CHEMISTRY

BOOKS - IIT-JEE PREVIOUS YEAR (CHEMISTRY)

THERMODYNAMICS AND THERMOCHEMISTRY

Jee Main And Advanced

1. δU is equal to

    A. Isochoric work

    B. isobaric work

    C. adiabatic work

    D. isothermal work

Answer: c

2. one mole of an ideal gas at 300k in themal contact with surroundings exponds isothermally from 1.0 L to 2.0 L against a constant presses of 3.0 atm. In this process. The change in entrogy of surrroundings (ΔS) in J^{-1} is

(1 L atm = 101.3 J)

A. 5.763

B. 1.013

C. -1.013

D. -5.763

Answer: c

3. The standed free energy of fromation of NO(g) is 86.6 kj/ mol at 298 K what is the standed free energy of fromation of $NO^2 g$ at 298 k? $K_p = 1.6 \times 10^{12}$

A. $R(298)In(1.6 \times 10^{12}) - 86600$

B. $866000 + R(298)In(1.6 \times 10^{12})$

C. $866000 + \dfrac{1.6 \times 10^{12}}{R(298)}$

D. $0.5[2 \times 86600 - R(298)In(1.6 \times 10^{12})]$

Answer: d

4. For the process, $H_2O(l) \rightarrow H_2O(g)$

   A. $\Delta S_{system} > 0$ and $\Delta S_{surrounding} > 0$

   B. $\Delta S_{system} > 0$ and $\Delta S_{surrounding} < 0$

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

   D. $\Delta S_{system} < 0$ and $\Delta S_{surrounding} < 0$

Answer: b

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5. For the process

$H_2O(l)(1\text{bar}, 373K) \rightarrow H_2O(g)(1\text{bar}, 373K)$ the correct set of thermodynamic parameters is

   A. $\Delta G = 0, \Delta S = +$

B. $\Delta G = 0, \Delta S = \quad -$

C. $\Delta G = + \quad \Delta S = 0$

D. $\Delta G = \quad - \quad \Delta S = +$

Answer: a

6. The value of $\log_{10} K$ for a reaction $A \Leftrightarrow B$ is (Given:

$\Delta_f H^{\ominus}_{298K} = \quad - 54.07 kJmol^{-1}$,

$\Delta_r S^{\ominus}_{298K} = 10 JK^{=1}mol^{-1}$, and $R = 8.314 JK^{-1}mol^{-1}$

A. 5

B. 10

C. 95

D. 100

Answer: b

7. The direct conversion of A to B is difficult, hence it is carried out as

$$A \rightarrow C \rightarrow D \rightarrow B$$
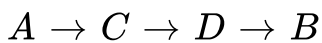
Given,

$$\Delta S_{(A \rightarrow C)} = 50eU, \Delta S_{(C \rightarrow D)} = 30eU, \Delta S_{(B \rightarrow D)} = 20eU,$$

where eU is entropy unit. Thus the change in entropy in $(A \rightarrow B)$ is:

A. $+100eu$

B. $+60eu$

C. $-100eu$

D. $-60eu$

Answer: b

8. A monoatomic ideal gas undergoes a process in which the ratio of P to V at any istant is constant and equal to unity. The molar heat capacity of the gas is

A. $\dfrac{4R}{2}$

B. $\dfrac{3R}{2}$

C. $\dfrac{5R}{2}$

D. 0

Answer: a

9. One mole of monoatomic ideal gas at $T(K)$ is exapanded from $1L$ to $2L$ adiabatically under constant external pressure of 1 atm . The final tempreture of gas in kelvin is

A. T

B. $\dfrac{T}{(2)^{\frac{5}{3}-1}}$

C. $T - \dfrac{2}{3 \times 0.082}$

D. $T + \dfrac{2}{3 \times 0.082}$

Answer: c

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10. Two moles of an ideal gas expanded isothermally and reversibly from $1L$ to $10L$ at $300K$. What is the enthalpy

change?

A. 4.98kJ

B. 11.45 KJ

C. $-11.45kJ$

D. 0 kJ

Answer: d

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11. Spontaneous adsorption of a gas on solid surface is an exothermic process because

A. ΔH increases for system

B. ΔS increases for system

C. Δs decreases for gas

D. ΔG increases for system

Answer: c

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12. One mole of a non-ideal gas undergoes a change of state

$(2.0 atm, 3.0L, 95K) \rightarrow (4.0 atm, 5.0L, 245K)$

With a change in internal energy $\Delta E = 30L$ atm. The change in

enthalpy (ΔH) in the process in L-atm is

A. 40

B. 42

C. 44

D. non defined , becouse pressure is not system

Answer: c

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13. Which of the following statements is flase?

    A. Work is a state function

    B. Temperature is a state function

    C. Change in the state is completely defined when the initial

        and final states are specified

    D. Work appears at the boundary of the system

Answer: a

14. In thermodynamics, a process is called reversible when

A. surroundings and sysytem change of the each other

B. there is no boundary between system and surroundings

C. the surroundings are always in equilibrium with the system

D. the System changes into the boundary surroundings spontaneously

Answer: c

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15. For an endothermic reaction, where ΔH represents the enthalpy of reaction in $kJmol^{-1}$, the minimum value for the energy of activation will be

A. less than (ΔH)

B. zero

C. more than (ΔH)

D. equal to (ΔH)

Answer: c

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16. The difference between the heats of reaction at constant pressure and a constant volume for the reaction $2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$ at $25°C$ in kJ is
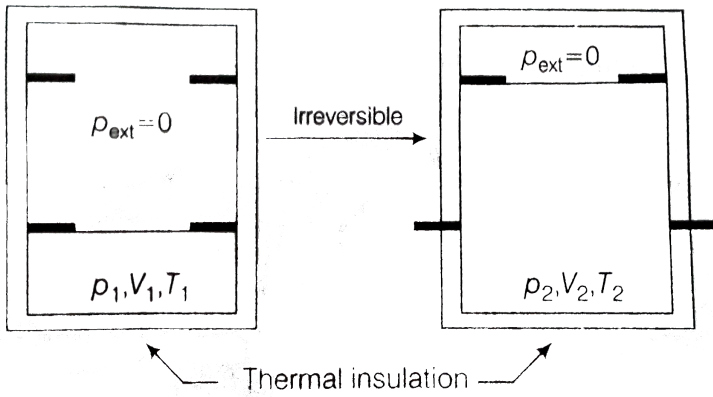
A. -7.43

