. One of the important approach of the study of real gases involves the analysis of a parameter Z called the compressibility factor $Z = \frac{PV_m}{RT}$ where P is pressure, V_m is molar volume ,T is absolute temperature and R is the universal gas constant .Such a relation can also be expressed as $Z = \left(\frac{V_{\text{m real}}}{V_{\text{m ideal}}}\right)$ (where $V_{\text{m ideal}}$ and V_("m real")` are the moler volume for ideal and real gas respectively tendencies among constituent particles.As pressure is force among is lowered or temperature is increased the value of Z approaches ideal behaviour

Following graph represents a pressure (P) volume (V) relationship at a fixed temperature (T) for moles of a real gas.The graph has two regions masked (I) and (II). Which of the folloing option true ?



A. $Z < 1$ in the region (II)

B. Z = 1 in the region (II)

C. Z = 1 for the curve

D. Z approaches 1 as we move from region (II) region(I)

Answer: D

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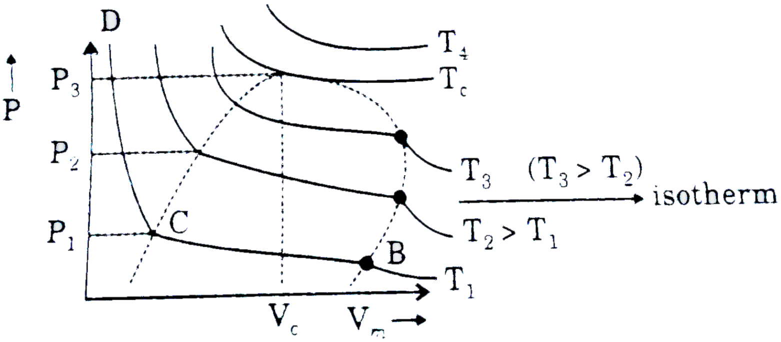
7. When perssure is increase at constant temperature, volume of gas decreases, AB $\rightarrow$ gases,Bc $\rightarrow$ vapour + liquid ,CD $\rightarrow$ liquid critical point .At this all the physical properties of liquid phase as density of liquid = density if vapour.

T_e or critical temp : Temperature above which a gas can not be liquified

V_e or critical volume : Volume occupied by one mole of gas at T_e abd P_e.



Critical constant Using van der Waals' Equations

$$\left(P+\frac{a}{V_m^2}\right)(V_m-b)=RT$$

$$\Rightarrow \left(PV_m^2+a\right)(V_m-b)=RTV_m^2$$

$$PV_m^3+aV_m-PbV_m^2=ab-RTV_m^2=0$$

$$\Rightarrow V_m^3-V_m^2\left(b+\frac{RT_e}{P}\right)+\frac{a}{p}\frac{V}{m}-\frac{ab}{p}=0$$

Since equation is cubic in V_m hence there will be roots of equation at any temperature and pressure.At critical point van der Waals' equation will be

$$V_m^3-V_m^2\left(b+\frac{RT_c}{P_c}\right)+\frac{a}{p_c}V_m-\frac{ab}{p_c}=0 \qquad \ldots.(i)$$

But at critical point all three roots of the equation should be equal, hence equation should be :

$$V_m=V_c$$

$$(V_m-V_c)^3=0$$

$V_m-3V_m^2V_c+3V_mV_c^2-V_c^3=0$....(ii)

Comparing with equation (i)

$b + \frac{RT_c}{p_c} = 3V_c$ ...(iii)

$\frac{a}{p_c} = 3V_e^2$...(iv)

$\frac{ab}{p_c} = V_c^3$....(v)

from eqns.(iv) and (v0, $V_c = 3b$

from eq. (iv) $p_c = \frac{a}{3V_c^2}$ substituting $p_c = \frac{a}{3(3b)^2} = \frac{a}{27b^2}$

from e.q (iii) $\frac{RT_c}{p_c} = 3V_c - b = 9b - b = 8b$

$\Rightarrow T_c = \frac{8a}{27Rb}$

At critical point, the slope of PV curve (slope of isotherm) will be zero at all other point slpoe will be negative zero is the maximum value of slope

$\left(\frac{\partial P}{\partial V_m}\right)_{Tc} = 0$...(iv)

$\frac{\partial}{\partial V_m}\left(\frac{\partial P}{\partial V_m}\right)_{Tc} = 0$

[Mathematically such points are known as point of inflection (where first two derivatives becomes zero) Using the two $T_c P_c$ and V_c can be calculated

If the critical constants for a hypothetical van der Waals' gas are $V_c = 150 cm^2 mol^{-1}$, $p_c = 300K$ Then the approxomate radius of the molecule is :

$\left(\text{Take} R = \frac{1}{12} Latm mol^{-1} K^{-1}\right]$

A. $\left(\frac{75}{2\pi N_A}\right)^{1/3}$

B. $\left(\frac{75}{8\pi N_A}\right)^{1/3}$

C. $\left(\frac{3}{\pi N_A}\right)^{1/3}$

D. $\left(\frac{3}{256\pi N_A}\right)^{1/3}$

Answer: B

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8. When perssure is increase at constant temperature, volume of gas decreases, AB $\rightarrow$ gases,BC $\rightarrow$ vapour +liquid ,CD $\rightarrow$ liquid critical point .At this all the physical properties of liquid phase as density of liquid = density if vapour.

T_e or critical temp : Temperature above which a gas can not be liquified

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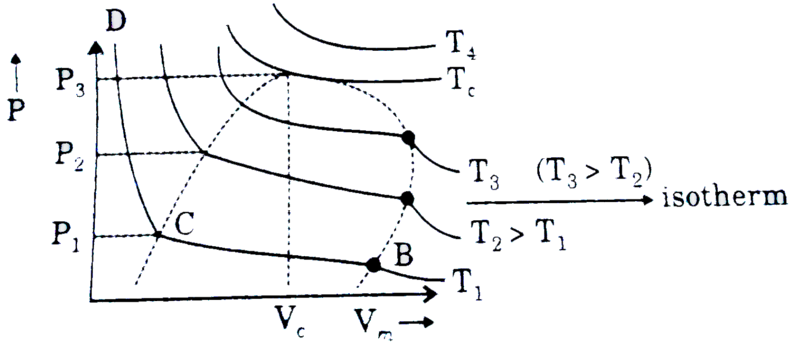

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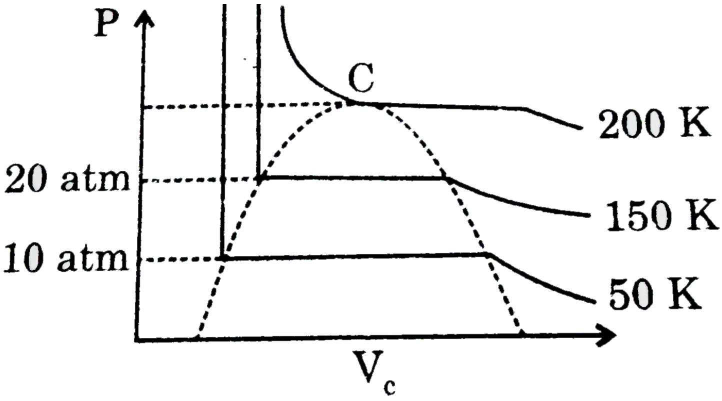
$$\frac{\partial}{\partial V_m}\left(\frac{\partial P}{\partial V_m}\right)_{Tc} = 0$$

[Mathematically such points are known as point of inflection (where first two derivatives becomes zero) Using the two $T_c P_c$ and V_c can be calculated

Identify the wrong statement related to the following graph



A. Between 50 K and K K temperature and pressure ranging from 10 atm to 20 atm gas has liquid atate only

B. Zero os the maximum value of the alpoe of P_V Curve

C. IF van der Waals' equation of state os applicable above critical tempreature then cubic equation of V_m will have one real and cubic two imaginary roots .

D. At 100 k and pressure below 20 atm it has liquid state only

Answer: A::D

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9. In the photoelectric effect the eletrons are emiited intantaneously from a given matal plate when it is irradiated with radiation of frequency equal to or greater then some minimum ferquency, is called the threshold frequency.According to Planck's idea, light may be considered to be made up discrete particles called photons.Each photon carries energy equal ti hv.When this photon cllides with the electron of the metal, the electron acquires energy of the emitted electron is given by :

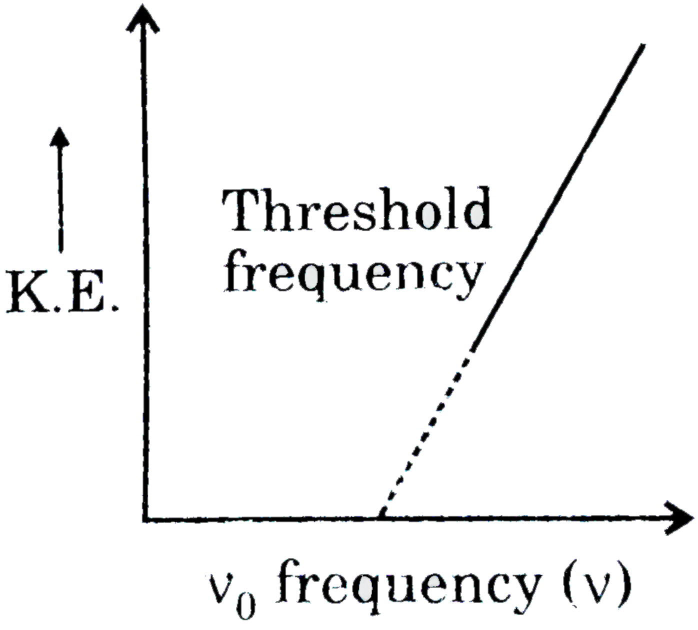
$$hv = K.\,E_{\text{maximum}} + PE = \frac{1}{2}mu^2 + PE$$

If the incident rediation is of threshold frequency the electron will be emitted without any kinetic energy

i.e hv_0

$$\therefore \frac{1}{2}mu^2 = hv - hv_0$$

A plot of kinetic energy of the emitted electron versus frequency of the incident radiation yields a straight line given as :



A laser producting monochromatic lights of different wavelenght is uesd to eject electrons from the sheet of glod having threshold frequency $6.15 \times 10^{14} s^{-1}$ Which of the following incident rediation will be suitable for the ejecting of electrons ?

A. 1.5 mloes of photons having frequency $3.05 \times 10^{9140} s^{-1}$

B. 0.5 moles of photons of frequency $12.3 \times 10^{12} s^{-1}$

C. All of the above

D.

Answer: C

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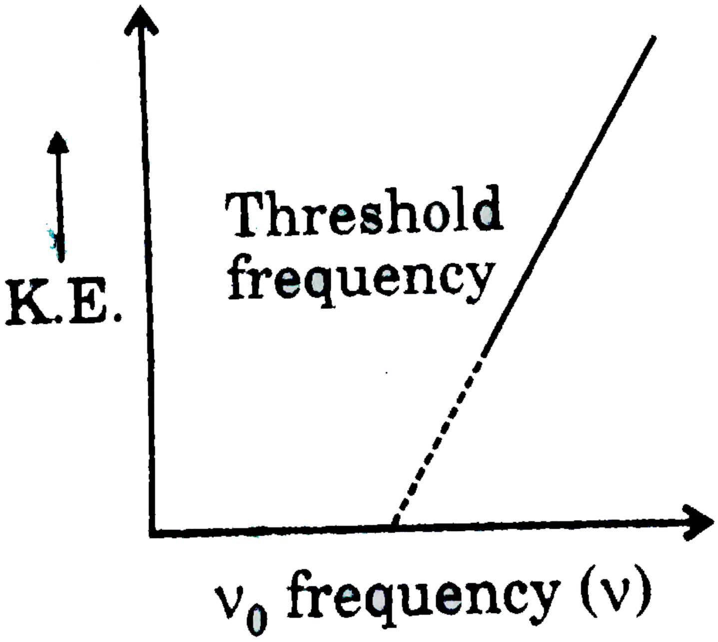

The number of photoelectrons emitted depends upon :

A. The intensity of the incident radiation

B. The frequency of incident radiation

C. the product if intensity and frequency of incident radiation

D. None of the above

Answer: A

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11. Effect of temperature on the equilibrium process analysed by using the thermodynamics

From the thermodynamics reaction

$\Delta G^\circ = -2.30RT\log k$

ΔG° : Standing free energy change

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ ...(ii)

ΔH° : Standard heat of the reaction gt

From eqns.(i) and(ii)

$-2RT\log k = \Delta H^\circ = T\Delta S^\circ$

ΔS° : standard entropy change

$$\Rightarrow \quad \log K = -\frac{\Delta H^\circ}{2.3RT} + \frac{\Delta S^\circ}{2.3R}$$

Clearly, if a plot of k vs 1/T is made then it is a straight lone having slope $= \frac{-\Delta H^\circ}{2.3R}$ amd y intercept $= \frac{\Delta S^\circ}{2.3R}$

If at temperature T_1 equilibrium constant be k_1 and at temperature T_2 equilibrium constant be k_2 then :

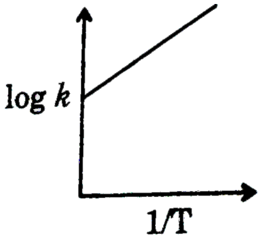
$$\Rightarrow \quad \log K_1 = -\frac{\Delta H^\circ}{2.3RT_1} + \frac{\Delta S^\circ}{2.3R} \text{..(iv)}$$

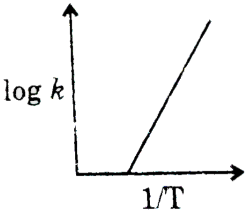
$$\Rightarrow \quad \log K_2 = -\frac{\Delta H^\circ}{2.3RT_2} + \frac{\Delta S^\circ}{2.3R} \text{...(v)}$$

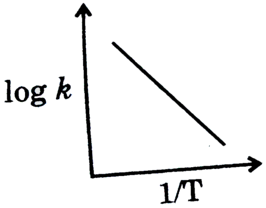
Substracting e.q (iv) from (v), we get

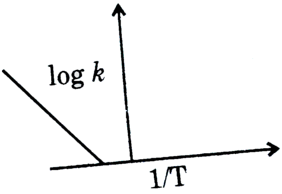
from the relation we can conclude that the of equilibrium constant increase in temperature for endothermic reaction eith but value of equilibrium constant decrease with the increase in temperature for exothermic reaction

For exothermic reaction if $\Delta S^\circ < 0$ then the sketch of log k vs $\frac{1}{T}$ may be

A. 

B. 

C. 

D. 

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$$\Rightarrow \quad \log K_2 = -\frac{\Delta H^\circ}{2.3RT_2} + \frac{\Delta S^\circ}{2.3R} \text{...(v)}$$

Substracting e.q (iv) from (v), we get

from the relation we can conclude that the of equilibrium constant increase in temperature for endothermic reaction eith but value of equilibrium constant decrease with the increase in temperature for exothermic reaction

If for a particular reversible reaction

$K_C = 57$ abd $355^\circ C$ and $K_C = 69$ at $450^\circ C$ then

A. $\Delta H < 0$

B. $\Delta H > 0$

C. $\Delta H = 0$

D. ΔH Whose sing can't be determined

Answer: B

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13. The variation of rate constant with temperature can be explained by Arrhenius equation. However , the can be explained by Activation energy is found to be temperature dependent/In such cases $\frac{d\text{in}K}{dT}=\frac{E_a}{RT^2}$ should be used to predict variation of rate constant with tempreature. On the basic of this information , answer the question that follow :

If for a reaction in $K=20-\frac{20}{T}+3$ in T then E_a at 300 K will be

A. 20 R

B. 900 R

C. 920 R

D. 880 R

Answer: C

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14. The variation of rate constant with temperature can be explained by Arrhenius equation. However , the can be explained by Activation energy is found to be temperature dependent/In such cases $\frac{d\text{in}K}{dT} = \frac{E_a}{RT^2}$ should be used to predict variation of rate constant with tempreature.

On the basic of this information , answer the question that follow :

Which if the following statement is not correct ?

A. Temperature coefficient of a reaction at high temperature will be less

B. Reaction with no activation energy will have no change in rate constant due to temperature

C. The factor by which catalyst increase rate constant will be same at all the temperature

D. Greater the activation energy, more sanitive will the rate constant be cecause of temperature

Answer: C

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15. If an element can exist in several oxidation states, it is convenient to display the reduction potentials corresponding to the various half reactions in diagrammatic from, known as Latimer diagram. The Latimer diagram for chlorine in acid solution is

$Cl_4^- \xrightarrow{+1.20V} ClO_3^- \xrightarrow{+1.60V} ClO_2^- \xrightarrow{+1.60V}$

$ClO^- \xrightarrow{+1.67V} Cl_2 \xrightarrow{+1.36V} Cl^-$

In basic solution is :

$ClO_4^- \xrightarrow{+0.37V} ClO_3^- \xrightarrow{+0.30V} ClO_2^- \xrightarrow{+0.68}$

$ClO^- \xrightarrow{+0.42V} Cl_2 \xrightarrow{+1.36} Cl^-$. The standard potentials for two nonadjacent species can also be calculated by using the concept that ΔG° is an additive property but using potential is not an assitive property and $\Delta G^\circ = -nFx^0$, If a given oxidation state is a the next higher oxidation state disproportionation can occur. The reverse of relative stabilities of the oxidation state can also be understood by drawing a graph of $\Delta G^\circ / F$ against oxidation state, known as Frost diagram, Choosing the stability of zero oxidation state arbitrery as zero. The most stable oxidation state of a apecies lies lowest in the digram Disproportionation is spontaneous if the species lies above a straight line joining its two product species.

What is the potential of couple $\frac{ClO^{-}}{Cl^{-}}$ at pH = 14 14?

A. 1.78V

B. $-0.94V$

C. $0.89V$

D. $-0.89V$

Answer: C

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16. If an element can exist in several oxidation states, it is convenient to display the reduction potentials corresponding to the various half reactions in diagrammatic from, known as Latimer diagram. The Latimer diagram for chlorine in acid solution is

$$Cl_4^{-} \xrightarrow{+1.20V} ClO_3^{-} \xrightarrow{+1.60V} ClO_2^{-} \xrightarrow{+1.60V}$$

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Which of the following statement s correct ?

A. Cl_2 undergoes disproportionation into Cl^{-0} and ClO^- at pH = 0 and pH = 14

B. Cl_2 undergoes disproportionation into Cl^- and ClO^- at pH = 14 and pH = 0

C. Cl_2 undergoes disproportionation into Cl^- and ClO^- at pH = 0 not at pH = 14

D. None of the above

Answer: B

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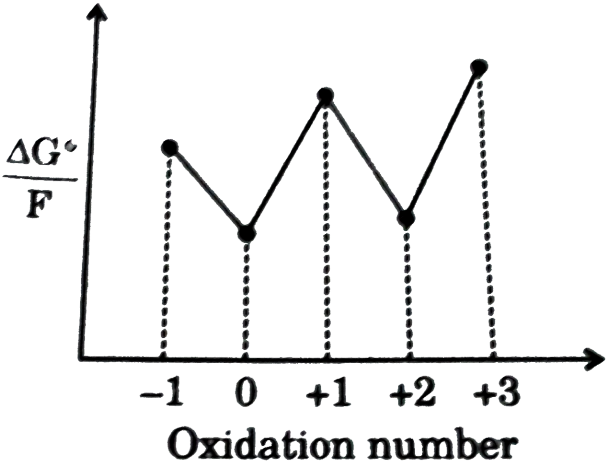
$$ClO_4^- \xrightarrow{+0.37V} ClO_3^- \xrightarrow{+0.30V} ClO_2^- \xrightarrow{+0.68}$$

$ClO^- \xrightarrow{+0.42V} Cl_2 \xrightarrow{+1.36} Cl^-$. The standard potentials for two nonadjacent species can also be calculated by using the concept that

ΔG° is an additive property but using potential is not an assitive property and $\Delta G^\circ = -nFx^0$, If a given oxidation state is a the next higher oxidation state disproportionation can occur. The reverse of relative stabilities of the oxidation state can also be understood by drawing a graph of $\Delta G^\circ / F$ against oxidation state, known as Frost diagram, Choosing the stability of zero oxidation state arbitrery as zero. The most stable oxidation state of a apecies lies lowest in the digram Disproportionation is spontaneous if the species lies above a straight line joining its two product species.

For a hypothetical element, the Frost diagram is shown in figure



Which of the following oxidation state is least stable ?

A. -1

B. 0

C. 2

D. 3

Answer: D

View Text Solution

18. If an element can exist in several oxidation states, it is convenient to display the reduction potentials corresponding to the various half reactions in diagrammatic from, known as Latimer diagram. The Latimer diagram for chlorine in acid solution is

$Cl_4^- \xrightarrow{+1.20V} ClO_3^- \xrightarrow{+1.60V} ClO_2^- \xrightarrow{+1.60V}$

$ClO^- \xrightarrow{+1.67V} Cl_2 \xrightarrow{+1.36V} Cl^-$

In basic solution is :

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Which of the following statement is correct according to above question ?

A. A^{+1} undergoes disproportionation into A and A^{2+}

B. A^{2+} undergoes disproportionation in A and A^{3+}

C. A undergoes comproportionation into A^{+1} and A^{-1}

D. All of the above

Answer: A

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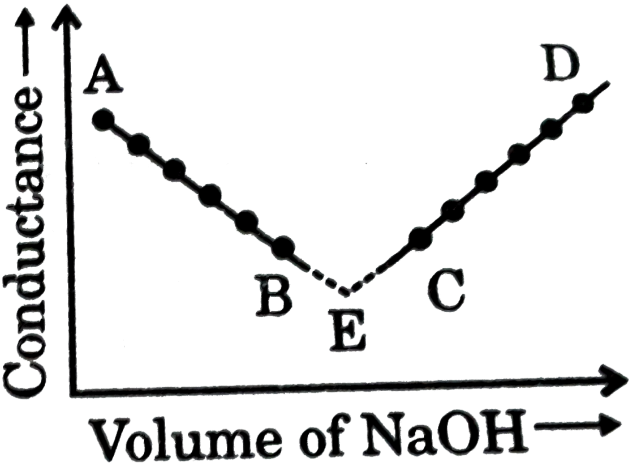
19. The principle on conductometric titration is based in the fact that during the titration, one of the ions is replaced by the other and invariably thses two ions differ in the ionic conductivity with the result that the conductivity of the solution varies during the course of the titration.Take,for example,the titration between strong acid, say HCl. and a strong base, say NaOH.Before NaOH is added the conuctance of HCl solution has a high value due ti the persence if highly hydrogen ions.As NaOH is added,H^+ ions are the replaced by relatively slower moving Na^+ ions.Consequently, the conductance of the solution decrease and this continues right upto the enuivalence point where the solution contains only NaCL.Beyond the equivalence point if more of NaOH is added, then the solution contains an excess of the fast moving OH^- with the result that its as more of NaoH added, we plot the conductance value vs the amount of NaOH added we get curve of the type shown in figure.The descending portion AB represents the conductance before the equivalence point (solution cintains a mixture if acid HCl and the salt NaCL and the ascending portion CD represents the conductances after the equivalence point (solution contains the salt NaCL and the excess of

NaOH). The point E which repersents only the minimum conductance is alkali and thus repersents the equivalence point.This point can, however, be obtained by the extrapoltion of the lines AB and CD and therefore one is not very particular in location this point experimentally as it is in the case of ordinary acid -base involving the acid base indicators

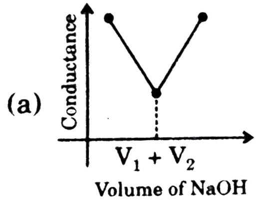


LET us take the specific exaanple of acetic acid being titration against NaOH.Before the addition the of alkali, the solution shows poor conductance due to feeble inization of acetic acid.Initially the addtion of alkali causes not only the replacement of H^+ by Na^+ but also suppresses the thus the conductance of the solution decrease in the begnning .But very soon the conductance starts increasing as addetion NaOH thus causing neutralizes the undissociated HAc to HAc with strong condutance eletroyte Na^+Ac^-.The increase in conducting OH^- ions gtthe graph near the highly equivalence point actual equivalence point can as usual be ontained by the extrapoiation method

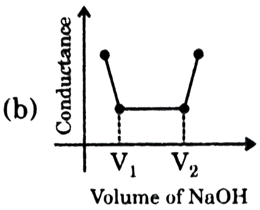
In all thses graphs it been assumed that the vloume change due addition of solution from burette in negligible heane vloume change of the sloution in beaker the conuctance of which is measured is almost constant throughout the measurement

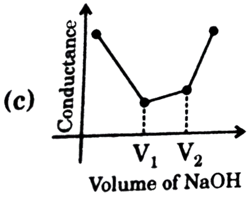
The most appropriate titration curve ibtained when a mixture of a strong acid (say HCl) and a weak acid (sayCH_3COOH0 is titration with (say NaOH) will be

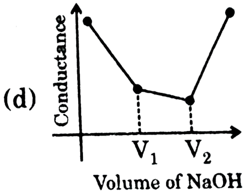
A.



