CBSE Board
Class XI Chemistry
Sample Paper - 9

Time: 3 Hours **Total Marks: 70**

Solution

Ans1 n and l (1)

Ans2

Because of surface tension falling liquid drops are spherical in shape. (1)

Ans3 Ununpentium (1)

Ans 4

Prop-2-en-1-ol (1)

Ans 5

1.008×10^{-14} (1)

Ans 6 For a reaction to be always spontaneous, ΔH should be negative and ΔS should be positive. (1)

Ans 7

Tertiary carbocation is more stable because of higher electron releasing inductive effect of more number of R groups and more hyperconjugating structures. (1)

Ans 8

$+1+(X) - 4=0$

$X= +3$ (1)

Ans9

(a) Due to small size of fluorine, new electron faces inter electronic repulsions which decrease the value of electron gain enthalpy. (1)

(b) Due to poor screening effect provided by d electrons in Ga, effective nuclear charge increases leading to decrease in size. (1)

Ans 10

Alkali metals have low ionisation enthalpies. (1)

Valence electrons in alkali metal atoms are loosely held. They get excited by energy of the flame.When they fall back, energy released fall in the visible region of spectrum giving colour to the flame. (1)

Ans 11

(a) Amount of useful work obtainable from a system is Gibbs free energy change (1)

(b) Enthalpy change accompanying formation of 1mole of a compound from its pure elements is called enthalpy of formation. (1)

OR

Enthalpy change in a reaction remains the same whether the reaction takes place in one step or in number of steps. (1)

Eg. When carbon burns to form carbon dioxide directly in one step, 393.5

kJ mol^{-1} of heat produced.

$C + O_2 \rightarrow CO_2$ $\Delta H = -393.5$ kJ mol^{-1} (1)

While

(i) $C + ½\ O_2 \rightarrow CO$; $\Delta H = -110.5$ kJ mol^{-1}

(ii) $CO + ½\ O_2 \rightarrow CO_2$; $\Delta H = -283.0$ kJ mol^{-1} (1)

Sum of (i) & (ii) is same (-393.5 kJ mol^{-1}) when the reaction takes place directly in one step.

Ans 12

(a) Li has a small size due to which Li^+ has high charge density. Hence it is heavily hydrated in solution. Thus, lithium is the best reducing agent. (1)

(b) Cs has a big size and low ionization enthalpy. Hence electron is easily ejected using light energy. Therefore it is used in photoelectric cells. (1)

Ans 13

(a) Ethyne, $HC{\equiv}CH$ (1)

(b) Butane-2,3-diol , $CH_3CH(OH)CH(OH)CH_3$ is formed (1)

Ans 14

(a) Due to inert pair effect outer's' electron are reluctant to participate in reactions. Thus lower oxidation state is more stable. (1)

(b) BCl_3 is a symmetrical molecule. This molecule is trigonal planar without any free electron pair. Resultant dipole moment of two B-Cl bonds is cancelled by the third one. It can also be explained as due to the planar symmetrical structure, the dipole moments of three B-Cl bonds compensate eachother, thus giving zero dipole moment. (1)

Ans 15

Reduction half reaction:

Step 1:

$MnO_4^- + 5e^- \rightarrow Mn^{2+}$

Step 2: $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ (1/2)

Oxidation half reaction:

Step 1:

$SO_2 \rightarrow HSO_4^- + 2e^-$

Step 2: $SO_2 + 2H_2O \rightarrow HSO_4^- + 3H^+ + 2e^-$ (1/2)

Multiply by required coefficient and add the two equations

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4\ H_2O)$ x2

$(SO_2 + 2H_2O \rightarrow HSO_4^- + 3H^+ + 2e^-)$ x5

Final reaction: $2MnO_4^- + 5SO_2 + 2H_2O + H^+ \rightarrow 2Mn^{2+} + 5\ HSO_4^-$ (1)

Ans 16

Number of emission lines= n(n-1)/2 (1)

= 5 x (4)/2 = 10 (1)

Ans 17

O_2 = KK $\{\sigma(2s)^2\ \sigma^*(2s)^2\ \sigma\ (2pz)^2\ \pi(2px)^2\ \pi\ (2py)^2\ \pi^*(2px)^1\ \pi^*(2py)^1\}$