B. $+3.72$

C. -3.72

D. $+7.43$

Answer: a

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17. An ideal gas in thermally insulated vessel at internal $(pressure) = P_1, (volume) = V_1$ and absolute $temperature = T_1$ expands irreversiby against zero external, pressure , as shown in the diagram,

The final internal pressure, volume and absolute temperature of

the gas are p_2, V_2 and T_2, respectively . For this expansion

A. $q = 0$

B. $T_2 = T_1$

C. $p_2 V_2 = p_1 V_1$

D. $P_2 V_2^{\gamma} = P_1 V_2^{\gamma}$

Answer: a,b,c

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18. Benzene and naphthalene form an ideal solution at room temperature. For this process,the true statement(s) is (are)

A. ΔG is positive

B. ΔG_{system} is positive
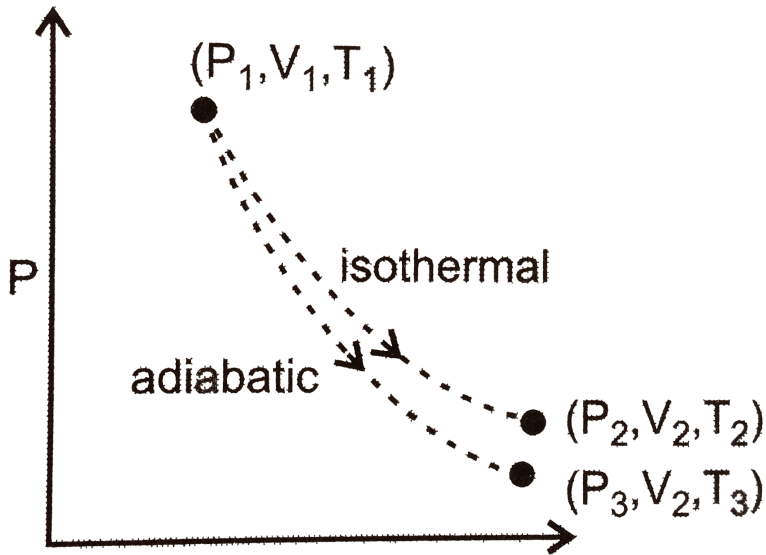
C. $\Delta S_{surroundings} = 0$

D. $\Delta H = 0$

Answer: b,c,d

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19. The reversible expansion of an ideal gas under adiabatic and isothermal conditions is shown in the figure. Which of the

following statement(s) is (are) correct?

A. $T_1 = T_2$

B. $T_3 > T_1$

C. $W_{isothemal} > W_{adiabatic}$

D. $\Delta U_{isothemal} > \Delta U_{adiabatic}$

Answer: a,c,d

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20. For an ideal gas, consider only $P - V$ work in going from an initial state X to the final state Z. The final state Z can be reached by either of the two paths shown in the figure. Which of the following choice(s) is (are) correct? [Take ΔS as change in entropy and w as work done]
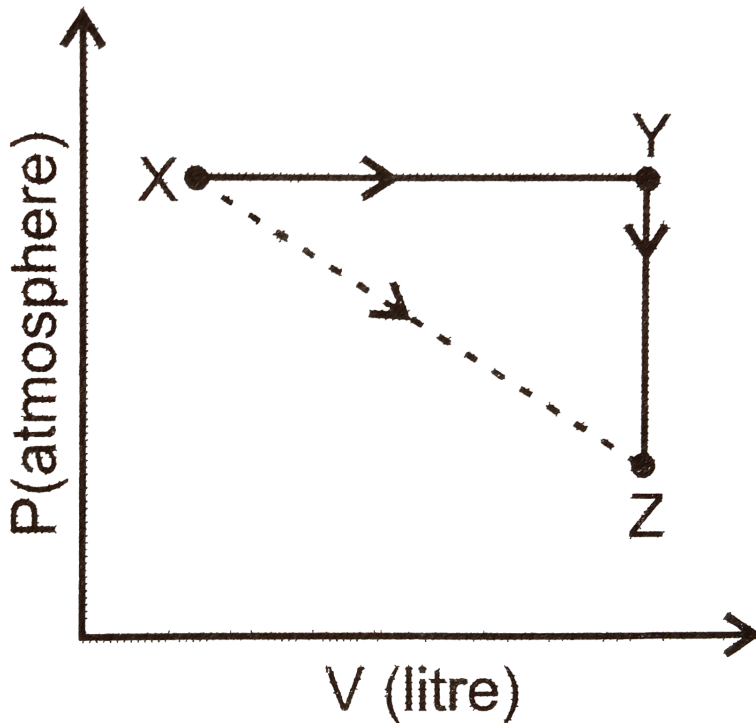
A. $\Delta S_X \rightarrow_Z = \Delta S_X \rightarrow_Y + \Delta S_Y \rightarrow_Z$

B. $W_X \to_z = W_X \to_Y + W_Y \to_Z$

C. $W_X \to_z \to_Z = W_X \to_Y$

D. $\Delta_X \to_Y \to_Z = \Delta S_X \to_Y$

Answer: a,c,d

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21. Among the following, the intensive property is (properties

are) :

A. molar conductivity

B. electromotive force

C. resistance

D. heat capacity

Answer: c,d

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22. Among the following , the state funcation (s) is (are)

A. internal energy

B. irreversible expansion work

C. reversible expansion work

D. molar enthalpy

Answer: a,c,d

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23. Identify the extensive quantities from the following

(i) refractive

(ii) volume

(iii) temperature

(iv) enthalpy

    A. enthalpy

    B. temperature

    C. volume

    D. refracative index

Answer: b,d

24. Assertion (A) : There is a natural asymmetry between converting work to heat and converting heat of work.

Reason (R) : No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work.

