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Class: 11
Subject: Chemistry
Topic: Chemical Thermodynamics
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. For which of the following enthalpy of formation, combustion and reaction are same?

$C_6H_6(l)+7\frac{1}{2}O_2(g) \rightarrow 6CO_2(g)+3H_2O(l).\Delta H=-3260kJ$

When 3.9 g of benzene is burnt, how much beat will be evolved?

A. 163 kJ

B. - 163 kJ

C. - 326 kJ

D. 326 kJ

Ans. A

Solution: On burning 78g of benzene (1 mole) 3260 Id of heat is liberated. Hence 3.9g of benzene gives 163 kJ of heat. Option 3, with the negative sign is not considered since the word liberated accounts for the negative sign. Hence writing -ve sign is not necessary

2. Amount of heat liberated when 0.49 g of sulphuric acid is neutralized by NaOH is

A. -57.3 kJ

B. -5.73 kJ

C. 0.573 kJ

D. -0.573 kJ

Ans. C

Solution:

	Amount	Heat liberated
Eq. mass of H_2SO_4 = 49	49 g	57.3 kJ
	0.49 g	?

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3. In which process entropy decreases?

A. crystallisation of sucrose from solution

B. rusting of iron involving oxidation

C. melting of ice

D. vaporisation of.camphor

Ans. A

4. For which of the following enthalpy of formation, combustion and reaction are same?

A. $H_2(g) + \frac{1}{2}O_2(g)$ $H_2O(l)$

B. $S(s) + O_2(g) \longrightarrow SO_2(g)$

C. $C(s) + O_2(g) \longrightarrow CO_2(g)$

D. all of above

Ans. D

Solution: In each case one mole of the compound is formed by burning one male of substance

5. One mole of a gas is heated at constant volume to raise the temperature from 298K to 308K. 500J of heat was supplied for this purpose. Which of the following statement applies for this process?

A. q = w = 500 J, D U = 0

B. q = D U = 500 J W = 0

C. W = 0, DU = 0, q = 500 J

D. DU = 0, q = W = - 500 J

Ans. B

Solution: Since volume is constant work done is zero. All the heat supplied goes to raise the internal energy (with temperature rising)

6. The temperature of a system increases during

A. isothermal expansion

B. adiabatic expansion

C. isothermal compression

D. adiabatic compression

Ans. D

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7. If D*H o* &D*S o* for a reaction are negative, then the reaction is

A. spontaneous at all temperatures

B. spontaneous only at low temperatures

C. spontaneous at high temperatures

D. not spontaneous at any temperature

Ans. B

Solution: $\Delta G = \Delta H\ T\Delta S$

ΔG is negative only if T is low such that numerical value of ΔH is more than $T\Delta S$

8. When a liquid is converted into its vapours the value of S becomes

A. Zero

B. +ve since entropy increases with the absorption of heat for the process

C. -ve since entropy decreases

D. one of the above statements are true

Ans. B

9. When 50 cm^3 of a strong acid is added .to 50 cm3 of an alkali, the temperature rises by 5°C. If 250 cm3 of each liquid are mixed, the temperature rise would be

A. 25°C

B. 20°C

C. 5°C

D. 10°C

Ans. C

10. A thermally insulated closed vessel contains hot water. This is an example of

A. closed system

B. open system

C. isolated system

D. reversible system

Ans. C

Solution: The system cannot exchange both matter and energy. Hence, by definition, it is an isolated system

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11. Entropy of a system is a measure of

A. disorder in the system

B. stability of the system

C. energy content of the system

D. available energy of a system

Ans. A

12.

