CHEMISTRY

BOOKS - NARENDRA AWASTHI

THERMODYNAMICS

Exercise

1. Out of molar entropy (I), specific volume (II), heat capacity (III), volume (IV), extensive properties are :

A. I, II

B. I, II, IV

C. II, III

D. III, IV

Answer: D

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2. Out of internal energy (I), boiling point (II), pH (III) and E.M.F. of the cell (IV) intensive properties are :

A. I, II

B. II, III, IV

C. I, III, IV

D. All of these

Answer: B

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3. Thermodynamic equilibrium involves

A. chemical equilibrium

B. mechanical equilibrium

C. thermal equilibrium

D. all the above simultaneously

Answer: D

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4. Which has maximum internal energy at $290K$?

A. Neon gas

B. Nitrogen gas

C. Ozone gas

D. Equal for all

Answer: C

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5. A $10g$ piece of iron $(C = 0.45J/g^\circ C)$ at $100^\circ C$ is dropped into $25g$ of water $(C = 4.2J/g^\circ C)$ at $27^\circ C$. Find temperature of the rion and water system at thermal equilibrium .

A. $30^\circ C$

B. $33^\circ C$

C. $40^\circ C$

D. None of these

Answer: A

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6. When freezing of a liquid takes place in a system it:

A. may have $q > 0$ or $q < 0$ depending on the liquid

B. is represented by $q > 0$

C. is represented by $q < 0$

D. has q = 0

Answer: C

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7. Mechanical work is specially important in systems that contain

A. gas-liquid

B. liquid-liquid

C. solid-solid

D. amalgam

Answer: A

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8. Determine which of the following reactions taking place at constant pressure represents system that do work on the surrounding environment

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ $(II) NH_4Cl(s) \rightarrow NH_3(g) + HCl(g$

A. I

B. III

C. II and III

D. I and II

Answer: C

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9. Determine which of the following reactions at constant pressure represent surrounding that do work on the system environment :

(P) $4NH_3(g) + 7O_2(g) \rightarrow 4NO_2 + 6H_2O(g)$

(Q) $CO.O(g) + 2H_2(g) \rightarrow CH_3OH(l)$

(R) $C(\text{s,graphite}) + H_2O(g) \rightarrow CO(g) + H_2(g)$

(S) $H_2O(s) \rightarrow H_2O(l)$

A. III, IV

B. II and III

C. II, IV

D. I and II, IV

Answer: D

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10. A sample of liquid in a thermally insulated constant (a calorimetre) is strirred for 2 hr. by a mechancal linkage to motor in the surrounding ,for this procees :

A. $w < 0, q = 0, \Delta U = 0$

B. $w > 0, q > 0, \Delta U > 0$

C. $w < 0, q > 0, \Delta U = 0$

D. $w > 0, q = 0, \Delta U > 0$

Answer: D

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11. An ideal gas expand against a constant external pressure at 2.0 atmosphere from 20 litre to 40 litre and absorb $10kJ$ of energy from surrounding . What is the change in internal energy of the system ?

A. 4052 J

B. 5948 J

C. 14052 J

D. 9940 J

Answer: B

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12. 2 mole of zinc is dissolved in HCl at 25° C. The work done in open vessel is :

A. $-2.477kJ$

B. $-4.\ 955kJ$

C. $0.0489kJ$

D. None

Answer: B

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13. 2 mole of an ideal gas at $27^\circ C$ expands isothermally and reversibly from a volume of 4 litre to 40 litre. The work done (in kJ) by the gas is :

A. 5200 J

B. 15600 kJ

C. 52 kJ

D. 5267 .6 kJ

Answer: A

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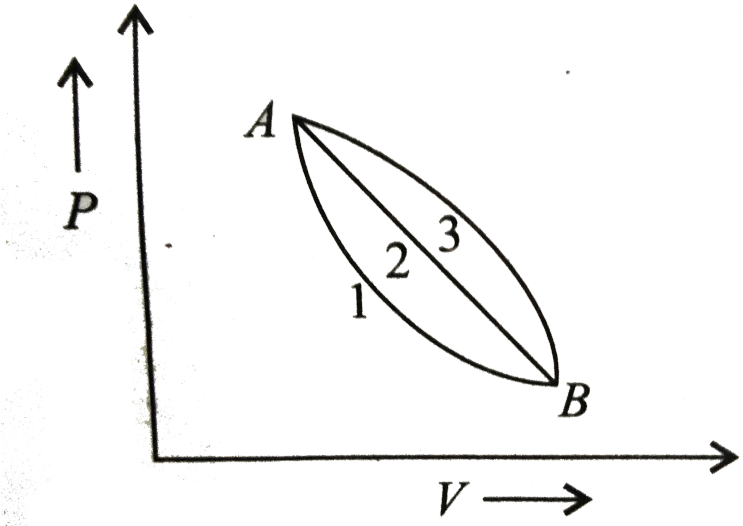
14. A given mass of gas expands from state A to state B by three paths 1, 2, and 3 as shown in the figure below. If w_1, w_2 and w_3, respectively, be the work done by the gas along three paths, then



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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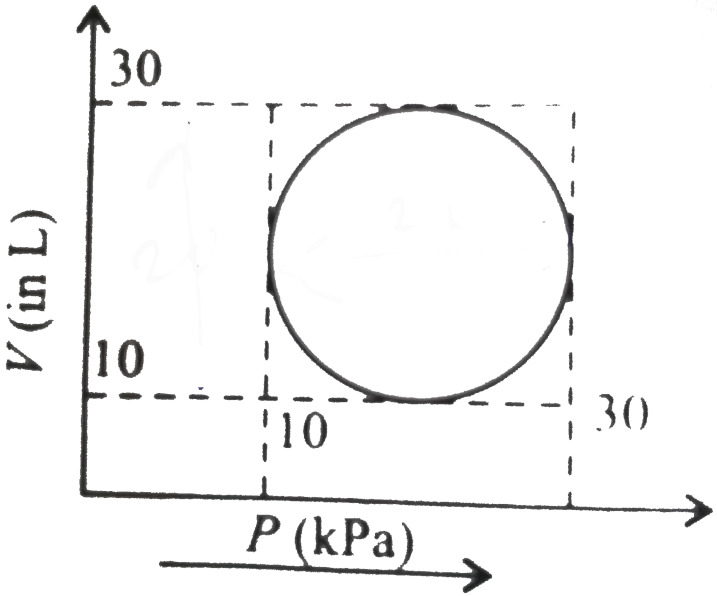
15. Heat energy absorbed by a system in going through a cyclic process shown in figure is



A. $10^7 \pi J$

B. $10^6 \pi J$

C. $10^2 \pi J$

D. $10^4 \pi J$

Answer: C

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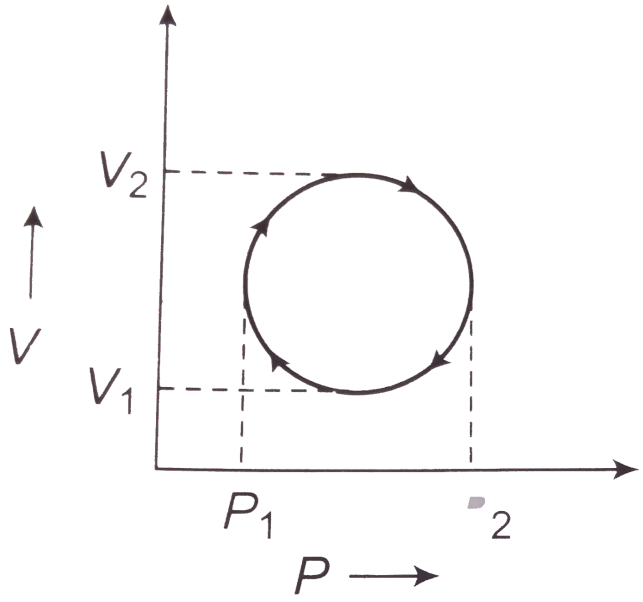

16.

In the cyclic process shown in the $V - P$ diagram the magnitude of the work is 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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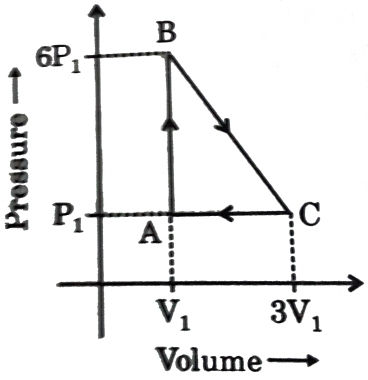
17. An ideal gas is taken around the cycle ABCA as shown in P-V diagram.

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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18. The temperature of an ideal gas increases in an:

A. It's temperature falls

B. Its temperature rises

C. Its temperature remains the same

D. Unpredicatable

Answer: C

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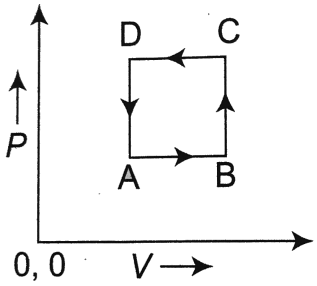
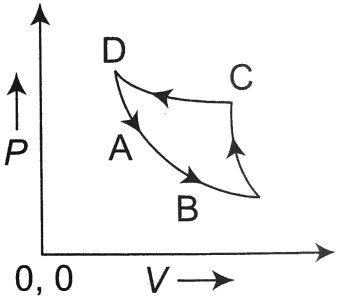
19. In following figs. Variation of volume by change of pressure is shown in Fig. A gas is taken along the path $ABCDA$. The change in internal

energy of the tgas will be:



(1)



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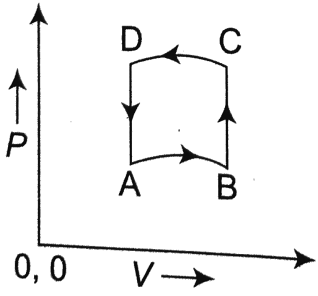

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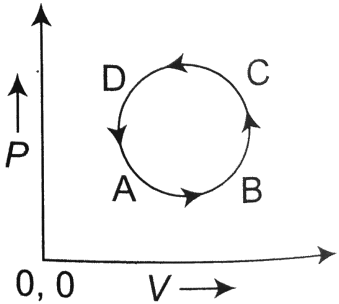

(4)

A. Positive in all the cases (1) to (4)

B. Positive in cases (1), (2), (3) but zero in case (4)

C. Negative in cases (1), (2), (3) but zero in case (4)

D. Zero in all the cases

Answer: D

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20. If the door of a refrigerator is kept open, then which of the following is true

A. gets cooled

B. gets heated

C. neigther gets cooled nor gets heated

D. gets cooled or heated depending on the initial temperature of the room

Answer: B

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21. The temperature of an ideal gas increases in an:

A. adiabatic expansion

B. isothermal expansion

C. adiabatic compression

D. isothermal compression

Answer: C

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22. For two mole of an ideal gas :

A. $C_v - C_p = R$

B. $C_p - C_v = 2R$

C. $C_p - C_v = R$

D. $C_v - C_p = 2R$

Answer: B

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23. Which of the following expression is/are true ?

A. $\left(\frac{\partial V}{\partial T}\right)_P = 0$

B. $\left(\frac{\partial P}{\partial T}\right)_V = 0$

C. $\left(\frac{\partial U}{\partial V}\right)_T = 0$

D. $\left(\frac{\partial U}{\partial T}\right)_V = 0$

Answer: C

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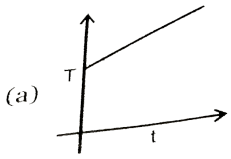
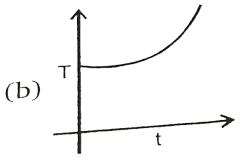
24. If liquefied oxygen at 1 atmospheric pressure is heated from 50K to 300k by supplying heat at constant rate. The graph of temperature vs time will be

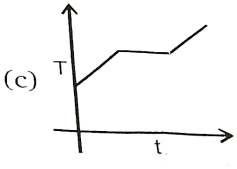
A.



B.



C.



D.

Answer: C

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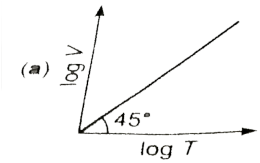
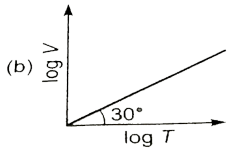
25. For a closed container containing 100 mol of an ideal gas fitted with movable, frictionless, weightless piston operating such that pressure of gas remain constant at 8.21 atm, which graph repsents correct variation of log Vv/s log T where V is in litre and T is in Kelvin ? $\left(R = 0.0821 \frac{atmL}{molK}\right)$

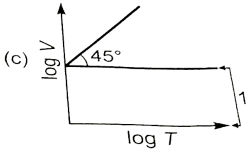
A.



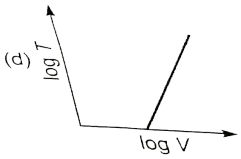
B.



C.



D.