- A. statement I is true, Statement II is true, Statement II is the

  correct explanation of Statement I

- B. Statement I is true , statement II is true , Statement II is

  not the correct explanation of Statement I

- C. Statement I is true, Statement II is false

- D. Statement I is false, Statement II is true

Answer: b

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25. Assertion (A): For every chemical reaction at equilibrium, standard Gibbs enegry of the reaction is zero.

Reason (R) : At constant temperature and pressure chemical reactions are spontaneous in the direction of the decreasing Gibbs energy.

- A. statement I is true, Statement II is true, Statement II is the correct explanation of Statement I

- B. Statement I is true , statement II is true , Statement II is not the correct explanation of Statement I

- C. Statement I is true, Statement II is false

- D. Statement I is false, Statement II is true

Answer: d

26. Assertion: The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero.

Reason: The volume occupied by the molecules of an ideal gas is zero.

- A. statement I is true, Statement II is true, Statement II is the correct explanation of Statement I

- B. Statement I is true , statement II is true , Statement II is not the correct explanation of Statement I

- C. Statement I is true, Statement II is false

- D. Statement I is false, Statement II is true

Answer: b

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27. A fixed mass m of a gas is subjected to transfromation of states from K to L to M and back to K as shown in the figure.
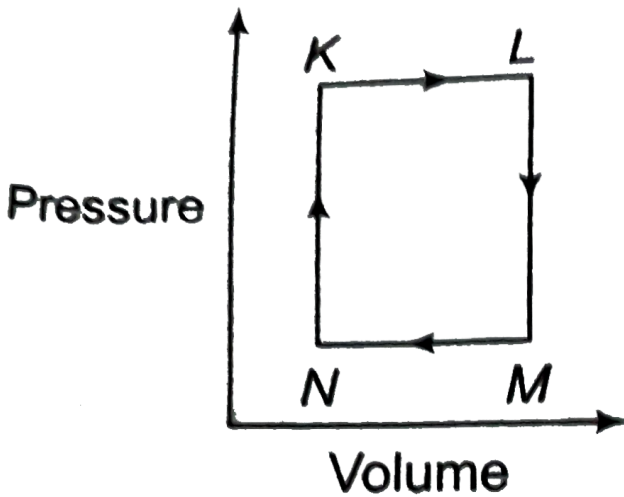
The pair of isochoric processes among the transfromation of states is

A. K to L and L to M

B. L to M and N to K

C. L to M and M to N

D. M to N and N to K

Answer: b

28. A fixed mass m of a gas is subjected to transformation of state: K to L to M and back to K as shown in the figure.

The succeeding operations that enabel this transformation of

state are
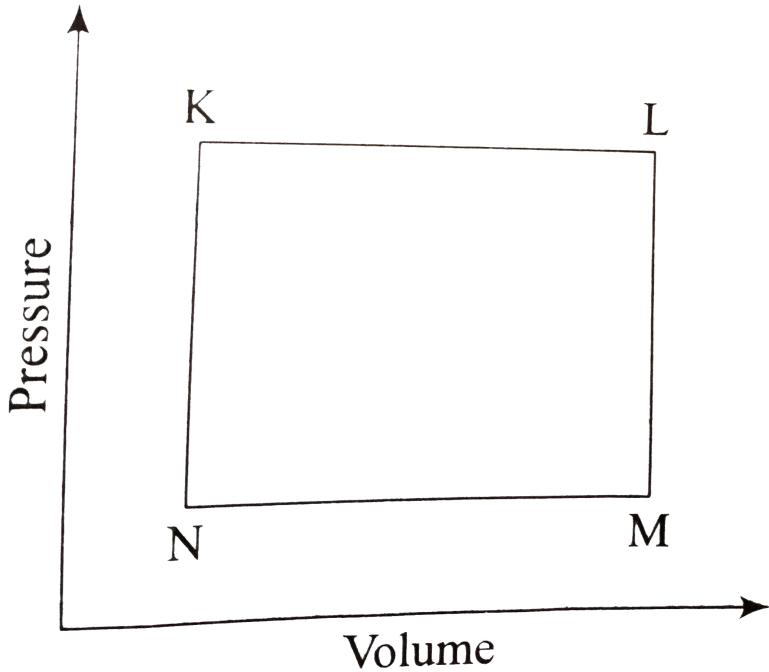
A. heating , cooling , heating , cooling

B. cooling , heating , cooling , heating

C. heating,cooling , cooling, heating

D. cooling , heating , heating , cooling

Answer: c

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29. Match the thermodynamic processes given under column I with the expressions given under column II.

	Column I		Column II
A.	Freezing of water at 273 K and 1 atm	p.	$q = 0$
B.	Expansion of 1 mole of an ideal gas into a vacuum under isolated conditions	q.	$W = 0$
C.	Mixing of equal volumes of two ideal gases at constant temperature and pressure in an isolated container	r.	$\Delta S_{sys} < 0$
D.	Reversible heating of H_2 (g) at 1 atm from 300 K to 600 K, followed by reversible cooling to 300 K at 1 atm	s.	$\Delta U = 0$
		t.	$\Delta G = 0$

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30. Match the transformations In column I with appropriate options in column II.

	Column I		Column II
A.	$CO_2(s) \longrightarrow CO_2(g)$	p.	Phase transition
B.	$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$	q.	Allotropic change
C.	$2H\bullet \longrightarrow H_2(g)$	r.	ΔH is positive
D.	$P_{(white,\ solid)} \rightarrow P_{(red,\ solid)}$	s.	ΔS is positive
		t.	ΔS is negative

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31. Enthalpy is an .... property.

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32. When Fe_S is dissovled in aqueous hydrochloric acid in a closed vessel the work done is _____

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33. The heat content of the products is more than that of the reactants in an................reaction.

34. A system is said to be...........if it can neither exchange matter nor energy with the surrounding's.

35. $C_P - C_V$ for an ideal gas is.............. .