B.



C. 

D. 

Answer: C

View Text Solution

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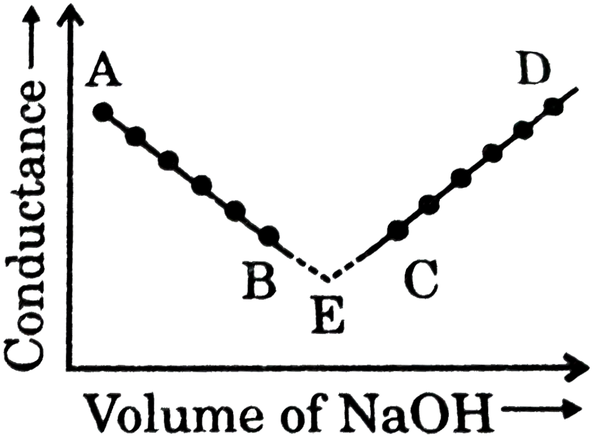

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If a 100 ml solution of 0.1 MHBr is titration using a very concentrated solution of NaOH then the conductivity (specific conductance0 of this solution at the equivalence wil be (assume volume change is negligible due addition of NaOH). Report your answer after mulitiplying it with 100 inSm^{-1}

[Given :

$$\lambda^{\circ}_{(Na^{+})} = 8 \times 10^{-3} Sm^2 mol^{-1}, \lambda^{\circ}_{(Br^{-})} = 4 \times 10^{-3} Sm^2 mol^{-1}]$$

A. 6

B. 12

C. 15

D. 24

Answer: B

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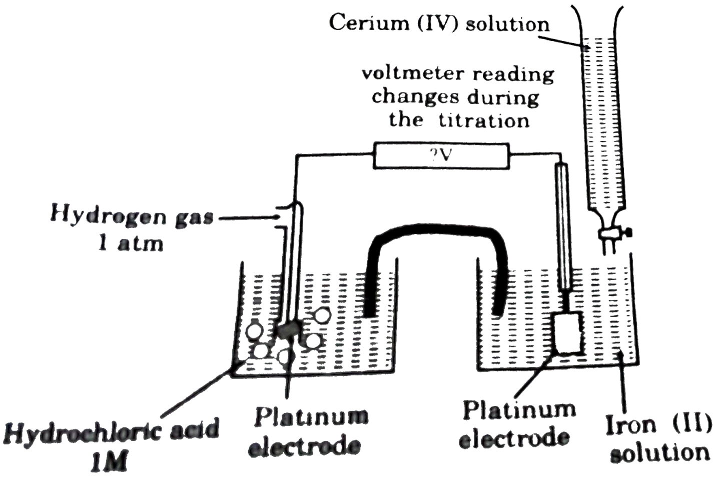
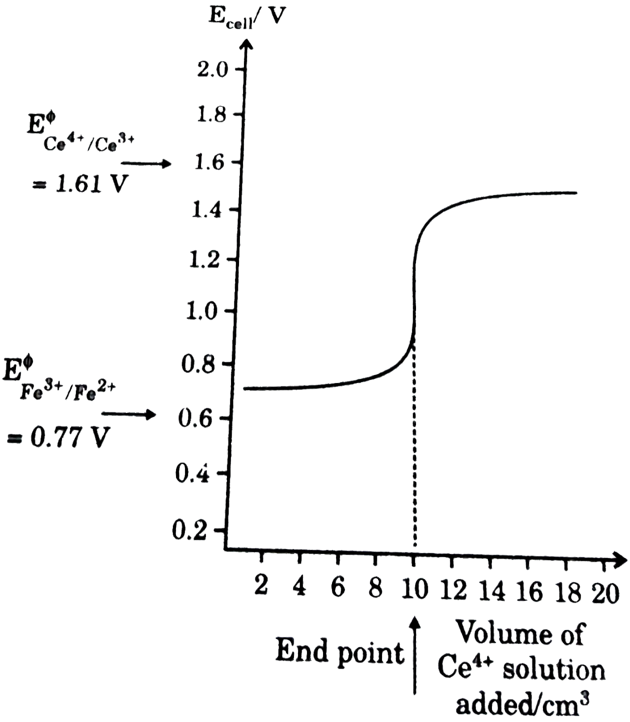
21. Titration are one of the methods we can use to discover the precise concentration of solutions. A typical titration involves adding a solution from a burette to another solution in a flask. The end point of the titration is found by watching a colour change taking place.However, a problem arises when a suitable indicator cannot be found, or when the colour change involved are unclear. In these cases, redox potential may sometimes come to the rescue.



A perticularly well known example (Fig.) is a method of discovering then concentration of iron (II) ions in a solution by titrating them with a solution of cerium (IV). The redox potential that are of interest here are $E^\circ_{Fe^{3+}|Fe^{2+}} = 0.77V \text{and} E^\circ_{Ce^{4+}|Ce^{3+}} = 1.61V$. These tell us that cerium (IV) ions are the oxidising agents. They should react according to the equation

$$Fe^{2+}(aq) + Ce^{4+}(aq) \rightarrow Fe^{3+}(aq) + Ce^{3+}(aq).$$

Now imagine that we know the concentration of the cerium (IV) ions solution in the burette. We want to measure the concentration of the cerium (IV) solution from the burette, some of the iron (II) ions are will be oxidised. As a consequence the beaker would now contain large number of unreacted iron (II) ions , but also some iron (III) ions as well. All of the cerium (III). The solution in the beaker now represents an iron $(III)\,/\,iron(II)$ half cell although not at standard conditions.Thus , the emf of the cell will be near, but not equal to $E^{\circ}_{Fe^{3+}|Fe^{2+}}$.



If we continue to add cerium (IV) solution , the number of iron (II) ions is gradually reduced and eventually only a very few are left (Table).At this stage the next few drops of cerium (IV) solution convert all the remaining irom (II) ions into iron (III), and some of the cerium (IV) ions are left unreacted. Once this happens we no longer have an iron $(III) / \mathrm{iron}(II)$ half-cell. Instead we have a solution in which there is a large number of cerium (III) ions and a smaller number of cerium (IV) ions. The solution in the beaker now behaves as a cerium $(IV) / \mathrm{cerium}(III)$half-cell (although not a standard one.)

Just before all the iron (II) ions are converted into iron (III) we have a cell with an EMF of around $+0.77V$. After all the iron (II) ions are oxidised we have a cell with an emf of about $+1.61V$. This rapid rise in emf occurs with the addition of just one drop of cerium (IV) solution. You should be able to understand why a graph of cell emf against volume of cerium (IV) solution of the iron (II) solution calculated in the usual way.

The cell shown below was set up

$$Pt\left|\underset{1\text{mol dm}^{-3}}{Fe^{3+}(aq), Fe^{2+}(aq)},\right|\left|\underset{1\text{mol dm}^{-3}}{Br^-(aq) \mid Br_2(l)},\right|Pt(s)$$

what would be the cell emf? If potassium cyanide solution were added to the left hand half cell (with due care!) what would you expect to happen to the emf of the cell ? $E^{\circ}_{Br_2/Br^-} = 1.07V$ and use data of previous question, if required.

A. $0.30V$, emf will increase from 0.30 V to$0.41V$

B. $1.84V$, emf will decrease from 1.84 V to$1.43V$

C. $0.30V$, emf will increase from 0.30 V to$0.71V$

D. $0.30V$, emf will increase from 0.30 V to$0.43V$

Answer: C

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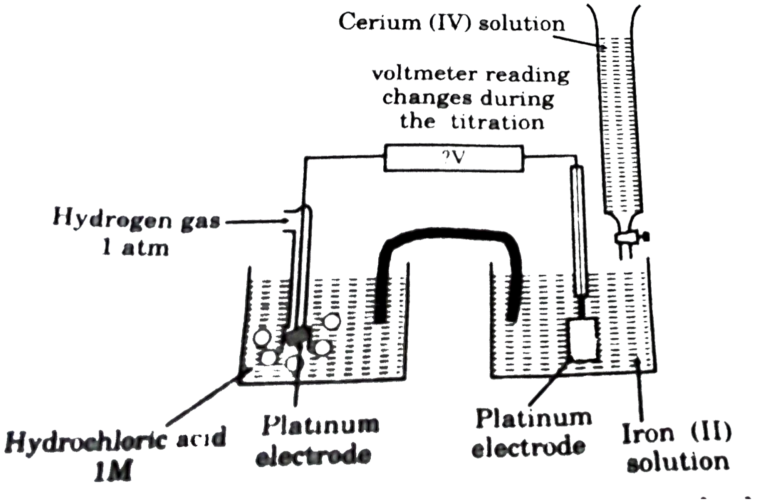

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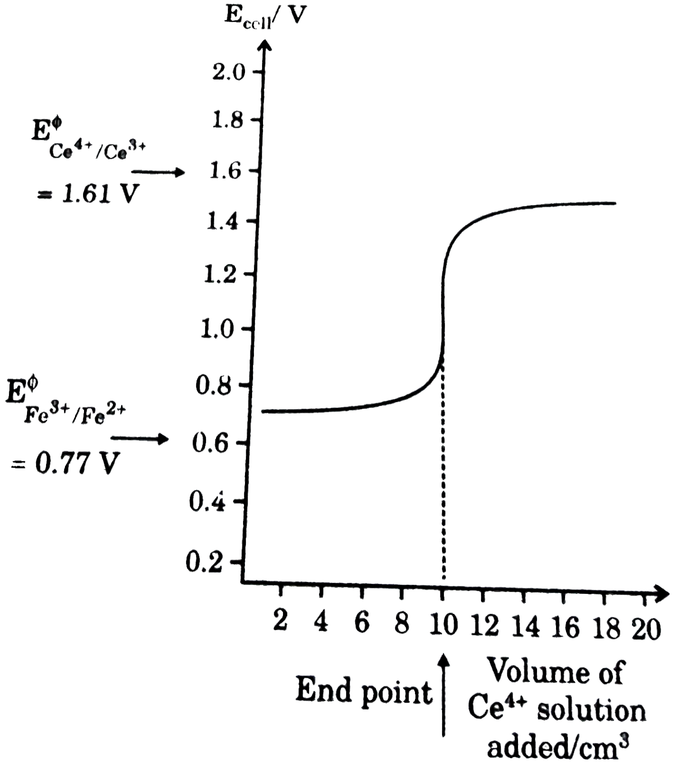

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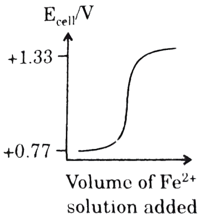
Imagine you were given a solution of potassium dichromate (VI) in a beaker and a solution of iron (II) sulphate in a burette. You do not know the concentration of dichromate (VI) ions , but the concentration of the iron (II) solution is known. Your task it to carry out a redox titration using the two solutions in order to determine the concentration of dichromate (VI) ions. Sketch a graph showing how the emf changes in the course of the above titration.

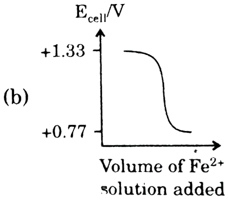
$$E_{Cr_2O_7^{2-}\,/\,Cr^{3+}} = 1.33V,\, E_{Fe^{3+}\,/\,Fe^{2+}} = 0.77V$$

(a)

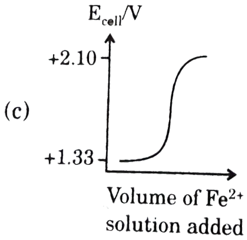


A.

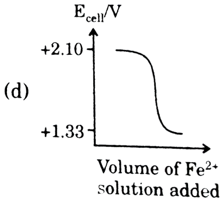
B.



C.



D.



Answer: B

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23. The speed of a molecule of a gas changes continuously as a result of collisions with other molecules and with the walls of the container. The speeds of individual molecules therefore change with time.

A direct consequence of the distribution of speeds is that the average kinetic energy is constant for a given temperature.

The average K.E. is defined as

$$\overline{KE} = \frac{1}{N}\left(\frac{1}{2}m\sum_{i} dN_i u_1^2\right) = \frac{1}{2}m\left(\sum_{i}\frac{dN_i}{N}.\ u_1^2\right)$$

where $\frac{dN}{N}$ is the fraction of molecules having speeds between u_i and $u_i + du$ and as proposed by maxwell

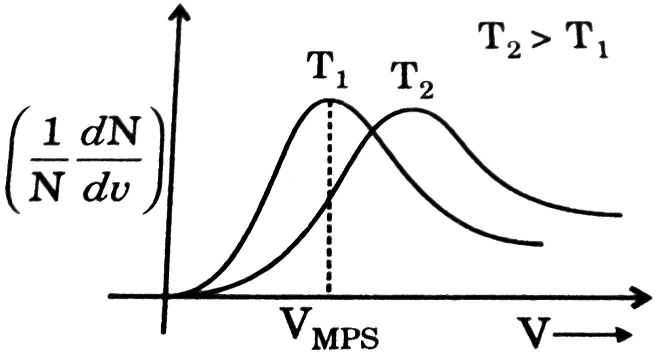
$$\frac{dN}{N} = 4\pi\left(\frac{m}{2\pi KT}\right)^{3/2}\exp\left(-\frac{\mathrm{mu}^2}{2KT}\right).\ u^2.\ du$$

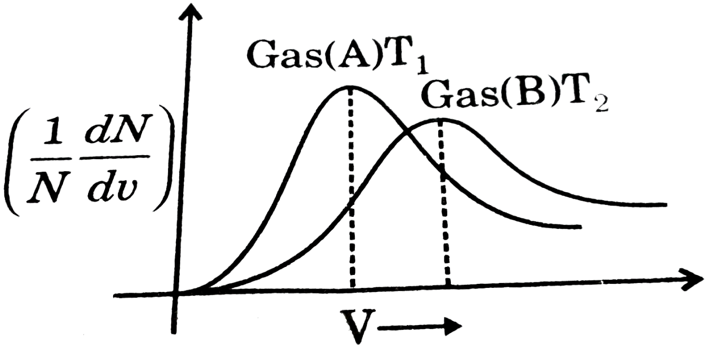
The plot of $\left(\frac{1}{N}\frac{dN}{du}\right)$ is plotted for a particular gas at two different temperature against u as shown.

The majority of molecules have speeds which cluster around $\mathrm{v_{MPS}}$ in the middle of the range of v. There area under the curve between any two speeds $V_1 \mathrm{and} V_2$ is the fraction of molecules having speeds between $V_1 \mathrm{and} V_2$.

The speed distribution also depends on the mass of the molecules. As the area under the curve is the same (equal to unity) for all gas samples, samples which have the same $\mathrm{V_{MPS}}$ will have identical Maxwellian plots.

On the basis of the above passage answer the questions that follow.





For the above graph, drawn for two different samples of gases at two different temperature $T_1 \text{and} T_2$. Which of the following statements is necessarily true?

A. If$T_2 < T_1, M_A$is necessarily greater thanM_B

B. If$T_1 > T_2, M_B$is necessarily greater thanM_A

C. $\frac{T_2}{M_B} < \frac{T_1}{M_A}$

D. Nothing can be predicted

Answer: A

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A direct consequence of the distribution of speeds is that the average kinetic energy is constant for a given temperature.

The average K.E. is defined as

$$\overline{KE} = \frac{1}{N}\left(\frac{1}{2}m\underset{i}{\Sigma}dN_i u_1^2\right) = \frac{1}{2}m\left(\underset{i}{\Sigma}\frac{dN_i}{N}.\,u_1^2\right)$$

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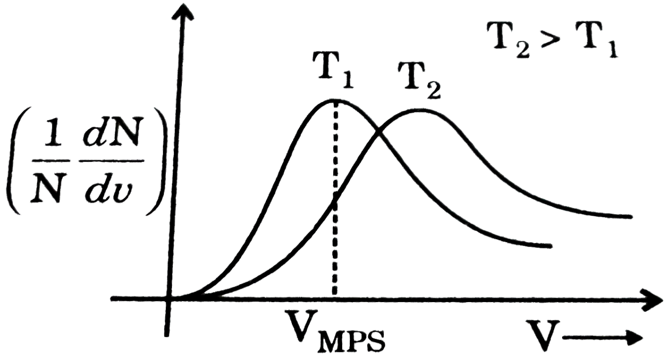

If two gases A and B and at temperature $T_A \text{and} T_B$ respectivley have identical Maxwellian plots then which of the following statement are true?

A. $T_B = T_A$

B. $M_B = M_A$

C. $\frac{T_A}{M_A} = \frac{T_B}{M_B}$

D. $\text{Gases A and B may be} O_2 \text{and} SO_2 at 27^\circ C \text{and} 327^\circ C \text{respectively}$

Answer: C::D

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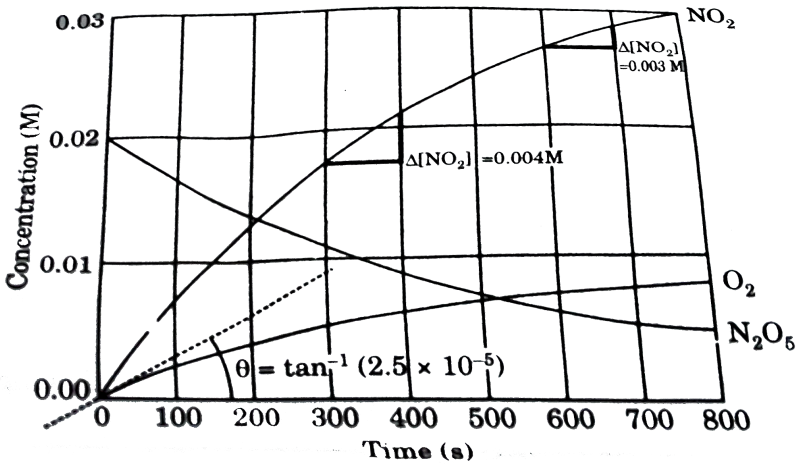
25. Concentrations measured as a function of time when gaseous N_2O_5 at initial concentration of $0.0200M$ decomposes ot gaseous $NO_2 \text{and} O_2 \text{at} 50^\circ C$. The change in concentration with time is given by the following graph.



The rate of formation of O_2 during the period 600-700 s is :

A. $4 \times 10^{-5} M / s$

B. $3 \times 10^{-5} M / s$

C. $5 \times 10^{-5} M/s$

D. $7.5 \times 10^{-6} M/s$

Answer: D

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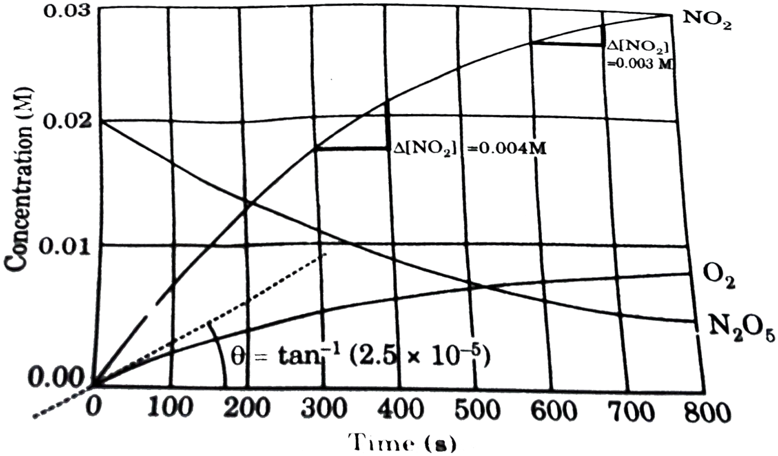
26. Concentrations measured as a function of time when gaseous N_2O_5 at initial concentration of $0.0200M$ decomposes ot gaseous $NO_2 andO_2 at 50^{\circ}C$. The change in concentration with time is given by the following graph.



The rate of decomposition of N_2O_5during the period 300-400 s is :

A. $4 \times 10^{-4} M/s$

B. $3 \times 10^{-5} M/s$

C. $2 \times 10^{-5} M/s$

D. $4 \times 10^{-8} M/s$

Answer: C

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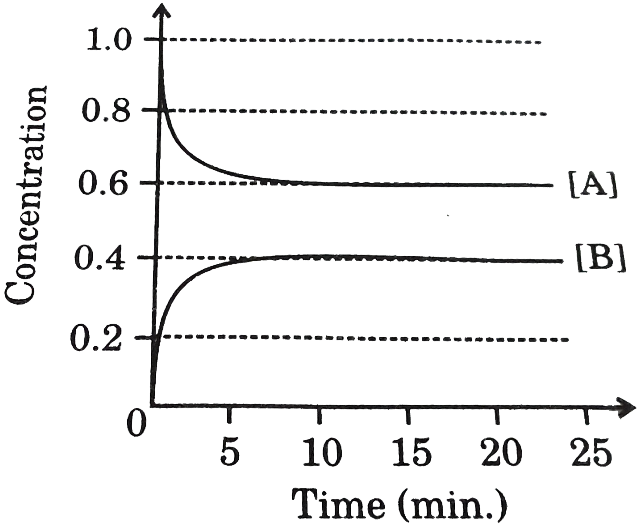
27.



For the reversible reaction $A \underset{k_b}{\overset{k_f}{\Longleftrightarrow}} B$ (having Ist order in both direction) the concentration as a function of time are given for a certain experimantal run.

Calculate [B] at time $t = \frac{1}{5}$min.

$$\left[\text{Given}: k_b = 3\text{min}^{-1}\text{and}\frac{1}{e} = 0.37\right]$$

A. 0.37

B. 0.153

C. 0.2

D. 0.252

Answer: D

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28. According to collision theory for determining the variation of rate of reaction with temperature the rate constant,$k = Ae^{-Ea/RT}$. For most of the practical purposes A and E_a[Arrhenius factor and Activation energy] are temperature independent. However they may vary slightly. Assuming the conditions given above answer the following questions.

If$A = K, T\text{and}E_a = K_2T^2$ and the given equation is still applicable where $K_1 \text{and} K_2$ are the constant and T represent temperature then which will be correct option?

(P) The maximum value of k will be equal to A

(Q) At lower temperature rate of reaction will increase with increase in temperature

(R) At higher temperature, rate of reaction will decrease with increase in temperature

A. All are true

B. Only Q and R are incorrect

C. Only P is incorrect

D. Only P and Q are incorrect

Answer: C

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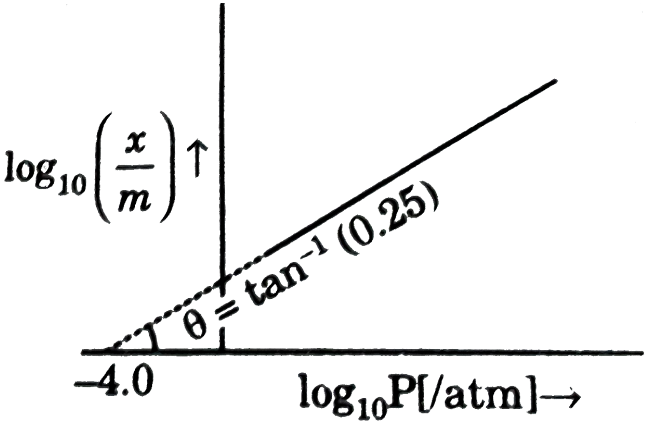
29. The adsorption of a gas at a metal surface is called occlusion. The extent of gas adsorbed at metal surface at a certain temperature depends on pressure as

$$\frac{x}{m} = K.P^{1/n}$$

where K and n are constant for a particular combination of gas and metal at fixed temperature and $\frac{x}{m}$ is the mass of gas adsorbed per unit mass of metal .For H_2 gas adsorbing at Pt-surface, the following graph is obtained.