Answer: A

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26. 10 mole of ideal gas expand isothermally and reversibly from a pressure of $05atm$ to $1atm$ at $300K$. What is the largest mass which can lifted through a height of 1 meter? (g= 9.8 ms^(-2)

A. 4000 kg

B. 4091.23 kg

C. 3424.58 kg

D. None of these

Answer: B

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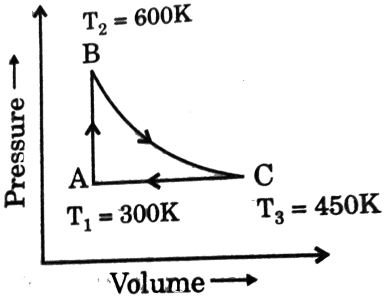
27. A heat engine carries one mole of an ideal monoatomic gas around the cycle as shown in the figure, the amount of heat added in the process AB and heat removed in the process CA are :



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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28. What is the final temperature of 0.10 mole monoatomic ideal gas that performs $75cal$ of work adiabatically.if the initial temperature is $227^{\circ}C$ (use $R = 2cal/K - mol$)

A. 250 K

B. 300 K

C. 350 K

D. 750 K

Answer: A

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29. The work done by 1 mole of ideal gas during an adiabatic process is (are) given by :

A. $\frac{P_2V_2 - P_1V_1}{\gamma - 1}$

B. $\frac{nR(T_1 - T_2)}{\gamma - 1}$

C. $\frac{P_2V_2 - P_1V_1}{\gamma}$

D. None of these

Answer: A

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30. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_P / C_V for the gas is

A. $\frac{3}{2}$

B. $\frac{5}{3}$

C. $\frac{7}{2}$

D. $\frac{4}{3}$

Answer: A

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31. A gas expands adiabatically at constant pressure such that $T \propto V^{-1/2}$ The value of $\gamma(C_{p,m}/C_{v,m})$ of the gas will be :

A. 1.3

B. 1.5

C. 1.7

D. 2

Answer: B

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32. For a reversible adiabatic ideal gas expansion $\frac{dp}{p}$ is equal to

A. $\gamma\frac{dV}{V}$

B. $-\gamma\frac{dV}{V}$

C. $\left(\frac{\gamma}{\gamma-1}\right)\frac{dV}{V}$

D. $\frac{dV}{V}$

Answer: B

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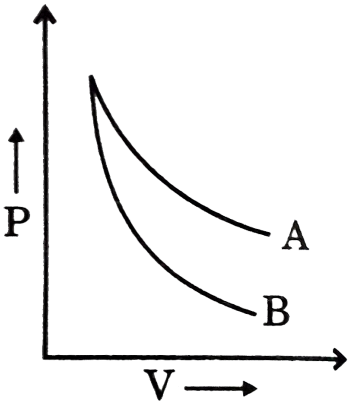
33. P-V plot for two gases (assuming ideal) during adiabatic processes are given in the figure. Plot A and plot B should correspond respectively to :



A. He and H_2

B. H_2 and He

C. He and Ne

D. H_2 and Cl_2

Answer: B

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34. Calculate the final temperature of a monoatomic idal gas that is compressed reversible and adiabatically from $16L$ to $2L$ at $300K$:

A. 600 K

B. 1044.6 K

C. 1200 K

D. 2400 K

Answer: C

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35. 5 mole of an ideal gas expand isothermally and irreversibly from a pressure of 10 atm to 1 atm against a constant external pressure of 1 atm. w_{irr} at 300 K is :

A. $-15.921kJ$

B. $-11.224kJ$

C. $-110.83kJ$

D. None of these

Answer: B

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36. With what minimum pressure (in kPa), a given volume of an ideal gas $(C_{p,m} = 7/2R)$ originally at 400 K and 100 kPa pressure can be compressed irreversibly adiabatically in order to raise its temperature to 600 K :

A. 362.5 kPa

B. 275 kPa

C. 437.5 kPa

D. 550 kPa

Answer: B

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37. The work done in adiabatic compression of 2 mole of an ideal monoatomic gas by constant external pressure of $2atm$ starting from initial pressure of $1atm$ and initial temperature of $30K(R = 2cal/\text{mol-degree})$

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38. One mole of an ideal gas $\left(C_{v,m} = \frac{5}{2}R\right)$ at 300 K and 5 atm is expanded adiabatically to a final pressure of 2 atm against a constant pressure of 2 atm. Final temperature of the gas is :

A. 270 K

B. 273 K

C. 248.5 K

D. 200 K

Answer: C

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39. 10 litre of a non linear polyatomic ideal gas at $127^{\circ}C$ and 2 atm pressure is suddenly released to 1 atm pressure and the gas expanded adiabatically against constant external pressure. The final temperature and volume of the gas respectively are.

A. T=350K,V = 17.5L

B. T = 300 K ,V = 15 L

C. T = 250 K, V = 12.5 L

D. None of these

Answer: A

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40. Calculate average molar heat capacity at constant volume of gaseous mixture contained 2 mole of each of two ideal gases $A\left(C_{v,m}=\frac{3}{2}R\right)$

and $B\left(C_{v,m}=\frac{5}{2}R\right)$:

A. R

B. 2R

C. 3R

D. 8R

Answer: B

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41. 0.5 mole each of two ideal gases $A\left(C_{v,m}=\frac{5}{2}R\right)$ and $B(C_{v,m}=3R)$ are taken in a container and expanded reversibly and adiabatically, during this process temperature of gaseous mixture decreased from 350 K to 250 K. Find ΔH (in cal/mol) for the process :

A. $-100R$

B. $-137.5R$

C. $-375R$

D. None of these

Answer: C

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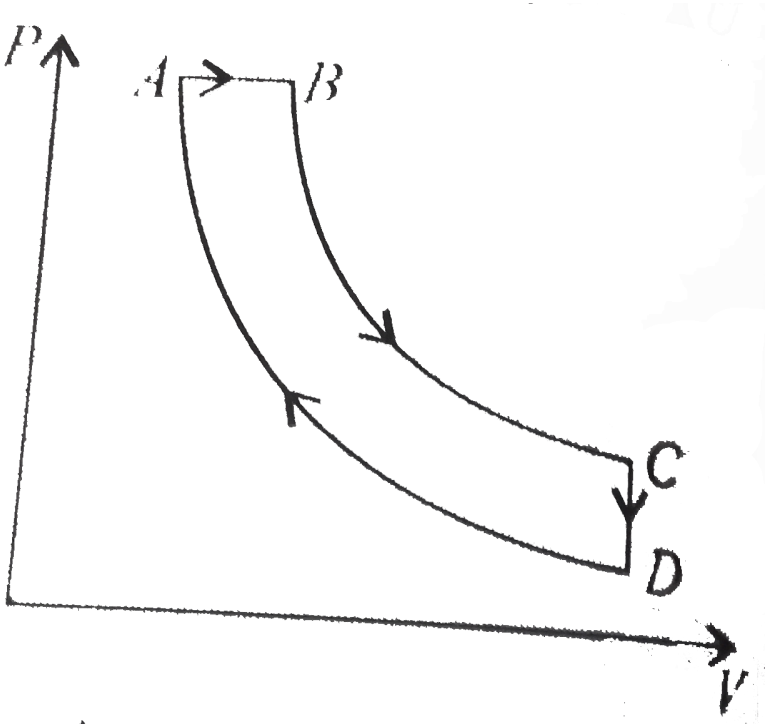
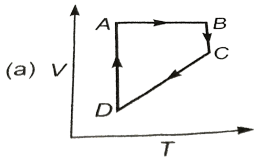
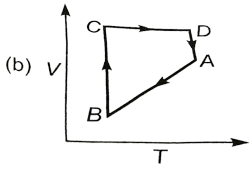
42. A cyclic process $ABCD$ is shown in the $P-V$ diagram. Which of the following curves represents the same process?



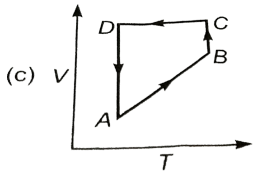
A.



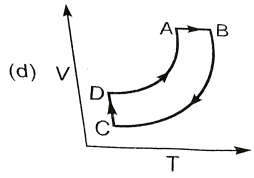
B.



C.



D.



Answer: A

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43. 36 mL of pure water takes 100 sec to evaporate from a vessel when a heater of 806 watt is used. The $\Delta H_{\text{vaporisation}}$ of H_2O is (density of water

$= 1g/cc)$

A. $40.3kJ/mol$

B. $43.2kJ/mol$

C. $4.03kJ/mol$

D. None of these

Answer: A

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44. For the reaction : $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$:

A. $\Delta H = \Delta U$

B. $\Delta H > \Delta U$

C. $\Delta H < \Delta U$

D. None of the above

Answer: B

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45. Consider the reaction at 300 K

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g), \Delta H^\circ = -185kJ$

If 2 mole of H_2 compeletely react with 2 mole of Cl_2 to form HCl. What is ΔU° for this reaction ?

A. 0

B. $-185kJ$

C. 370 kJ

D. None of these

Answer: D

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46. Which of the indicated relationship is correct for the following exothermic reaction carried out at constant pressure?

$CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$

A. $\Delta U = \Delta H$

B. $\Delta U > \Delta H$

C. $w < 0$

D. $q > 0$

Answer: B

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47. One mole of an ideal gas undergoes a change of state (2.0) atm, 3.0 L) to (2.0 atm, 7.0 L) with a change in internal energy $(\Delta U) = 30$ L-atm. The change in enthalpy (ΔH) of the process in L-atm :

A. 22

B. 38

C. 25

D. None of these

Answer: B

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48. What is the change internal energy when a gas contracts from 377 mL to 177 mL under a constant pressure of 1520 torr, while at the same time being cooled by removing 124 J heat ?

$[Take: (1Latm) = 101.3J)]$

A. 40.52 J

B. $-83.48J$

C. $-248J$

D. None of these

Answer: B

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49. For the real gases reaction,

$2CO(g) + O_2(g) \rightarrow 2CO_2(g), \Delta H = -560kJ.$ In 10 litre rigid vessel at 500 K the initial pressure is 70 bar and after the reaction it becomes 40 bar. The change in internal energy is :

A. $-557kJ$

B. $-530kJ$

C. $-563kJ$

D. None of these

Answer: B

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50. One mole of non $-$ ideal gas undergoes a change of state $(1.0atm, 3.0L, 200K)$ to $(4.0atm, 5.0L, 250K)$ with a change in internal energy $(\Delta U) = 40L - atm$. The change in enthalpy of the process in $L - atm$,

A. 43

B. 57

C. 42

D. None of these

Answer: B

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51. Consider the reacting at $300K$

$$C_6H_6(l) + \frac{15}{2}O_2(l) \rightarrow 6CO_2(g) + 3H_2O(l), \Delta H = -3271\text{kJ}$$

What is ΔU for the combustion of 1.5 mole of benzene at $27^\circ C$?

A. $-3267.25kJ$

B. $-4900.88kJ$

C. $-4906.5kJ$

D. $-3274.75kJ$

Answer: B

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52. For the reaction , $FeCO_3(s) \rightarrow FeO(s) + CO_2(g), \Delta H = 82.8kJ$ at $25^\circ C$, what is $(\Delta E \text{ or } \Delta U)$ at $25^\circ C$?

A. 82.8 kJ

B. 80.32 kJ

C. $-2394.77kJ$

D. $-3274.75kJ$

Answer: B

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53. At 5×10^5 bar pressure density of diamond and graphite are $3g/cc$ and $2g/cc$ respectively, at certain temperature $'T'$.Find the value of

$\Delta U - \Delta H$ for the conversion of 1 mole of graphite to 1 mole of diamond at temperature $'T'$:

A. 100 kJ/mol

B. 50 kJ/mol

C. $-100kJ/mol$

D. None of these

Answer: A

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54. Predict which of the following reaction (s) has a positive entropy change?

$I\,.\,Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$

$II\,.\,NH_4Cl(s) \rightarrow NH_3(g) + HCl(g)$

$III\,.\,2NH_3(g) \rightarrow N_2 + 3H_2(g)$

A. I and II

B. III

C. II and III

D. II

Answer: c

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55. Predict which of the following reaction(s) has a negative entropy change?

$I.\ CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

$II.\ NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$

$III.\ 2KClO_4(s) \rightarrow 2KClO_3(s) + O_2(g)$

A. III

B. II

C. I and II

D. I

Answer: C

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56. Which of the following reactions is asssociated with the most negative change in entropy?

A. $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

B. $C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$

C. $C(s, \text{graphite}) + O_2(g) \rightarrow CO_2(g)$

D. $3C_2H_2(g) \rightarrow C_6H_6(l)$

Answer: D

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57. When two moles of an ideal gas $\left(C_{p.m.} = \frac{5}{2}R\right)$ heated form 300K to 600K at constant pressure, the change in entropy of gas (ΔS) is:

A. $\frac{3}{2}R\ln 2$

B. $-\frac{3}{2}R\ln 2$

C. $5R\ln 2$

D. $\frac{5}{2}R\ln 2$

Answer: C

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58. Which of the following expression for entropy change of an irreversible process ?

A. $dS > \frac{dq}{T}$

B. $dS = \frac{dq}{T}$

C. $dS < \frac{dq}{T}$

D. $dS = \frac{dU}{T}$

Answer: A

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59. Which of the following expression is known as Clausius inequality ?

