CHEMISTRY

BOOKS - OMEGA PUBLICATION

THERMODYNAMICS

Questions

1. Define the follwing terms :

(i) System

(ii) Surroundings

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2. Name and explain the different types of the system.

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3. Explain the term state function.

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4. What is meant by the internal energy ?

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5. What is an adiabatic process ?

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6. Define the followings :

Reversible process

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7. Define the followings :

Irreversible process.

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8. What are the units of heat ?

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9. What are the sign conventions, for heat and work ?

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10. A system 500 j or heat and does work of 50 j on its sourroundings. Calculate the change in internal energy.

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11. Give the different statements of first law of thermodynamics.

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12. Give the mathematical form of the first law of thermodynamics.

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13. State and explain zeroth law of thermodynamics.

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14. In a process , 701 j of heat is absorbed by a system and 394 j of work is done by the system. What is the change in internal energy for the proces ?

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15. How many kinds of plants are there?

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16. Calculate the work done in isothermal reversible change.

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17. Name any two plants that belong to herbs?

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18. Derive the relationship between ΔH and ΔU.

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19. Prove that $\Delta H = \Delta U + \Delta$ ngRT.

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20. For the reactions : $C(s) + O_2(g) \rightarrow CO_2(g)$

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21. The enthaply change (ΔH) for reaction, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ is 92.38 kj at 298 K. What is ΔU at 298 K ?

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22. Name any two plants that are known as shrubs?

23. What are exothermic and endothermic reactions ?

24. What are exothermic reactions ? Give an example.

25. What are endothermic reactions ? Give an example.

26. What is the origin of enphlpy change in chemical reaction ?

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27. Why enthalpy change is negative for exothermic reaction, while it is positive for endothermic reaction ?

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28. What are extensive properties ? Give examples.

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29. What are intensive properties ? Give examples.

30. Derive the relationship between C_p and C_v.

31. Calculate the number of kJ of heat neccesary to raise the temperature of 60.0g of aluminum from $35°C$ to $55°C$. Molar heat capacity of Al is 24 J $mol^{-1}k^{-1}$.

32. What is heat capacity at constant volume and at constant pressure ?

33. What is the reaction centre?

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34. Define the term standard enthalpy of formation $\left(\Delta_f H^{\ominus}\right)$. Also give an exaple.

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35. Define standard enthalpy of fusion or molar enthaply of fusion $\left(\Delta_{fus} H^{\ominus}\right)$.

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36. Define the term standard enthalpy of vaporization $\left(\Delta_{vap}H^{\ominus}\right)$.

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37. Define the term standard enthalpy of vaporization $\left(\Delta_{vap}H^{\ominus}\right)$.

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38. Define the term standard enthalpy of formation $\left(\Delta_f H^{\ominus}\right)$. Also give an exaple.

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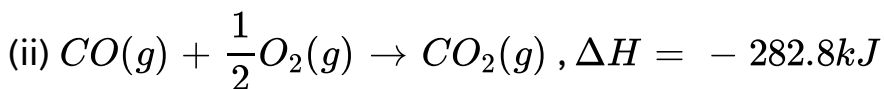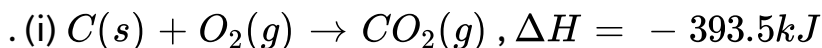**39.** What is thermochemical equation ? Illustrate with an example.

40. Heat change for a reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ is - 92.2 kj/mol. Calculate the heat of formation of one mole of a ammonia.

41. Calculate the heat of formation of carbon monoxide from the following data.

. (i) $C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = -393.5 kJ$

(ii) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g), \Delta H = -282.8 kJ$

42. What are stamens?

43. Calculate the enthaply of formation of benzene. The enthaply of combustion of benzene is - 3266.0 kj. The enthaples of formation of CO_2 and H_2O are -393.1 and -286.0 kj respectively.

**44.** Calculate the enthalpy change in the reaction, $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$ at 298 K,given that the

enthalpy of formation at 298 K for NH_3 and H_2O are -46.0 and $-286.0 KJmol^{-1}$ respectively.

45. Does the stem prepare food for any plant?

46. Enthaples of formation of $CO(g)$, $CO_2(g)$, $N_2O(g)$ and $N_2O_4(g)$ are - 110, - 393, 81 and $9.7 kjmol^{-1}$ respectively. Find the value of ΔH for the reaction:

$$N_2O_4(g) + 3CO(g) \rightarrow N_2O(g) + 3CO_2(g)$$
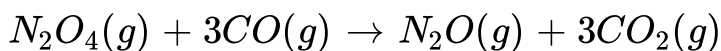
47. The enthalpy of formation of methane (CH_4) at cosntant pressure and 300 k is - 78.84 kj. What will be enthalpy of formation at constant volume ?

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48. State and explain Hess's law.

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49. State and explain Hess's law.

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50. Calculate the enthalpy of hydration of $BaCl_2$ to $BaCl_2.2H_2O(s)$ given that the enthalpy of solution of $BaCl_2(s)$ is $-20.6kJmol^{-1}$ and that of $BaCl_2.2H_2O(s)$ is $+8.8KJmol^{-1}$.