The mass of H_2 gas adsorbed on the surface of 10 gm Pt at 16 atm is :

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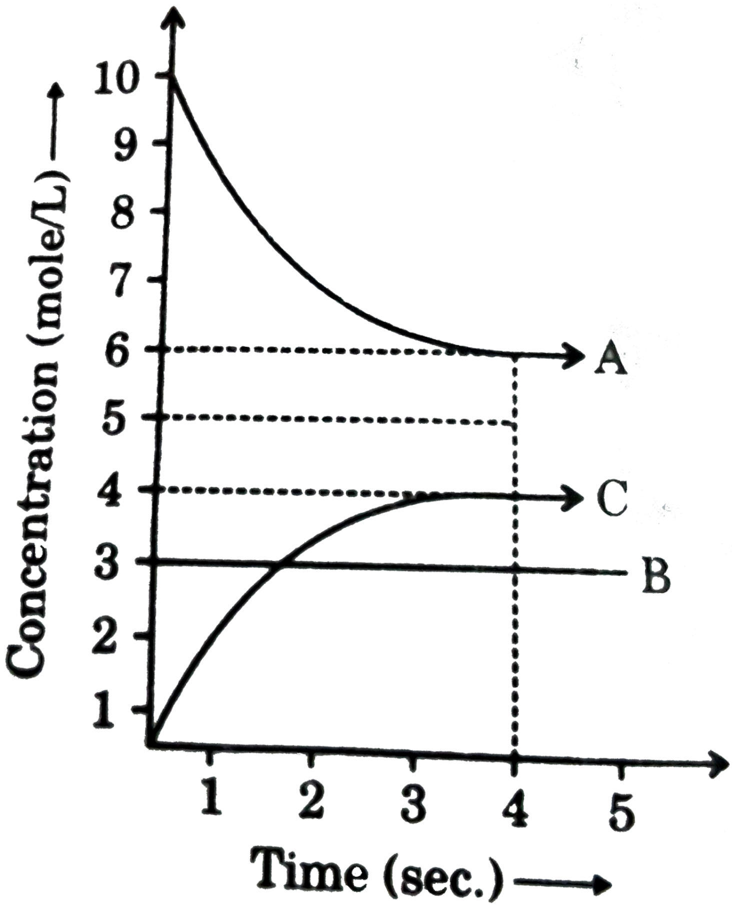
30. A,B and C react in the 1:1:1 stoichiometric ratio. The concentration of A,B and C where found to vary with time as shown in the figure below:



The value of equilibrium repreasented in above sketch will be :

A. $\frac{12}{7}$

B. $\frac{2}{3}$

C. 2

D. $\frac{2}{9}$

Answer: B

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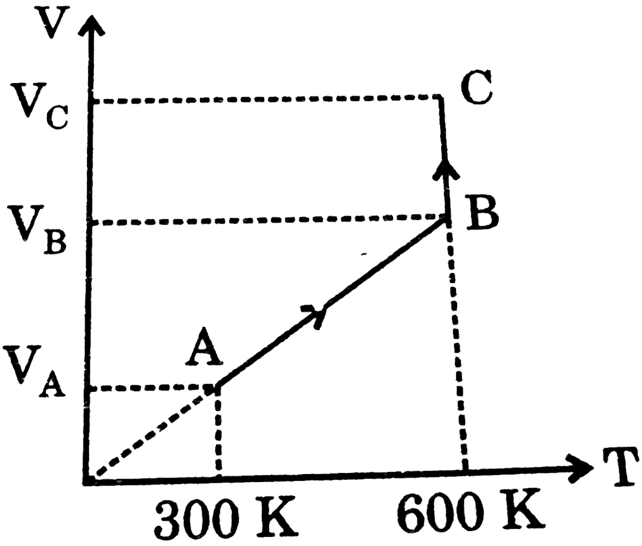
31.



Above graph is plotted for 1 mole of ideal monoatomic gas.

Find net heat exchange for the process BC, if $\frac{V_C}{V_B} = \frac{4}{1}$:

A. $+600RIn2$

B. $-600RIn2$

C. $+1200RIn2$

D. $-1200 RIn2$

Answer: C

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32. The process by which a gas through a small hole into vacuum is called effusion. The rate of change of pressure (p) of a gas at constant temperature due to effusion of gas from a vessel of constant volume can be related to rate of change of number of molecules by the expression:

$$\frac{dp}{dt} = \frac{kT}{V}\left(\frac{dN}{dt}\right)$$

where Rate of change of number of molecules

$$\Rightarrow \qquad -\frac{dN}{dt} = \frac{pA_0}{(2\pi mkR)^{1/2}}$$

where, k= Boltzmann constant

$N_A =$ Avogadro's number

$T =$ temperature (in K) $\Rightarrow \qquad -\frac{dN}{dt} = \frac{pA_0}{(2\pi mkR)^{1/2}}$

$N_A =$ Avogadro's number

$T =$ temperature (in K)

V = volume of vessel

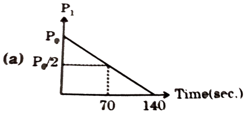
N = 1 no.of molecules

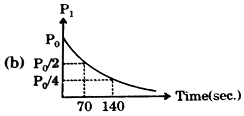
A_0 = area of aperture

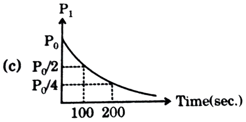
m = mass of single molecule

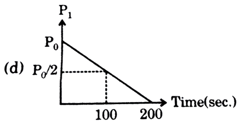
$$\gamma = \frac{V}{A_0}\sqrt{\frac{2\pi m}{kT}}$$

If under any conditions $\gamma = 100\,\text{sec}$ then select the correct graph of pressure of gas at any time (P_t) us Time (t). [Given : In 2=0.7]

A. 

B. 

C. 

D. 

Answer: B

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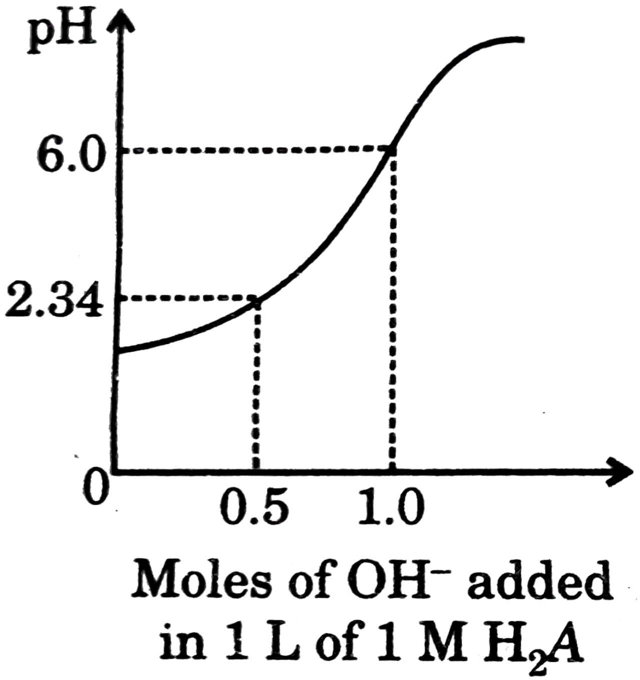
33. Titration of diprotic acid (H_2A) by strong base has been summarised in following graph



What is the pH at II equivalence point?

A. 6.0

B. 11.83

C. 9.66

D. 12

Answer: B

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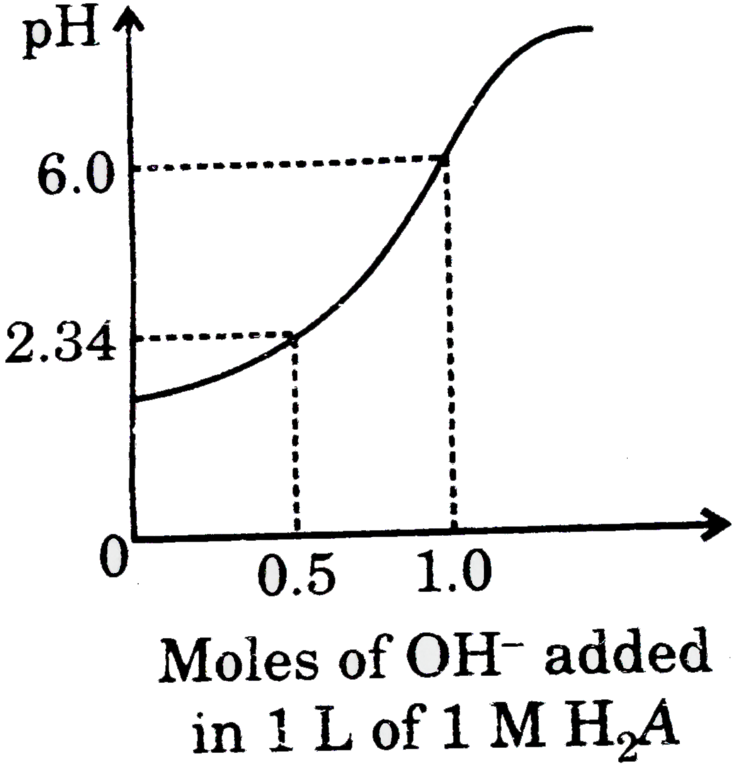
34. Titration of diprotic acid (H_2A) by strong base has been summarised in following graph



What is composition of mixture when pH of solution is 10.137?

A. $25\%\ HA, 75\%\ A^{2-}$

B. $75\ \%\ HA,\ 25\ \%\ A^{2-}$

C. $25\ \%\ H_2A^+,\ 75\ \%\ H_2A$

D. $75\ \%\ H_2A^+,\ 25\ \%\ H_2A$

Answer: A

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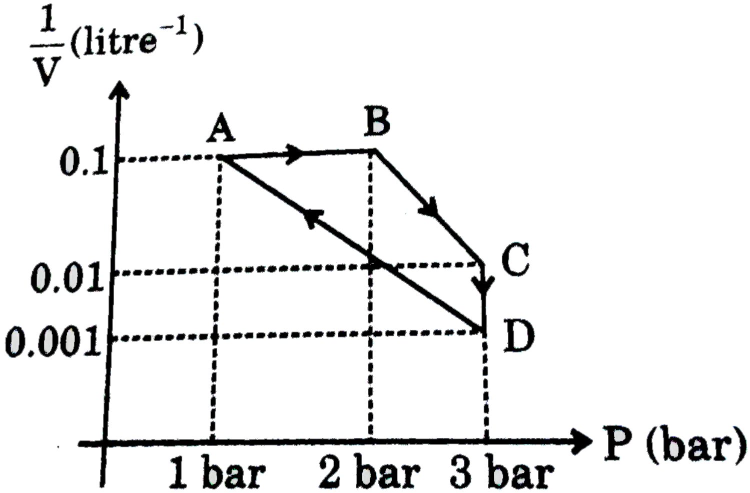
35. For an ideal gas if heat given in process AB is 10kJ then answer the following questions.

$(1\text{bar}.\ l = 0.1kJ)$



Enthalpy change in process BCD is :

A. $697kJ$

B. $1526kJ$

C. $3278kJ$

D. $1135kJ$

Answer: C

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36. Thermodynamics stability is often used in chemical reactions to predict extent of reaction or to predict the preferred product in some reaction. Thermodynamically a more stable substance will be the one which has lower Gibb's free energy.In various cases,it might be decided on the basis of enthalpy, however , that may not always be true. The thermodynamic data Therefore can be used for prdicting stability among isotopes and to decide the possible transformation.Based on this information and the data given below, answer the questions that follow.

Date: $\begin{array}{ll} \Delta H_f^\circ \text{ of } Sn_{(\text{white})} = 0 & \Delta H_f^\circ \text{ of } Sn_{(\text{grey})} = -2.1kJ/\text{mole} \\ S^\circ \text{ of } Sn_{(\text{white})} = 0 & S^\circ \text{ of } Sn_{(\text{grey})} = 44J/K-\text{mole} \end{array}$

All above data at 300K.

Density of $Sn_{(w)} = 7.36 g / ml$

Density of $Sn_{(g)} = 5.769 gm / ml$

One such transformation is 'tin pest' which is an autocatalytic, allotropic transformation of the element tin causing deterioration of tin objects at low temperatures.

As temperature is reduced, what can be predicted for objects containing tin ?

A. Transformation from white tin to grey tin occurs changing it to a more brittle form

B. There will be a contraction in volume observed due to the allotropic change

C. The reaction will slow down after after initiation

D. The objects will become stronger

Answer: A

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37. This type of deviation is also expected in the following mixture :

A. ethanol and cyclohexane

B. ethyl bromide and ethyl chloride

C. benzonitrile and ethyl cyanide

D. diethyl ether and chloroform

Answer: D

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38. Total vapour pressure of mixture of 1 mol of volatile component A($p_A^\circ = 100$mm Hg) and 3 mol of volatile component B(p_B°=60 mm Hg) is 75 mm. For such case:

A. there is positive deviation from Raoult's law

B. boiling point has been lowered

C. force of attraction between A and B is smaller than that between A and A or between B and B

D. all the above statements are correct.

Answer: D

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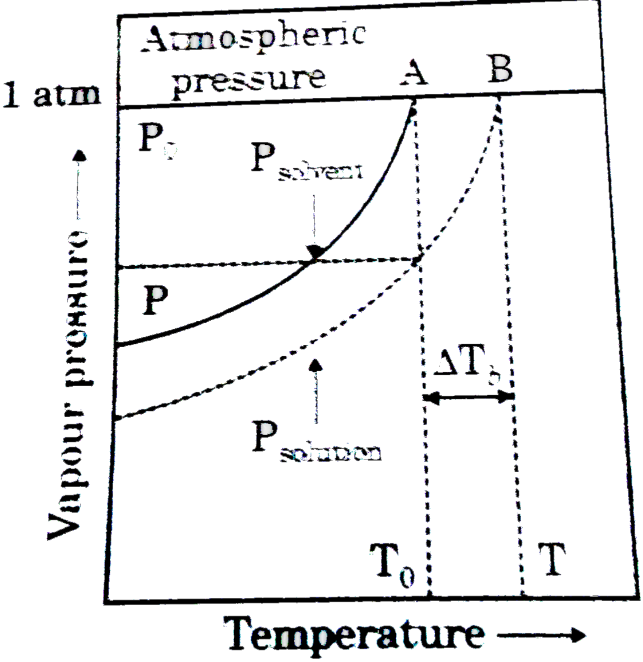
39. Figure explains elevation in boiling point when a non-volatile solute is added to a solvent. Variation of vapour pressure with temperaure and elevation in boiling point is marked.



Elevation in b.p of an aqueous urea solution is $0.52^{\circ}\left(K_b = 0.52^{\circ} mol^{-1} kg\right)$. Hence, mole fraction of urea in this solution is:

A. 0.982

B. 0.0567

C. 0.943

D. 0.018

Answer: D

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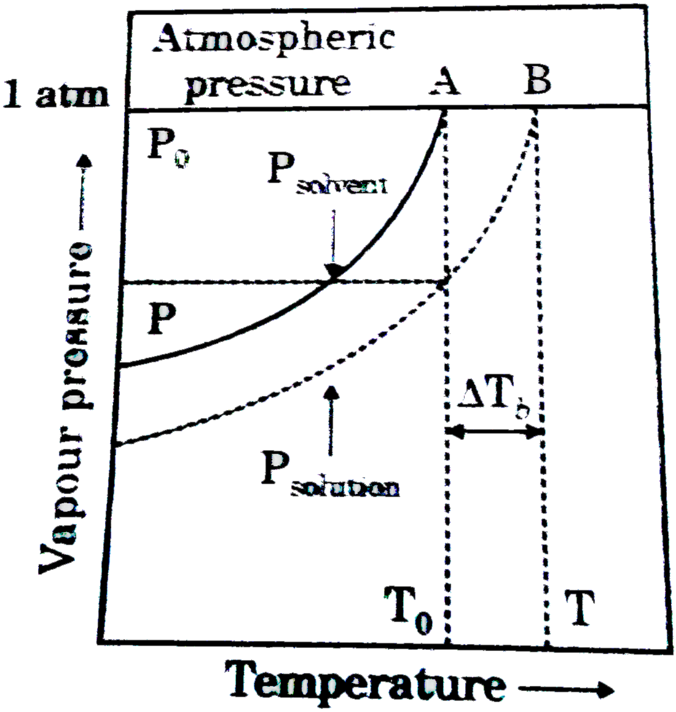
40. Figure explains elevation in boiling point when a non-volatile solute is added to a solvent. Variation of vapour pressure with temperaure and elevation in boiling point is marked.



Ratio of $\Delta T_b / K_b$ of $6\ \%$ AB_2 and $9\ \%$ A_2B (AB_2 and A_2B both are non-electrolytes) is 1 mol/kg in both cases. Hence, atomic masses of A and B are respectively.

A. 60,90

B. 40,40

C. 40,10

D. 10,40

Answer: C

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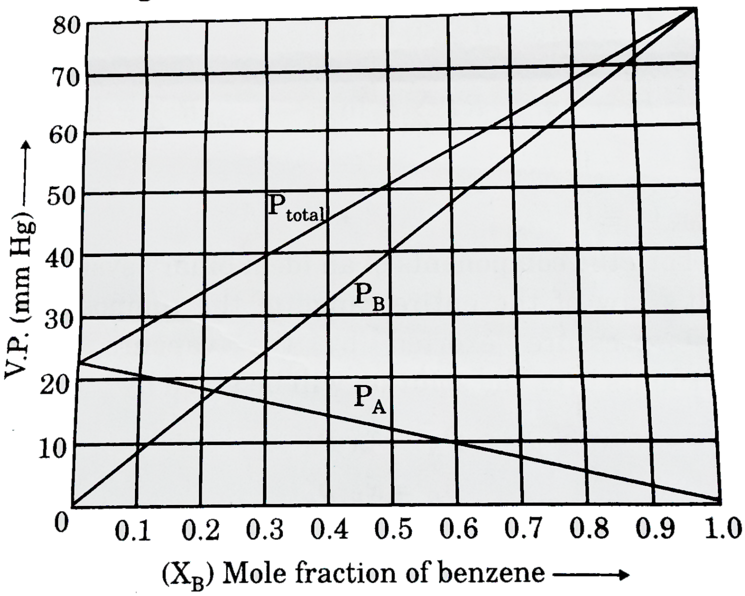
41. Answer the questions (given below) which are based on the following diagram. Vapour pressure plots of benzene-toluence mixture at $20^\circ C$. Solution of benzene and toluence are ideal. Raoult's law is valid for both components over the entrie range of concentration.



There is deviation from ideal behaviour if mixture contains:

A. n-hexane and n-heptane

B. chlorobenzene and bromobenzene

C. o-xylene and p-xylene

D. acetone and chloroform

Answer: D

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42. When a liquid is completely miscible with another liquid, a homogeneous solution consisting of a single phase is formed. If such a solution is placed in a closed evacuated vessel, the total pressure exerted by the vapour, after the system attained equilibrium will be equal to the sum of partial pressures of the constituents. A solution is said to be ideal if its constituents follow Raoult's law under all conditions of concentrations, i.e., where p_i is the partial pressures of the constituent i, whose mole fraction in the solution is x_i and p_i° is the corresponding vapour pressure of the pure constituent. The change in the thermodynamic functions when an ideal solution is formed by mixing pure components is given by the following expression.

$$\Delta_{mix} = G = n_{\text{total}} RT \sum_i x_i Inx_i \text{ ...(i)}$$

where, n_{total} is the total amount of all the constituents present in the solution.

$$\Delta_{mix} F = \; - n_{\text{total}} R \sum_i x_i Inx_i \text{ ......(ii)}$$

$$\Delta_{mix} H = \; - n_{\text{total}} RT \sum_i x_i Inx_i - n_{\text{total}} R \sum_i x_i Inx_i = 0 \text{ ....(iii)}$$

$$\Delta_{mix} U = 0 \text{ ....(iv)}$$

Since botli the components of an ideal binary system follow Raoult's law of the entire range of the compositions, the partial pressure exerted by the vapours of these constituents over the solution will be given by

$p_A = x_A p_A^\circ$ ....(v)

$p_B = x_B p_B^\circ$ ....(vi)

where, x_A and x_B are the mole fractions of the two constituents in the liquid phase and p_A° and p_B° are the respective vapour pressure of the pure constituents. The total pressure (p) over the solution will be the sum of the partial pressure. The composition of the vapour phase (y_A) can be determined with the help of Dalton's law of partial pressures.

A plot of reciprocal of total pressure $\left(\frac{1}{p}\right)$ (y-axis) us y_A (x-axis) gives :

A. a linear plot with slope $= \left(\frac{1}{p_B^\circ} - \frac{1}{p_A^\circ}\right)$

B. a linear plot with slop $= \left(\frac{1}{p_A^\circ} - \frac{1}{p_B^\circ}\right)$

C. a linear plot with slope $= \frac{1}{p_B^\circ}$

D. a linear plot with slope $= p_A^\circ p_B^\circ$

Answer: B

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43. When a liquid is completely miscible with another liquid, a homogeneous solution consisting of a single phase is formed. If such a solution is placed in a closed evacuated vessel, the total pressure exerted by the vapour, after the system attained equilibrium will be equal to the sum of partial pressures of the constituents. A solution is said to be ideal if its constituents follow Raoult's law under all conditions of concentrations, i.e., where p_i is the partial pressures of the constituent i, whose mole fraction in the solution is x_i and p_i° is the corresponding vapour pressure of the pure constituent. The change in the thermodynamic functions when an ideal solution is formed by mixing pure components is given by the following expression.

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where, n_{total} is the total amount of all the constituents present in the solution.

$\Delta_{mix} F = \; - n_{\text{total}} R \sum_i x_i Inx_i$ ......(ii)

$\Delta_{mix} H = \; - n_{\text{total}} RT \sum_i x_i Inx_i - n_{\text{total}} R \sum_i x_i Inx_i = 0$ ....(iii)

$\Delta_{mix} U = 0$ ....(iv)

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Two liquids A and B form an ideal solution at temperature T. when the total vapour pressure above the solution is 600 torr, the mole fraction of A in the vapour phase is 0.35 and in the liquid phase 0.70. The vapour pressure of pure B and A are:

A. 800 torr, 1300 torr

B. 1300 torr, 300 torr

C. 300 torr, 1300 torr

D. 300 torr, 800 torr

Answer: B

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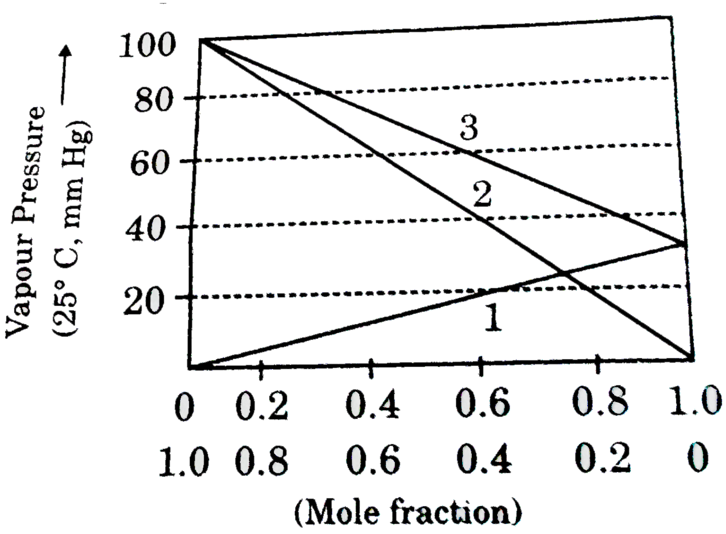
44. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



What is $p^{\circ}_{\text{toluence}}(25^{\circ}C)$?