A. $\oint \frac{dq}{T} \leq 0$

B. $\oint \frac{ds}{T} = 0$

C. $\oint \frac{T}{dq} \leq 0$

D. $\oint \frac{dq}{T} \geq 0$

Answer: A

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60. When two moles of ideal gas $\left(C_v = \frac{3}{2}R\right)$ heated from 300 K to 600 K at constant volume, calculate ΔS_{gas} :

A. $5R \ln 2$

B. $\frac{3}{2}R \ln 2$

C. $3R\ln 2$

D. $-3R\ln 2$

Answer: C

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61. If one mole of an ideal gas $\left(C_{p.m.} = \frac{5}{2}R\right)$ is expanded isothermally at 300K until it's volume is tripled, then change in entropy of gas is:

A. zero

B. infinity

C. $\frac{5}{2}R\ln 3$

D. $R\ln 3$

Answer: D

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62. If one mole of an ideal gas $C_p = \frac{5}{2}R$ is expanded isothermally at 300 k until it's volume is tripled., if expansion is carried out freely $(P_{ext} = 0), then \Delta Sis:$

A. zero

B. infinity

C. $R \ln 3$

D. None

Answer: C

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63. When one mole of an ideal gas is compressed to half of its initial volume and simultaneously heated to twice its initial temperature, the change in entropy of gas (ΔS) is:

A. $C_{p,m} \ln 2$

B. $C_{v,m} \ln 2$

C. $R \ln 2$

D. $(C_{v,m} - R) \ln 2$

Answer: D

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64. What is the change in entropy when 2.5 mole of water is heated from $27^\circ C$ to $87^\circ C$?

Assume that the heat capacity is constant $(C_p)_m(H_2O) = 4.2J/gK, \ln(1.2) = 0.18)$

A. 16.6 J/K

B. 9 J/K

C. 34.02 J/K

D. 1.89 J/K

Answer: C

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65. Calculate standard entropy change in the reaction

$Fe_2O_3(s) + 3H_2(g) \rightarrow 2Fe(s) + 3H_2O(l)$

Given : $S_{m_0}(Fe_2O_3, s) = 87.4, S_m^\circ(Fe, s) = 27.3$

$S_m^\circ(H_2, g) = 130.7, S_m^\circ(H_2O, l) = 69.9JK^{-1}mol^{-1}$

A. $-212.5JK^{-1}mol^{-1}$

B. $-215.2JK^{-1}mol^{-1}$

C. $-120.9JK^{-1}mol^{-1}$

D. None of these

Answer: B

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66. Calculate the entropy change $(J/molK)$ of the given reaction. The molar entropies $(J/K-mol)$ are given in brackets after each substance:

$2PbS(s)[19.2]+3O_2(g)[205.1]$

$\rightarrow 2PbO(s)[66.5]+2O_2(g)[248.2]$

A. -113.5

B. -168.3

C. $+72.5$

D. -149.2

Answer: B

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67. Given $\Delta_r S^\circ = -266$ and the listed $[S_m^\circ value]$ Calculate S° for $Fe_3O_4(s)$

$4Fe_3O_4(s)[...]+O_2(g)[205]\rightarrow 6Fe_2O_3(s)[87]$

A. calculate S° for $Fe_3O_4(s)$:

$$4Fe_3O_4(s)[.....] + O_2(g)[205] \rightarrow 6Fe_2O_3(s)[87]$$

B. $+111.1$

C. $+122.4$

D. 145.75

Answer: C

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68. The entropy change for a phase transformation is :

A. $\frac{\Delta U}{\gamma + dT}$

B. $\frac{\Delta T}{\Delta H}$

C. $\frac{\Delta H}{T}$

D. $\frac{\Delta H + \Delta G}{T}$

Answer: C

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69. What is the melting point of benzene if $\Delta H_{\text{fusion}} = 9.95kJ/mol$ and $\Delta S_{\text{fusion}} = 35.7J/K - \text{mol}$

A. $278.7^\circ C$

B. $278.7^\circ K$

C. 300 K

D. 298 K

Answer: B

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70. ΔS for freezing of 10 g of $H_2O(l)$ (enthalpy of fusion is 80 cal/g) at $0^\circ C$ and 1 atm is :

A. $12.25J/K$

B. $-0.244 J/K$

C. $-2.93 J/K$

D. $-12.25 J/K$

Answer: D

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71. Chloroform has $\Delta H_{\text{vaporization}} = 29.2 kJ/\text{mol}$ and boils at $61.2^\circ C$. What is the value of $\Delta S_{\text{vaporization}}$ for chloroform ?

A. $87.3 J/\text{mol} - K$

B. $477.1 J/\text{mol} - K$

C. $-87.3 J/\text{mol} - K$

D. $-477.1 J/\text{mol} - K$

Answer: A

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72. The entropy if vaporisation of benzene is $85JK^{-1}mol^{-1}$. When 117g benzene vaporizes at its's normal boiling point, the entropy change in surrounding is:

A. $-85JK^{-1}$

B. $-85 \times 1.5JK^{-1}$

C. $85 \times 1.5JK^{-1}$

D. None of these

Answer: B

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73. Identify the correct statement regarding entropy

A. At absolute zero temperature, the entropy of perfectly crystalline substances is $+ve$

B. At absolute zero temperature entropy of perfectly crystalline substance is taken to be zero

C. At $0^{\circ}C$ the entropy of a perfectly crystalline substance is taken to be zero

D. At absolute zero temperature, the entropy of all crystalline substance is taken to be zero

Answer: B

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74. Calculate ΔS for following process :

$$\underset{\text{at}100K}{X(s)} \rightarrow \underset{\text{at}200K}{X(l)}$$

Given : Melting point of $X_s = 100K, \Delta H_{\text{Fusion}} = 20kJ/\text{mol}, C_{p.m}(X, l) = 10J/\text{mol}.\ K$

A. $26.93J/K$

B. $206.93J/K$

C. $203 J / K$

D. $206.93 k J / K$

Answer: B

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75. For a perfectly crystalline solid $C_{p.m.} = aT^3$, where ais constant. If $C_{p.m.}$ is 0.42.J//K-"mol" at 10K, molar entropy at 10K is:

A. 0.42 J/k mol

B. 0.14 J/K mol

C. 1.12 J/K mol

D. zero

Answer: C

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76. Consider the following spontaneous reaction $3X_2(g) \rightarrow 2X_3(g)$. What are the sign of ΔH, ΔS and ΔG for the reaction ?

A. $+ve,\ +ve,\ +ve$

B. $+ve,\ -ve,\ -ve$

C. $-ve,\ +ve,\ -ve$

D. $-ve,\ -ve,\ -ve$

Answer: D

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77. For the reaction $2H(g) \rightarrow H_2(g)$, the sign of ΔH and ΔS respectively are :

A. $+,\ -$

B. $+,\ +$

C. $-,\ +$

D. $-, \ -$

Answer: D

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78. Consider the following reaction.

$$C_6H_6(l) + \frac{15}{2}O_2(g) \rightarrow 6CO_2(g) + 3H_2O(g)$$

signs of ΔH, ΔS and ΔG for the above reaction will be

a) $+, \ -, \ +$

b) $-, \ +, \ -$

c) $-, \ +, \ -$

d) $+, \ +, \ -$

A. $+, \ -, \ +$

B. $-, \ +, \ -$

C. $-, \ +, \ -$

D. $+, \ +, \ -$

Answer: B

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79. Consider the following reaction at temperature T :

$$CH_2 = CH_2(g) + Cl_2(g) \rightarrow ClCH_2CH_2Cl(g)$$

$$\Delta_r H^\circ = -217.5 kJ/\text{mol}, \quad \Delta_r S^\circ = -233.9 J/K - \text{mol}$$

Reaction is supported by :

a) entropy

b) enthalpy

c) both (a) & (b)

d) neither

A. entropy enthalpy

B. enthalpy

C. both (a) & (b)

D. neither

Answer: B

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80. For a process to be spontaneous, ΔG must be..... .

A. $(\Delta G)_{\text{system}}$ must be negative

B. $(\Delta G)_{\text{system}}$ must be positive

C. $(\Delta S)_{\text{system}}$ must be positive

D. $(\Delta S)_{\text{system}}$ must be negative

Answer: A

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81. For a reaction to occur spontaneously

A. ΔS must be negative

B. $(-\Delta H + T\Delta S)$ must be positive

C. $\Delta H + T\Delta S$ must be negative

D. ΔH must be negative

Answer: B

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82. Which of the following conditions reagarding a chemical process ensures its spontaneity at all temperature?

A. $\Delta H > 0, \Delta G < 0$

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

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

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

Answer: B

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83. The free energy change $\Delta G = 0$, when

A. the system is at equilibrium

B. catalyst is added

C. reactants are initially mixed thoroughly

D. the reactants are completely consumed

Answer: A

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84. Which of the following conditions regarding a chemical process ensures its spontaneity at all temperature ?

A. ΔH and ΔS both $+ve$

B. ΔH is $-ve$ and ΔS is $+ve$

C. ΔH and ΔS both $-ve$

D. ΔH is $+ve$ and ΔS is $-ve$

Answer: D

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85. Suppose that a reaction has $\Delta H = -40kJ$ and $\Delta S = -50J/K$. At what temperature range will it change from spontaneous to non-spontaneous?

A. 0.8 K to 1 K

B. 799 K to 800 K

C. 800 K to 801 K

D. 799 K to 801 K

Answer: D

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86. For isothermal expansion in case of an ideal gas :

A. $\Delta G = \Delta S$

B. $\Delta G = \Delta H$

C. $\Delta G = -T.\Delta S$

D. None of these

Answer: C

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87. What is the normal boiling point of mercury?

Given : $\Delta H_f^\circ(Hg, l) = 0, S^\circ(Hg, l) = 77.4J/K - \text{mol}$

$\Delta H_f^\circ(Hg, g) = 60.8kJ/\text{mol}, S^\circ(Hg, g) = 174.4J/K - \text{mol}$

A. 624.8 K

B. 626.8 K

C. 636.8 K

D. None of these

Answer: B

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88. 19 gm of ice is converted into water at $0^{\circ}C$ and 1 atm. The entropies of $H_2O(s)$ and $H_2O(l)$ are 38.2 and $60J/\mathrm{mol}\ K$ respectively. The enthalpy change for this conversion is :

A. $5951.4J/\mathrm{mol}$

B. $595.14J/\mathrm{mol}$

C. $-5951.4J/\mathrm{mol}$

D. None of these

Answer: A

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89. Using the listed $[\Delta G_f^\circ$ values] calculate ΔG° for the reaction :

$3H_2S(g)[-33.6] + 2HNO_3(l)[-80.6] \rightarrow 2NO(g)[+86.6] + 4H_2O(l)[-$

A. -513.2

B. -1037.0

C. $+433.4$

D. $+225.0$

Answer: A

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90. From the following ΔH° and ΔS° values, predict which of reactions I, II and III would be spontaneous at $25^\circ C$.

	$\Delta H^\circ(kJ)$	$\Delta S^\circ(J/K)$
$I.$	$+10.5$	$+30$
$II.$	$+1.8$	-113
$III.$	-126	$+84$

A. III

B. I

C. II and III

D. I and II

Answer: A

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91. Calculate ΔH_f° for Ubr_4 from the ΔG° of reaction and the S° values at 298 K.

$U(s) + 2Br_2(l) \rightarrow UBr_4(s), \Delta G^\circ = -788.6kJ. \quad S^\circ(J/K - \text{mol})50.3,$

A. $-822.1kJ/mol$

B. $-841.2kJ/mol$

C. $-775.6kJ/mol$

D. $-804.3kJ/mol$

Answer: A

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92. The entropies of H_2 (g) and H (g) are 130.6 and 114.6 J $mol^{-1}K^{-1}$ respectively at 298 K. Using the data given below calculate the bond energy of H_2 (in kJ/mol) :

$H_2(g) \rightarrow 2H(g), \Delta G^{\circ} = 406.6kJ$

A. 377.2

B. 436

C. 425.5

D. 430.5

Answer: B

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93. Consider the ΔG_f° and ΔH_f° (kJ/mol) for the following oxides. Which can be most easily decomposed to form the metal and oxygen gas?

A. $ZnO(\Delta G^\circ = -318.4, \Delta H^\circ = -348.3)$

B. $Cu_2O(\Delta G^\circ = -146.0, \Delta H^\circ = -168.8)$

C. $HgO(\Delta G^\circ = -58.5, \Delta H^\circ = -90.8)$

D. $PbO(\Delta G^\circ = -187.9, \Delta H^\circ = -217.3)$

Answer: C

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94. which of the folowing statement is correct?

A. $\left[\frac{\partial \ln K_p}{\partial T}\right] = \frac{\Delta H^\circ}{RT^2}$

B. $\frac{\partial \ln K}{\partial T} = \frac{E_a}{RT^2}$

C. $\left[\frac{\partial \ln K_p}{\partial T}\right] = \frac{\Delta U}{RT^2}$

D. All of these

Answer: D

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95. Calculate ΔG° (kJ/mol) at $127^{\circ}C$ for a reaction with $K_{\text{equilibrium}} = 10^5$:

A. -38.294

B. -16.628

C. -9.16

D. None of these

Answer: A

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96. When reaction is at standard state at equilibrium, then

A. $\Delta H^{\circ} = 0$

B. $\Delta S^{\circ} = 0$

C. equilibrium constant K=0

D. equilibrium constant K=1

Answer: D

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97. For the auto-ionization of water at $25^\circ C$, $H_2O(l) \Leftrightarrow H^+(aq) + OH^-$ (aq) equilibrium constant is 10^{-14}. What is ΔG° for the process?