36. The total energy of $1mol$ of an ideal monatomic gas at $27°C$ is........ .

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37. The first law of thermodynamics is not adequate in predicting the direction of a process.($True/False$)

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38. The heat capacity of a diatomic gas is higher than that of a mono-atomic gas. $(True/False)$

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39. For the reaction

$2CO + O_2 \rightarrow 2CO_2, \Delta H = -560kJ,$
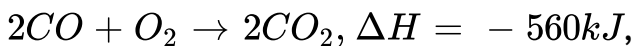
$2mol$ of CO and $1mol$ of O_2 are taken in a container of volume

$1L$. They completely form $2mol$ of CO_2. The gaseous deviate

appreciably from ideal behaviour. If the pressure in the vessel

changes from 70 to $40atm$, find the magnetic (absolute) value

of $\Delta U at 500K$. $(1L - atm = 0.1kJ)$

40. $100mL$ of a liquid is contained in an insulated container at

a pressure of 1bar. The pressure is steeply increased to 100bar.

The volume of the liquid is decreased by $1mL$ at this constant

pressure. Find ΔH and ΔU.

41. Two moles of a perfect gas undergo the following process:

(a) A reversible isobaric expansion from (1.0 atm, 20.0 litre) to (1.0 atm,40.0litre). (b) A reversible isochoric change of state from (1.0 atm, 40.0 litre) to (1.0 atm, 40.0 litre). (b) A reversible isochoric change of state from (1.0 atm, 40.0 litre) to (0.5 atm, 40.0 litre). (c) A reversible isothermal compression from (0.5atm, 40.0 litre) to (1.0 atm, 20.0 litre). (i) Sketch with labels each of the process on the same $P - V$ diagram. (ii) Calculate the total work (W) and the total heat change (q) involved in the above process. (iii) What will be the value of ΔU, ΔH and ΔS for the overall process?

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42. When 1pentyne (A) is treated with $4N$ alcoholic KOH at $175°C$, it is slowly converted into an equilibrium mixture of

1.3 % of 1pentyne (A), 95.2 % 2-pentyne (B) and 3.5 % of 1, 2 -pentandiene (C). The equilibrium was maintained at $175°C$. calculate $\Delta G^{\ominus}$ for the following equilibria:

$B \Leftrightarrow A, \Delta G^{\ominus}_1 = ?$

$B \Leftrightarrow C, \Delta G^{\ominus}_2 = ?$
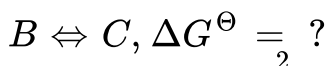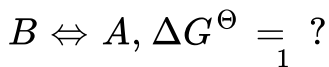
From the calculated value of $\Delta G^{\ominus}_1$ and $\Delta G^{\ominus}_2$, indicate the order of stability of A, B and C.

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43. Show that the reaction

$$CO(g) + (1/2)O_2(g) \rightarrow CO_2(g)$$
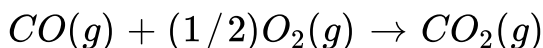
at $300K$ is spontaneous and exothermic, when the standard entropy change is $-0.094kJmol^{-1}K^{-1}$. The standard Gibbs free energies of formation for CO_2 and CO are -394.4 and $-137.2kJmol^{-1}$, respectively.

44. A sample of argon gas at $1 atm$ pressure and $27°C$ expands reversibly and adiabatically from $1.25 dm^3$ to $2.50 dm^3$. Calculate the enthalpy change in this process. C_{vm} for orgon is $12.48 JK^{-1} mol^{-1}$.

45. A gas mixture of $3.67L$ of ethylene and methane on complete combustion at $25°C$ produces $6.11L$ of CO_2. Find out the heat evolved on buring $1L$ of the gas mixture. The heats of combustion of ethylene and methane are -1423 and $-891 kJmol^{-1}$, respectively, at $25°C$.

46. An athelete is given $100g$ of glucose $(C_6H_{12}O_6)$ of energy equivalent to $1560kJ$. He utilises 50% of this gained enegry in the event. In order to avoid storage of enegry in the body, calculate the weight of water he would need to perspire. The enthalpy of evaporation of water is $441kJ/mol$.

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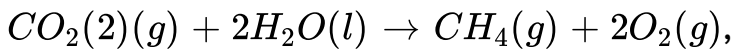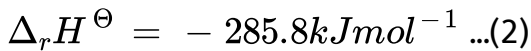**47.** The following statement is true only under some specific conditions. Write the conditions for the following statement in not more than two sentences.

The heat energy q absorbed by a gas is ΔH.

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48. With the help of thermochemical equations given below, determine $\Delta_r H^{\ominus}$ at $298K$ for the following reaction:

$C(\text{graphite}) + 2H_2(g) \rightarrow CH_4(g), \Delta_r H^{\ominus} = ?$

$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g), \Delta_r H^{\ominus} = -393.5 kJmol^{-1}$

...(1)

$H_2(g) + 1/2O_2(g) \rightarrow H_2O(l),$

$\Delta_r H^{\ominus} = -285.8 kJmol^{-1}$ ...(2)

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

$\Delta_r H^{\ominus} = +890.3 kJmol^{-1}$ ...(3)
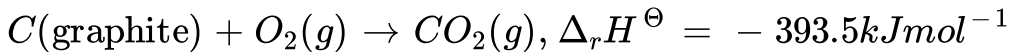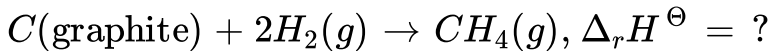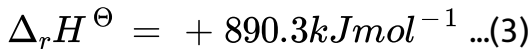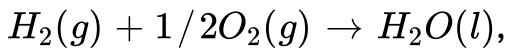
   A. $+78.8 kJmol^{-1}$

   B. $+144.0 kJmol^{-1}$

   C. $-74.8 kJmol^{-1}$

   D. $-144.0 kJmol^{-1}$

Answer: c

49. The enthalpies of combustion of carbon and carbon monoxide are -393.5 and $-282.5 KJmol^{-1}$ respectivaly. The enthalpy of formation of carbon monoxide per mole is:

A. 676.5

B. -676.5

C. -110.5

D. 110.5

Answer: c

50. For the complete combustion of ethanol, $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ the amount of heat produced as measured in bomb calorimeter is $1364.47KJmol^{-1}$ at $25°C$. Assuming ideality, the enthalpy of combustion, ΔH_C, for the reaction will be $\left[R = 8.314JK^{-1}mol^{-1}\right]$

A. $-1366.95KJmol^{-1}$

B. $-1361.95KJmol^{-1}$

C. $-1350.50KJmol^{-1}$

D. $-1350.50kJmol^{-1}$

Answer: a

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51. The standard enthalpies fo formation of $CO_2(g)$, $H_2O(1)$, and glucose (s) at $25°C$ are $-400kJmol^{-1}$, $-300kJmol^{-}$, and $-1300kJmol^{-1}$, respectively. The standard enthalply of combustion per gram of glucose at $25°C$ is

A. $+2900kJ$

B. $-2900Kj$

C. $-16.11Kj$

D. $+16.11Kj$

Answer: c

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52. Using the data provided, calculate the multiple bond energy $(kJmol^{-1})$ of a $C \equiv C$ bond in C_2H_2. That energy is (take

the bond energy of a $C - H$ bond as $350 kJmol^{-1}$).

$$2C_{(s)} + H_{2(g)} \rightarrow C_2H_{2(g)}, \Delta = 225 kJmol^{-1}$$

$$2C_{(s)} \rightarrow 2C_g), \Delta H = 1410 kJmol^{-1}$$

$$H_{2(g)} \rightarrow 2H_{(g)}, \Delta H = 330 kJmol^{-1}$$
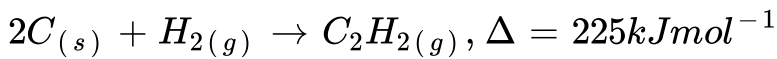
A. 1165

B. 837

C. 865

D. 815

Answer: d

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53. The species which by definition has zero standard molar enthalpy of formation at $298K$ is

A. $Br_2(g)$

B. $Cl_2(g)$

C. $H_2O(g)$

D. $CH_4(g)$
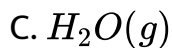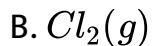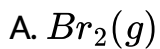
Answer: b

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54. The bond energy (in kcal mol^{-1}) of a $C - c$ single bond is approximately

A. 1

B. 10

C. 100

D. 1000

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55. $\Delta_{vap}H = 30kJmol^{-1}$ and $\Delta_{vap}S = 75Jmol^{-1}K^{-1}$. Find the temperature of vapour, at 1 atm.
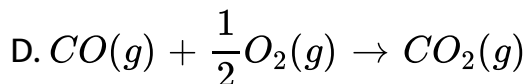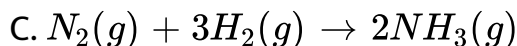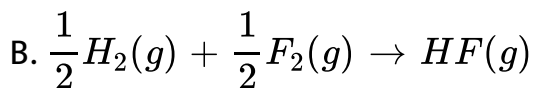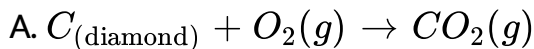
A. 400K

B. 350K

C. 298K

D. 250K

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56. Which of the reaction defines $\Delta_f H^\circ$?

A. $C_{(\text{diamond})} + O_2(g) \rightarrow CO_2(g)$

B. $\dfrac{1}{2} H_2(g) + \dfrac{1}{2} F_2(g) \rightarrow HF(g)$

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

D. $CO(g) + \dfrac{1}{2} O_2(g) \rightarrow CO_2(g)$

Answer: b

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57. ΔH_1° for $CO_2(g), CO(g)$ and $H_2O(g)$ are $-393.5, \ -110.5$ and $-241.8 kJmol^{-1}$ respectively. Standard enthalpy change for the reaction

$CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$ is
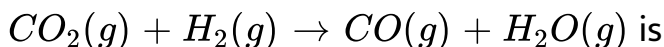
A. 524.1

B. `+41.2

C. $- 262.5$

D. $- 41.2$

Answer: b

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58. The following is (are) endothermic reaction (s)

A. Combustion of methane

B. Decompostion of water

C. Dehydrogenation of ethane to ethylene

D. Conversion of graphite to diamond

Answer: b,c,d

59. In a constant volume calorimeter, $3.5g$ of a gas with molecular weight 28 was burnt in excess oxygen at $298.0K$. The temperature of the calorimeter was found to increase from $298.0K \rightarrow 298.45K$ due to the combustion process. Given that the heat capacity of the calorimeter is $2.5kJK^{-1}$, find the numerical value for the enthalpy of combustion of the gas in $kJmol^{-1}$

60. The standard heat of formation values of $SF_6(g)$, $S(g)$, and $F(g)$ are $-1100, 275$, and $80kJmol^{-1}$, respectively. Then the

average $S - F$ bond enegry in SF_6

61. From the following data, calculate the enthalpy change for the combustion of cyclopropane at $298K$. The enthalpy of formation of $CO_{2(g)}, H_2O_{(l)}$ and $Propene_{(g)}$ are $-393, -285.8$ and $20.42 kJmol^{-1}$ respectively. The enthalpy of isomerisation of cyclopropane to propene is $-33.0 kJmol^{-1}$

62. Compute the heat of formation of liquie methyl alcohol is kilojoule per mol using the following data. Heat of vaporisation of liquid methyl alcohol $= 38 kJ/mol$. Heat of formation of gaseous atoms from the elements in their standard states

$: H = 218kJ/mol, C = 715kJ/mol, O = 249kJ/mol.$

Average bond energies :

$C - H 415kJ/mol, C - O 356kJ/mol, O - H 463kJ/mol.$

63. The standard molar enthalpies of formation of cyclohexane (l) and benzene (l) at $25°C$ are -156 and $+49kJmol^{-1}$, respectively. The standard enthaly of hydrogenation of cyclohenxene (l) at $25°C$ is $-119kJmol^{-1}$ Use this data to estimate the magnitude of the resonance enegry of benzene.