A. 30 mm Hg

B. 400 mm Hg

C. 22 mm Hg

D. 40 mm Hg

Answer: A

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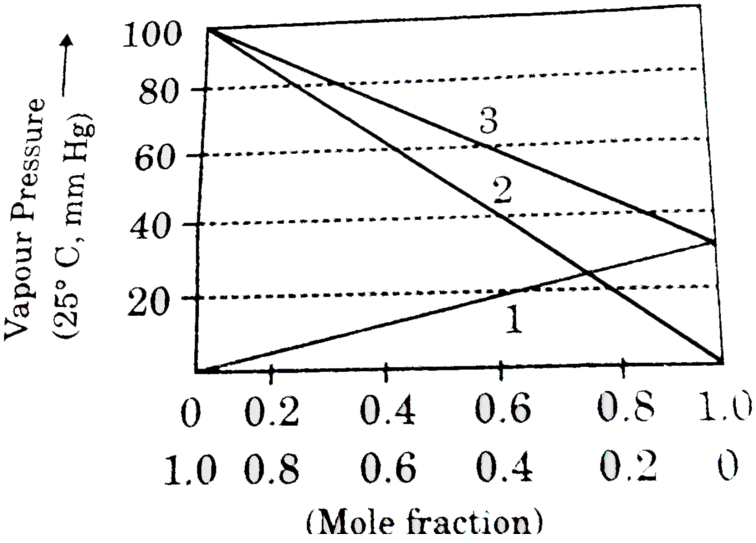
45. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



A. 760 torr

B. 40 torr

C. 60 torr

D. 130 torr

Answer: C

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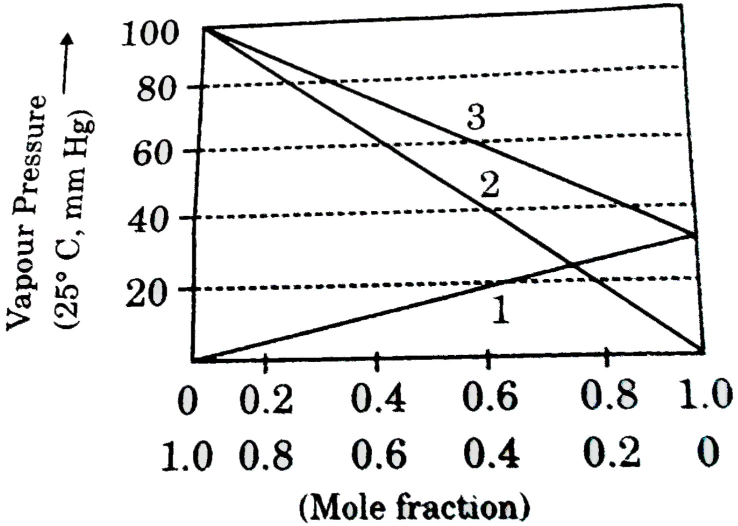
46. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



The composition of liquid for which the vapour contains equal number of benzene and toluence molecules is about:

A. $X_{\text{toluence}} = 0.75$

B. $X_{\text{toluence}} = 0.50$

C. $X_{\text{toluence}} = 0.40$

D. $X_{\text{toluence}} = 0.90$

Answer: A

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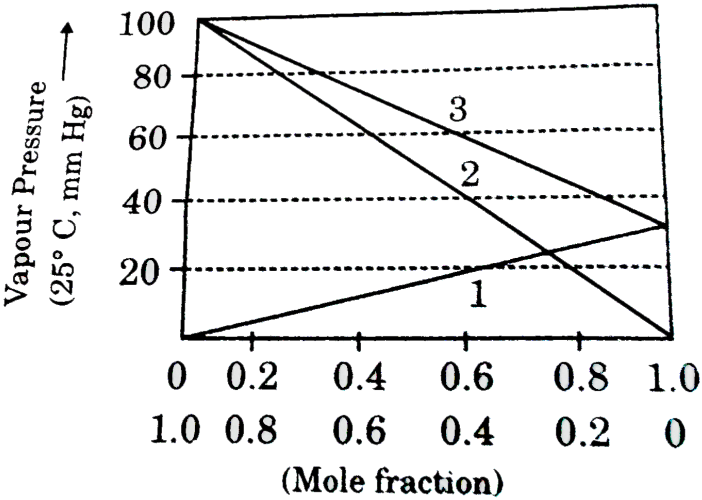
47. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



$p_{\text{total}} = p_{\text{benzene}} + p_{\text{toluene}}$ and $p_{\text{total}} = p^{\circ}_{\text{benzene}}$ or $p^{\circ}_{\text{toluene}}$, are simultaneously valid for:

A. all compositions

B. $X_{\text{toluence}} = 0.5$ only

C. $X_{\text{toluene}} = 0$ or $X_{\text{benzene}} = 0$

D. never

Answer: C

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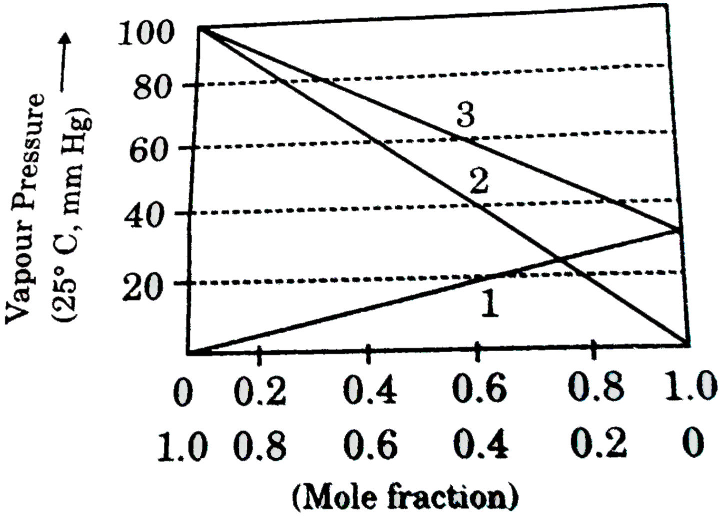
48. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



Which laws are exemplified by the diagram ?

A. Only Raoult's law

B. Only Dalton's law

C. Both Raoult's law and Dalton's law

D. Pascal's law

Answer: C

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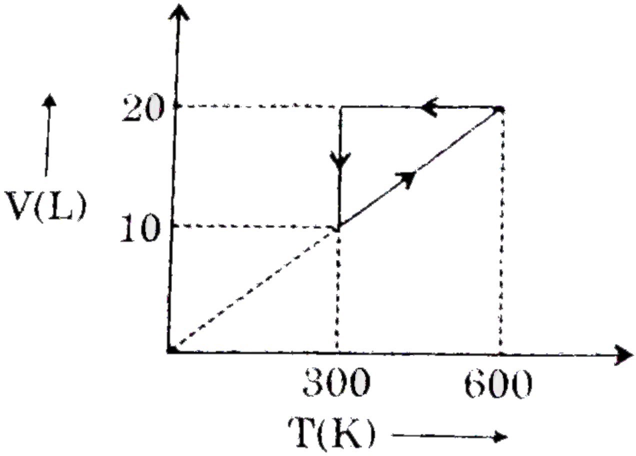
49. One moles of an ideal monoatomic gas undergo the state change as shown in following graph (ln 2 = 0.7)



Efficiency of the cycle will be :

A. 50 %

B. 25 %

C. 13.63 %

D. 12 %

Answer: D

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Comprehension 2

1. One mole of an ideal gas undergoes a process (10L, 4atm) to (4L, 10 atm). The process may be represented by straight line in P-V diagram

The correct statement for the process :

A. The temperature of gas is constant throughout the process

B. The temperature of gas will first increase and then decrease in the process

C. The temperature of gas will first decrease and then increase in the process

D. The initial and final temperature if gas are different

Answer: B

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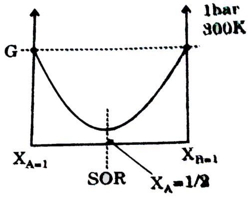
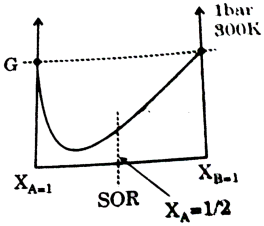
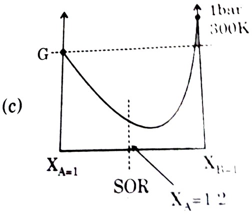
Comprehension 3

1. In order to perdict variation of Gibbs free energy with progress of reaction at constant temperature and 1 bar pressure, it is important to know realtive stability of the components involved in chemical reaction at standard useful work then the change in Gibbs free energy should be calculated

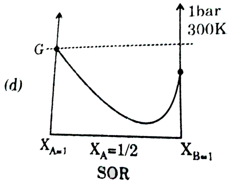
Which of the following options correctly represects the graph between Gibbs free energy (G0 and state of reaction (SOR) at 1 bar and 300 K for the reaction But -1 ene (A) $\Leftrightarrow$ but -2 ene (B)

A. 

B. 



C.



D.

Answer: D

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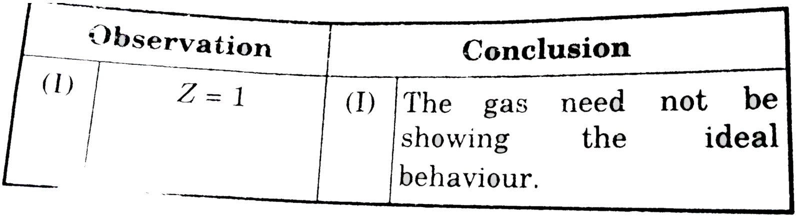
Comprehension 4

1. One of the important approach of the study of real gases involves the analysis of a parameter Z called the compressibility factor $Z = \frac{PV_m}{RT}$ where P is pressure, V_m is molar volume ,T is absolute temperature and R is the universal gas constant .Such a relation can also be expressed as $Z = \left(\frac{V_{\text{m real}}}{V_{\text{m ideal}}}\right)$ (where $V_{\text{m ideal}}$ and V_("m real")` are the moler volume for ideal and real gas respectively tendencies among constituent particles.As pressure is force among is lowered or temperature is increased the value of Z approaches ideal behaviour

Choose the conslusions which are appropriate for the observation stated



Observation		Conclusion	
(I)	$Z = 1$	(I)	The gas need not be showing the ideal behaviour.

A. All conclusions are true

B. Conclusions I, II and IV are ture

C. Conclusions I,III and IV are true

D. Cinclusions III and Iv are true

Answer: D

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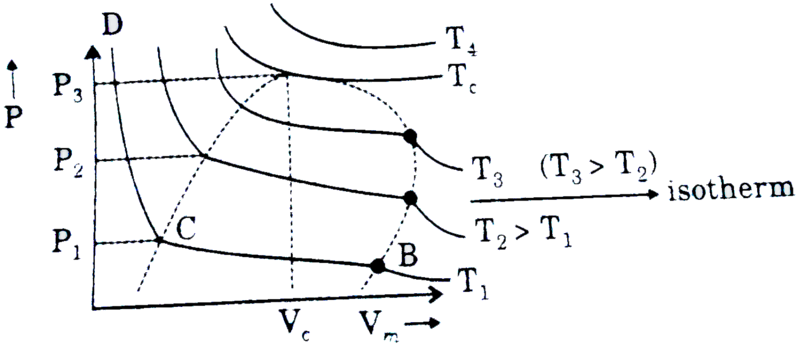
Comprehension 5

1. When perssure is increase at constant temperature, volume of gas decreases, AB → gases,Bc → vapour +liquid ,CD → liquid critical point .At this all the physical properties of liquid phase as density of liquid = density if vapour.

T_e or critical temp : Temperature above which a gas can not be liquified

V_e or critical volume : Volume occupied by one mole of gas at T_e abd P_e.



Critical constant Using van der Waals' Equations

$$\left(P+\frac{a}{V_m^2}\right)(V_m-b) = RT$$

$$\Rightarrow \left(PV_m^2+a\right)(V_m-b) = RTV_m^2$$

$$PV_m^3 + aV_m - PbV_m^2 = ab - RTV_m^2 = 0$$

$$\Rightarrow V_m^3 - V_m^2\left(b+\frac{RT_e}{P}\right) + \frac{a}{p}\frac{V}{m} - \frac{ab}{p} = 0$$

Since equation is cubic in V_m hence there will be roots of equation at any temperature and pressure.At critical point van der Waals' equation will be

$$V_m^3 - V_m^2\left(b+\frac{RT_c}{P_c}\right) + \frac{a}{p_c}V_m - \frac{ab}{p_c} = 0 \quad \ldots.\ (i)$$

But at critical point all three roots of the equation should be equal, hence equation should be :

$V_m = V_c$

$(V_m - V_c)^3 = 0$

$V_m - 3V_m^2 V_c + 3V_m V_c^2 - V_c^3 = 0$....(ii)

Comparing with equation (i)

$b + \frac{RT_c}{p_c} = 3V_c$ ...(iii)

$\frac{a}{p_c} = 3V_e^2$...(iv)

$\frac{ab}{p_c} = V_c^3$....(v)

from eqns.(iv) and (v0, $V_c = 3b$

from eq. (iv) $p_c = \frac{a}{3V_c^2}$ substituting $p_c = \frac{a}{3(3b)^2} = \frac{a}{27b^2}$

from e.q (iii) $\frac{RT_c}{p_c} = 3V_c - b = 9b - b = 8b$

$\Rightarrow T_c = \frac{8a}{27Rb}$

At critical point, the slope of PV curve (slope of isotherm) will be zero at all other point slpoe will be negative zero is the maximum value of slope

$\left(\frac{\partial P}{\partial V_m}\right)_{Tc} = 0$...(iv)

$\frac{\partial}{\partial V_m}\left(\frac{\partial P}{\partial V_m}\right)_{Tc} = 0$

[Mathematically such points are known as point of inflection (where first two derivatives becomes zero) Using the two $T_c P_c$ and V_c can be calculated

A scientist proposed the following equation of state

$P=\frac{RT}{V_m}-\frac{B}{V_m^2}+\frac{C}{V_m^2}$ If this equation leads to the critical behaviour then critical temperature is

A. $\frac{8B}{27RC}$
B. $\frac{B}{8RC}$
C. $\frac{B^2}{3RC}$

D. none of these

Answer: C

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Comprehension 6

1. In the photoelectric effect the eletrons are emiited intantaneously from a given matal plate when it is irradiated with radiation of frequency equal to or greater then some minimum ferquency, is called the threshold frequency.According to Planck's idea, light may be considered to be made up discrete particles called photons.Each photon carries energy equal ti hv.When this photon cllides with the electron of the metal, the electron acquires energy of the emitted electron is given by :

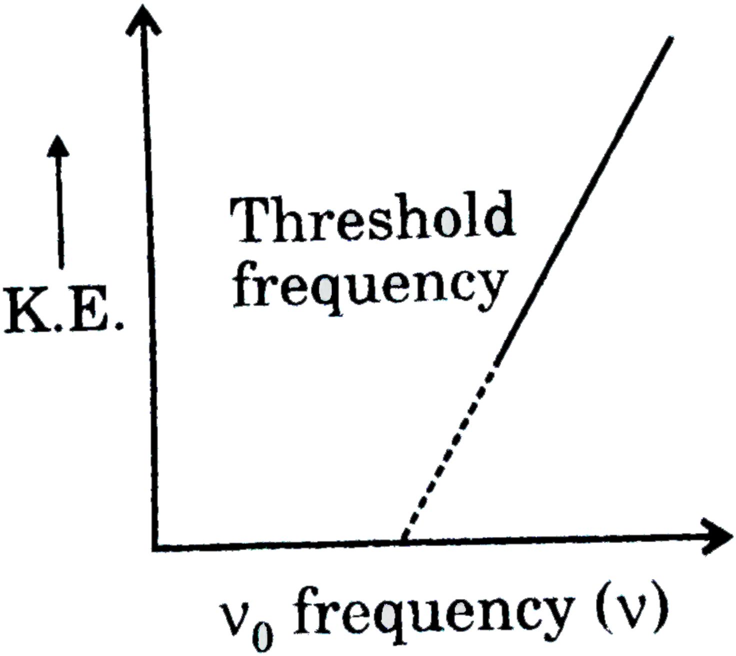
$$hv = K.\,E_{\text{maximum}} + PE = \frac{1}{2}mu^2 + PE$$

If the incident rediation is of threshold frequency the electron will be emitted without any kinetic energy

i.e hv_0

$$\therefore \frac{1}{2}mu^2 = hv - hv_0$$

A plot of kinetic energy of the emitted electron versus frequency of the incident radiation yields a straight line given as :



A beam of white light is dispersed into its wavelenght components of potassium metal. What of the electron emitted by the different light component ?

A. Blue gtgreen gt orange gt yellow

B. Violet gt blue gt orange gt red

C. yellow gt green gt blue gt voilet

D. Orange gt yellow gt blue gt voilet

Answer: B

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Comprehension 7

1. Effect of temperature on the equilibrium process analysed by using the thermodynamics

From the thermodynamics reaction

$\Delta G^\circ = -2.30 RT \log k$

ΔG° : Standing free energy change

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ ...(ii)

ΔH° : Standard heat of the reaction gt

From eqns.(i) and(ii)

$-2RT \log k = \Delta H^\circ = T\Delta S^\circ$

ΔS° : standard entropy change

$$\Rightarrow \quad \log K = -\frac{\Delta H^\circ}{2.3RT} + \frac{\Delta S^\circ}{2.3R}$$

Clearly, if a plot of k vs 1/T is made then it is a straight lone having slope $= \frac{-\Delta H^\circ}{2.3R}$ amd y intercept $= \frac{\Delta S^\circ}{2.3R}$

If at temperature T_1 equilibrium constant be k_1 and at temperature T_2

equilibrium constant be k_2 then :

$$\Rightarrow \quad \log K_1 = -\frac{\Delta H^\circ}{2.3RT_1} + \frac{\Delta S^\circ}{2.3R} \text{..(iv)}$$

$$\Rightarrow \quad \log K_2 = -\frac{\Delta H^\circ}{2.3RT_2} + \frac{\Delta S^\circ}{2.3R} \text{...(v)}$$

Substracting e.q (iv) from (v), we get

from the relation we can conclude that the of equilibrium constant increase in temperature for endothermic reaction eith but value of equilibrium constant decrease with the increase in temperature for exothermic reaction

If statndard heat of dissociation of PCl_5 is 230 cal then slope of the graph of log vs $\frac{1}{T}$ is :

A. 50

B. -50

C. 10

D. none of these

Answer: B

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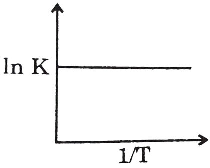
Comprehension 8

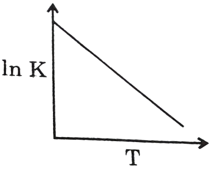
1. The variation of rate constant with temperature can be explained by Arrhenius equation. However , the can be explained by Activation energy is found to be temperature dependent/In such cases $\frac{d\text{in}K}{dT} = \frac{E_a}{RT^2}$ should be used to predict variation of rate constant with tempreature. On the basic of this information , answer the question that follow :

If Arrhenius constant and E_a (activation energy0 are assumed to be constant then which of the following graph will be correct

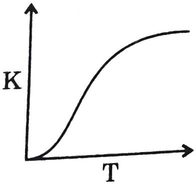
A. (a)

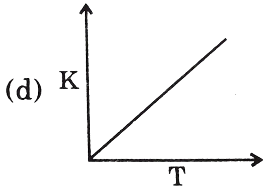


B. (b)



C. (c)



D. 

Answer: C

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Comprehension 9

1. If an element can exist in several oxidation states, it is convenient to display the reduction potentials corresponding to the various half reactions in diagrammatic from, known as Latimer diagram. The Latimer diagram for chlorine in acid solution is

$$Cl_4^- \xrightarrow{+1.20V} ClO_3^- \xrightarrow{+1.60V} ClO_2^- \xrightarrow{+1.60V}$$

$$ClO^- \xrightarrow{+1.67V} Cl_2 \xrightarrow{+1.36V} Cl^-$$

In basic solution is :

$$ClO_4^- \xrightarrow{+0.37V} ClO_3^- \xrightarrow{+0.30V} ClO_2^- \xrightarrow{+0.68}$$

$ClO^- \xrightarrow{+0.42V} Cl_2 \xrightarrow{+1.36} Cl^-$. The standard potentials for two nonadjacent species can also be calculated by using the concept that ΔG° is an additive property but using potential is not an assitive property and $\Delta G^{\circ} = -nFx^0$, If a given oxidation state is a the next higher oxidation state disproportionation can occur. The reverse of relative stabilities of the oxidation state can also be understood by drawing a graph of $\Delta G^{\circ} / F$ against oxidation state, known as Frost diagram, Choosing the stability of zero oxidation state arbitrery as zero. The most stable oxidation state of a apecies lies lowest in the digram Disproportionation is spontaneous if the species lies above a straight line joining its two product species.

Which of the following couple have same value of potential at pH = 0 and pH = 14?

A. $\frac{ClO_4^-}{ClO_3^-}$

B. $\frac{ClO_2^-}{Cl_2}$

C. $\frac{ClO^-}{Cl_2}$

D. $\frac{Cl_2}{Cl^-}$

Answer: D

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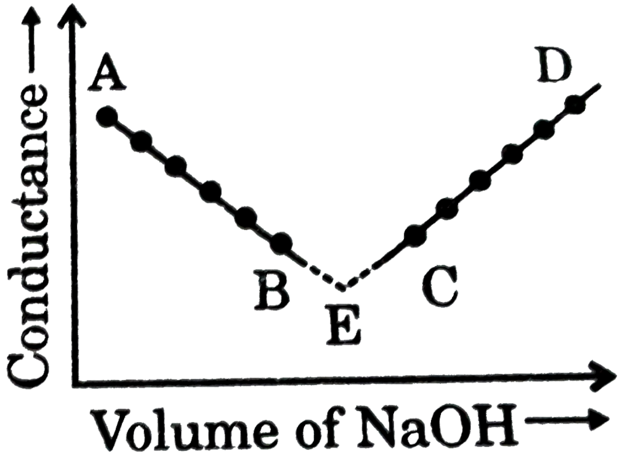
Comprehension 10

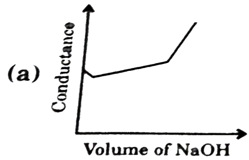
1. The principle on conductometric titration is based in the fact that during the titration, one of the ions is replaced by the other and invariably thses two ions differ in the ionic conductivity with the result that the conductivity of the solution varies during the course of the titration.Take,for example,the titration between strong acid, say HCl. and a strong base, say NaOH.Before NaOH is added the conuctance of HCl solution has a high value due ti the persence if highly hydrogen ions.As NaOH is added,H^{+} ions are the replaced by relatively slower moving Na^{+} ions.Consequently, the conductance of the solution decrease and this continues right upto the enuivalence point where the solution contains only NaCL.Beyond the equivalence point if more of NaOH is added, then the solution contains an excess of the fast moving OH^{-} with the result that its as more of NaoH added, we plot the conductance value vs the amount of NaOH added we get curve of the type shown in figure.The descending portion AB represents the conductance before the equivalence point (solution cintains a mixture if acid HCl and the salt NaCL and the ascending portion CD represents the conductances after the equivalence point (solution contains the salt NaCL and the excess of NaOH). The point E which repersents only the minimum conductance is alkali and thus repersents the equivalence point.This point can, however, be obtained by the extrapoltion of the lines AB and CD and therefore one is not very particular in location this point experimentally as it is in the case of ordinary acid -base involving the acid base indicators

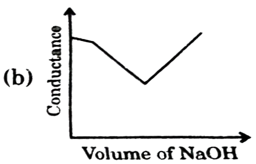


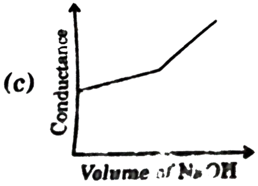
LET us take the specific exaanple of acetic acid being titration against NaOH.Before the addition the of alkali, the solution shows poor conductance due to feeble inization of acetic acid.Initially the addtion of alkali causes not only the replacement of H^{+} by Na^{+} but also suppresses the thus the conductance of the solution decrease in the begnning .But very soon the conductance starts increasing as addetion NaOH thus causing neutralizes the undissociated HAc to HAc with strong condutance eletroyte $Na^{+}Ac^{-}$.The increase in conducting OH^{-} ions gtthe graph near the highly equivalence point actual equivalence point can as usual be ontained by the extrapoiation method

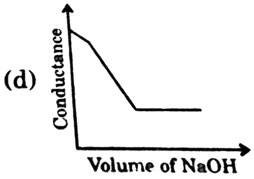
In all thses graphs it been assumed that the vloume change due addition of solution from burette in negligible heane vloume change of the sloution in beaker the conuctance of which is measured is almost constant throughout the measurement

the nature of curve obtained for the titration between weak acid vs strong base as described in the above will be

A. 

B. 

C. 

D. 