A. $\cong 8 \times 10^4 J$

B. $\cong 3.5 \times 10^4 J$

C. $\cong 10^4 J$

D. None of these

Answer: A

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98. State Hess's law. Give two applications of it.

A. the standard enthalpy of an overall reaction is the sum of the enthalpy changes in individual reactions.

B. enthalpy of formation of a comound is same as the enthalpy of decomposition of the compound into constituent elements, but with opposite sign.

C. at constant temperature the pressure of a gas is inversely proportional to its volume

D. the mass of a gas dissolved per litre of a solvent is proportional to the pressure of the gas in equilibrium with the solution

Answer: A

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99. An imaginary reaction $X \rightarrow Y$ takes place in three steps

$X \rightarrow A, \Delta H = -q_1, \quad B \rightarrow A, \Delta H = -q_2, \quad B \rightarrow Y, \Delta H = -q_3$

If Hess's law is applicable, then the heat of the reaction $(X \rightarrow Y)$ is :

A. $q_1 - q_2 + q_3$

B. $q_2 - q_3 - q_1$

C. $q_1 - q_2 - q_3$

D. $q_3 - q_2 - q_1$

Answer: B

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100. The enthalpy change for a reaction does not depend upon:

A. the physical states of reactants and products

B. use of different reactants for the same product

C. the number of intermediate reaction steps

D. the differences in initial or final temperature of involved substances

Answer: C

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101. The standard enthalpy of formation of gaseous H_2O at 298 K is -241.82 kJ/mol. Calculate ΔH° at 373 K given the following values of the molar heat capacities at constant pressure :

$H_2O(g) = 33.58 \ \text{JK}^{-1} \ \text{mol}^{-1}, \quad H_2(g) = 29.84 \ \text{JK}^{-1} \ \text{mol}^{-1}, \quad O_2(g)$

Assume that the heat capacities are independent of temperature :

A. $-242.6kJ/mol$

B. $-485.2kJ/mol$

C. $-121.3kJ/mol$

D. $-286.4kJ/mol$

Answer: A

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102. Which of the following value of ΔH_f° represent that the product is least stable ?

A. $-94.0 kcal mol^{-1}$

B. $-231.6 kcal mol^{-1}$

C. $+21.4 kcal mol^{-1}$

D. $+64.8 kcal mol^{-1}$

Answer: D

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103. For which of the following substances is the heat of formation in the standard state zero ?

A. Sucrose

B. Ethanol

C. Aluminium

D. Calcium chloride

Answer: C

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104. Calculate the standard enthalpy of reaction for the following reaction using the listed enthalpies of reaction :

$3Co(s) + 2O_2(g) \rightarrow Co_3O_4(s)$

$2Co(s) + O_2(g) \rightarrow 2CoO(s), \quad \Delta H_1^\circ = -475.8kJ$

$6CoO(s) + O_2(g) \rightarrow 2Co_3O_4(s), \Delta H_2^\circ = -355.0kJ$

A. $-891.2kJ$

B. $-120.8kJ$

C. $+891.2kJ$

D. $-830.8kJ$

Answer: A

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105. Given the following equations and ΔH° values, determine the enthalpy of reaction at 298 K for the reaction :

$C_2H_4(g) + 6F_2(g) \rightarrow 2CF_4(g) + 4HF(g)$

$H_2(g) + F_2(g) \rightarrow 2HF(g), \qquad \Delta H_1^{\circ} = -537 \text{ kJ}$

$C(s) + 2F_2(g) \rightarrow CF_4(g), \qquad \Delta H_2^{\circ} = -680 \text{ kJ}$

$2C(s) + 2H_2(g) \rightarrow C_2H_4(g), \qquad \Delta H_3^{\circ} = 52 \text{ kJ}$

A. -1165

B. -2486

C. $+1165$

D. $+2486$

Answer: B

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106. Given :

$C(\text{diamond}) + O_2 \rightarrow CO_2, \Delta H = -395kJ$

$C(\text{graphite}) + O_2 \rightarrow CO_2, \Delta H = -393kJ$

The enthalpy of formation of diamond from graphite is

A. $+2.0kJ$

B. $-1.5kJ$

C. $-788kJ$

D. 788 kJ

Answer: A

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107. Which of the following equations represents a reaction that provides the enthalpy of formation of CH_3Cl?

A. $C(s) + HCl(g) + H_2(g) \rightarrow CH_3Cl(g)$

B. $C(s) + 3H(g) + Cl(g) \rightarrow CH_3Cl(g)$

C. $C(s) + 3/2H_2(g) + 1/2Cl_2(g) \rightarrow CH_3Cl(g)$

D. $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$

Answer: C

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108. Use the given standard enthalpies of formation (in kJ/mol) to determine the enthalpy of reaction of the following reaction :

$NH_3(g) + 3F_2(g) \rightarrow NF_3 + 3HF(g)$

$\Delta H_f^\circ(NH_3)(g) = -46.2,$ $\Delta H_f^\circ(NF_3)(g) = -113.0$

$\Delta H_f^\circ(HF)(g) = -269.0$

A. $-335.8kJ/mol$

B. $-873.8kJ/mol$

C. $-697.2kJ/mol$

D. $-890.4kJ/mol$

Answer: B

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109. The standard enthalpy of formation of octane (C_8H_{18}) is $-250kJ/mol$. Calculate the enthalpy of combustion of C_8H_{18}. The enthalpy of formation of $CO_2(g)$ and $H_2O(l)$ are $-394kJ/mol$ and $-286kJ/mol$ respectively.

A. -5200 kJ/mol

B. -5726 kJ/mol

C. -5476 kJ/mol

D. -5310 kJ/mol

Answer: C

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110. Determine the enthalpy of formation of B_2H_6(g) in kJ/mol of the following reaction :

$B_2H_6(g) + 3O_2(g) \rightarrow B_2O_3(s) + 3H_2O(g),$

Given :

$\Delta_r H^\circ = -1941 \text{ kJ/mol}, \quad \Delta H_f^\circ(B_2O_3, s) = -1273 \text{ kJ/mol},$

$\Delta H_f^\circ(H_2O, g) = -241.8 \text{ kJ/mol}$

A. -75.6

B. $+75.6$

C. -57.4

D. -28.4

Answer: C

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111. Consider the following reactions:

$C(s) + O_2(g) \rightarrow CO_2(g) + x \text{ kJ}$

$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g) + y \text{ kJ}$

The heat formation of CO(g) is :

A. $-(x + y)$ kJ/mol

B. $(x - y)$ kJ/mol

C. $(y - x)$ kJ/mol

D. None of these

Answer: C

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112. If $\Delta_f H^\circ(C_2H_4)$ and $\Delta_f H^\circ(C_2H_6)$ are x_1 and x_2 kcal mol^{-1}, then heat of hydrogenation of C_2H_4 is :

A. $x_1 + x_2$

B. $x_1 - x_2$

C. $x_2 - x_1$

D. $x_1 + 2x_2$

Answer: C

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113. Calculate the heat of formation of n butane from the following data:

a. $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l), \Delta H = -5757.2kJ$

b. $C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = -405.4kJ$

c. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l), \Delta H = -572.4kJ$

A. 575.6

B. -287.8

C. -174

D. 57.56

Answer: B

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114. The enthalpy of the reaction forming PbO according to the following equation is 438 kJ. What heat energy (kJ) is released in formation of 22.3 g PbO(s)?

(Atomic masses : Pb = 207, O = 16.0)

$2Pb(s) + O_2(g) \rightarrow 2PbO(s)$

A. 21.9

B. 28.7

C. 14.6

D. 34.2

Answer: A

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115. The fat, $C_{57}H_{104}O_6(s)$, is metabolized via the following reaction. Given the enthalpies of formation, calculate the energy (kJ) liberated when 1.0 g of this fat reacts.

$C_{57}H_{104}O_6(s) + 80O_2(g) \rightarrow 57CO_2(g) = -52H_2O(l)$

$\Delta_f H^\circ(C_{57}H_{104}O_6, s) = -70870 \text{ kJ/mol}, \Delta_f H^\circ(H_2O, l) = -285.8$

,

$\Delta_f H^\circ(CO_2, g) = -393.5 \text{ kJ/mol}$

A. 37.98

B. 40.4

C. 33.4

D. 30.2

Answer: A

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116. The heat of formation of $NH_3(g)$ is -46 kJ mol^{-1}. The ΔH (in kJ mol^{-1}) of the reaction, $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is

A. 46

B. -46

C. 92

D. -92

Answer: C

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117. Consider the following reaction:

$H_2O(l) \rightarrow H_2O(g) \quad \Delta H_1 = 44kJ$

$2CH_3OH(l) + 3O_2 \rightarrow 4H_2O(l) + 2CO_2(g) \quad \Delta H_2 = -1453kJ$

What is the value of ΔH for second reaction if water vapour instead of liquid water is formed as product?

A. $-1409kJ$

B. $-1629kJ$

C. $-1277kJ$

D. None of these

Answer: C

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118. The standard enthalpy change for the following reaction is 436.4 kJ :

$H_2(g) \rightarrow H(g) + H(g)$

What is the $\Delta_f H^\circ$ of atomic hydrogen (H)?

A. 872.8 kJ/mol

B. 218.2 kJ/mol

C. -218.2 kJ/mol

D. -436.9 kJ/mol

Answer: B

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119. Determine enthalpy of formation for $H_2O_2(l)$, using the listed enthalpies of reaction :

$N_2H_4(l) + 2H_2O_2(l) \rightarrow N_2(g) + 4H_2O(l),$

$$\Delta_r H_1^\circ = -818 kJ/mol$$

$$N_2H_4(l) + O_2(g) \rightarrow N_2(g) + 2H_2O(l)$$

$$\Delta_r H_2^\circ = -622 kJ/mol$$

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l) \qquad \Delta_r H_3^\circ = -285 kJ/mol$$

A. -383 kJ/mol

B. -187 kJ/mol

C. -498 kJ/mol

D. None of these

Answer: B

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120. Heat of combustion of ethanol at constant pressure and at temperature TK is found to be $-qJ \ \ \text{mol}^{-1}$. Hence, heat of combustion (in J mol^{-1}) of ethanol at the same temperature and at constant volume will be :

A. RT - q

B. $-(q+RT)$

C. q - RT

D. q + RT

Answer: A

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121. Stearic acid $\left[CH_3(CH_2)_{16}CO_2H\right]$ is a fatty acid the part of fat that stores most of the energy .1.0 g of Stearic acid was burnt in a bomb calorimeter . The bomb had capacity of 652 $J/^\circ C$. If the temperature of 500 g water rose from 25.0 to $39.3^\circ C$ how much heat is released when the stearic acid was burned?

$[\text{Given}\ \ C_p(H_2O)=4.18J/g^\circ c]$

A. 39.21 kJ

B. 29.91 kJ

C. 108 kJ

D. 9.32 kJ

Answer: A

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122. what do you mean by ortho position ?

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123. What do you mean by para position ?

Watch Video Solution

124. Write bond line formula for propane.

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125. If the enthalpy of formation and enthalpy of solution of HCl (g) are-92.3kj /mol and -75.14kJ/mol respectively then find the enthalpy of Cl^- (aq):

A. -17.16 kJ/mol

B. -167.44 kJ/mol

C. 17.16 kJ/mol

D. None of these

Answer: B

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126. At $25^\circ C$, when 1 mole of $MgSO_4$ was dissolved in water, the heat evolved was found to be 91.2 kJ. One mole of $MgSO_4.7H_2O$ on dissolution gives a solution of the same composition accompanied by an absorption of 13.8 kJ. The enthalpy of hydration, i.e., ΔH_h for the reaction $MgSO_4(s) + 7H_2O(l) \rightarrow MgSO_4.7H_2O(s)$:

A. $-105kJ/\mathrm{mol}$

B. $-77.4kJ/\mathrm{mol}$

C. 105 kJ/mol

D. None of these

Answer: A

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127. Write iupac name of CH3-CH = CH -COOH

Watch Video Solution

128. What do you mean by meta position?

Watch Video Solution

129. Enthalpy of neutralization of HCl by NaOH is -55.84 kJ/mol and by NH_4OH is 51.34 kJ/mol. The enthalpy of ionization of NH_4OH is :

A. 107.18 kJ/mol

B. 4.5 kJ/mol

C. -4.5 kJ/mol

D. None of these

Answer: B

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130. Which of the following equations are exothermic or endothermic?

N_2(g) +O_2(g) +180 kj gives 2NO(g)`

A. $CaCO_3 \rightarrow CaO + CO_2$

B. $Fe + S \rightarrow FeS$

C. $NaOH + HCl \rightarrow NaCl + H_2O$

D. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Answer: A

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131. Which of the following is not correct?