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51. Define heat of combustion.

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52. Define the term enthalpy of combustion. What is its signification ?

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53. Explain Enthalpy of combustion.

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54. Define the term- Petiole?

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55. What is calorific value of a fuel?

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56. What is enthalpy of atomization ? Give an example.

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57. What is meant by bond dissociation enthaply ?

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58. What is meant by the term bond enthalpy ?

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59. Define ionization enthalpy with an example.

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60. 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.

61. Calculate the enthaply change in the reaction, $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O$ (i)The enthalpy change of formation of $CH_4(g), CO_2(g)$ and H_2O (i) are - 74.8 kj mol^{-1}, $- 393.5 KJmol^{-1}$ and $- 286 KJmol^{-1}$ respectively.
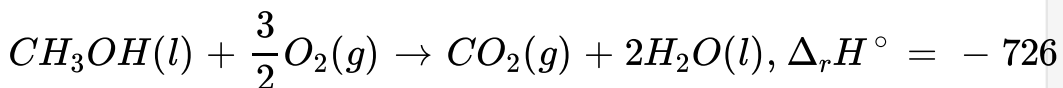
62. Enthalpy of combustion of carbon to CO_2 is - 393.5 kj mol^{-1}. Calculate the heat released upon formation of 35.2 g of CO_2 from carbon and dioxygen gas.
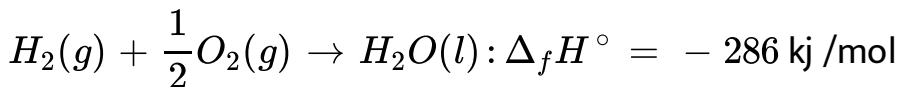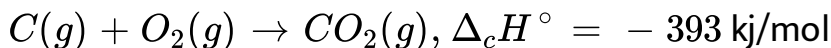
63. Calculate the standard enthaply of formation of $CH_3OH(l)$ from the following data

$$CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l), \Delta_rH° = -726$$ kj/mol

$$C(g) + O_2(g) \rightarrow CO_2(g), \Delta_cH° = -393 \text{ kj/mol}$$

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l) : \Delta_fH° = -286 \text{ kj /mol}$$

64. What is lamina?

65. Calculate the enthalpy of transition when C (diamond) changes to C (graphite) given that enthalpies of combustion of C (diamond) and C (graphite) are - 393.5 and -395.4 $KJmol^{-1}$ respectively.

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66. The enthalpy change for the transiton of liquid water to steam is 40.8 kj mol^{-1} at 373 K. Calculate the entropy change for the process.

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67. Define enthalpy of solution.

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68. Define the term enthaply of neutralization.

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69. What is the value of enthalpty of neutralization of strong

acid and strong base ?

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70. Why is enthalpy of neutralization of strong acids and

strong bases always - 57.1 kj ?

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71. Enthalpy of neutralization of acetic acid and sodium hydroxide is less than - 57.1 kj. Explain why ?

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72. Define lattice enthalpy of an ionic solid. Also give an example.
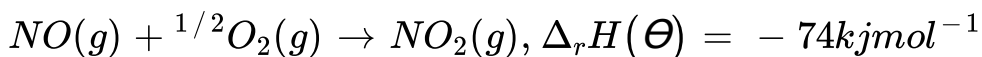
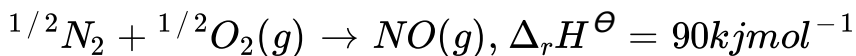▶ **Watch Video Solution**

73. What are the coordination number of Na^+ and Cl^- ions in NaCl?

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74. What is a spontanceous reaction ? Explain with an example.

75. Comment on the thermodynamic stability of NO(g), given

$$^{1/2}N_2 + {}^{1/2}O_2(g) \rightarrow NO(g), \Delta_r H^{\ominus} = 90 kjmol^{-1}$$

$$NO(g) + {}^{1/2}O_2(g) \rightarrow NO_2(g), \Delta_r H(\ominus) = -74 kjmol^{-1}$$

76. State the second law of thermodynamics ?

77. What is entropy of the system ?

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78. For an isolated system $\Delta U = 0$, what will be ΔS ?

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79. For the reactions

$2Cl(g) \rightarrow Cl_2(g)$, what are the signs of ΔH and ΔS ?

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80. Define absolute entropy ?

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81. State third law of themodynamics ?

82. Explain the process by which plant loses excess of water?

83. The equilibrium constant for a reaction is 10. What will be the value of ΔG° ?

R = 8.314 $jK^{-1}mol^{-1}$, $T = 300K$.

84. For the reactions at 298 K,

$2A + B \rightarrow C, \Delta H = 400 kjmol^{-1}$ and $\Delta S = 0.2 kjK^{-1}mol^{-1}$

. At what temperature will the reaction become spontaneous

considering ΔH and ΔS to be constant over the

temperature range ?

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85. Give the state of reaction when $\Delta G = 0$.

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86. Give the state of reaction when $\Delta G < 0$

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87. What are tap roots and give example?