Answer: A

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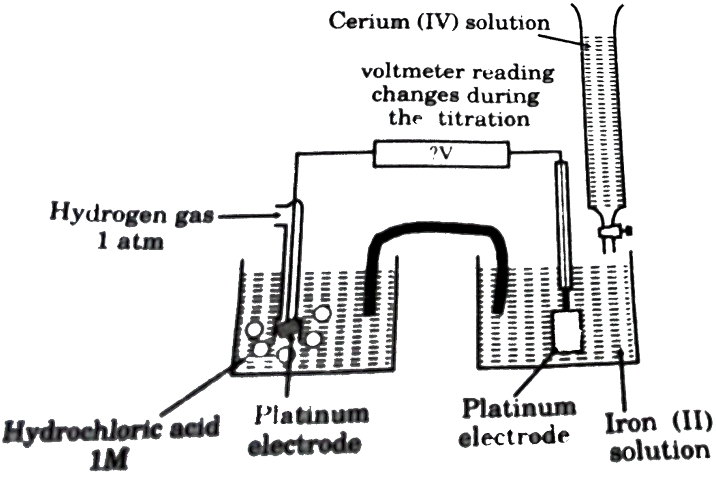
Comprehension 11

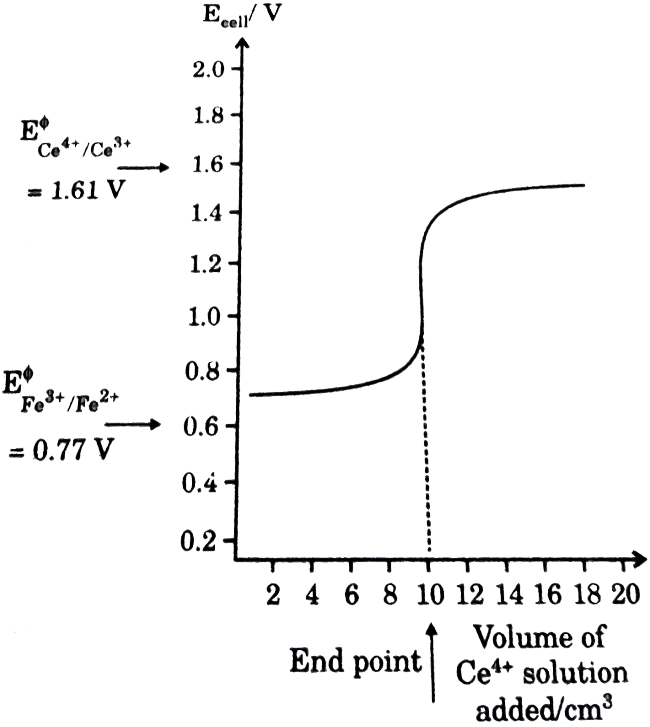
1. Titration are one of the methods we can use to discover the precise concentration of solutions. A typical titration involves adding a solution from a burette to another solution in a flask. The end point of the titration is found by watching a colour change taking place.However, a problem arises when a suitable indicator cannot be found, or when the colour change involved are unclear. In these cases, redox potential may sometimes come to the rescue.



A perticularly well known example (Fig.) is a method of discovering then concentration of iron (II) ions in a solution by titrating them with a solution of cerium (IV). The redox potential that are of interest here are $E^{\circ}_{Fe^{3+}|Fe^{2+}} = 0.77V \text{and} E^{\circ}_{Ce^{4+}|Ce^{3+}} = 1.61V$. These tell us that cerium (IV) ions are the oxidising agents. They should react according to the equation

$Fe^{2+}(aq) + Ce^{4+}(aq) \rightarrow Fe^{3+}(aq) + Ce^{3+}(aq)$.

Now imagine that we know the concentration of the cerium (IV) ions solution in the burette. We want to measure the concentration of the cerium (IV) solution from the burette, some of the iron (II) ions are will be oxidised. As a consequence the beaker would now contain large number of unreacted iron (II) ions , but also some iron (III) ions as well. All of the cerium (III). The solution in the beaker now represents an iron $(III)/iron(II)$ half cell although not at standard conditions.Thus , the emf of the cell will be near, but not equal to $E^{\circ}_{Fe^{3+}|Fe^{2+}}$.



If we continue to add cerium (IV) solution , the number of iron (II) ions is gradually reduced and eventually only a very few are left (Table).At this stage the next few drops of cerium (IV) solution convert all the remaining irom (II) ions into iron (III), and some of the cerium (IV) ions are left unreacted. Once this happens we no longer have an iron $(III)/\text{iron}(II)$ half-cell. Instead we have a solution in which there is a large number of cerium (III) ions and a smaller number of cerium (IV) ions. The solution in the beaker now behaves as a cerium $(IV)/\text{cerium}(III)$half-cell (although not a standard one.)

Just before all the iron (II) ions are converted into iron (III) we have a cell with an EMF of around $+0.77V$. After all the iron (II) ions are oxidised we have a cell with an emf of about $+1.61V$. This rapid rise in emf occurs with the addition of just one drop of cerium (IV) solution. You should be able to understand why a graph of cell emf against volume of cerium (IV) solution of the iron (II) solution calculated in the usual way.

When an ion is converted into a complex ion, the redox potential change. you can see this in the combination of standard emf of the iron $(III)/\text{iron}(II)$ system $(+0.36V)$. The cyanide ion is said to stabilize the oxidation state of the iron. If you were to make up a cell

$$Pt(s)\left|\underset{1\text{mol dm}^{-1}}{Fe(CN)_6^{3-}(aq), Fe(CN)_6^{4-}}\right|\left|\underset{1\text{mol dm}^{-3}}{Fe^{3+}(aq), Fe^{2+}(aq)}\right|Pt(s)$$

what would be the emf and what would be the cell reaction?

A. $0.41V Fe(CN)_6^{4-}(aq) + Fe^{3+}(aq) \rightarrow Fe(CN)_6^{3-}(aq) + Fe^{2+}(aq)$

B. $0.13V Fe(CN)_6^{4-}(aq) + Fe^{3+}(aq) \rightarrow Fe(CN)_6^{3-}(aq) + Fe^{2+}(aq)$

C. $0.41 V Fe(CN)_6^{3-}(aq) + \quad Fe^{2+}(aq) \rightarrow Fe(CN)_6^{4-}(aq) + Fe^{3+}(aq)$

D.

$$\left(0.13 V Fe(CN)_6^{3-}(aq) + Fe^{2+}(aq)\right), \Big(, \rightarrow Fe(CN)_6^{4-}(aq) + Fe^{3+}$$

Answer: A

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Comprehension 12

1. The speed of a molecule of a gas changes continuously as a result of collisions with other molecules and with the walls of the container. The speeds of individual molecules therefore change with time.

A direct consequence of the distribution of speeds is that the average kinetic energy is constant for a given temperature.

The average K.E. is defined as

$$\overline{KE} = \frac{1}{N}\left(\frac{1}{2} m \underset{i}{\Sigma} dN_i u_1^2\right) = \frac{1}{2} m \left(\underset{i}{\Sigma} \frac{dN_i}{N} . \, u_1^2\right)$$

where $\frac{dN}{N}$ is the fraction of molecules having speeds between u_i and

$u_i + du$ and as proposed by maxwell

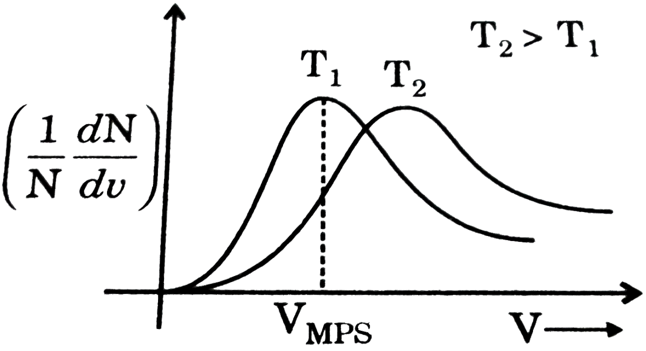
$$\frac{dN}{N} = 4\pi\left(\frac{m}{2\pi KT}\right)^{3/2} \exp\left(-\frac{mu^2}{2KT}\right). u^2. du$$

The plot of $\left(\frac{1}{N}\frac{dN}{du}\right)$ is plotted for a particular gas at two different temperature against u as shown.

The majority of molecules have speeds which cluster around v_{MPS} in the middle of the range of v. There area under the curve between any two speeds $V_1 \text{and} V_2$ is the fraction of molecules having speeds between $V_1 \text{and} V_2$.

The speed distribution also depends on the mass of the molecules. As the area under the curve is the same (equal to unity) for all gas samples, samples which have the same V_{MPS} will have identical Maxwellian plots.

On the basis of the above passage answer the questions that follow.



If a gas sample contains a total of N molecules. The area under any given maxwellian plot is equal ot :

A. infinite

B. N

C. 1

D. $\int_{0}^{N}\left(\frac{dN}{du}\right).\,du$

Answer: C

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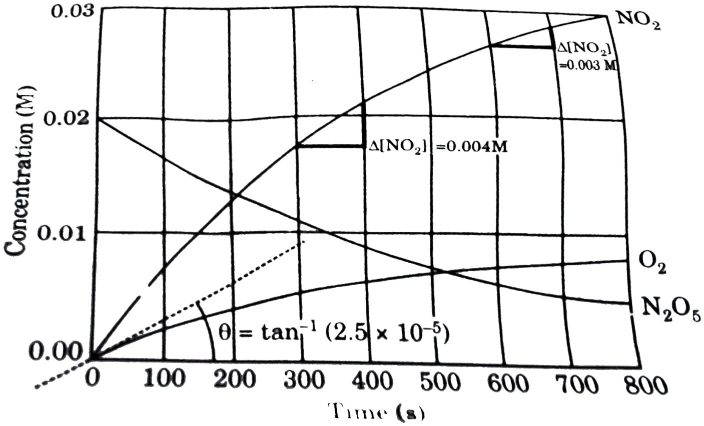
Comprehension 13

1. Concentrations measured as a function of time when gaseous N_2O_5 at initial concentration of $0.0200M$ decomposes ot gaseous $NO_2 \text{and} O_2 \text{at} 50^\circ C$. The change in concentration with time is given by the following graph.



The instantaneous rate of disappearance of N_2O_5 at the beginning of the reaction is :

A. $2 \times 10^{-5} M / s$

B. $1 \times 10^{-5} M / s$

C. $5 \times 10^{-5} M / s$

D. zero

Answer: C

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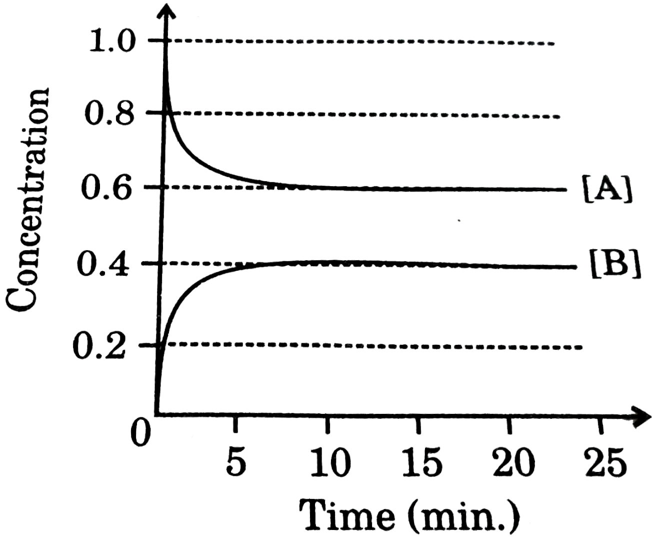
Comprehension 14



1.

For the reversible reaction $A \underset{k_b}{\overset{k_f}{\Longleftrightarrow}} B$ (having Ist order in both direction) the concentration as a function of time are given for a certain experimantal run.

At what time (t) is the rete of change of concentration A equal to the rate of change of concentration of B in magnitude?

A. $t = 0$only

B. $t \geq t_{\text{equilibrium}}\text{only}$

C. $t = 0$min only

D. At all times

Answer: D

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Comprehension 15

1. According to collision theory for determining the variation of rate of reaction with temperature the rate constant,$k = Ae^{-Ea/RT}$. For most of the practical purposes A and E_a[Arrhenius factor and Activation energy] are temperature independent. However they may vary slightly.

Assuming the conditions given above answer the following questions.

For constant A and E_a, which parameters when plotted will give a straight line with given slope?

A. $\text{ln k vs T ,Slope} = \frac{E_a}{R}$

B. $\text{ln k vs}\frac{1}{T}\text{slope} = \frac{E_a}{R}$

C. $\text{ln k vs}\frac{1}{T}, \text{slope} = \frac{E_a}{R}$

D. $\text{ln k vs}T, \text{slope} = \frac{E_a}{R}$

Answer: C

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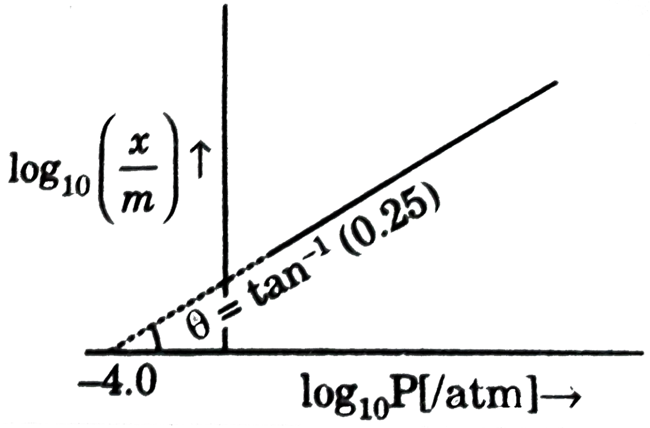
Comprehension 16

1. The adsorption of a gas at a metal surface is called occlusion. The extent of gas adsorbed at metal surface at a certain temperature depends on pressure as

$$\frac{x}{m} = K.\,P^{1/n}$$

where K and n are constant for a particular combination of gas and metal at fixed temperature and $\frac{x}{m}$ is the mass of gas adsorbed per unit mass of metal .For H_2 gas adsorbing at Pt-surface, the following graph is obtained.



The correct values of K and n are respectively.

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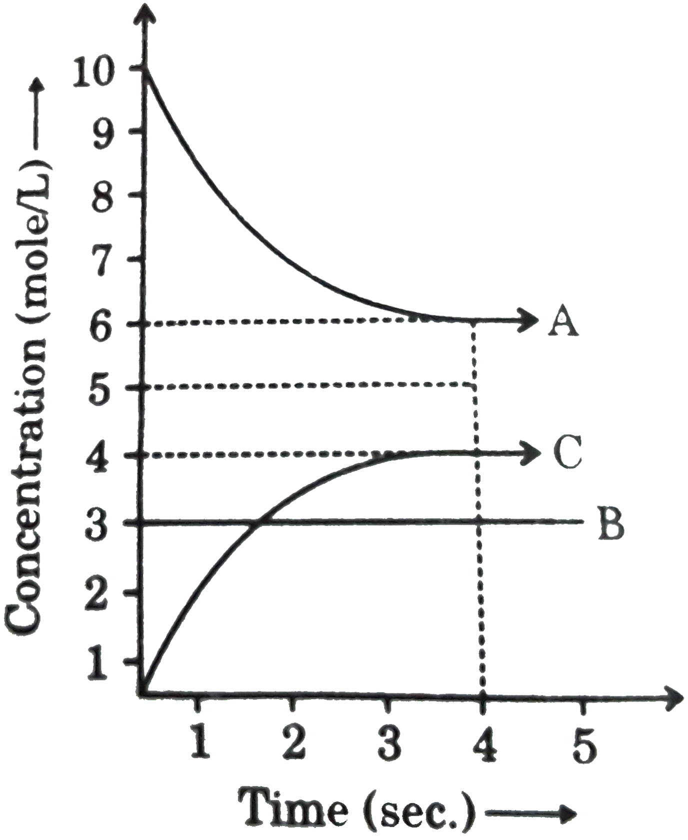
Comprehension 17

1. A,B and C react in the 1:1:1 stoichiometric ratio. The concentration of A,B and C where found to vary with time as shown in the figure below:



Which of the following equilibrium reaction represents the correct variation of concentration with time?

A. $C(g)+A(g) \Leftrightarrow B(g)$

B. $A(g)+B(g) \Leftrightarrow C(g)$

C. $C(g)+B(g) \Leftrightarrow A(g)$

D. $A(g)+B(g) \Leftrightarrow C(g)$

Answer: D

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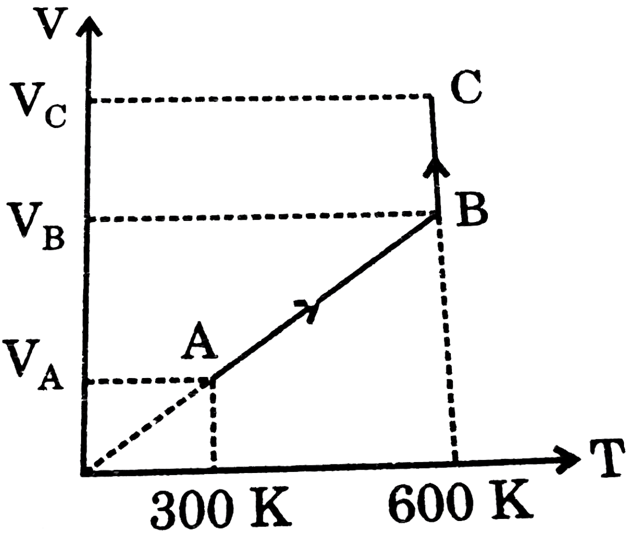
Comprehension 18



1.

Above graph is plotted for 1 mole of ideal monoatomic gas.

Correct relation of $V_A \text{and} V_B$ will be :

A. $\frac{V_B}{V_A} = \frac{1}{1}$

B. $\frac{V_B}{V_A} = \frac{2}{1}$

C. $\frac{V_B}{V_A} = \frac{1}{2}$

D. none of these

Answer: B

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Comprehension 19

1. The process by which a gas through a small hole into vacuum is called effusion. The rate of change of pressure (p) of a gas at constant temperature due to effusion of gas from a vessel of constant volume can be related to rate of change of number of molecules by the expression:

$$\frac{dp}{dt} = \frac{kT}{V}\left(\frac{dN}{dt}\right)$$

where Rate of change of number of molecules

$$\Rightarrow \qquad -\frac{dN}{dt} = \frac{pA_0}{(2\pi mkR)^{1/2}}$$

where, k= Boltzmann constant

$N_A =$ Avogadro's number

$T =$ temperature (in K) $\Rightarrow \qquad -\frac{dN}{dt} = \frac{pA_0}{(2\pi mkR)^{1/2}}$

$N_A =$ Avogadro's number

$T =$ temperature (in K)

$V =$ volume of vessel

$N =$ 1 no.of molecules

$A_0 =$ area of aperture

$m =$ mass of single molecule

$\gamma = \frac{V}{A_0}\sqrt{\frac{2\pi m}{kT}}$

If initial pressure is P_0 then pressure of gas at any time t in the container at constant V and T is given by:

A. $P_0 e^{-t/y}$

B. $P_0 e^{t/\gamma}$

C. $P_0\left(1 - e^{-t/\gamma}\right)$

D. $P_0\left(1 - e^{t/\gamma}\right)$

Answer: A

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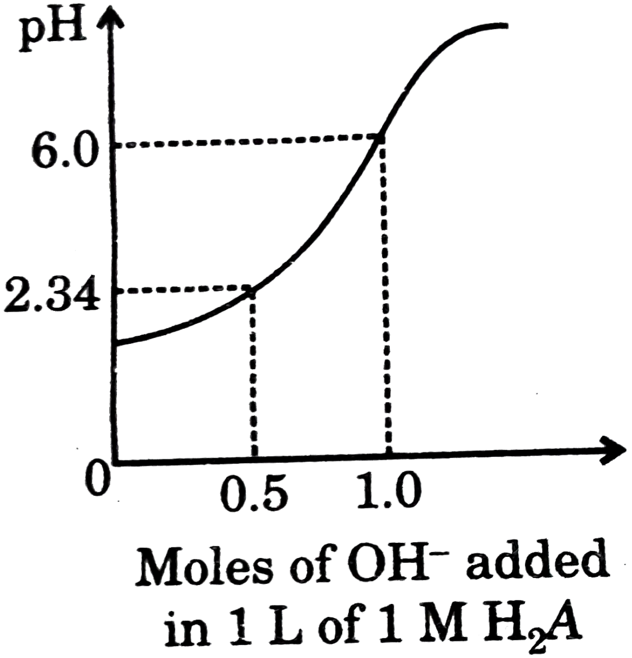
Comprehension 20

1. Titration of diprotic acid (H_2A) by strong base has been summarised in following graph



What are the pH of solution when it shows maximum buffer action?

A. $2.34, 6$

B. $6, 9.66$

C. $2.34, 9.66$

D. $6, 12$

Answer: C

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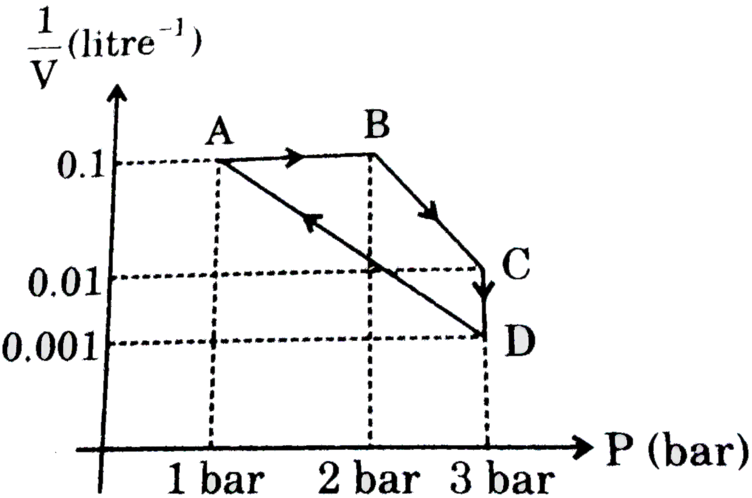
Comprehension 21

1. For an ideal gas if heat given in process AB is 10kJ then answer the following questions.

$(1\text{bar}.\ l = 0.1kJ)$



The ΔH for the process AB is :

A. $11 kJ$

B. $9 kJ$

C. $10 kJ$

D. $12 kJ$

Answer: A

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Comprehension 22

1. Thermodynamics stability is often used in chemical reactions to predict extent of reaction or to predict the preferred product in some reaction. Thermodynamically a more stable substance will be the one which has lower Gibb's free energy.In various cases,it might be decided on the basis of enthalpy, however , that may not always be true. The thermodynamic data Therefore can be used for prdicting stability among isotopes and to decide the possible transformation.Based on this information and the data given below, answer the questions that follow.

Date: $\begin{array}{ll} \Delta H_f^\circ \text{of} Sn_{(\text{white})} = 0 & \Delta H_f^\circ \text{of} Sn_{(\text{grey})} = -2.1 kJ/\text{mole} \\ S^\circ \text{of} Sn_{(\text{white})} = 0 & S^\circ \text{of} Sn_{(\text{grey})} = 44 J/K - \text{mole} \end{array}$

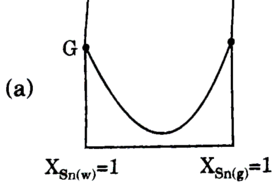
All above data at 300K.

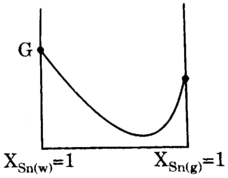
Density of $Sn_{(w)} = 7.36 g/ml$

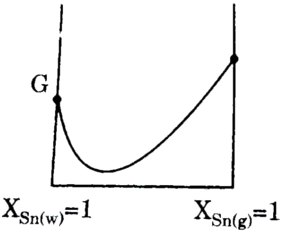
Density of $Sn_{(g)} = 5.769 gm/ml$

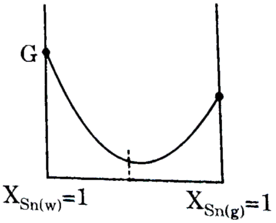
One such transformation is 'tin pest' which is an autocatalytic, allotropic transformation of the element tin causing deterioration of tin objects at low temperatures.

Which of the following graph is correct for the allotropic transition $Sn_{(\text{white})} \rightarrow Sn_{(\text{grey})}$ at 1 bar and 298 K?

A. 

B. 

C. 

D. 