Robert Brown discovered the cell.

A. Dissolution of a salt in excess of water may be endothermic process

B. Neutralisation is always exothermic

C. The absolute value of enthalpy (H) can be determined by calorimeter

D. The heat of reaction at constant volume is denoted by δU

Answer: C

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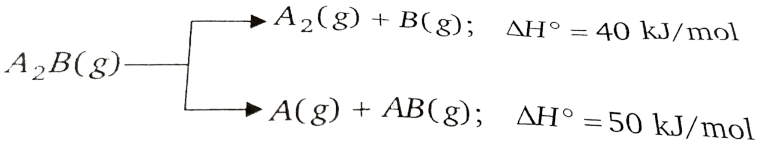
132. Substance $A_2B(g)$ can undergoes decomposition to form two set of products :



If the molar ratio of $A_2(g)$ to A(g) is $5:3$ in a set of product gases, then the energy involved in the decomposition of 1 mole of $A_2B(g)$ is :

A. 48.75 kJ/mol

B. 43.73 kJ/mol

C. 46.25 kJ/mol

D. None of these

Answer: B

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133. Write structure of diphenylmethane.

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134. The enthalpy change for the following reaction is 368 kJ. Calculate the average O-F bond energy.

$OF_2(g) \rightarrow O(g) + 2F(g)$

A. 184 kJ/mol

B. 368 kJ/mol

C. 536 kJ/mol

D. 736 kJ/mol

Answer: A

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135. Calculate the enthalpy change for the reaction $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$. The bond enthalpy of $H - H, Cl - Cl$ and $H - Cl$ ar 437, 244 and 433 kj mol^{-1} respectively.

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

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

C. $\frac{X}{6}$

D. data insufficient

Answer: D

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136. The table given below lists the bond dissociation energy (E_{diss}) for single covalent bonds formed between C and atoms A, B, D, E.

Bond	$E_{\text{diss}}\left(\text{kcal mol}^{-1}\right)$
$C-A$	240
$C-B$	382
$C-D$	276
$C-E$	486

Which of the atoms has smallest size ?

A. D

B. E

C. A

D. D

Answer: B

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137. Write iupac names of the following: CH2=CH-CH(CH3) -CH=CH-CH=CH2

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138. Write iupac names of the following: CH=C-CH(CH3)-CH=CH2

Watch Video Solution

139. Write iupac names of the following: CH3-C=C-CH(CH3)2

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140. A heating coil is immersed in a 100 g sample of H_2O (l) at a 1 atm and 100° C in a closed vessel. In this heating process , $60\,\%$ of the liquid is converted to the gaseous form at constant pressure of 1 atm . The densities of liquid and gas under these conditions are 1000 kg/m^3 and 0.60 kg/m^3 respectively . Magnitude of the work done forthe process is : (Take : 1L-atm= 100J)`

A. 4997J

B. 4970J

C. 9994 J

D. None of these

Answer: C

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141. A rigid and insulated tank of $3m^3$ volume is divided into two compartments. One compartment of volume of $2m^3$ contains an ideal gas

at 0.8314 Mpa and 400 K while the second compartment of volume of $1m^3$ contains the same gas at 8.314 Mpa and 500 K. If the partition between the two compartments is rptured, the final temperature of the gas is :

A. 420 K

B. 450 K

C. 480 K

D. None of these

Answer: C

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142. Write iupac names of the following: Cl2-CH-CH2-OH

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143. For an ideal gas $\frac{C_{p,m}}{C_{v,m}} = \gamma$. The molecular mass of the gas is M, its specific heat capacity at constant volume is :

A. $\frac{R}{M(\gamma - 1)}$

B. $\frac{M}{R(\gamma - 1)}$

C. $\frac{\gamma RM}{\gamma - 1}$

D. $\frac{\gamma R}{M(\gamma - 1)}$

Answer: A

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144. 1 mole of an ideal gas $A(C_{v.m} = 3R)$ and 2 mole of an ideal gas B are $\left(\left(C_{v,m} = \frac{3}{2}R\right)\right.$ taken in a container and expanded reversible and adiabatically from 1 litre of 4 letre starting from initial temperature of 320 K. ΔE or ΔU for the process is :

A. 240 R

B. 240 R

C. 480 R

D. -960 R

Answer: D

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145. Calculate the work done by the system in an irreversible (single step) adiabatic expansion of 2 mole of a polyatomic gas $(\gamma = 4/3)$ from 300 K and pressure 10 atm to 1 atm :

A. -227

B. $-205R$

C. $-405R$

D. None of these

Answer: C

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146. Write iupac names of the following: Br-CH2-CH2-CHO

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147. A gas $\left(C_{v.m} = \frac{5}{2}R\right)$ behaving ideally is allowed to expand reversibly and adiabatically from 1 litre to 32 litre. Its initial temperature is $327^{\circ}C$. The molar enthalpy change (in J/mol) for the process is :

A. $-1125R$

B. -675

C. $-1575R$

D. None of these

Answer: C

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148. Two mole of an ideal gas is heated at constant pressure of one atmosphere from $27^{\circ}C$ to $127^{\circ}C$. If $C_{v,m} = 20 + 10^{-2}\ \mathrm{T\ JK^{-1}}.mol^{-1}$, then q and ΔU for the process are respectively:

A. $6362.8J, 4700J$

B. $3037.2J, 4700J$

C. $7062.8J, 5400J$

D. None of these

Answer: A

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149. 10 mole of an ideal gas is heated at constant pressure of one atmosphere from $27^{\circ}C$ to $127^{\circ}C$. If $C_{v,m} = 21.686 + 10^{-3}T\left(JK^{-1}.mol^{-1}\right)$, then ΔH for the process is :

A. 3000 J

B. 3350 J

C. 3700 J

D. $3181.4J, 2350J$

Answer: D

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150. For polytropic process PV^x = constant, molar heat capacity (C_m) of an ideal gas is given by:

A. $C_{v,m} + \frac{R}{(x-1)}$

B. $C_{v,m} + \frac{R}{(1-x)}$

C. $C_{v,m} + R$

D. $C_{p,m} + \frac{R}{(x-1)}$

Answer: B

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151. 2 mole of an ideal monoatomic gas undergoes a reversible process for which $PV^2 = C$. The gas is expanded from initial volume of 1 L to final volume of 3 L starting from initial temperature of 300 K. Find ΔH for the process :

A. -600 R

B. -1000 R

C. -3000 R

D. None of these

Answer: B

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152. Calculate ΔS for 3 mole of a diatomic ideal gas which is heated and compressed from 298 K and 1 bar to 596 K and 4 bar: [Given:

$C_{v,m}(gas) = \frac{5}{2}R, \ln(2) = 0.70, R = 2calK^{-1}mol^{-1}]$

A. -14.7cal K^{-1}

B. $+14.7calK^{-1}$

C. $-4.9calK^{-1}$

D. 6.3 cal K^{-1}

Answer: D

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153. One mole of an ideal monoatomic gas at $27^\circ C$ is subjected to a reversible isoentropic compression until the temperature reached to $327^\circ C$. If the initial pressure was $1.0atm$, then find the value of in P_2

(Given : $\ln 2 = 0.7$)

A. 1.75 atm

B. 0.176 atm

C. 1.0395 atm

D. $2.0atm$

Answer: A

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154. Two moles of an ideal gas is expanded irreversibly and isothermally at $37^\circ C$ until its volume is doubled and $3.41KJ$ heat is absorbed from surrounding. $\Delta S_{\text{total}}(\text{system} + \text{surrounding})$ is:

A. $-0.52J/K$

B. $0.52J/K$

C. $22.52J/K$

D. 0

Answer: B

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155. For a perfectly crystalline solid $C_{p,m} = aT^3 + bT$, where a and b are constant. If $C_{p,m}$ is 0.40 J/K mol at 10 K and 0.92 J/K mol at 20 K, then molar entropy at 20 K is :

A. 0.92 J/K mol

B. 8.66 J/K mol

C. 0.813 J/K mol

D. None of these

Answer: C

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156. What are hybridisation states of each carbon atom in the following compound : (CH3)2CO

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157. Combustion of sucrose is used by aerobic organisms for providing energy for the life sustaining process. If all the capturing of energy from the reaction is done through electrical process (non P-V work), then calculate, maximum available energy which can be captured by combustion of 34.2 g of sucrose :

(Given : $\Delta H_{\text{combustion}}(\text{sucrose}) = -6000 kJ mol^{-1}$

$\Delta S_{\text{combustion}} = 180 j/K - mol$ and bodyntemperature is 300 K)

A. 600 kJ

B. 594.6 kJ

C. 5.4 kJ

D. 605.4 kJ

Answer: D

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158. For the hypothetical reaction

$A_2(g) + B_2(g) \rightarrow 2AB_g$

ΔG_r° and ΔS_r° are $20KJ/mol$ and $-20JK^{-1}mol^{-1}$

respectively at $200K$ $\Delta_r C_p$ is $20JK^{-1}$ then ΔH_r° at $400Kis$

A. 20 kJ/mol

B. 7.98 kJ/mos

C. 28 kJ/mol

D. None of these

Answer: A

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159. Write structure of cyclopentanone.

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160. Write structure of 3-hydroxybutanoic acid.

Watch Video Solution

161. Write structure of cyclopropane

Watch Video Solution

162. write structure of dicholomethane

Watch Video Solution

163. write the iupac name of compound C6H5-CH2-COOH

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164. What are hybridisation states of each carbon atom in the following compound : CH3-CH=CH2

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165. Calculate the heat produced (in kJ) when 224 gm of CaO is completely converted to $CaCO_3$ by reaction with CO_2 at 27° in a container of fixed volume.

Given :

$\Delta H_f^\circ(CaCO_3, s) = -1207 kJ/mol, \quad \Delta H_f^\circ(CaO, s) = -635 kJ/mol$

$\Delta H_f^\circ(CO_2, g) = -394 kJ/mol, \left[\text{Use R} = 8.3 JK^{-1} mol^{-1}\right]$

A. 702.04 kJ

B. 721.96 kJ

C. 712 kJ

D. 721 kJ

Answer: A

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166. When 1.0 g of oxalic acid $(H_2C_2O_4)$ is burnt in a bomb calorimeter whose capacity is 8.75 KJ/K, the temperature increases by 0.312 K, the enthalpy of combustion of oxalic acid at$27^\circ C$ is :

A. $-245.7kJ/mol$

B. $-244.452kJ/mol$

C. $-241.5kJ/mol$

D. None of these

Answer: D

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167. Write the structure of para toluic acid

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168. The enthalpy of neutralization of a Weak monoprotic acid (HA) in 1 M solution with a strong base is -55.95 KJ/mol . If the unionized acid required 1.4 KJ/mol heat for it's comptate ionzatation and enthalpy of netralization of the strong monobasic acid with a strong monoacidic base is -57.3 KJ/mol . What is the % ionzation of the weak acid in molar solution ?

A. $1\ \%$

B. $3.57\ \%$

C. $35.7\ \%$

D. $0.1\ \%$

Answer: B

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169. What are hybridisation states of each carbon atom in the following compound : C6H6

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170. Indicate the sigma and pi bond in the following molecules : C6H6

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171. Indicate the sigma and pi bond in the following molecules : C6H12 (cyclohexane)

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172. Indicate the sigma and pi bond in the following molecules : CH2Cl2

Watch Video Solution

173. Indicate the sigma and pi bond in the following molecules : CH2=C=CH2

Watch Video Solution

174. Indicate the sigma and pi bond in the following molecules : CH3NH2

Watch Video Solution

175. Indicate the sigma and pi bond in the following molecules : HCONHCH3

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176. Write bond line formula for ethylene glycol

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177. Write bond line formula for 2-methylbutanal

Watch Video Solution

178. Write bond line formula for heptan-3-one

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179. The first law of thermodynamics for a closed system is dU = dq + dw, where dw = $dw_{pv} + dw_{\text{non-pv}}$. The most common type of $w_{\text{non-pv}}$ is electrical work. As per IUPAC convention work done on the system is positive.

A system generates 50 J electrical energy, has 150 J of pressure-volume work done on it by the surroundings while releasing 300 J of heat energy. What is the change in the internal energy of the sytem?