CO (g) CO (g) - 393.5 kJ at 298 K. In the above case 393.5 kJ of heat is liberated graphite 2 2 + ¾¾® =

A. when C,O2 and CO2 are all at 298 K throughout burning

B. when only C and O2 are at 298 K initially

C. When increase in temperature during combustion is neglected

D. When C, O2 and CO2 are all at 298 K at the time of heat measurements

Ans. D

Solution: Burning takes place only at high temperature. But initially the reactants are at 298 K. The product formed is cooled to 298 K before heat measurements is done

Given $C(s) + O_2(g) \longrightarrow CO_2(g)$; DH = - 395 kJ

$S(s) + O_2(g) \longrightarrow SO_2(g)$; DH = - 295 kJ

$CS_2(l) + 3O_2(g) \longrightarrow CO_2(g) + 2SO_2(g)$; ΔH = - 1110 kJ

13. So heat of formation of carbon disulphide is

A. 85 kJ

B. 125 kJ

C. 165 kJ

D. 205 kJ

Ans. B

Solution: C(s) + 2S(s) ® CS2 (l) ; H = ?.

The value of ΔH is obtained by the following consideration: eq. (1) + eq. (2) × 2 + reverse of eq. (3)

14. The equilibrium constant for a reaction is 1020 at 300 K. The standard fee energy change for this reaction is

A. -115kJ

B. +l l5kJ

C. 166kJ

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D. -166kJ

Ans. A

Solution:

$\Delta G = -2.303\ RT \log K_p$ Note : If R is kJ, then ΔG value will be in kJ.

$\therefore \Delta G = -2.303 \times (8.314 \times 10^{-3}) \times 300 \times \log 1020$

= - 2.303 ´ 8.3 14 ´ 10-3 ´ 300 ´ 20 = - 114.9 kJ

15. In electrometric effect, the electrophile causes complete transfer of

A. σ electrons
B. valence electrons
C. π electrons
D. lone pair of electrons
Ans. C
Solution: π electrons

16. The law of Lavisher and Lap lace illustrates

A. the principle of conservation of energy

B. equivalence of mechanical and thermal energy

C. the principle of conservation of matter

D. equivalence of mechanical and chemical energy

Ans. A

17. For the transitio n C (diamond) ® C (graphite); DH = - 1.5 k.J.It follows that

A. Diamond is exothermic

B. graphite is endothermic

C. graphite is stabler than diamond

D. diamond is stabler than graphite

Ans. C
Solution: Transition of diamond to graphite is an exothermic process. Hence graphite is stabler

18. Internal energy of a system consists of vibrational energy which

A. includes both potential and kinetic energy

B. only kinetic energy

C. only potential energy

D. neither potential nor kinetic energy

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Ans. A

Solution: When a molecule executes vibration, interconversion of potential energy of kinetic energy takes place. Hence vibrational energy includes both the forms.

19. The bond energies of H2 and I2 molecules are 435.4 kJ and 150.6 kJ respectively. The bond energy of HI will be

A. 217.7 kJ

B. 580.6 kJ

C. 293 kJ

D. 586 kJ

Ans. C

Solution:

Total energy absorbed when 2 moles of hydrogen atoms and iodine atoms are formed $= 435.4 + 150.6 = 586$ kJ. This amount of heat is liberated when 2 moles of HI are formed. Hence H - I bond energy $= \frac{586}{2} = 293$ kJ

20. The enthalpies of nccceutralization of HCl and HCN by NaOH are -55.9 an -12.lkJ mol-1, respectively. The enthalpy of ionization of HCN is

A. -43.8kJ mol-1

B.68.0 kJ mol-1

C.43.8 kJ mol-1

D.68 kJ mol-1

Ans. C

Solution:

$HCl + NaOH \longrightarrow NaCl + H_2O;\ \Delta H = -55.9$ kJ

Neutralisa tion of HCN involves 2 steps

Step 1: Ionisation of HCN: $HCN \longrightarrow H^+ + CN^-;\ \Delta H = a$ kJ

Step 2 : Neutralisa tion of ions : $(H^+ + CN^-) + NaOH \rightarrow NaCN + H_2O;$

$\Delta H = -55.9$ kJ. This value is taken as -55.9 since this is the value found for neutralisa tion of HClas given in the problem.

The net value of neutralisa tion of IICN, is $-a + (55.9)$ kJ

This is equal to -12.1 kJ. Hence $a - 55.9 = 12.1 \quad \therefore a = 43.8$ kJ