Answer: C

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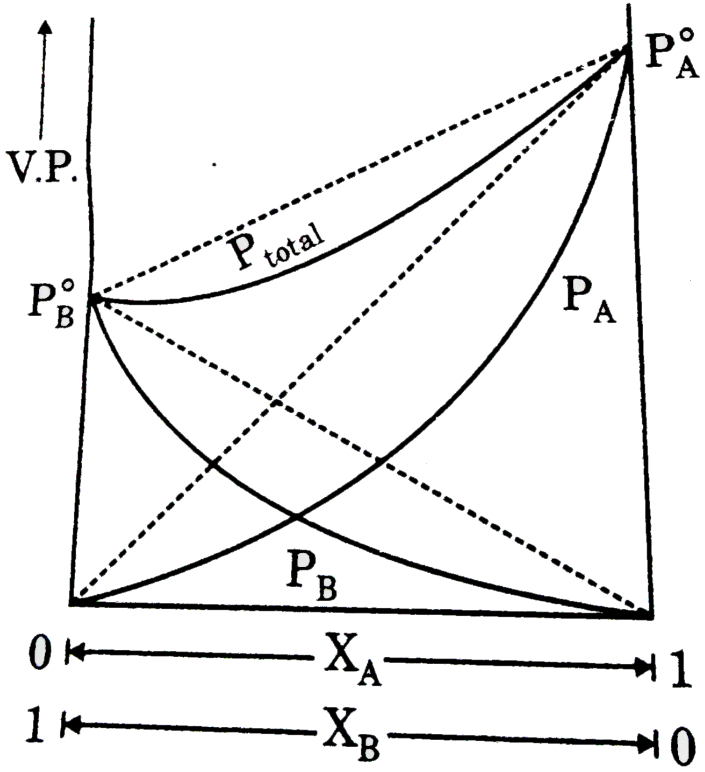
Comprehension 23

1. Answer the questions (given below) which are based on the following diagram: vapour pessure diagram for real solution of two liquids A and B that exhibit a negative deviation from Raoult's law. The vapour pressure of both A and B are less than predicted by Raoult's law. The dashed lines represent the plots for ideal solutions.



Solution containing components A and B show this type of deviation from ideal behaviour when:

A.

$$\begin{array}{llll} \text{Attraction}A\ldots B & \Delta H_{\text{mix}} & \Delta V_{\text{mix}} & B. \\ \text{Larger than average of}A\ldots A.\ B..\ B\text{attraction} & +ve & +ve & \text{larg} \end{array}$$

B. $$\begin{array}{llll} \text{Attraction}A\ldots B & \Delta H_{\text{mix}} & \Delta V_{\text{mix}} & B.\ P \\ \text{As in}(a) & -ve & -ve & \text{As in}(a) \end{array}$$

C.

$$\begin{array}{llll} \text{Attraction}A\ldots B & \Delta H_{\text{mix}} & \Delta V_{\text{mix}} & \\ \text{Smaller than average of}A\ldots A..\ B..\ B\text{attraction} & +ve & +ve & \text{S} \end{array}$$

D. $$\begin{array}{llll} \text{Attraction}A\ldots B & \Delta H_{\text{mix}} & \Delta V_{\text{mix}} & B.\ P \\ \text{As in}(c) & -ve & -ve & \text{As in}(c) \end{array}$$

Answer: B

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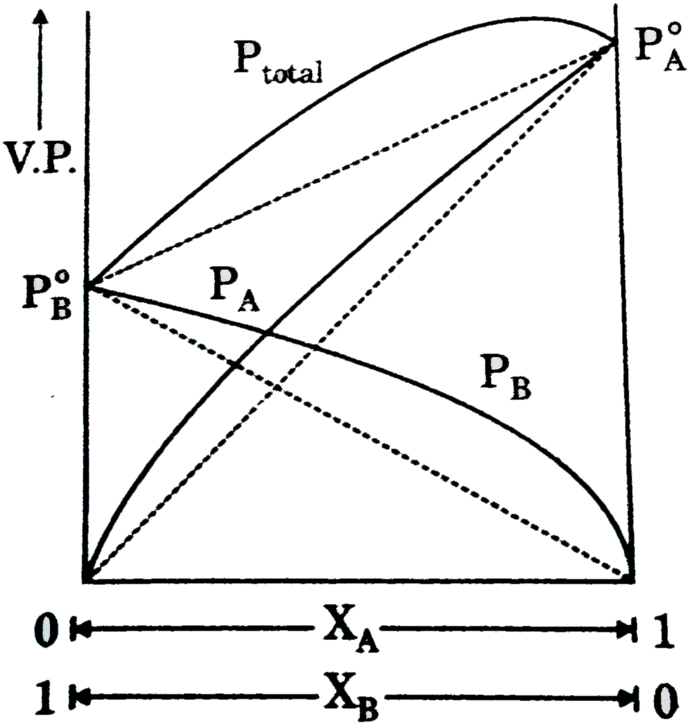
Comprehension 24

1. Answer the questions (given below) which are based on the following diagram ?



Consider some facts about the above phase diagram. Vapour pressure diagram for real solutions of two liquids A and B that exhibit a positive deviation from Raoult's law. The vapour presssure of both A and B are greater than predicted by Raoult's law. The dashed lines represented the plots for ideal solutions.

A : This is obserbed when A...B attractions are greater than average of A...B and B.....B attraction :

B : $\Delta H_{mix} = +ve, \Delta V_{mix} = +ve$

C : Boiling point is smaller than expected such that vaporisation is increased

D : Mixture can from azeotropic mixture Select correct facts.

A. A,B,C

B. B,C,D

C. A,C,D

D. A,B,C,D

Answer: B

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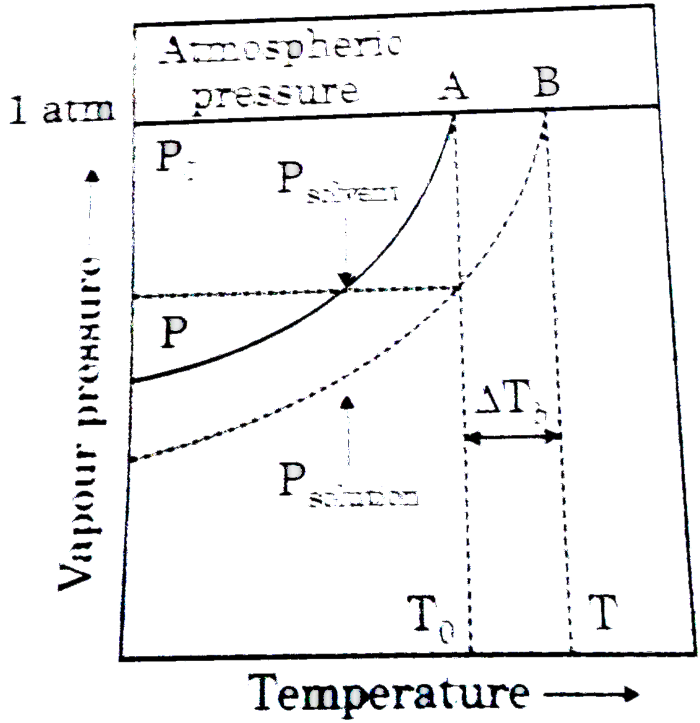
Comprehension 25

1. Figure explains elevation in boiling point when a non-volatile solute is added to a solvent. Variation of vapour pressure with temperaure and elevation in boiling point is marked.



Given that ΔT_b is the elevation in boiling point of the solvent in a solution of molarity m then $\lim_{m \to 0}\left(\frac{\Delta T_b}{m}\right)$ is equal to:

A. K_b (molal elevation constant)

B. L_v (latent heat of vaporisation)

C. ΔS (entropy change)

D. x (mole fraction of solute)

Answer: A

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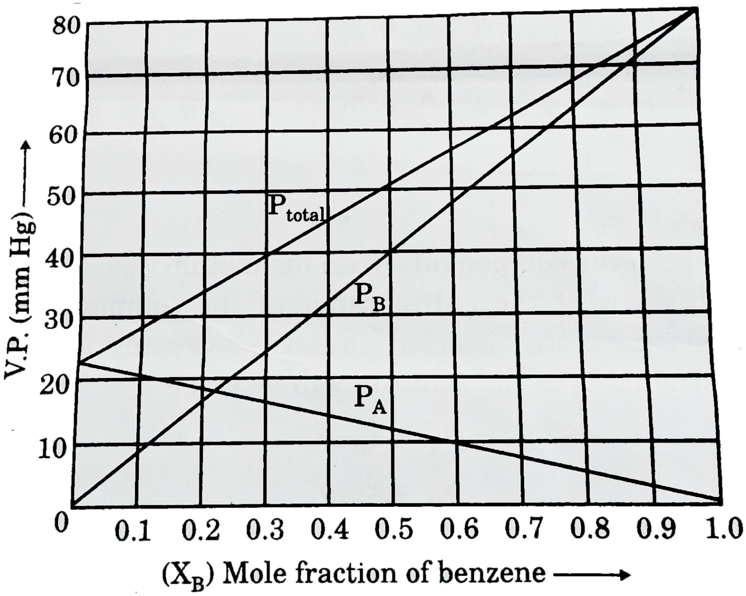
Comprehension 26

1. Answer the questions (given below) which are based on the following diagram. Vapour pressure plots of benzene-toluence mixture at $20^{\circ}C$. Solution of benzene and toluence are ideal. Raoult's law is valid for both components over the entrie range of concentration.



An ideal solution consisting of two components A and B (such as benzene and toluence) is one in whic:

A. the intermolecular attraction A...A, B...B and A...B are equal

B. $\Delta H_{mix} = 0, \Delta V_{mix} = 0$

C. both of the above conditions are followed

D. none of the above conditions are followed

Answer: C

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Comprehension 27

1. When a liquid is completely miscible with another liquid, a homogeneous solution consisting of a single phase is formed. If such a solution is placed in a closed evacuated vessel, the total pressure exerted by the vapour, after the system attained equilibrium will be equal to the sum of partial pressures of the constituents. A solution is said to be ideal if its constituents follow Raoult's law under all conditions of concentrations, i.e., where p_i is the partial pressures of the constituent i, whose mole fraction in the solution is x_i and p_i° is the corresponding vapour pressure of the pure constituent. The change in the thermodynamic functions when an ideal solution is formed by mixing pure components is given by the following expression.

$\Delta_{mix} = G = n_{\text{total}} RT \sum_i x_i In x_i$ ...(i)

where, n_{total} is the total amount of all the constituents present in the solution.

$\Delta_{mix} F = \, - n_{\text{total}} R \sum_i x_i In x_i$ ......(ii)

$\Delta_{mix} H = \, - n_{\text{total}} RT \sum_i x_i In x_i - n_{\text{total}} R \sum_i x_i In x_i = 0$ ....(iii)

$\Delta_{mix} U = 0$ ....(iv)

Since botli the components of an ideal binary system follow Raoult's law of the entire range of the compositions, the partial pressure exerted by the vapours of these constituents over the solution will be given by

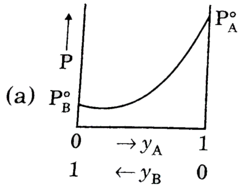
$p_A = x_A p_A^\circ$ ....(v)

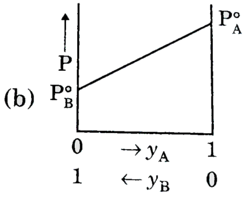
$p_B = x_B p_B^\circ$ ....(vi)

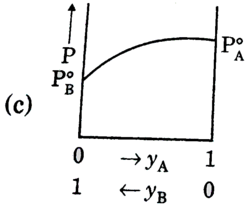
where, x_A and x_B are the mole fractions of the two constituents in the liquid phase and p_A° and p_B° are the respective vapour pressure of the pure constituents. The total pressure (p) over the solution will be the sum of the partial pressure. The composition of the vapour phase (y_A)

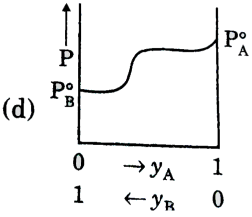
can be determined with the help of Dalton's law of partial pressures.

For an ideal solution in which $p_A^\circ > p_B^\circ$, the plot of total pressure (p) us the mole fraction of A at constant temperature in the vapour phase is:

A. 

B. 

C. 

D. 

Answer: A

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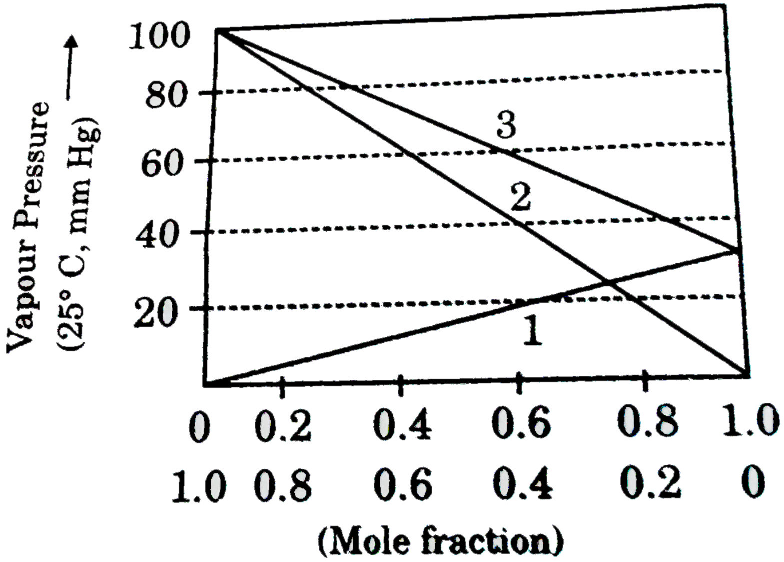
Comprehension 28

1. Consider the following partially labelled figure (graph is upto scale) for an ideal binary solution of benzene and toluence and answer the following questions.



Which graph corresponds to benzene ?

A. 1

B. 2

C. 3

D. Any of 1 or 2

Answer: B

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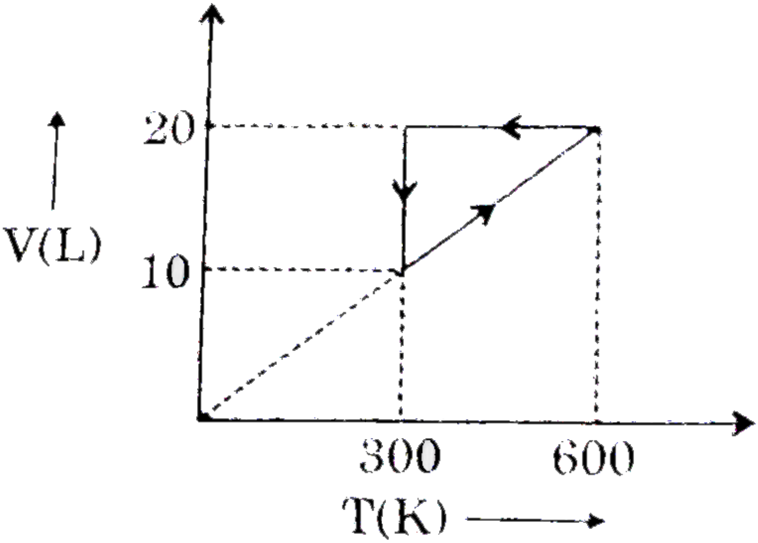
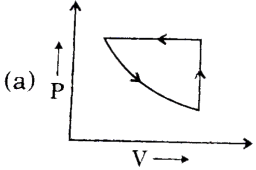
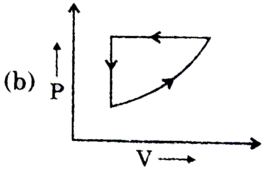
Comprehension 29

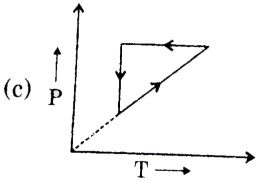
1. One moles of an ideal monoatomic gas undergo the state change as shown in following graph (ln 2 = 0.7)

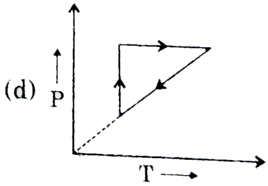


Correct graph for the process in paragraph is:

A. 

B. 

C. 

D. 

Answer: D

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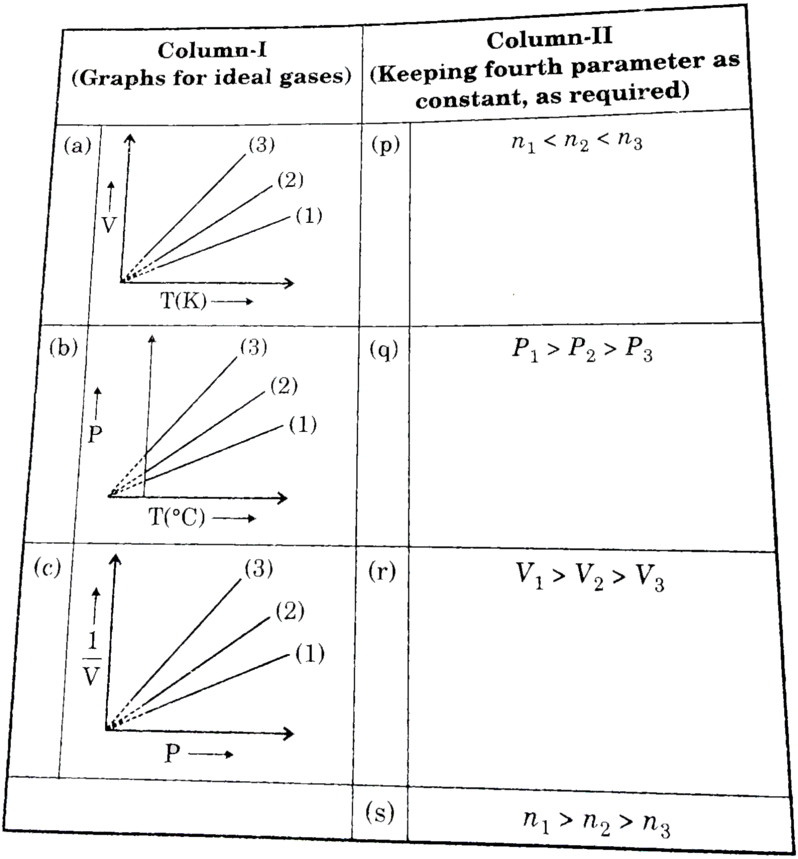
Match The Column Type

1. Match the following columns



Column-I (Graphs for ideal gases)		Column-II (Keeping fourth parameter as constant, as required)	
(a)		(p)	$n_1 < n_2 < n_3$
(b)		(q)	$P_1 > P_2 > P_3$
(c)		(r)	$V_1 > V_2 > V_3$
		(s)	$n_1 > n_2 > n_3$

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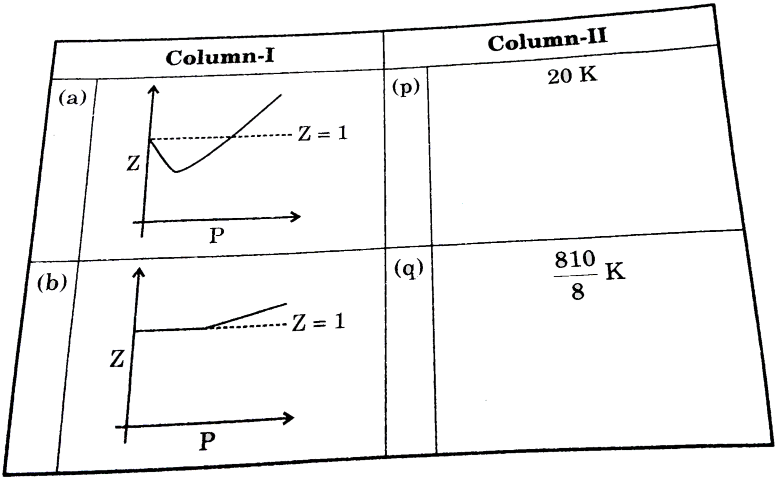
2. For a certain van der Waal's gas, critical temperature is-$243^\circ C$. Match the graphs (given in column-I) with the temperature of the gas (given in column-II).



	Column-I		Column-II
(a)		(p)	20 K
(b)		(q)	$\frac{810}{8}$ K

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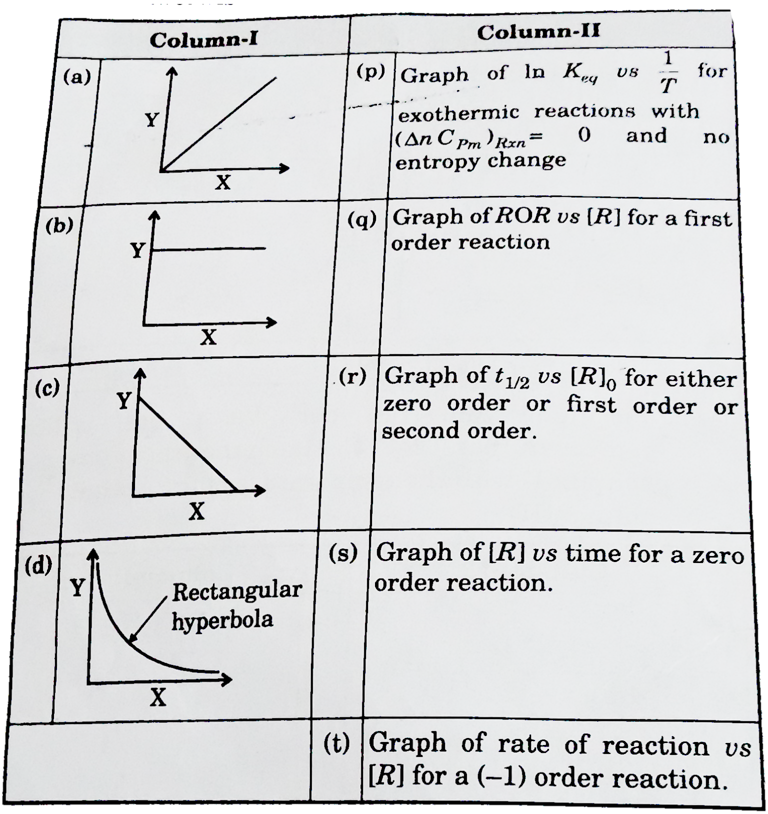
3. Match the graphs given in column-I to the parameters and conditions. {Given: ROR represents rate of reaction, [R] represents concentration of reactant, $t_{1/2}$ represents half life, $[R]_0$ represents initial concentration of reactant.} All other units have their usual meaning. Assume reactions to involve only one reactant unless otherwise stated.



Column-I		Column-II	
(a)	Y X	(p)	Graph of $\ln K_{eq}$ vs $\frac{1}{T}$ for exothermic reactions with $(\Delta n\, C_{Pm})_{Rxn} = 0$ and no entropy change
(b)	Y X	(q)	Graph of ROR vs $[R]$ for a first order reaction
(c)	Y X	(r)	Graph of $t_{1/2}$ vs $[R]_0$ for either zero order or first order or second order.
(d)	Y Rectangular hyperbola X	(s)	Graph of $[R]$ vs time for a zero order reaction.
		(t)	Graph of rate of reaction vs $[R]$ for a (–1) order reaction.