A. -500

B. -100

C. -300

D. -200

Answer: D

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180. Write iupac name of CH3-CH2-CH2-C6H5

Watch Video Solution

181. Write iupac name of CH3-CH(Cl)-CH3

Watch Video Solution

182. Write iupac name of C6H5-CH2-C6H5

Watch Video Solution

183. If the boundary of system moves by an infinitesimal amount, the work involved is given by $dw = -P_{\text{ext}}dV$

for irreversible process $w = -P_{\text{ext}}\Delta V \qquad (\text{where } \Delta V = V_f - V_i)$

for reversible process $P_{\text{ext}} = P_{\text{int}} \pm dP \cong P_{\text{int}}$

so for reversible isothermal process $w = -nRT \ln. \dfrac{V_f}{V_i}$

2mole of an ideal gas undergoes isothermal compression along three different plaths :

(i) reversible compression from $P_i = 2$ bar and $V_i = 8L$ to $P_f = 20$ bar

(ii) a single stage compression against a constant external pressure of 20 bar, and

(iii) a two stage compression consisting initially of compression against a constant external pressure of 10 bar until $P_{\text{gas}} = P_{\text{ext}}$, followed by compression against a constant pressure of 20 bar until $P_{\text{gas}} = P_{\text{ext}}$

Total work done on the gas in two stage compression is :

A. 40

B. 80

C. 160

D. None of these

Answer: B

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184. Give the iupac names of the following compound : Cl-CH2-CH2-CHO

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185. Standard Gibb's energy of reaction $(\Delta_r G^\circ)$ at a certain temperature can be computed $\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$ and the change in the value of $\Delta_r H^\circ$ and $\Delta_r S^\circ$ for a reaction with temperature can be computed as follows :

$$\Delta_r H^\circ_{T_2} - \Delta_r H^\circ_{T_1} = \Delta_r C_p^\circ (T_2 - T_1)$$

$$\Delta_r S^\circ_{T_2} - \Delta_r S^\circ_{T_1} = \Delta_r C_p^\circ \text{ ln. } \left(\frac{T_2}{T_1}\right)$$

$$\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$$

and by $\Delta_r G^\circ = -\text{RT } \ln K_{eq}$.

Consider the following reaction : $CO(g) + 2H_2(g) \Leftrightarrow CH_3OH(g)$

Given :

$\Delta_f H^\circ(CH_3OH, g) = -201 \text{ kJ/mol}, \quad \Delta_f H^\circ(CO, g) = -114 \text{ kJ/m}$

$S^\circ(CH_3OH, g) = 240 \text{ J/K-mol}, \quad S^\circ(H_2, g) = 29 \text{ JK}^{-1} \text{ mol}^{-1}$

$S^\circ(CO, g) = 198 \text{ J/mol-K}, \quad C^\circ_{p,m}(H_2) = 28.8 \text{ J/mol-K}$

$C^\circ_{p,m}(CO) = 29.4 \text{ J/mol-K}, \quad C^\circ_{p,m}(CH_3OH) = 44 \text{ J/mol-K}$

and $\ln\left(\frac{320}{300}\right) = 0.06$, all data at 300 K

$\Delta_r G^\circ$ at 320 K is :

A. 152.6 J/K-mol

B. 181.6 J/K-mol

C. -16 J/K-mol

D. None of these

Answer: C

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186. Standard Gibb's energy of reaction $(\Delta_r G^\circ)$ at a certain temperature can be computed $\Delta_r G^\circ = \Delta_r H^\circ - T.\,\Delta_r S^\circ$ and the change in the value of $\Delta_r H^\circ$ and $\Delta_r S^\circ$ for a reaction with temperature can be computed as follows :

$$\Delta_r H^\circ_{T_2} - \Delta_r H^\circ_{T_1} = \Delta_r C_p^\circ (T_2 - T_1)$$

$$\Delta_r S^\circ_{T_2} - \Delta_r S^\circ_{T_1} = \Delta_r C_p^\circ \text{ ln. } \left(\frac{T_2}{T_1}\right)$$

$$\Delta_r G^\circ = \Delta_r H^\circ - T.\,\Delta_r S^\circ$$

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$C^\circ_{p,m}(CO) = 29.4\ \text{J/mol-K}$, $C^\circ_{p,m}(CH_3OH) = 44\ \text{J/mol-K}$

and $\ln\left(\frac{320}{300}\right) = 0.06$, all data at 300 K

$\Delta_r H^\circ$ at 300 K for the reaction is :

A. -87 kJ/mol

B. 87 kJ/mol

C. -315 kJ/mol

D. -288 kJ/mol

Answer: A

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187. Standard Gibb's energy of reaction $(\Delta_r G^\circ)$ at a certain temperature can be computed $\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$ and the change in the value of $\Delta_r H^\circ$ and $\Delta_r S^\circ$ for a reaction with temperature can be computed as follows :

$$\Delta_r H^\circ_{T_2} - \Delta_r H^\circ_{T_1} = \Delta_r C_p^\circ (T_2 - T_1)$$

$$\Delta_r S^\circ_{T_2} - \Delta_r S^\circ_{T_1} = \Delta_r C_p^\circ \ln. \left(\frac{T_2}{T_1}\right)$$

$$\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$$

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$C^\circ_{p,m}(CO) = 29.4 \text{ J/mol-K}$, $C^\circ_{p,m}(CH_3OH) = 44 \text{ J/mol-K}$

and $\ln\left(\frac{320}{300}\right) = 0.06$, all data at 300 K

$\Delta_r S^\circ$ at 320 K is :

A. 155.18 J/mol-K

B. 150.02 J/mol-K

C. 172 J/mol-K

D. None of these

Answer: D

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188. Write iupac name of CH3-CH2-COOH

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189. Standard Gibb's energy of reaction $(\Delta_r G^\circ)$ at a certain temperature can be computed $\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$ and the change in the value of $\Delta_r H^\circ$ and $\Delta_r S^\circ$ for a reaction with temperature can be computed as follows :

$$\Delta_r H^\circ_{T_2} - \Delta_r H^\circ_{T_1} = \Delta_r C^\circ_p (T_2 - T_1)$$

$$\Delta_r S^\circ_{T_2} - \Delta_r S^\circ_{T_1} = \Delta_r C^\circ_p \text{ ln. } \left(\frac{T_2}{T_1}\right)$$

$$\Delta_r G^\circ = \Delta_r H^\circ - T.\Delta_r S^\circ$$

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$S^\circ(CO, g) = 198 \text{ J/mol-K}$, $C^\circ_{p,m}(H_2) = 28.8 \text{ J/mol-K}$

$C^\circ_{p,m}(CO) = 29.4 \text{ J/mol-K}$, $C^\circ_{p,m}(CH_3OH) = 44 \text{ J/mol-K}$

and $\ln\left(\frac{320}{300}\right) = 0.06$, all data at 300 K

$\Delta_r G^\circ$ at 320 K is :

A. -48295.2 kJ/mol

B. 240.85 kJ/mol

C. 240.85 kJ/mol

D. -81.91 kJ/mol

Answer: D

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190. Enthalpy of neutralzation is defined as the enthalpy change when 1 mole of acid $/$ —base is completely neutralized by base $/$acid in dilute solution .

For Strong acid and strong base neutralization net chemical change is

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

$\Delta_r H^\circ = -55.84 KJ/mol$

$\Delta H^\circ_{\text{ionization}}$ of aqueous solution of strong acid and strong base is zero .

when a dilute solution of weak acid or base is neutralized, the enthalpy of neutralization is somewhat less because of the absorption of heat in the ionzation of the because of the absorotion of heat in the ionization of

the weak acid or base ,for weak acid /base

$\Delta H^{\circ}_{\text{neutrlzation}} = \Delta H^{\circ}_{\text{ionization}} + \Delta_r H^{\circ}\left(H^{+} + OH^{-} \rightarrow H_2O\right)$

If enthalpy of neutralization of CH_3COOH by NaOH is -49.86KJ/mol then enthalpy of ionization of CH_3COOH is:

A. 5.98 kJ/mol

B. -5.98 kJ/mol

C. 105.7 kJ/mol

D. None of these

Answer: A

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191. Enthalpy of neutralzation is defined as the enthalpy change when 1 mole of acid /base is completely neutralized by base /acid in dilute solution .

For Strong acid and strong base neutralization net chemical change is

$H^{+}(aq) + OH^{-}(aq) \rightarrow H_2O(l)$

$\Delta_r H^\circ = -55.84 KJ/mol$

$\Delta H^\circ_{\text{ionization}}$ of aqueous solution of strong acid and strong base is zero .

when a dilute solution of weak acid or base is neutralized, the enthalpy of neutralization is somewhat less because of the absorption of heat in the ionzation of the because of the absorotion of heat in the ionization of the weak acid or base ,for weak acid /base

$\Delta H^\circ_{\text{neutrlzation}} = \Delta H^\circ_{\text{ionization}} + \Delta_r H^\circ \left(H^+ + OH^- \rightarrow H_2O\right)$

What is ΔH° for complate neutralization of strong diacidic base $A(OH)_2 by HNO_3$?

A. -55.84 kJ/mol

B. 111.68 kJ/mol

C. 55.84 kJ/mol

D. None of these

Answer: B

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192. Enthalpy of neutralzation is defined as the enthalpy change when 1 mole of acid /base is completely neutralized by base /acid in dilute solution .

For Strong acid and strong base neutralization net chemical change is

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

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when a dilute solution of weak acid or base is neutralized, the enthalpy of neutralization is somewhat less because of the absorption of heat in the ionzation of the because of the absorotion of heat in the ionization of the weak acid or base ,for weak acid /base

$\Delta H^\circ_{\text{neutrlzation}} = \Delta H^\circ_{\text{ionization}} + \Delta_r H^\circ \left(H^+ + OH^- \rightarrow H_2O\right)$

under same conditions ,how many mL of 0.1 m NaOH and 0.05 M H_2A (strong diprotic acid) solution should be mixed for a total volume of 100mL to producce the hight rise in temperature ?

A. $25:75$

B. $50:50$

C. $75:25$

D. $66.66:33.33$

Answer: B

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193. Gibbs Helmholtz equation relates the enthalpy, entropy and free energy change of the process at constant pressure and temperature as

$\Delta G = \Delta H - T\Delta S \qquad (\text{at constant P, T})$

In General the magnitude of ΔH does not change much with the change in temperature but the terms $T\Delta S$ changes appreciably. Hence in some process spontaneity is very much dependent on temperature and such processes are generally known as entropy driven process.

For the reaction at 298 K, $A_2B_4 \rightarrow 2AB_2$

$\Delta H = 2$ kJ and ΔS = 20 J/K at constant P and T, the reaction will be

A. spontaneous and entropy driven

B. spontaneous and enthalpy driven

C. non-spontaneous

D. at equilibrium

Answer: A

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194. Gibbs Helmholtz equation relates the enthalpy, entropy and free energy change of the process at constant pressure and temperature as

$$\Delta G = \Delta H - T\Delta S \qquad (\text{at constant P, T})$$

In General the magnitude of ΔH does not change much with the change in temperature but the terms $T\Delta S$ changes appreciably. Hence in some process spontaneity is very much dependent on temperature and such processes are generally known as entropy driven process.

When $CaCO_3$ is heated to a high temperature it decomposes into CaO and CO_2, however it is quite stable at room temperature. It can be explained by the fact that

A. $\Delta_r H$ dominates the term $T\Delta S$ at high temperature

B. the term $T\Delta S$ dominates the $\Delta_r H$ at high temperature

C. at high temperature both $\Delta_r S$ and $\Delta_r H$ becomes negative

D. thermodynamics can not say anything about spontaneity

Answer: B

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195. Gibbs Helmholtz equation relates the enthalpy, entropy and free energy change of the process at constant pressure and temperature as

$$\Delta G = \Delta H - T\Delta S \qquad (\text{at constant P, T})$$

In General the magnitude of ΔH does not change much with the change in temperature but the terms $T\Delta S$ changes appreciably. Hence in some process spontaneity is very much dependent on temperature and such processes are generally known as entropy driven process.

The Dissolution of $CaCl_2.6H_2O$ in a large volume of water is endothermic to the extent of 3.5 kcal mol^{-1} and ΔH for the reaction is -23.2 kcal mol^{-1}.

$CaCl_2(s) + 6H_2O(l) \rightarrow CaCl_2.6H_2O(s)$

Select the correct statement :

A. $\Delta H_{\text{solution}}$ for anhydrous $CaCl_2$ is - 19.7 kcal/mol and the process is enthalpy driven

B. $\Delta H_{\text{solution}}$ for anhydrous $CaCl_2$ is - 19.7 kcal/mol and the process is entropy driven

C. Dissolution of $CaCl_2.6H_2O$ in water is enthalpy driven process

D. The $\Delta_r S$ the reaction $CaCl_2(s) + 6H_2O(l) \rightarrow CaCl_2.6H_2O(s)$ is negative

Answer: A

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196. Identify the intensive quantities from the following :

A. Enthalpy

B. Temperature

C. Pressure

D. Mass

Answer: B::C

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197. Identify the extensive quantities from the following :

A. Gibb's energy

B. Entropy

C. Refractive index

D. Specific heat

Answer: A::B

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198. Identify the state functions from the following :

A. temperature

B. Work

C. Volume

D. both (1) and (3)

Answer: C

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199. Which of the following statementl is/are correct as per IUPAC sign convention?