Bond order= (number of bonding electrons-no. of antibonding electrons)/2

Bond order = 2

Paramagnetic (1)

O_2^{2-} = KK $\{\sigma(2s)^2\ \sigma^*(2s)^2\ \sigma\ (2pz)^2\ \pi(2px)^2\ \pi\ (2py)^2\ \pi^*(2px)^2\ \pi^*(2py)^2\}$

Bond order = 1

Diamagnetic (1)

Ans 18

Solution of alkali metals in liquid ammonia contains ammoniated electron and ammoniated ions which make the solution conducting in nature. (2)

Ans 19

(a)M = (W_B x 1000)/ (M_B x vol. of solution in mL)

= (2.52 x 1000) / (126 x 250) (1)

= 0.08 M (1)

(b) (i) 3.29×10^3

(ii) 0.0326 (1)

Ans 20

(a) Hund's rule of maximum multiplicity (1)

(b) Electronic configuration = $1s^2\ 2s^2\ 2p^6\ 3s^2 3p^6\ 3d^6$ (1)

No. of unpaired electrons = 4 (1)

Ans 21

(i) $C(s) + O_2(g) \rightarrow CO_2(g)\ \Delta H = -393.5\ kJ\ mol^{-1}$

(ii) $H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(g)\ \Delta H = -241.8\ kJ\ mol^{-1}$

(iii) $2C(s) + 2H_2(g) \rightarrow C_2H_4(g)\ \Delta H = +52.3\ kJ\ mol^{-1}$ (1)

Required equation is

$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)\ \Delta H = ?$ (1)

2 x eq (i) +2 x eq (ii) - eq (iii) gives

$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$

$\Delta H = 2(-393.5) + 2(-241.8) - 52.3$

$= -1322.9\ kJ\ mol^{-1}$ (1)

Ans 22

(a) Sewage water (1)

(b) Carbon dioxide and methane (1)

(c) Primary pollutants get converted into various other pollutants by various chemical changes. The new products formed are called secondary pollutants. (1)

Ans 23

(i) Electrophiles are the positively charged or electron deficient species.

Example - BF_3, CH_3^+ (1½)

(ii) Compounds having same molecular formula but differ in the position of substituent or functional group on the carbon skeleton.

CH_3-CH(OH)-CH_3 & CH_3-CH_2-CH_2-OH (1½)

Ans 24

To determine the volume of H_2SO_4 used

Volume of acid taken = 100 mL of M/10 H_2SO_4 = 10 mL of 1M H_2SO_4

Volume of alkali used for neutralization of excess acid ≡ 160 mL of

M/10 NaOH = 16 mL of 1M NaOH

Now 1 mole of acid neutralises 2 mole of NaOH

So 16 ml of NaOH ≡ 8 mL of H_2SO_4

Volume of acid used by ammonia = 10 - 8 = 2 mL

To determine the percentage of nitrogen

1 mole of H_2SO_4 neutralizes 2 mole of NH_3

2 mL of 1M of H_2SO_4 ≡ 4 mL of 1M NH_3

but 1000 mL of 1M NH_3 contain Nitrogen = 14 g

Then 4 mL of 1M NH_3 will contain Nitrogen = 14 x 4 /1000 = 0.056g (1/2)

But this much of amount of nitrogen is present in 0.50 g of the organic compound

Then % of N_2 = (0.056 / 0.5) x100 = 11.2 % (1)

So, sunita is right since percentage of N = 11.2% (1/2)

Values associated: Good knowledge of chemistry and helping and caring nature for friends. (1)

Ans 25

(a) PCl_5: 5 bond pairs trigonal bipyramidal (1)

XeO_3: 3 bond pairs and 1 lone pair, trigonal pyramidal (1)

(b) Because of resonance all bonds possess partial double bond character hence bond lengths are equal. (1)

OR

(a)Hybridization of S atom in SF_4 is sp^3d (1)

Hybridization of S atom in SO_4^{2-} is sp^3 (1)

(b) Due to intermolecular H-bonding, water has a high boiling point. (1)

Ans 26

Van der Waals parameter 'a' is the measure of intermolecular forces while 'b' is the measure of effective size of gas particles. (1)

Unit of a = bar L^2 mol^{-2}

Unit of b = L mol^{-1} (1)

(b) At OK or -273^oC, volume of the gas will be zero which is not possible. (1)

Ans. 27

(i) 1 mole of C_2H_6 contains 2 moles of carbon.