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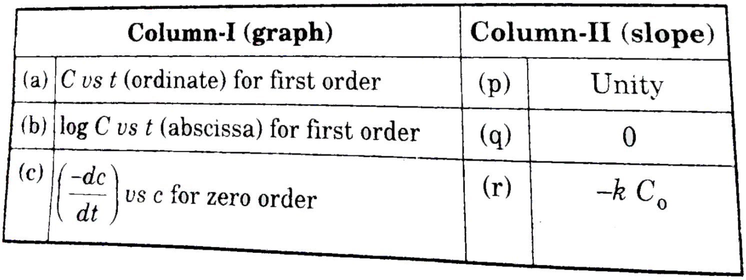
4. Match the following columns



Column-I (graph)		Column-II (slope)	
(a)	C *vs* t (ordinate) for first order	(p)	Unity
(b)	log C *vs* t (abscissa) for first order	(q)	0
(c)	$\left(\frac{-dc}{dt}\right)$ *vs* c for zero order	(r)	$-k\,C_0$

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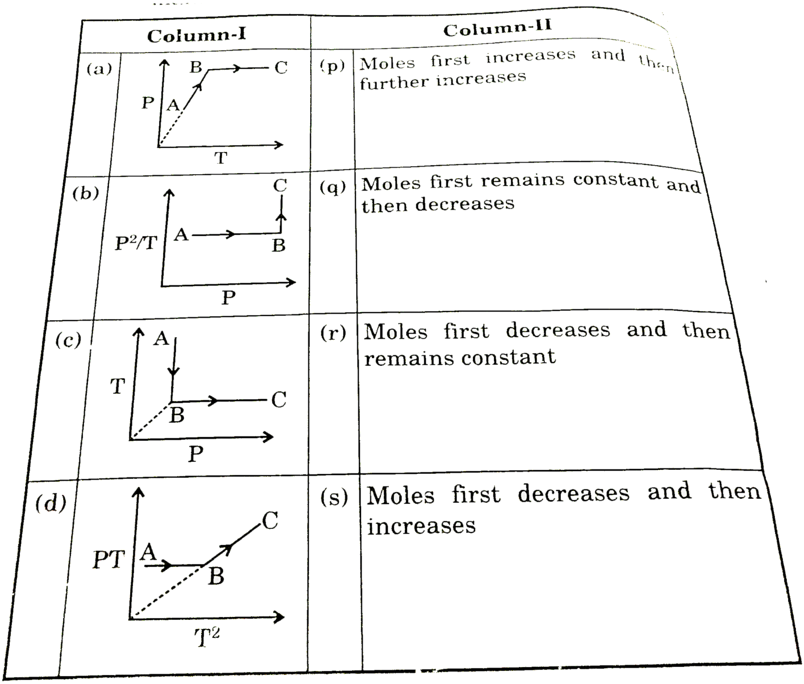
5. The following graphs are plotted for an ideal gas taken from state A to state B and then to state C, maintaining volume constant.



Column-I		Column-II
(a)	(p)	Moles first increases and then further increases
(b)	(q)	Moles first remains constant and then decreases
(c)	(r)	Moles first decreases and then remains constant
(d)	(s)	Moles first decreases and then increases

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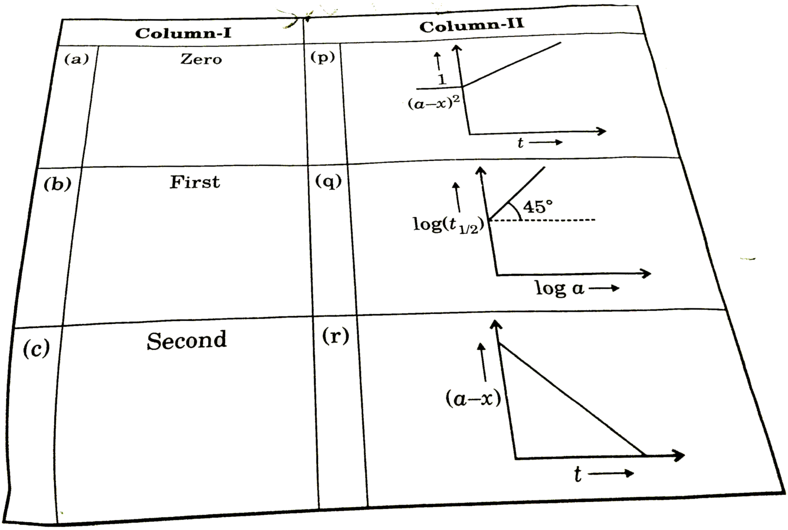
6.



	Column-I		Column-II
(a)	Zero	(p)	
(b)	First	(q)	
(c)	Second	(r)	

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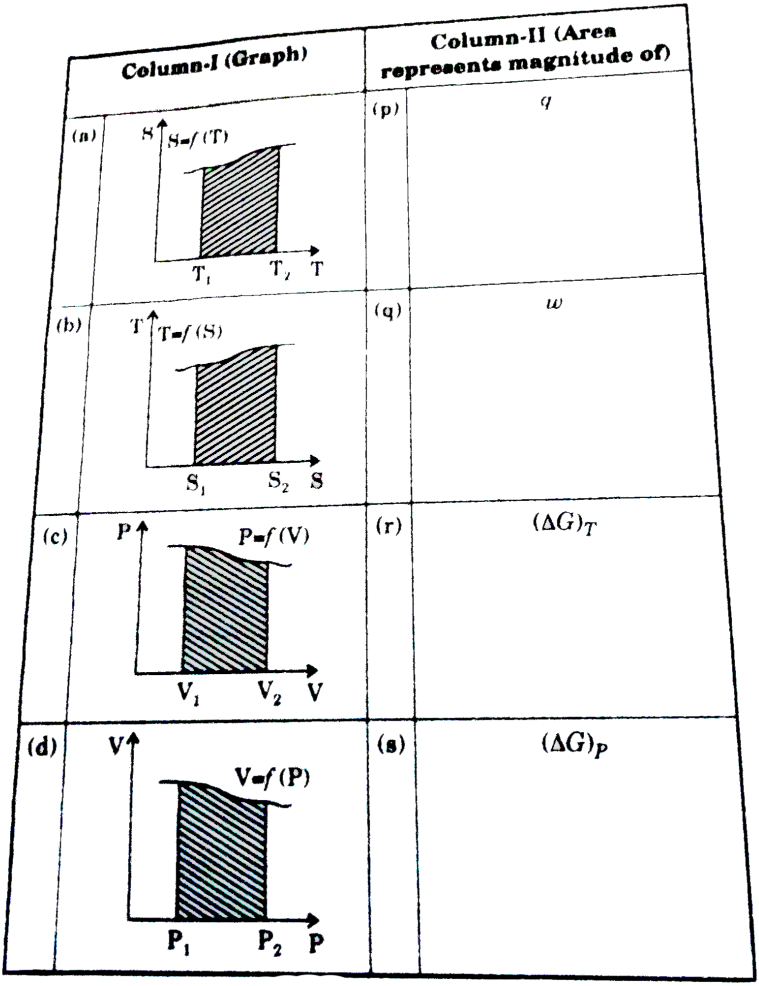
7. Match the following columns



	Column-I (Graph)		Column-II (Area represents magnitude of)
(a)	S $S = f(T)$ T_1 T_2 T	(p)	q
(b)	T $T = f(S)$ S_1 S_2 S	(q)	w
(c)	P $P = f(V)$ V_1 V_2 V	(r)	$(\Delta G)_T$
(d)	V $V = f(P)$ P_1 P_2 P	(s)	$(\Delta G)_P$

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8. In each situation of column-I a process ABC is given for fixed amount of an ideal gas. Match each of column-I with correct result in column-II.

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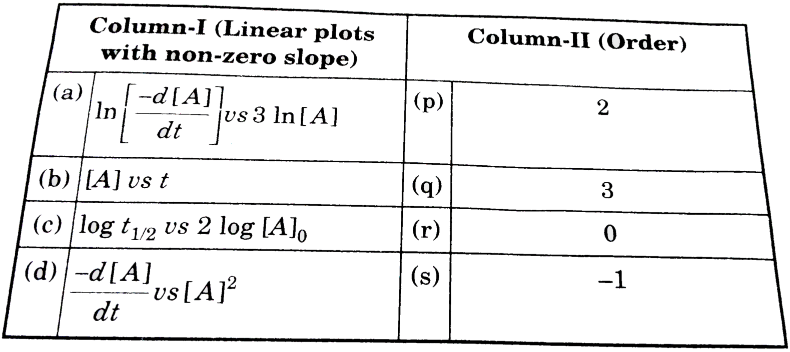
9.



Column-I (Linear plots with non-zero slope)		Column-II (Order)	
(a)	$\ln\left[\frac{-d[A]}{dt}\right] vs\, 3\ln[A]$	(p)	2
(b)	$[A]\ vs\ t$	(q)	3
(c)	$\log t_{1/2}\ vs\ 2\log[A]_0$	(r)	0
(d)	$\frac{-d[A]}{dt} vs\, [A]^2$	(s)	-1

[A] = reactant concentration at time 't', k = rate constant

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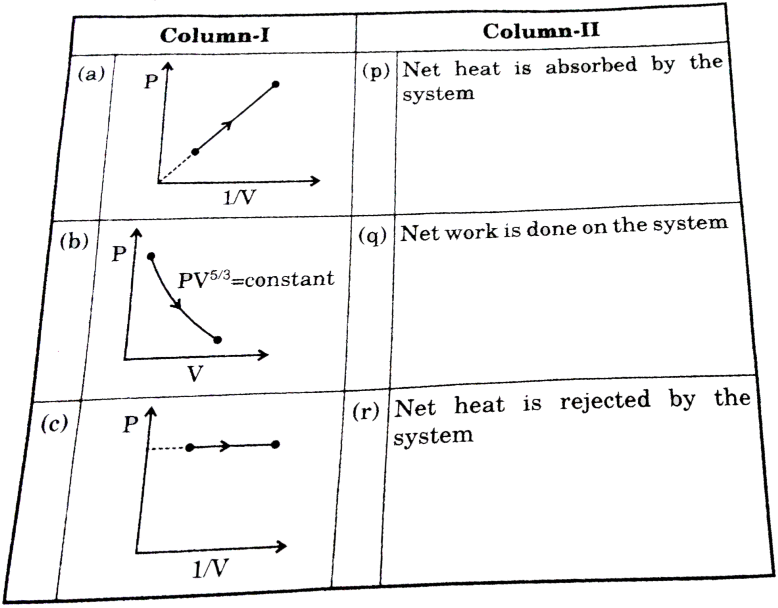
10. The figures given below depict different processes for a given amount of an ideal gas.



	Column-I		Column-II
(a)		(p)	Net heat is absorbed by the system
(b)		(q)	Net work is done on the system
(c)		(r)	Net heat is rejected by the system

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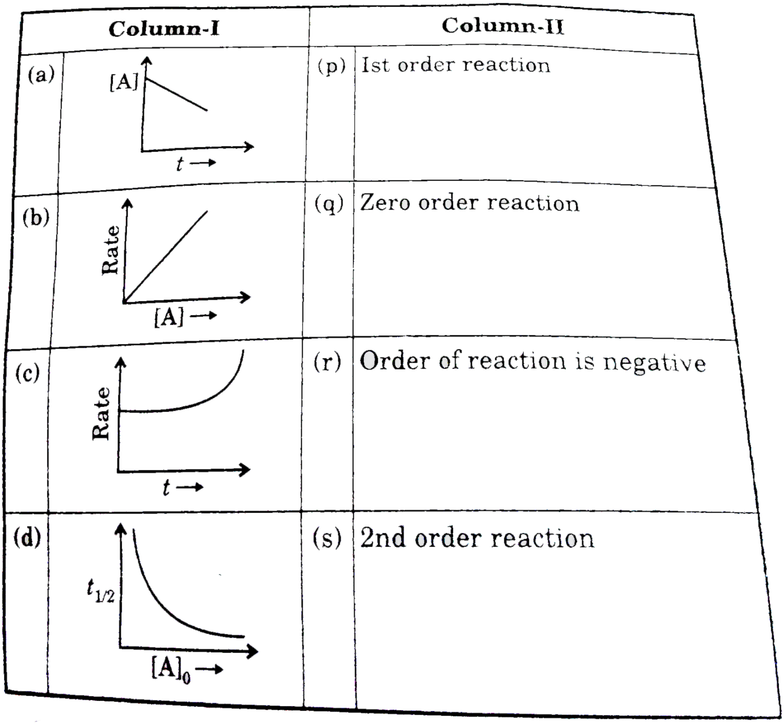
11. Match the following columns



	Column-I		Column-II
(a)		(p)	Ist order reaction
(b)		(q)	Zero order reaction
(c)		(r)	Order of reaction is negative
(d)		(s)	2nd order reaction

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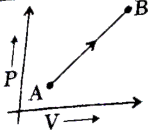
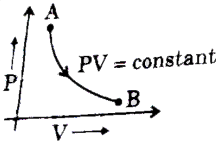
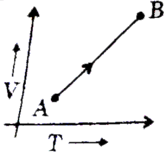
12. One mole of an ideal gas going from state-A to state-B through different processes. Column-I shows graph of the process and column-II shows change in parameter in these process. Match the following:

	Column-I		Column-II
(a)		(p)	$q > 0$
(b)		(q)	$W > 0$
(c)		(r)	$\Delta U > 0$

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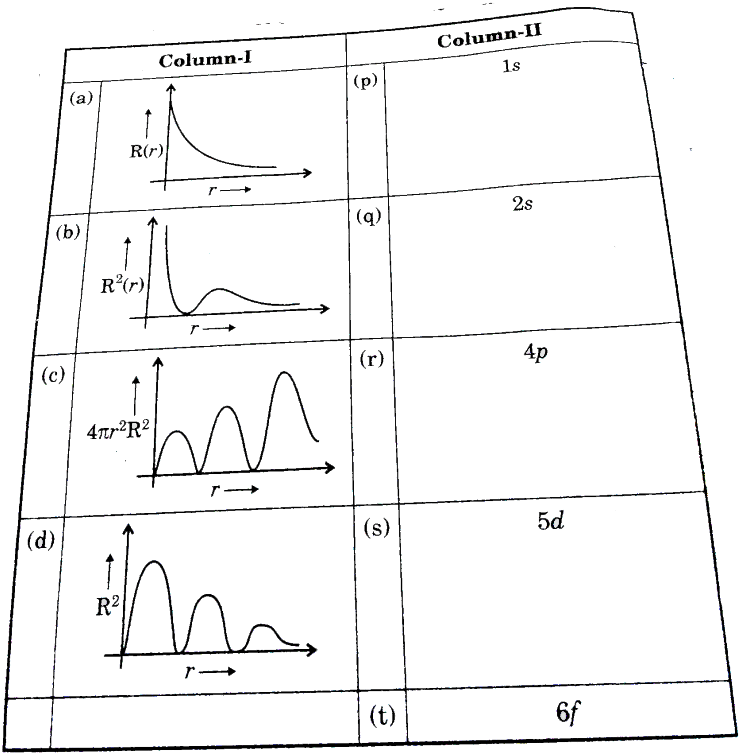
13. R(r) is the radial part of the wave function and r is the distance of electron from the nucleus.



	Column-I		Column-II
(a)	$R(r)$ $r \longrightarrow$	(p)	1s
(b)	$R^2(r)$ $r \longrightarrow$	(q)	2s
(c)	$4\pi r^2R^2$ $r \longrightarrow$	(r)	4p
(d)	R^2 $r \longrightarrow$	(s)	5d
		(t)	6f

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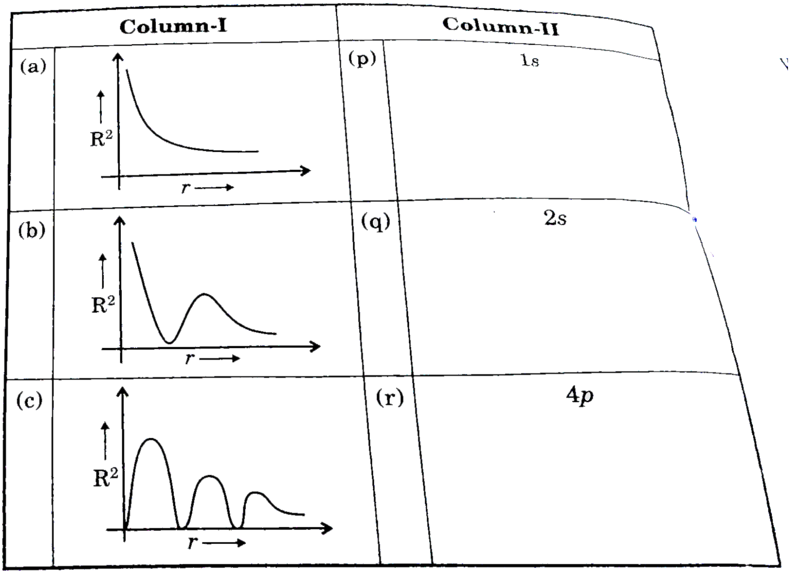
14. Match the following columns



	Column-I		Column-II
(a)		(p)	1s
(b)		(q)	2s
(c)		(r)	4*p*

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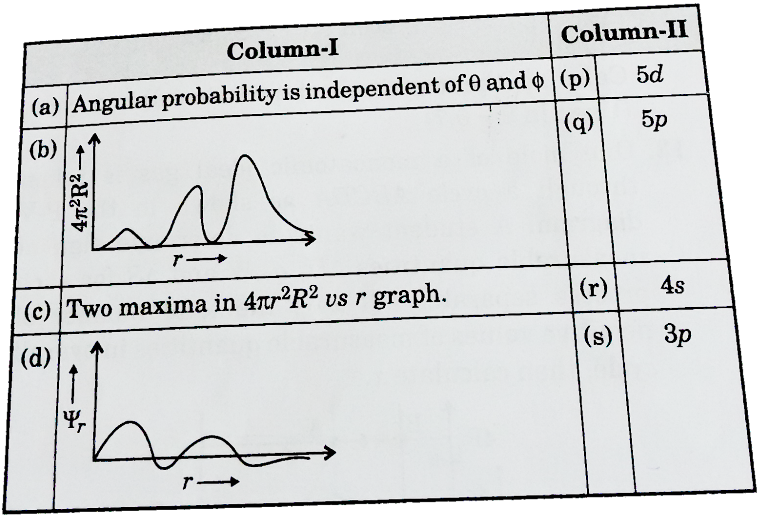
15. Match the following Columns



Column-I		Column-II	
(a)	Angular probability is independent of θ and ϕ	(p)	5d
(b)		(q)	5p
(c)	Two maxima in $4\pi r^2R^2$ vs r graph.	(r)	4s
(d)		(s)	3p

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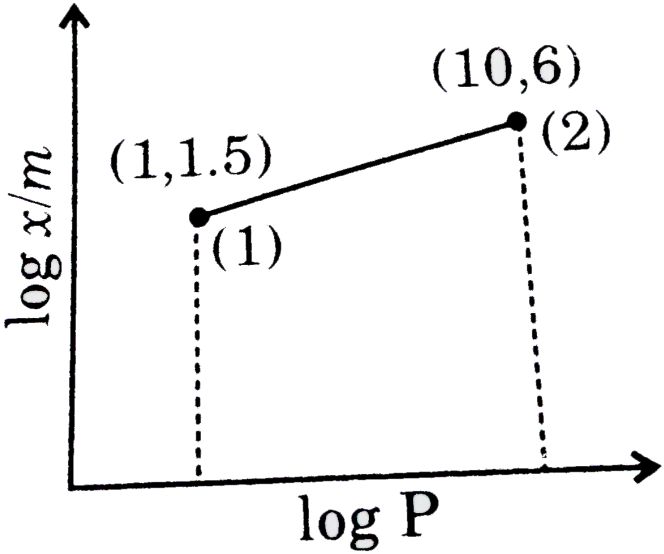
Subjective Type

1. For adsorption of a gas on solid surface, following isotherm was obtained. Where P is pressure of gas in atm, x represents amount of gas adsorbed and m represents mass of adsorbent, calculate the value of $\frac{x}{m}$

of the gas at same temperature and at a pressure of 81 atm.



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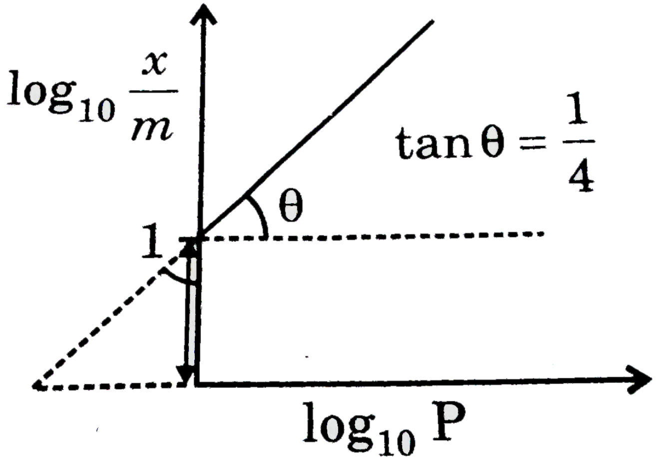
2. From the following graph of log x / m us log P, calculate mass of $H_{\circ}$ gas adsorped on the surface of 1gm palladium at pressure of $81 \times 10^{-4} atm.$

[Express answer in gm)



$(x)(M) =$ Mass of gas absorbed per unit mass of absorbent.

P = Partial pressure of gas in atm.

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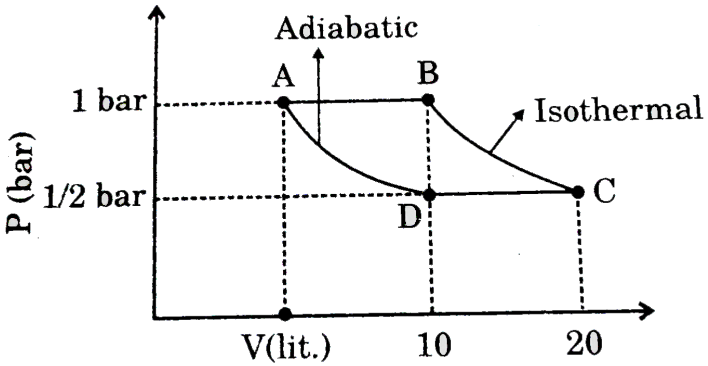
3. Calculate magnitude of work involved in the reversible cyclic process ABCD if a diatomic ideal gas is involved.



[Given $2^{\frac{5}{7}} = 1.6, \ln 2 = 0.7]$

Express answers in bar-lit and round off to next integer.

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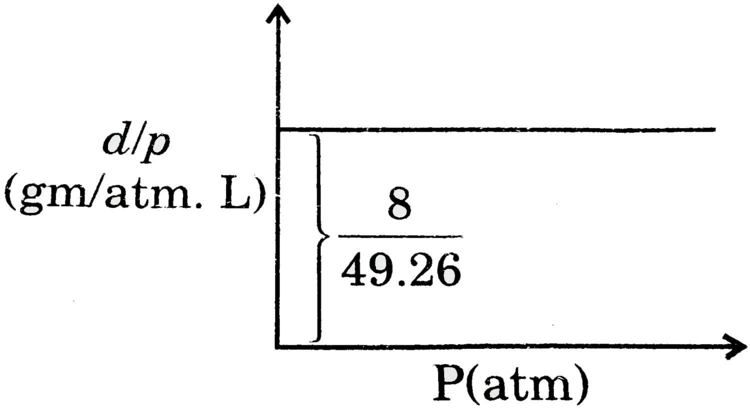
4. From the graph of $\frac{d}{P}$ us P at a constant temperature of 300 K. calculate molar mass of the gas.



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5. For adsorption of gas over solid surface following data is obtained at 300 K.

Pressure of gas (mm of Hg)	100	25
Amount adsorbed per Kg of charcoal	$3gm$	$1.5gm$

The slope of the graph between log P us log x / m will be:

[x / m and P are in same units as given in question.]

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6. For a fixed amount of a real gas when a graph of Z us P was plotted then at very high pressure slope was observed to be $0.01 atm^{-1}$. At the same temperature if a graph is plotted between PV us P then for 2 moles of the gas the y intercept is found to be 40 atm-litre. Calculate excluded volume in litres for 20 moles of the real gas/

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7. 10 moles of an ideal gas is subjected to an isochoric process (volume constant) and a graph of log P us log T is plotted where P is in 'atm' and is in 'Kelvin'. If volume of the container is 82.1 ml then calculate sum of a,b and c.