88. Match the Column I with Column II

89. Calculate the entropy change in surroundings when 1.00 mol of H_2O_l is formed under standard conditons $\Delta_f H^\circ = -286K$.

90. Determine the value of ΔH and ΔU for the reversible isothermal evaporation of 90.0 g of water at $100°C$. Assume that water behaves a an ideal gas and beat of evaporation of wager is 540 cal/g $(R = 2.0 calmol^{-1}K^{-1})$

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Multiple Choice Questions Mcq

1. The intensive property among these quantities is

A. mass

B. volume

C. enthalpy

D. mass/volume

Answer: D

2. Identify the extensive property among the followings

A. Temperature

B. Pressure

C. Viscosity

D. Enthalpy

Answer: D

3. An adiabatic expansion of an ideal gas always has

4. During isothermal expansion of an ideal gas, its

    A. internal energy increases

    B. ehthalpy decreases

    C. internal energy remians unaffected

    D. enthalpy reduces to zero.

Answer: C

5. Enthalpy of a reaction ΔH is expressed as

A. $\Delta H = \sum H_p - \sum H_R$

B. $\Delta H = dH_p + dH_R$

C. $\Delta H = \dfrac{dH_p}{dH_R}$

D. $\Delta H = \dfrac{dH_R}{dH_p}$

Answer: A

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6. The heat required to raise the temperature of a body by 1C

degree is called

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7. According to the second law of thermodynamics , a process (reaction is) spontaneous, if during the process

A. $\Delta S_{universe} > 0$

B. $\Delta S_{universe} = 0$

C.

D. $\Delta S_{universe} = \Delta S_{system}$

Answer: A

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8. Considering entropy (S) as a thermodynamic parameter the criterion for the spontaneity of any process is

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

B. $\Delta S_{\text{system}} - \Delta S_{\text{surroundings}} > 0$

C. $\Delta S_{\text{system}} > 0$

D. $\Delta S_{\text{surroundings}} > 0$ only.

Answer: A

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9. $\Delta G = \Delta H - T\Delta S$ was given by

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10. What is pistil?

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11. The occurrence of reaction is impossible if

    A. ΔH is + ve , ΔS is also + ve

    B. Δ H is - ve , ΔS is also - ve

    C. Δ H is - ve , Δ S is + ve

    D. ΔH is + ve , ΔS is - ve.

Answer: D

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12. One calorie is equivalent to

    A. 4.184 joule

    B. 10^7 years

C. 4.2×10^7 ergs

D. 13.6 eV

Answer: C

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13. For an adiabatic proces which of the following relations is correct ?

A. $\Delta E = q$

B. q = 0

C. q = + W

D. $P\Delta V = 0$

Answer: B

14. For the reactions : $C(s) + O_2(g) \rightarrow CO_2(g)$

    A. $\Delta H < \Delta E$
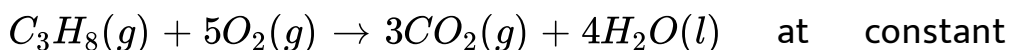
    B. $\Delta H > \Delta E$

    C. $\Delta H = \Delta E$

    D. $q = P\Delta V$

Answer: C

15. For the reaction :

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ at   constant

temperature $\Delta H - \Delta U$

A. $+ RT$

B. $- 3RT$

C. 3RT

D. $- RT$

Answer: B

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16. Which one of the following expressions represents the first law of thermodynamics ?

A. $q = \Delta E = w$

B. $\Delta E = q - w$

C. $\Delta E = q + w$

D. $\Delta E = q + PdV$

Answer: C

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17. For a reaction $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

A. $\Delta H = \Delta U$

B. $\Delta U > \Delta U$

C. $\Delta H < \Delta U$

D. None of these

Answer: C

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18. What do mean by the term- Weed?

19. What are trees? Give two examples?

20. For a reversible process at equilibrium, the change in entropy may be expressed as

A. $\Delta S = \Delta H$

B. $\Delta S = \Delta \dfrac{H}{T}$

C. $\Delta S = q_{rev}/T$

D. $\Delta S = T\Delta H$

Answer: C

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21. $\Delta G = \Delta H - T\Delta S$ was given by

A. Boltzman

B. Faraday

C. Gibbs Helmholtz

D. Thomson.

Answer: C

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22. Change in internal energy is determined by

A. Bunsen's calorimeter

B. Bomb calorimeter

C. Backmann's thermometer

D. None of these

Answer: B

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23. A well stoppered thermos flask contains some ice cube. This is an example of

A. Closed system

B. open system

C. Isolated system

D. Non-thermodynamic system.

Answer: C

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24. Enthalpy of a reaction ΔH is expressed as

A. H = U + PV

B. H = U - PV

C. $\Delta H = \Delta U + P\Delta V$

D. $\Delta H = \Delta U - P\Delta V$.

Answer: C

25. For an ideal gas C_p and C_v are related as

A. $C_v - C_p = R$

B. $C_p + C_v = R$

C. $C_p - C_v = R$

D. $C_p - C_v = RT$

Answer: C