64. The polymerisation of ethylene to linear polyethylene is represented by the reaction

$$nCH_2 = CH_2 \rightarrow (- CH_2 - CH_2 -)_n$$
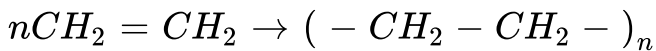
When n has a large integral value. Given theat the average enthalpies of bond dissociation for $C = C$ and $C - C$ at $298K$ are $+590$ and $+331 kJmol^{-1}$ respectively, calculate the enthalpy of polymerisation per mole of ethylene at $298K$.

65. In order to get maximum calorific output a burner should have an optimum fuel to oxygen ratio which corresponds to three times as much oxygen as is required theorectically for complete combusion of the fuel A burner which has been adjused for methane as fuel (with xLh^{-1} of CH_4 and $6xLh^{-1} ofCO_2$) is to be readjusted for butane C_4H_{10} in order to get the same calorific output what should be the rate of supply to butane and oxygen? Assume that losses due to incomplete combustion etc are the same for both fuels and

that the gases behave ideally Heats of combusion

$$CH_4 = 809 kJmol^{-1}, C_4H_{10} = 2878 kJmol^{-1}.$$

66. Determine enthalpy change for,

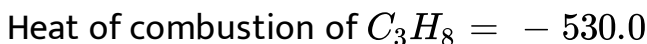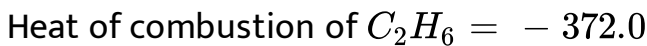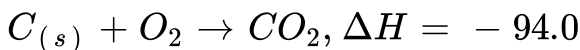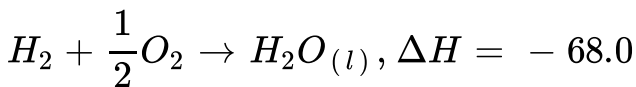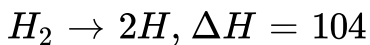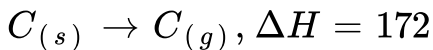$$C_3H_{8(g)} + H_{2(g)} \rightarrow C_2H_{6(g)} + CH_{4(g)}$$
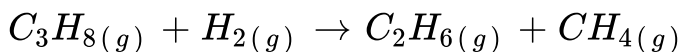
at $25°C$ using heat of combustion values under standard condition.

$Compounds$	$H_{2(g)}$	$CH_{4(g)}$	$C_2H_{6(g)}$	$C_{(Graphite)}$
$\Delta H° in kJ/mol$	-285.8	-890.0	-1560.0	-393.5

The standard heat of formation of $C_3H_{8(g)}$ is $-103.8 kJmol^{-1}$

.

67. Using the data (all vaues in $kcalmol^{-1}at25°C$) given below, calculate bond energy of $C - C$ and $C - H$ bonds.

$C_{(s)} \rightarrow C_{(g)}, \Delta H = 172$

$H_2 \rightarrow 2H, \Delta H = 104$

$H_2 + \dfrac{1}{2}O_2 \rightarrow H_2O_{(l)}, \Delta H = -68.0$

$C_{(s)} + O_2 \rightarrow CO_2, \Delta H = -94.0$

Heat of combustion of $C_2H_6 = -372.0$

Heat of combustion of $C_3H_8 = -530.0$

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68. The enthalpy of combustion of H_2 , cyclohexene (C_6H_{10}) and cyclohexane (C_6H_{12}) are -241 , -3800 and $-3920KJ$ per mol respectively. Heat of hydrogenation of cyclohexene is

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69. An intimate mixture of ferric oxide and aluminium is used as solid fuel in rockets. Calculate the fuel value per cm^3 of the mixture.

Heats of formation and densities are as follows:

$H_{f(Al_2O_3)}^{\ominus} = -399 kcal mol^{-1}, H_{f(Fe_2O_3)}^{\ominus} = -199 kcal mol^{-1}$

Density of $Fe_2O_3 = 4.0 gcm^{-3}$, Density of $Al = 2.0 gcm^{-3}$

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70. The standard molar heats of formation of ethane, carbon dioxide, and liquid water are -21.1, -94.1, and $-68.3 kcal$, respectively. Calculate the standard molar heat of combustion of ethane.

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71. The bond dissociation energy of gaseous H_2, Cl_2 and HCl are $104, 58$ and $103 kcal mol^{-1}$ respecitvely. Calculate the enthalpy of formation for HCl gas.

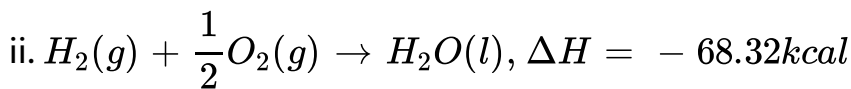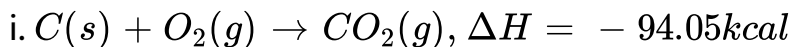▶ **Watch Video Solution**

72. Given the following standard heats of reactions:

(a) heat of formation of water $= -68.3 kcal$, (b) heat of combustion of $C_2 H_2 = -310.6 kcal$, (c) heat of combustion of ethylene $= -337.2 kcal$. Calculate the heat of reaction for the hydrogenation of acetylene at constant volume and at $25°C$.
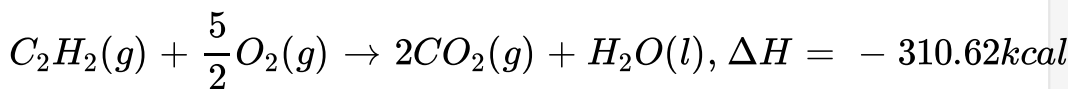
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73. Given that:

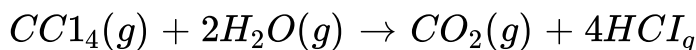i. $C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = -94.05 kcal$

ii. $H_2(g) + \dfrac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -68.32 kcal$

iii.

$$C_2H_2(g) + \dfrac{5}{2}O_2(g) \rightarrow 2CO_2(g) + H_2O(l), \Delta H = -310.62 kcal$$

The heat of formation fo acetylene is
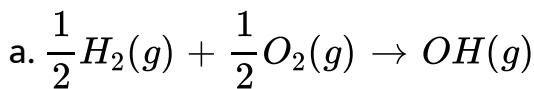
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74. The standared enthalpies of formation at $298K$ for $CC1(g), H_2O(g), CO_2(g)$ and $HC1(g)$ are $-106.7, -241.8, -393.7,$ and $-92.5 kJmol^{-1}$, respectively.