A. The work done by the system on the surrounding is negative

B. The work done by the surrounding on the system is positive

C. The heat absorbed by the system from the surrounding is positive

D. The heat absorbed by the surrounding from the system is positive

Answer: A::B::C

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200. In an isothermal irreversible expansion of an ideal gas as per IUPAC sign convention :

A. $\Delta U = 0$

B. $\Delta H = 0$

C. $w = -nRT \ln. \frac{P_1}{P_2}$

D. $w = -q$

Answer: A::B::D

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201. In reversible isothermal expansion of an ideal gas :

A. w = 0

B. $U_1 = U_2$

C. $H_1 = H_2$

D. $q = nRT \ln. \frac{V_2}{V_1}$

Answer: B::C::D

Watch Video Solution

202. An adiabatic process is that process in which :

A. energy is transferred as heat

B. no energy is transferred as heat

C. $\Delta U = w$

D. None of these

Answer: B::C::D

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203. The density of the ideal gas is given by

A. $nC_v\Delta T$

B. $\frac{nR}{\gamma-1}(T_2-T_1)$

C. $-nRP_{\text{ext}}\left[\frac{T_2P_1-T_1P_2}{P_1P_2}\right]$

D. $-2.303 \quad \text{RT} \log \frac{V_2}{V_1}$

Answer: A::B::C

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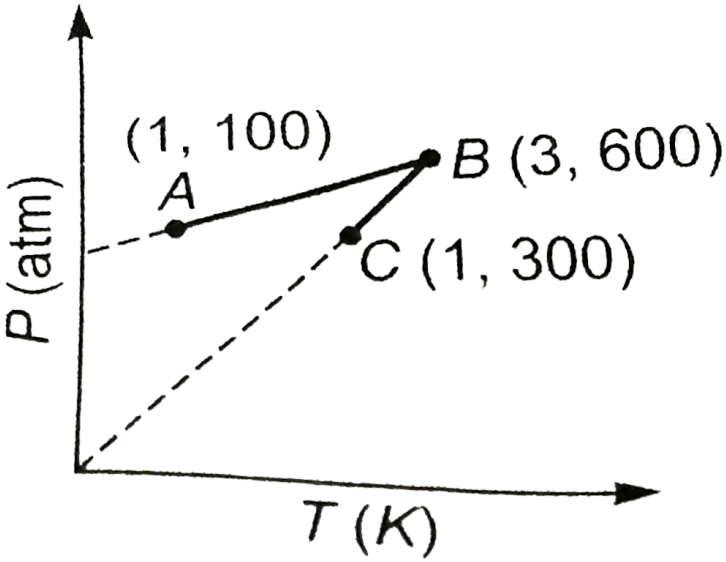

204.

One mole of an ideal gas is subjected to a two step reversible process (A-B and B-C). The pressure at A and C is same. Mark the correct statement(s) :

A. Work involved in the path AB is zero

B. In the path AB work will be done on the gas by the surrounding

C. Volume of gas at C = 3 $\times$ volume of gas at A

D. Volume of gas at B is 16.42 litres

Answer: C::D

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205. Which of the following is/are correct?

A. $\Delta H = \Delta U + \Delta(PV)$ when P and V both changes

B. $\Delta H = \Delta U + P\Delta V$ when pressure is constant

C. $\Delta H = \Delta U + V\Delta P$ when volume is constant

D. $\Delta H = \Delta U + P\Delta V + V\Delta P$ when P and V both changes

Answer: A::B::C

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206. $\Delta H < \Delta U$ for the reaction(s) :

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

B. $Ag_2O(s) \rightarrow 2Ag(s) + \frac{1}{2}O_2(g)$

C. `N2O4(g) → 2NO2(g)

D. $C(s) + O_2(g) \rightarrow CO_2(g)$

Answer: A::C

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207. Which of the following conditions will always lead to a non-spontaneous change ?

A. ΔH and ΔS both $+ve$

B. $\Delta H = -ve, \Delta S = +ve$

C. $\Delta H = +ve, \Delta S = -ve$

D. $\Delta H = -ve, \Delta S = -ve$

Answer: A::C::D

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208. For a process to be spontaneous at constant T and P :

A. $\left(\Delta G_{\text{system}}\right)_{T,P} = 0$

B. $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} > 0$

C. $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} < 0$

D. $\left(\Delta G_{\text{system}}\right)_{T,P} < 0$

Answer: B::D

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209. Write iupac name of CH3-CH(OH)-CH2OH

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210. Give the iupac names of the following compound : CH3-CH2-CH(CH3)-CH2-CN

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211. Give the iupac names of the following compound : CH3-CH(CH3)-CH2-CH2-CH(CH3)-CH2-CH3

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212. Give the iupac names of the following compound : CH3-CH2-C(Cl)(Br)-CH2-CH2-CH2-CH3

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213. Let $f: R \to R$ be a function defined by $f(x+1) = \frac{f(x)-5}{f(x)-3}, \forall x \in R.$ Then, which of the following statements is/are true?

A. $\Delta U = 0$ for combustion of C_2H_6(g) in a sealed rigid adiabatic container

B. $\Delta_f H^\circ$ (S, monoclinic) $\neq 0$

C. If dissociation energy of $CH_4(g)$ is $1656 kJ/\text{mol}$ and C_2H_6 (g) is 2812 kJ/mol, then value of C-C bond energy will be 328 kJ/mol

D. If

$\Delta H_f(H_2O, g) = -242 \text{ kJ/mol}$, $\Delta H_{\text{vap}}(H_2O, l) = 44 \text{ kJ/mol}$

then, $\Delta_f H^\circ \left(OH^-, aq.\right)$ will be -142 kJ/mol

Answer: A:C

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214. Match the following :

(i) sin (90°–A)	(a) Sin A
(ii) Cos 0°	(b) 0
(iii) Sin 0°	(c) 1
(iv) Cas (90°–A)	(d) Cos A

.

A. Reaction $\Delta_r H(\text{kJ/mol})$

$$HA(aq) + BOH(aq) \rightarrow BA(aq) + H_2O \qquad -42.3$$

B. Reaction $\Delta_r H(\text{kJ/mol})$

$$HA(g) + BOH(aq) \rightarrow BA(aq) + H_2O \qquad -93$$

C. Reaction $\Delta_r H(\text{kJ/mol})$

$$HA(g) \rightarrow H^+(aq) + A^-(aq) \qquad -55.7$$

D. Reaction $\Delta_r H(\text{kJ/mol})$

$$B^+(aq) + OH^-(aq) \rightarrow BOH(aq) \qquad -20$$

Answer: A::B::C

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215. Select correct statement(s)

A. An adiabatic system can exchange energy with its surroundings.

B. A thermodynamic property which is intensive is additive.

C. Work done may be zero in a cyclic process.

D. For a simple compressible substance, the relation dq - P . Dv = 0 is true for any cycle involving mechanical work only.

Answer: A::C::D

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216. For an isolated system, the entropy :

A. either increases or remains constant

B. either decreases or remains constant

C. can never decrease

D. can never increase

Answer: A::C

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217. The normal boiling point of a liquid X is 400 K. ΔH_{vap} at normal boiling point is 40 kJ/mol. Select correct statement(s) :

A. $\Delta S_{\text{vaporisation}} < 100$ J/mol.K at 400 K and 2 atm

B. $\Delta S_{\text{vaporisation}} < 10$ J/mol.K at 400 K and 1 atm

C. $\Delta G_{\text{vaporisation}} < 0$ at 410 K and 1 atm

D. $\Delta U = 43.32$ kJ/mol.K at 400 K and 1 atm

Answer: A::C

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218. Select correct statement(s)

A. A closed system with all adiabatic boundaries must be an isolated system

B. Total heat exchange in a cyclic process may be zero

C. Entropy of a closed system is maximum at equilibrium

D. Molar Gibb's Energy is an extensive property

Answer: A::C::D

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219. Select correct statement(s) for the reaction $H_2O(g) + CO(g) \rightarrow H_2(g) + CO_2(g)$ substance

$CO(g)$	$CO_2(g)$	$H_2O(g)$	$H_2(g)$
$\Delta_f H^{\circ}_{400}\left(\text{kcal mol}^{-1}\right)$	-25	-95	-55	0
$S^{\circ}_{400}\left(\text{cal mol}^{-1}\text{K}^{-1}\right)$	45	50	40	30

A. Reaction is enthalpy driven

B. Reaction is entropy driven

C. Reaction is spontaneous at 400 K

D. Reaction is non-spontaneous at 400 K

Answer: A::C

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220. Match the following columns

Column-I	Column-II
(A) Reversible cooling of an ideal gas at constant volume	(P) $w=0; q<0; \Delta U<0$
(B) Reversible isothermal expansion of an ideal gas	(Q) $w<0; q>0; \Delta U>0$
(C) Adiabatic expansion of non-ideal gas into vacuum	(R) $w=0; q=0; \Delta U=0$
(D) Reversible melting of sulphur at normal melting point	(S) $w<0; q>0; \Delta U=0$

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221. Match the following columns

Column-I	Column-II
(A) Adiabatic process	(P) $q = 0$
(B) Isothermal process	(Q) $\Delta H = 0$
(C) Isoenthalpic process	(R) $\Delta T = 0$
(D) Isoentropic process	(S) $\Delta S = 0$

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222. Give the iupac names of the following compound : Cl2CHCH2OH

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223. Match the following columns

Column-I	Column-II
(A) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ in a closed system	(P) $\Delta H < \Delta U$
(B) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ in a closed system	(Q) $\Delta H = \Delta U \neq 0$
(C) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ in a closed system	(R) $\Delta H > \Delta U$
(D) $CO(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO_2(g)$ in an isolated system	(S) $\Delta U = 0$

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224. Which of the following represents the correct iupac for compounds concerned ? a. 2,2-dimethylpentane OR 2-dimethylpentane.

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225. Which of the following represents the correct iupac for compounds concerned ? b. 2,4,7-trimethyloctane OR 2,5,7-trimethyloctane

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226. Match the following columns

Column-I	Column-II
(A) $(\Delta G_{system})_{T,P} = 0$	(P) Process is in equilibrium
(B) $\Delta S_{system} + \Delta S_{surrounding} > 0$	(Q) Process is nonspontaneous
(C) $\Delta S_{system} + \Delta S_{surrounding} < 0$	(R) Process is spontaneous
(D) $(\Delta G_{system})_{T,P} > 0$	(S) System is unable to do useful work

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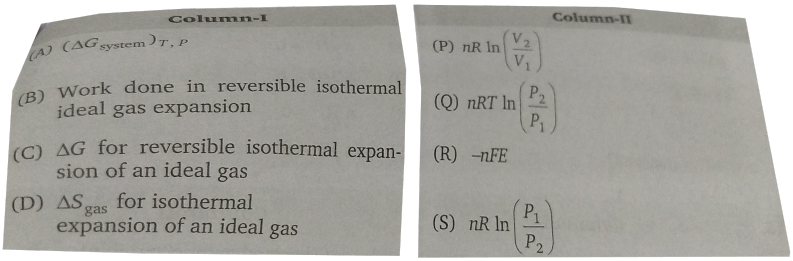
227. Match the following columns



Column-I	Column-II
(A) $(\Delta G_{system})_{T,P}$	(P) $nR \ln\left(\frac{V_2}{V_1}\right)$
(B) Work done in reversible isothermal ideal gas expansion	(Q) $nRT \ln\left(\frac{P_2}{P_1}\right)$
(C) ΔG for reversible isothermal expansion of an ideal gas	(R) $-nFE$
(D) ΔS_{gas} for isothermal expansion of an ideal gas	(S) $nR \ln\left(\frac{P_1}{P_2}\right)$

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228. Which of the following represents the correct iupac for compounds concerned ? 2-chloro-4-methylpentane OR 4-chloro-2-methylpentane

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229. Which of the following represents the correct iupac for compounds concerned ? but-3-yn-1-ol OR but-4-ol-1-yne

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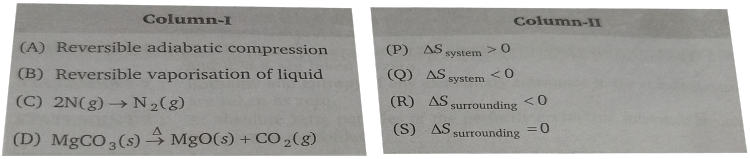
230. Match the following columns



Column-I	Column-II
(A) Reversible adiabatic compression	(P) $\Delta S_{system} > 0$
(B) Reversible vaporisation of liquid	(Q) $\Delta S_{system} < 0$
(C) $2N(g) \rightarrow N_2(g)$	(R) $\Delta S_{surrounding} < 0$
(D) $MgCO_3(s) \xrightarrow{\Delta} MgO(s) + CO_2(g)$	(S) $\Delta S_{surrounding} = 0$

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231. Write structural formula of 4-nitroaniline.

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232. Write structure of anisole.

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233. Heat and work are "definite quantities".

Heat and work are not properties of a system. Their values depend on the path of the process and vary accordingly.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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234. There is no change in internal energy for an ideal gas at constant temperature.

Internal energy of an ideal gas is a function of temperature only.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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235. STATEMENT-1 : The Heat absorbed during the isothermal expansionof an ideal gas against vacuum is zero.

STATEMENT-2 : The volume occupied by the molecules of an ideal gas is zero.

A. If both the statements are TRUE and REASON is the correct explanation of ASSERTION

B. If both the statements are TRUE but REASON is NOT the correct explanation of ASSERTION

C. If ASSERTION is TRUE and REASON is FALSE

D. If ASSERTION is FALSE and REASON is TRUE

Answer: B

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236. ΔH and ΔU are the same of the reaction, $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$,

All reactants and products are gases where all gases are ideal.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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237. Write structural formula of 2,3-dibromo-1-phenylpentane

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238. Write structural formula of 2-hydroxybenzaldehyde.