Where : a = slope of the graph

b = x intercept of the graph

c = y intercept of the graph

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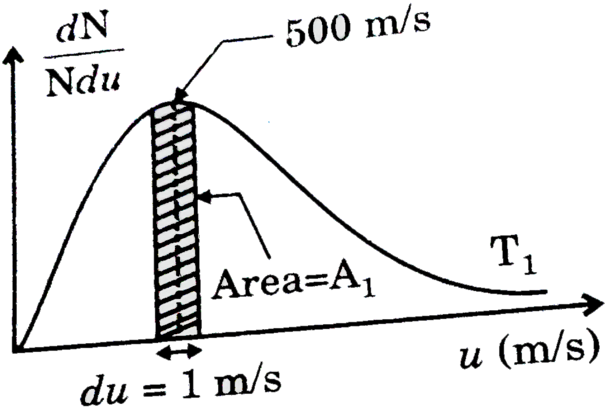
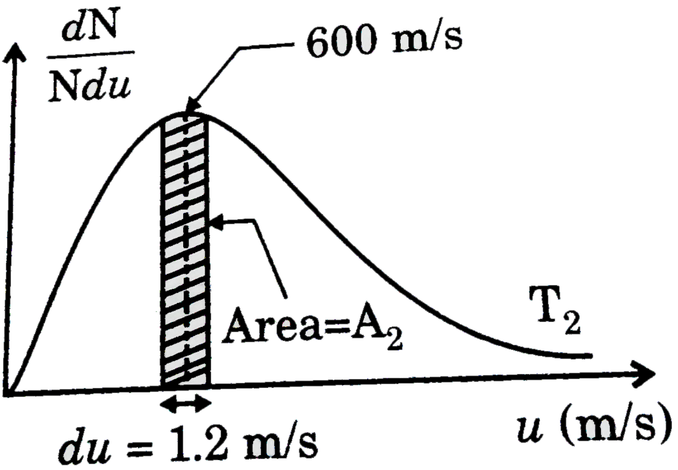
8. For O_2 gas at T_1 and T_2 following Maxwell speed distribution is observed [not to be scale]





Ratio A_1 / A_2 is equal to

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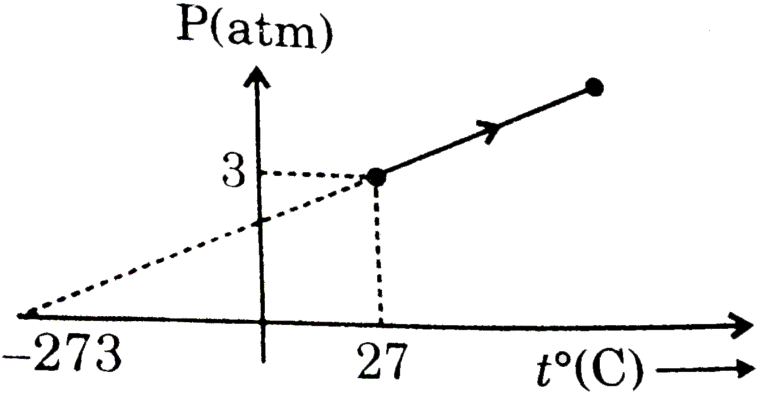
9. Two moles of an ideal gas undergoes the process depicted below. Given that $\left(\frac{\delta P}{\delta T}\right)_v$ is $x \times 10^{-y}$, then calculate the value of (y-x).



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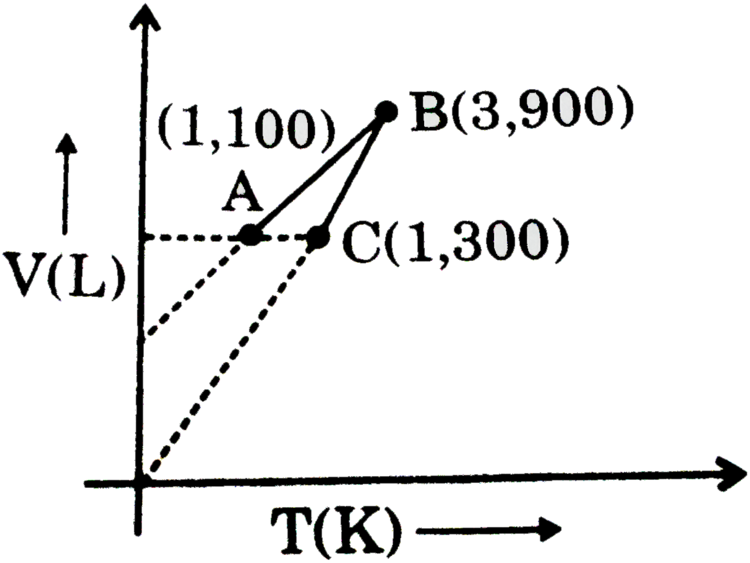
10. One mole of an ideal gas is subjected to a two step reversible process A-B and B-C. The volume at A and C is same. Find the value of the ratio

$$\frac{\text{Pressure of gas at C}}{\text{Pressure of gas at A}}$$



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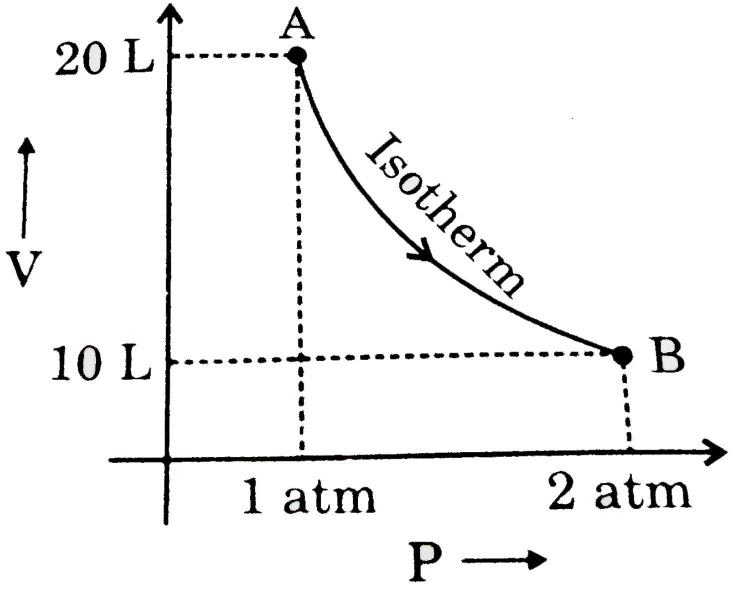
11. Calculate ΔG (in L atm) from the graph of an ideal gas undergoing process AB. [Take: ln 2 = 0.7]



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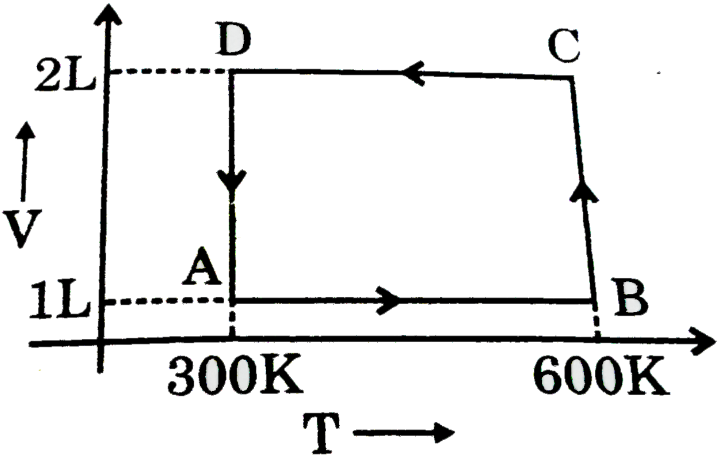
12. One mole of an ideal monoatomic gas undergoes the following cyclic process. Calculate the magnitude of work (in cal) in a cycle. (Use: ln 2 =

0.7)



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13. One mole of a monoatomic ideal gas is taken through a cycle ABCDA as shown in the P-V diagram. A student wants to determine sign of measurable quantities $\Delta U, q, W$ and ΔS for reach process separately. If x is the total number of negative values of measurable quantities in overall cycle, then calculate x.

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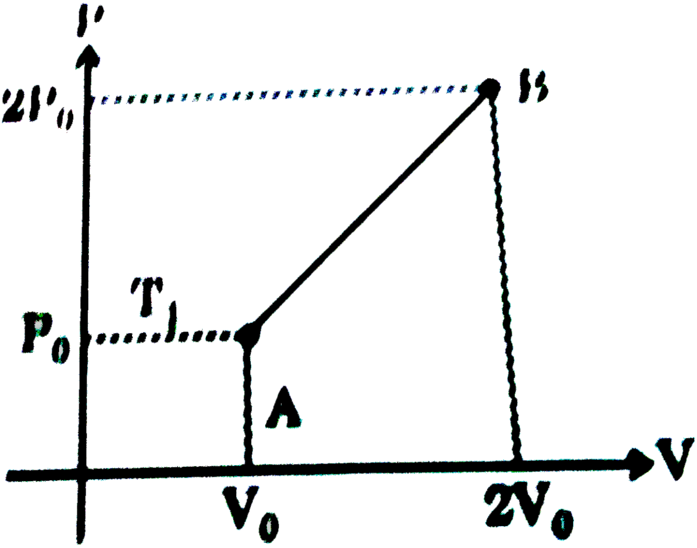
14. One mole of a gas is taken from state A to state B as shown in figure. Work done by the gas is $\alpha \times 10^{\beta} J$. Find the value of $\alpha + \beta$. (Given: $T_1 = 320K, R = \frac{25}{3}$)



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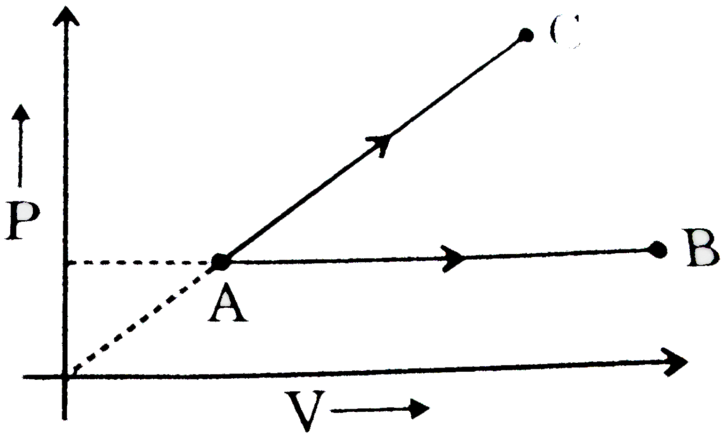
15. One mole of an ideal monoatomic gas is heated according to path AB and AC. If temperature of state B and C are equal then calculate

$\frac{q_{AC}}{q_{AB}} \times 10.$



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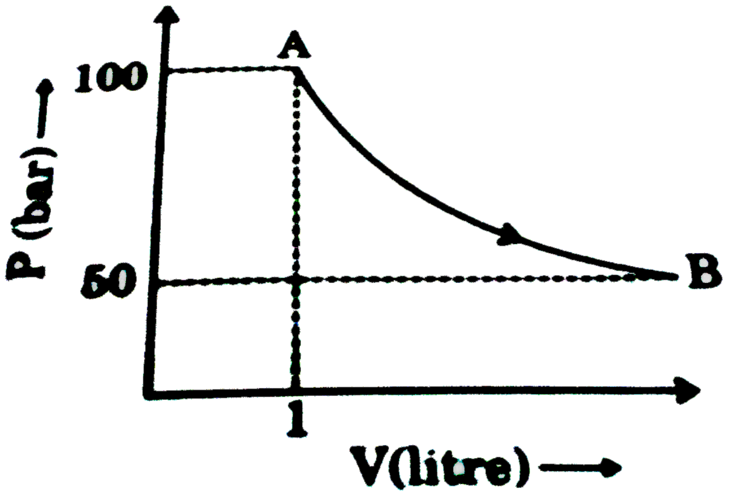
16. Find the heat absorbed by an ideal gas (in kJ)w it follows the graph (given below) during isothermal expansion [ln 2 = 0.7]

[Tale: 1 litre-bar = 0.1 kJ]



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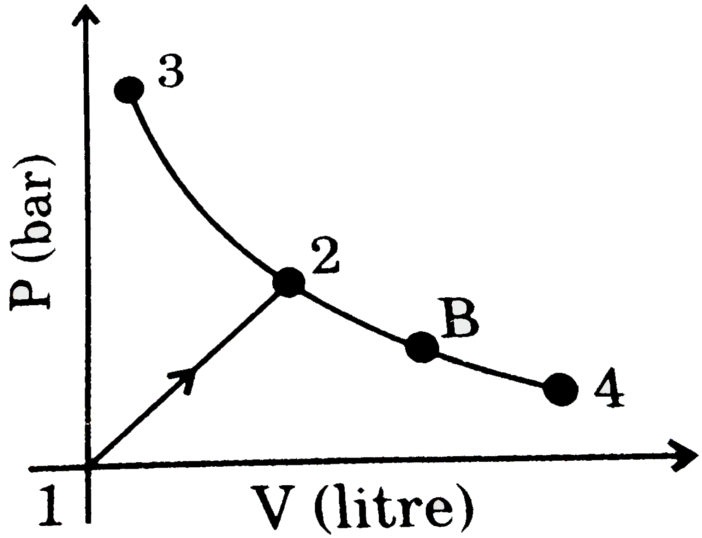
17. If work done by an ideal gas in process 1-2 on the given graph is 0.4 kJ then product of pressure and volume at point B (in bar-L) is (Enthalpy of gas in process 3-4 is constant) (1 bar-L = 100 J)



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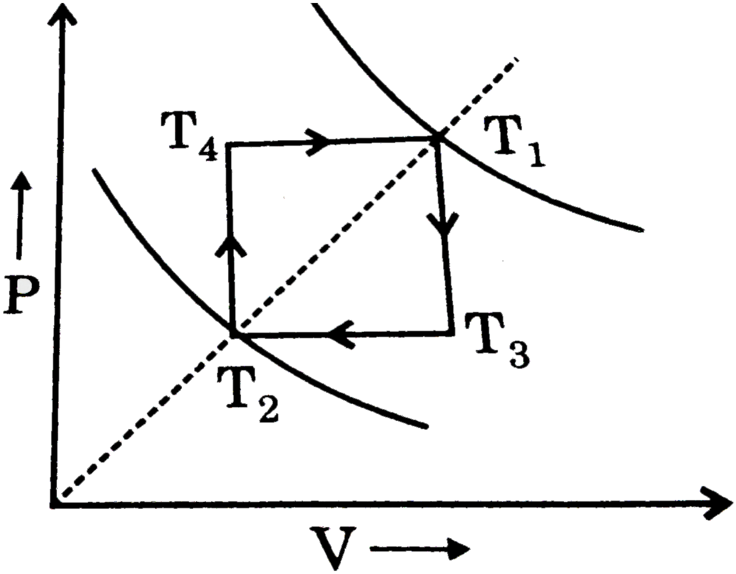
18. Between two isotherms we have a cycle as shown. Find the work done by the gas during the cycle in (J). [Take: $T_1 = 127^\circ C, T_2 = 16^\circ C, n = 1$

mole]



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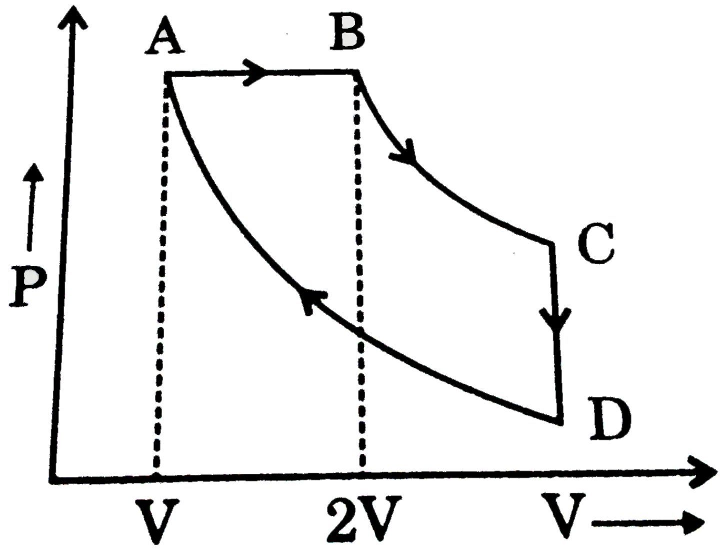
19. Calculate magnitude of net work in following cyclic process for 1 mole of an ideal monoatomic gas (in cal).

(Given: $B \rightarrow C$ isothermal process: $D \rightarrow A$ adiabatic process :

$T_A = 300K, T_D = 75, T_D = 75K, R = 2cal/\text{mole} - K : \ln 2 = 0.7)$



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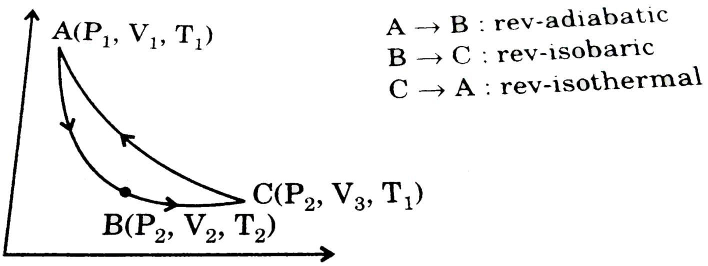
20. One mole of monoatomic gas taken through a cyclic process as shown in figure.



Calculate $\sum_{ABCA} = \frac{dq_{rev}}{T}$.

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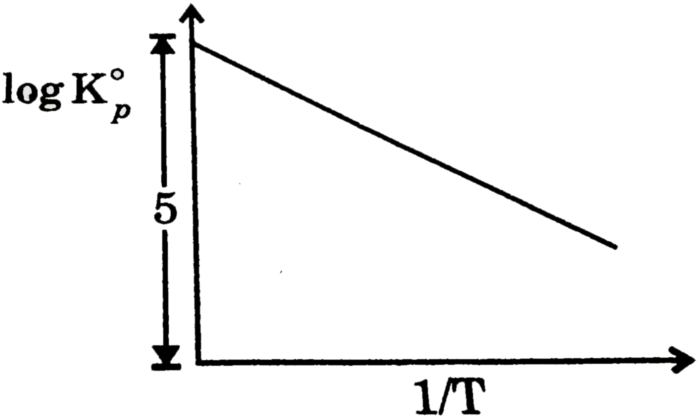
21. For the reaction $A(s) \rightarrow A(g)$, the variation of log K_P° us $\frac{1}{T}$ is given by:



If S_m°, $A(g)$ is $31.78cal/K$ mole, then calculate $S_m^\circ A(s)$ in cal/K mole.

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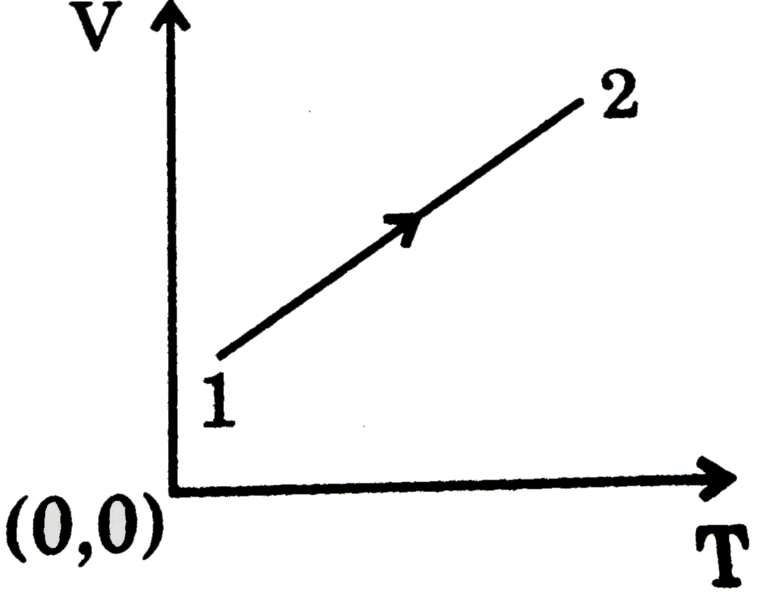
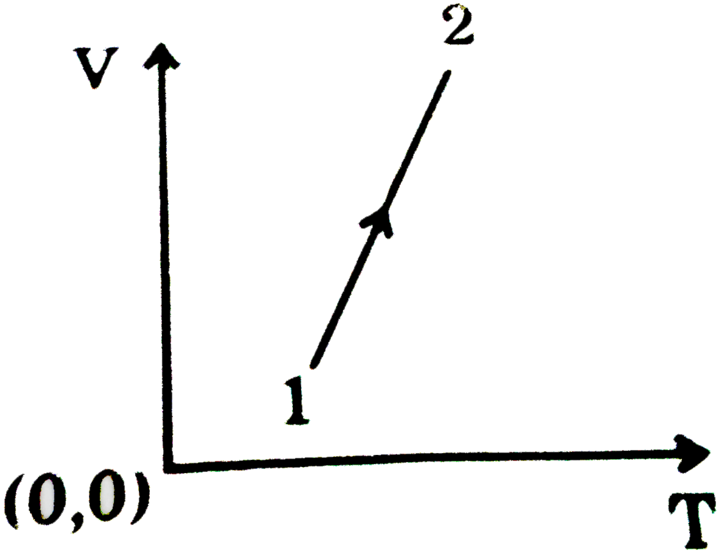
22. An ideal gas is subjected to the following changes. Answer the following questions:

(a) A curve showing the dependence of pressure on absolute temperature was obtained for a certain gas. Does compression or expansion takes place when the gas is being heated [constant moles]?



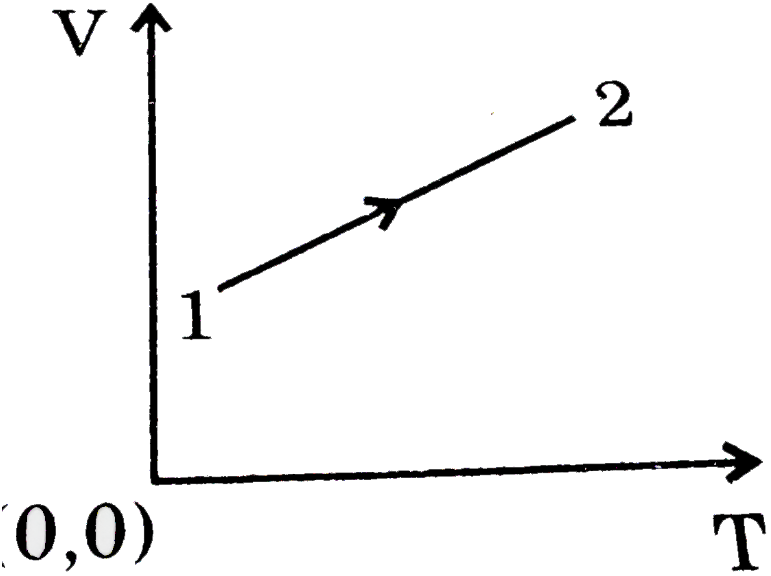
Code	Process
1	Compression
2	Expansion

(b) Use the volume temperature curve to find graphically the nature of change in the pressure of a gas during heating [constant moles.]



Code	Process
3	Increases
4	Decreases
5	Remains constant

(c) The piston in a gas filled cylinder is lossely fitted aganist the wall of the cylinder and can slowly let the gas go past it. The volume temperature curve for the gas at constant pressure has the form shown in the figure. Use this curve to determine whether the amount of gas in the cylinder has increased or decreased.



Code	Amount of Gas
6	Increases
7	Decreases
8	Remains constant

Write your answer as "abc", for example if your answer is code: 1,4,8 the, write your answer as 148.

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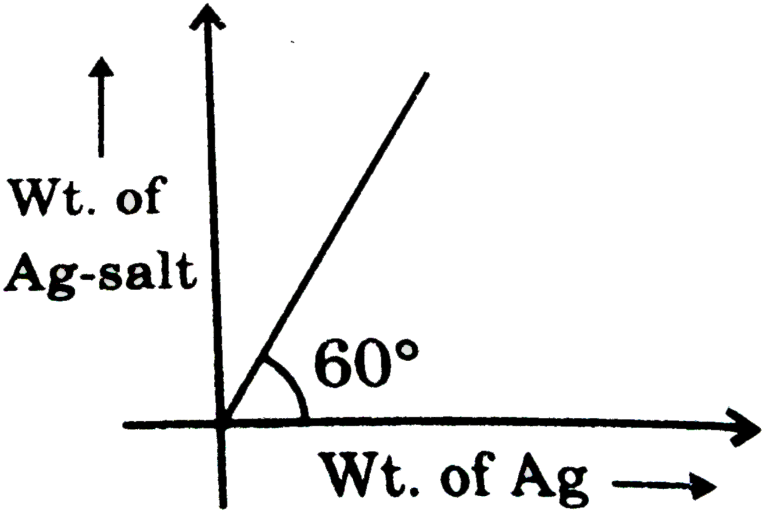
23. For calculation of molecular weight of a dibasic acid using silver salt method, when a graph is plotted between weight of silver salt and weight of Ag, a straight line is obtained as shown:



Find molecular weight of acid. (Take, $\sqrt{3} = 1.7$) Give your answer after multiplying by 10.

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