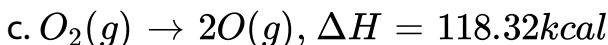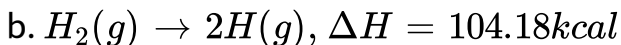Calculate $\Delta H^{\ominus}_{298K}$ for the reaction

$$CC1_4(g) + 2H_2O(g) \rightarrow CO_2(g) + 4HCI_g$$

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75. The enthalpies for the following reactions $\left(\Delta H^{\ominus}\right)$ at $25°C$ are given below.

a. $\dfrac{1}{2}H_2(g) + \dfrac{1}{2}O_2(g) \rightarrow OH(g)$

$\Delta H = 10.06kcal$

b. $H_2(g) \rightarrow 2H(g)$, $\Delta H = 104.18kcal$
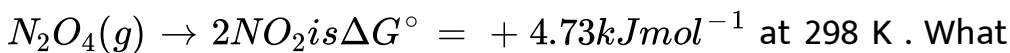
c. $O_2(g) \rightarrow 2O(g)$, $\Delta H = 118.32kcal$

Calculate the $O - H$ bond energy in the hydroxyl radical.

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76. the standed reaction free energy for

$N_2O_4(g) \rightarrow 2NO_2 is \Delta G° = +4.73kJmol^{-1}$ at 298 K . What is value of ΔG and what is the spontaneous direction of the reaction when the partical pressure fo the gases are

$P_{N_2O_4} = 0.80atm$ and $P_{NO_2} = 2.10atm$?

A. `+ 6.83 kJ mol^(-1), ("towards reactant")

B. `-8.96 kJ mol^(-1), ("towards product")

C. `+8.96 kJ mol^(-1), ("towards product")

D. `+8.96 kJ mol^(-1), ("towards reactant")

Answer:

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77. we consider a grwing plant. Limting our system to plant itself, to be an exmple of decreasing entropy, small molecules, like carbon dioxide, CO_2 and water H_2O are built into complex but orderly arroangements of macromolecules, which one of the follwing statement applies?

A. The second law of thermodynamics, that the entropy of the unicerse is increasing, is being violated

B. Plant growth is so complex that the laws of thermodynamics cannot be applied successfully

C. The second law thermodynamics is not being violated because the entropy of the plant's surroundings is increasing

D. The second law of themodynamics is not being violated because the entropy of the plant's surrounding is dereasing

Answer:

78. One mole of a monationc ideal gas intially at a pressure of 2.00 bar and a temperature of 300 K is taken to a final pressure of 4.00 bar by a reversible path defined by $P/V = cons \tan t.\, Tak \in gC_v$ to be equal to $12.5 Jmol^{-1}K^{-1}$ The correct dedution for this process is (are)

A. final T =1092 K
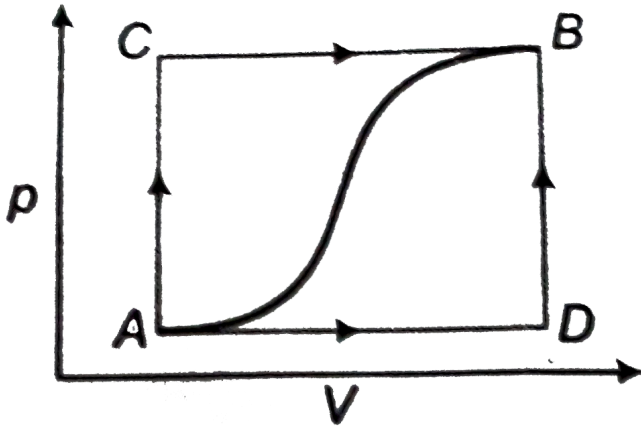
B. E= 10.2 kJ

C. W = -3.4 kJ

D. Q = 6.8 kJ

Answer:

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79. How much heat flows into the system along path ADB it the work done by the system is 10 J?

When a system is taken from state A to state B along the parth ACB in the figure below ,80 j of heat flows into the system and the system does 30 J of work.

A. 40 J

B. 60 J

C. 80 J

D. Insufficient infromation

Answer:

80. When the system is retuned form state B to A along the curved path, the work doen on the system is 20 J Does the system absorb ro liberate heat, and how much?

When a system is taken from state A to state B along the parth ACB in the figure below ,80 j of heat flows into the system and the system does 30 J of work.
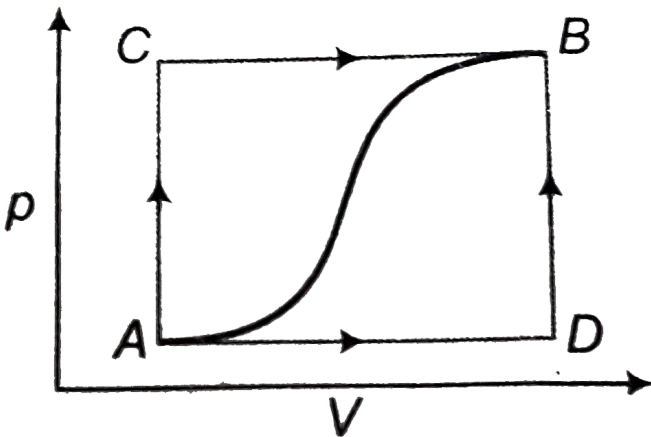
A. $-70J,$ heat is liberated

B. `-60J , heat is liberated

C. 70 j , heat is absorbed

D. 60 J , heat is absorbed

Answer:

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81. Assertion All reversible reaction proceeds in direction of lower Gibbs' energy.