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239. There cannot be chemical equilibrium in an open system.

There is no fixed mass in an open system.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-7

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-7

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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240. Write iupac name of phenyl ethyl alcohol.

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241. Statement -1: Enthalpy and entropy of any elements substance in the standard states are taken as zero .

Statement-2: At absolute zero , partiles of the perfectly crystalline substance become completely motioness.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-9

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-9

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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242. Write iupac name of cumene.

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243. Write structure of 2-chlorotoluene

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244. The incorrect iupac name of the compound is 3,3-diethylbutane. write its structural formula and correct the iupac name of the comppound.

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245. $|\Delta_f H|$ of $(H_2O, l) > |\Delta_f H|$ of (H_2O, g)

$\Delta H_{\text{condensation}}$ is negative.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-13

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-13

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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246. All combustion reactions are exothermic.

Enthalpies of products are greater than enthalpies of reactants $\left(\Sigma v_p \Delta_f H(P) > \Sigma v_R \Delta_f H(R)\right)$

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: C

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247. Enthalpy of neutralization is defined as the enthalpy change when 1 mole of acid/base is completely neutralized by base/acid in dilute solution.

For strong acid and strong base neutralization net chemical change is

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l), \qquad \Delta_r H^\circ = -55.84 \ \text{kJ/mol}$

$\Delta H^\circ_{\text{ionization}}$ of aqueous solution of strong acid and strong base is zero.

when a dilute solution of a weak acid or base is neutralized, the enthalpy of neutralization is some what less because of the absorption of heat in the ionization of the weak acid or base, for weak acid/base

$\Delta H^\circ_{\text{neutralization}} = \Delta H^\circ_{\text{ionization}} + \Delta_r H^\circ \left(H^+ + OH^- \rightarrow H_2O\right)$

If enthalpy of neutralization of CH_3COOH by HCl is -49.86 kJ/mol then enthalpy of ionization of CH_3COOH is :

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-15

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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248. Assertion : — Internal energy of a real gas may change during expansion at const. temperature.

Reason : — Internal energy of a real gas ia function of T & P.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-16

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-16

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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249. What is the power of a machine which does 2000 joules of work in 10 seconds ?

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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250. The expansion of a gas into an evacuated space takes place non-spontaneously.

A process in which all steps cannot be retraced by themselves is called a spontaneous process.

A. If both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-18

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-18

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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251. Write the structural formulae for : 4-methylpent-2-ene

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252. 2 mole of an ideal gas at $27^{\circ}C$ expands isothermally and reversibly from a volume of 4 litre to 40 litre. The work done (in kJ) by the gas is :

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253. A diatomic ideal gas is expanded according to PV^3 = constant, under very high temperature (Assume vibration mode active). Calculate the molar heat capacity of gas (in cal / mol K) in this process.

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254. A heat engine operating between $227^{\circ}C$ and $77^{\circ}C$ absorbs 10 kcal of heat from the $227^{\circ}C$ reservoir reversibly per cycle. Calculate total work done (in kcal) in two cycles.

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255. Write the structural formulae for : 2-methylpropan-2-ol

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256. Molar heat capacities at constant pressure for A, B and C are 3, 1.5 and 2 J/K mol. The enthalpy of reaction and entropy of reaction, A + B $\rightarrow$ 3C are 20 kJ/mol and 20 J/K mol at 300 K. Calculate ΔG (in kJ / mol) for the reaction,

$$\frac{1}{2}A + B \rightarrow \frac{3}{2}C$$

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257. Standard molar enthalpy of combustion of glucose is -2880 kJ. If only 25% of energy is available for muscular work and 1.0 km walk consumes 90 kJ of energy, what maximum distance (in km) a person can walk after eating 90 g of glucose.

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258. If $\Delta_f H^\circ(C_2H_4)$ and $\Delta_f H^\circ(C_2H_6)$ are x_1 and x_2 kcal mol^{-1}, then heat of hydrogenation of C_2H_4 is :

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259. The integral enthalpies of solution of anhydrous $CuSO_4$ (s) and hydrated $CuSO_4.5H_2O(s)$ are -70 kJ per mol and 10 kJ per mol respectively. Determine the magnitude of enthalpy of hydration of 0.1 mole anhydrous $CuSO_4$ (s) as

$CuSO_4(s) + 5H_2O(l) \rightarrow CuSO_4.5H_2O(s)$

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260. If enthalpy of neutralisation of HCl by NaOH is -57 kJ mol^{-1} and with NH_4OH is -50 kJ mol^{-1}. Calculate enthalpy of ionisation of NH_4OH (aq).

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262. x g sample of NH_4NO_3 is decomposed in a Bomb calorimeter. The temperature of calorimeter increase by $4^\circ C$. The heat capacity of the system is $1.25\ \mathrm{kJ}/.^\circ C$. Calculate the value of x. Given molar heat of decomposition of NH_4NO_3 at constant volume is 400 kJ mol^{-1}.

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263. A heat engine operating between $227^\circ C$ and $77^\circ C$ absorbs 10 kcal of heat from the $227^\circ C$ reservoir reversibly per cycle. Calculate total work done (in kcal) in two cycles.

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264. Calculate work done in chemical reaction (in kcal)

$A(s) + 3B(g) \rightarrow C(l)$ at $227^\circ C$ at 1 atm in closed vessel.

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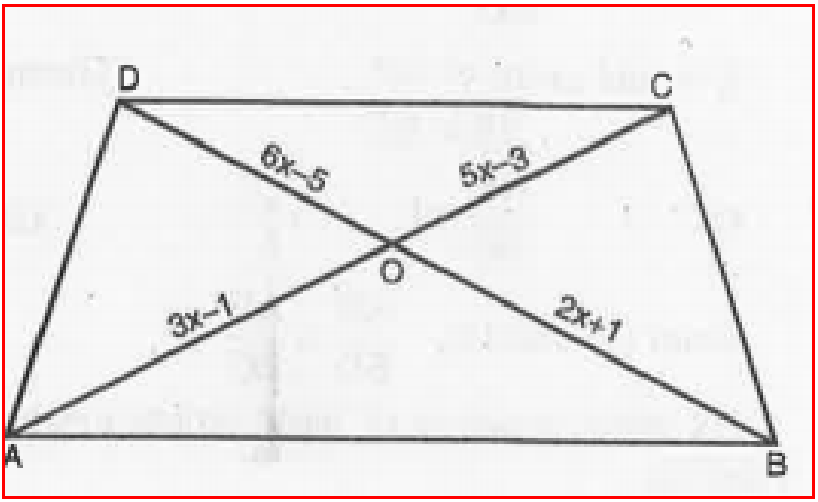
265. Infigure, if AB II DC,find the value of x .



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Level 1 Q 1 To Q 30

1. An ideal gas expands against a constant external pressure of 2.0 atmosphere from 20 litre to 40 litre and absorbs 10 kJ of heat from surrounding. What is the change in internal energy of the system? (Given : 1 atm-litre = 101.3 J)

A. 4

B. 5

C. 2

D. 3

Answer: C

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2. One mole of an ideal gas at $25^{\circ}C$ expands in volume from 1.0 L to 4.0 L at constant temperature. What work (in J) is done if the gas expands against vacuum $(P_{\text{external}} = 0)$?

A. -4.0×10^2

B. -3.0×10^2

C. -1.0×10^2

D. Zero

Answer: D

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3. At $25^\circ C$, a 0.01 mole sample of a gas is compressed from 4.0 L to 1.0 L at constant temperature. What is the work done for this process if the external pressure is 4.0 bar?

A. $1.6 \times 10^3 J$

B. $8.0 \times 10^2 J$

C. $4.0 \times 10^2 J$

D. $1.2 \times 10^3 J$

Answer: D

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4. Calculate the work done (in J) when 4.5 g of H_2O_2 reacts against a pressure of 1.0 atm at $25^\circ C$ $2H_2O_2(l) \rightarrow O_2(g) + 2H_2O(l)$

A. -1.63×10^2

B. 4.5×10^2

C. 3.2×10^2

D. -6.1×10^2

Answer: A

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5. Temperature of 1 mole of a gas is increased by $2^\circ C$ at constant pressure. Work done is :

A. R

B. 2R

C. $R/2$

D. 3R

Answer: B

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6. If w_1, w_2, w_3 and w_4 for an ideal gas are magnitude of work done in isothermal, adiabatic, isobaric and isochoric reversible expansion processes, the correct order will be :

A. $w_1 > w_2 > w_3 > w_4$

B. $w_3 > w_2 > w_1 > w_4$

C. $w_3 > w_2 > w_4 > w_1$

D. $w_3 > w_1 > w_2 > w_4$

Answer: D

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Level 1 Q 31 To Q 60

1. A gas expands against a variable pressure given by $P = \frac{20}{V}$ (where P in atm and V in L). During expansion from volume of 1 litre to 10 litre, the gas undergoes a change in internal energy of 400 J. How much heat is absorbed by the gas during expansion?

A. 46 J

B. 4660 J

C. 5066 J

D. 4260 J

Answer: C

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2. 2 mole of an ideal gas at $27^{\circ}C$ expands isothermally and reversibly from a volume of 4 litre to 40 litre. The work done (in kJ) by the gas is :

A. $w = -28.72kJ$

B. $w = -11.488kJ$

C. $w = -5.736kJ$

D. $w = -4.988kJ$

Answer: B

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Level 1 Q 91 To Q 120

1. At $25^{\circ}C, \Delta G^{\circ}$ for the process $H_2O(l) \Leftrightarrow H_2O(g)$ is 8.6 kJ. The vapour pressure of water at this temerapture, is nearly :

A. 24 torr

B. 285 torr

C. 32.17 torr

D. 100 torr

Answer: A

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2. The molar entropies of HI(g), H(g) and I(g) at 298 K are 206.5, 114.6, and 180.7 J $mol^{-1}K^{-1}$ respectively. Using the ΔG° given below, calculate the bond energy of HI.

$$HI(g) \rightarrow H(g) + I(g), \quad \Delta G^{\circ} = 271.8kJ$$

A. $282.4kJ\text{mol}^{-1}$

B. $298.3kJ\text{mol}^{-1}$

C. $290.1kJ\text{mol}^{-1}$

D. $315.4kJ\text{mol}^{-1}$

Answer: B

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Level 1 Q 121 To Q 150

1. Gasoline has an enthalpy of combustion 24000 kJ/mol gallon. When gasoline burns in an automobile engine, approximately 30% of the energy released is used to produce mechanical work. The remainder is lost as heat transfer to the engine's cooling system. As a start on estimating how much heat transfer is required, calculate what mass of water could be heated from $25^{\circ}C$ to $75^{\circ}C$ by the combustion of 1.0 gallon of gasoline in an automobile? (Given : $C(H_2O) = 4.18J/g^{\circ}C$)

a) 34.45 kg

b) 80.383 kg

c) 22 kg

d) 224 kg

A. 34.45 kg

B. 80.383 kg

C. 22 kg

D. 224 kg

Answer: B

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Level 2 Q 1 To Q 30

1. Write structure of 2,2-dimethylheptane.

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Level 3 One Or More Answers Are Correct

1. Assume ideal gas behaviour for all the gases considered and neglect vibrational degrees of freedom. Separate equimolar sample. Separate

equimolar samples of Ne, O_2 , CO_2 and SO_2 were subjected to a two process as mentioned. Initially all are at same state of temperature and pressue.

Step I $\rightarrow$ All undergo reversible adiabatic expansion to attain same final volume, which is double the original volume thereby causing the decreases in their temperature.

Step $\rightarrow$ After step I all are given appropriate amount of heat isochorically to restore the original temperature.

Mark the correct option(s) :

A. Due to step I only, the decrease in temperature will be maximum for Ne

B. During step II, heat given will be minimum for SO_2

C. There will be no change in internal energy for any of the gas after both the steps of process are competed

D. The P-V graph of O_2 and CO_2 will be same

Answer: A::C::D

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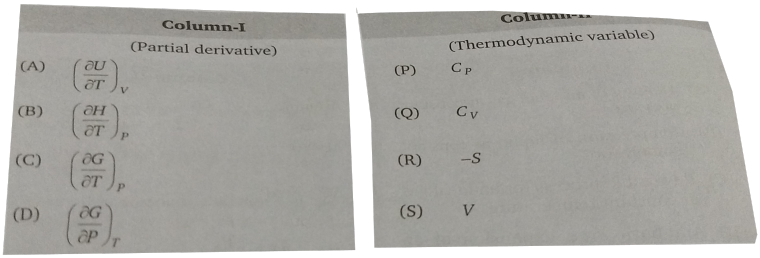
Level 3 Match The Column

1. Match the following columns



Column-I (Partial derivative)		Column-II (Thermodynamic variable)	
(A)	$\left(\frac{\partial U}{\partial T}\right)_V$	(P)	C_P
(B)	$\left(\frac{\partial H}{\partial T}\right)_P$	(Q)	C_V
(C)	$\left(\frac{\partial G}{\partial T}\right)_P$	(R)	$-S$
(D)	$\left(\frac{\partial G}{\partial P}\right)_T$	(S)	V

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2. Write the structural formulae for : 1,3-dimethylcyclohexane

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