Therefore, number of moles of carbon in 3 moles of C_2H_6 =6 (1)

(ii) 1 mole of C_2H_6 contains 6 moles of atoms of hydrogen.

Therefore, number of moles of hydrogen atoms in 3 moles of C_2H_6 = 3 x 6 =18 (1)

(iii) 1 mole of C_2H_6 = 6.022 x10^{23} molecules

Therefore, number of molecules in 3 mole of C_2H_6 = 3 x 6.022 x 10^{23}

= 1.807 x 10^{23} molecule (1)

Ans.28

(a) (i) Group II cations have low K_{sp}. In the presence of HCl, degree of dissociation of H_2S is suppressed so only Group II is precipitated.

$HCl \rightarrow H^+ + Cl^-$

$H_2S \rightleftharpoons 2H^+ + S^{2-}$ (1)

F is more electronegative than O. Hence H-F bond is more polar thereby HF is more acidic. (1)

(b) $C_2H_6\,(g) \rightleftharpoons C_2H_4\,(g) + H_2\,(g)$

Initial preassure	4.0 atm	0 atm	0 atm
At Equilibrium	4 - p	p	p

(1)

$K_p = (p \times p) / (4-p)$ (1)

$= 0.04$ (1)

OR

(a)pH would increase. Due to common ion effect degree of dissociation of weak acid is suppressed causing pH to increase. (2)

(b) $K_c = [CO_2(g)]$ (1)

(c) No effect of catalyst (1)

Equilibrium will shift towards backward direction. (1)

Ans 29

(a) Pentan-3-one & methanal (1)

(b) For alkanes containing odd number of carbon atoms a mixture of two alkyl halides has to be used since two alkyl halides can react in three different ways therefore gives mixture of three different alkanes. (1)

$CH_3\text{-}Br + Br\text{-}CH_2\text{-}CH_3 \rightarrow CH_3\text{--}CH_2\text{-}CH_3$

$CH_3\text{-}Br + Br\text{-}CH_3 \rightarrow CH_3\text{-}CH_3$

$CH_3\text{-}CH_2\text{-}Br + Br\text{-}CH_2\text{-}CH_3 \rightarrow CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_3$ (1)

(c) CH_3CO^+ (1)

(d) ethene (1)

OR

(a) (i) $CH_3\text{-}CH_2C(OH)\text{-}(CH_3)_2$ (1)

(ii) $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2Br$ (1)

(iii) C_6H_5Cl (1)

(b) (i) Planarity

(ii) Complete delocalization of the π electrons in the ring

(ii) Presence of (4n+2) π electrons in the ring where n is an integer (n = 0,1,2,...)

(1)

Ans 30

(a)

(i) Because it has +3 and 0 oxidation states also which are more stable (1)

$Ga^{+} \rightarrow Ga + Ga^{+3}$

(ii) It is a lewis acid (1)

(iii) Due to absence of d orbital (1)

(b)

(i) $Sn + 2\ H_2O \xrightarrow{\Delta} SnO_2 + 2H_2$ (1)

(ii) $2BF_3 + 6NaH \rightarrow B_2H_6 + 6NaF$ (1)

OR

(a) $2Al + 6HCl \rightarrow 2Al^{3+} + 6Cl^{-} + 3\ H_2$ (Basic nature of Aluminium) (1)

$Al + 2NaOH \rightarrow Na_2AlO_2 + H_2$ (Acidic nature of aluminium) (1)

(b) (i) It forms aluminium oxide on the surface so Al becomes passive. (1)

(ii) Due to increase in size which is due to screening effect provided by core electrons.

(1)

(iii) It does not behave as a protonic acid rather as Lewis acid and accepts hydroxyl ion from water.

(1)