Reson Reversible reaction proceeds spontaneously towards a state of equilibrium where the Gibbs' energy is minimum

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82. Assertion Isothemal expansion of ideal gas againt vacuum must be simultaneously adiabatic.

reason The work done by system in the above process is zero.

83. Match the statements of column I with values of column II.

	Column I		Column II
A.	An extensive properties	p.	Work done in a reversible process.
B.	An intensive properties	q.	$\Delta H°$
C.	A state function	r.	$\Delta S°$
D.	This can be known if two other parameters from column II are known at a given temperature.	s.	K_{eqm}

Others

1. The standard state Gibba free energies of formations of C("graphite") and ("diamond") at T =298k are

$$\Delta fG^\circ \left[C(\text{graphite}) = \quad O \ kJmol^{-1}\right.$$

$$\Delta fG^\circ \left[C(\text{graphite}) = \quad O \ kJmol6^{-1}\right.$$

The standed state means that the presses should be 1 bar, and substance of graphite [C(graphite)] to diamond [C(diamond)] reduces its volume by $2 \times 10^{10} m^{-1}$ If C(graphite) is converted to C(diamond) isothemally at T= 298k the pressure at which C(graphite) is in equilibrium with C(diamond) ,is

[useful infromation : $1J - Kgm^2 s^{-2}$

$1pa = 1kgm^{-1}s^{-2}:1^- = 10^5 pa\big]$

   A. 58001 bar

   B. 1450 bar

   C. 14501 bar

   D. 29001

Answer: c

2. A piston filled with 0.04 mole of an ideals gas expands revesrsiby from 50.0 mL to 375 ml at a canstant heat. The values of q and w for the process will be

(R= 8.314 J/ mol. K in 7.5 = 2.01)

A. $q = +208j, W = -208$

B. $q = -208j, W = -208$

C. $q = -208j, W = +208$

D. $q = +208j, W = +208J$

Answer: a

3. An ideal gas is expanded form $(P_1V_1T_1)$ to $(p_2, V_2T_2$ used different conditions. The correct statement (s) among the following is (are)

A. The work done by the gas is less when it is expanded revesibly from $V_1, (\rightarrow)V_2$ under abiabitc conditions as compared to that when expanded reversibly form $v_1(\rightarrow)V_2$ under isothemal conditions.

B. The change in internal energy of the gas is (i) zero , if it is expanded reversibly with $T_1 = T_2$ and (ii) positive if it is expaned reversiby under abiabatic conditions with $T_1 \neq T_2$

C. If the expansion is carried out freely, it is simultaneously both isothermal as well as adiabatic

D. The work done on the gas is maximum when it is compressed irrversibly from $(p_2 V_2)$ to (P_1, V_1) against constant pressen P_1

Answer: a,c,d

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4. For a reaction taking place in a container in equilibrium with its surroundings the effect of temperature on its equilibrium constant K in terms of change in entrogy is described by

A. with increase in temperature, the value of K for endothermic reaction increases beacouse unfavourable

change in entrogy of the surroundings decreases

B. With increase in temperature , the value of K for exothermic reactions decreause becacuse favourable change in entropy of the surrounding decreases

C. With increase in temperature, the value of K endothermic rection increases becouse the entrogy change of the system is negative

D. With increase in temperature, the value of K for endothemic reaction increses because the entrogy change of the system is positive

Answer: a,b

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5. One mole of an ideal gas is taken from a to b along two parths dented by the solid and the dashed lines as shown in the graph below. If the work done along the solid line path is W_s and that along the dotted line path is W_d then the interger closet to the ratio W_d/W_s is
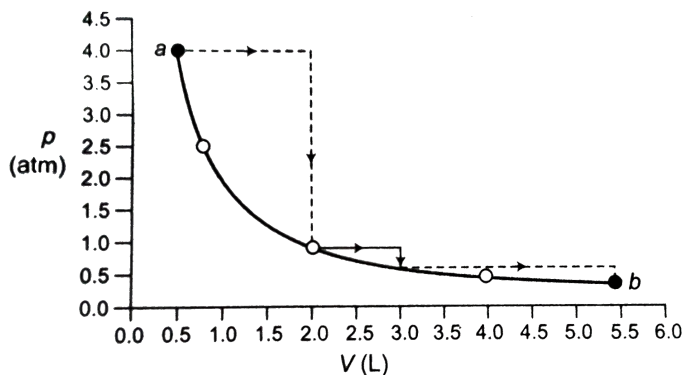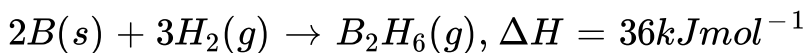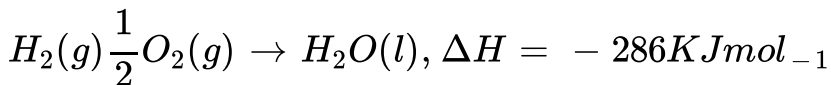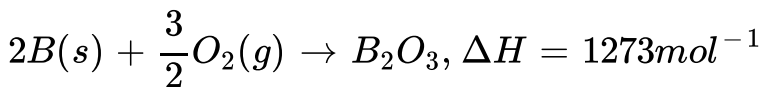
6. C_v value of He is always $3\dfrac{R}{2} but C_v value of H_2 is 3\dfrac{R}{2}$ at low temperature and $5\dfrac{R}{2}$ at moderate temperature and more than $5\dfrac{R}{2}$ at higher temperature. Explain in two or three lines.

7. Diborane is a potenial rocket fuel which undergoes combustion according to the diborane.

$$2B(s) + \frac{3}{2}O_2(g) \rightarrow B_2O_3, \Delta H = 1273mol^{-1}$$

$$H_2(g)\frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -286KJmol_{-1}$$

$$2B(s) + 3H_2(g) \rightarrow B_2H_6(g), \Delta H = 36kJmol^{-1}$$