CBSE Board
Class XI Chemistry
Sample Paper - 5

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

General Instructions

1. All questions are compulsory.
2. Question nos. 1 to 8 are very short answer questions and carry 1 mark each.
3. Question nos. 9 to 18 are short answer questions and carry 2 marks each.
4. Question nos. 19 to 27 are also short answer questions and carry 3 marks each
5. Question nos. 28 to 30 are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

Q. 1 What happens when sodium metal is heated in free supply of air? [1]

Q. 2 Given: [1]

$$2Al(s) + \frac{3}{2} O_2(g) \rightarrow Al_2O_3(s), \Delta_f H^\theta = -1{,}670 \text{ kJ/mol for } Al_2O_3(s).$$

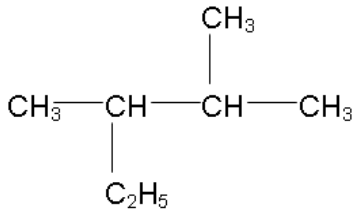
Determine ΔH^θ for the reaction $2Al_2O_3(s) \rightarrow 4Al(s) + 3O_2(g)$.

Q. 3 Explain why BeH_2 molecule has zero dipole moment although the Be-H bonds are polar? [1]

Q. 4 Predict the shape of the PH_3 molecule according to VSEPR theory. [1]

Q. 5 Which isotope of hydrogen is radioactive? [1]

Q. 6 Write the correct IUPAC name of the compound given below: [1]



Q. 7 How many mono substituted derivatives of naphthalene are possible? [1]

Q. 8 Name any two gases responsible for greenhouse effect. [1]

Q. 9 Arrange the following ions in order of increasing ionic radius: K^+, P^{3-}, S^{2-},Cl^-.

Give reason. [2]

Q. 10 The successive ionization energies of a certain element are I_1 = 589.5 kJ/mol, I_2 =1145 kJ/mol, I_3= 4900 kJ/mol, I_4 = 6500 kJ/mol, and I_5 = 8100

kJ/mol. This pattern of ionization energies suggests that the unknown element is: [2]

a) K

b) Si

c) Ca

d) As

Explain your answer.

Q. 11 A sample of gas occupies 3.00 L at 760 torr. Calculate the volume the gas will occupy if the pressure is changed to 1.45 atm and the temperature remains constant. [2]

Q. 12 A mixture of hydrogen and oxygen at 1 bar pressure contains 20 % by mass of hydrogen .Calculate the partial pressure of hydrogen. [2]

Q. 13 Complete the following reactions [2]

(i) $P_4O_{10}(s) + H_2O(l) \rightarrow$

(ii) $SiCl_4(l) + H_2O(l) \rightarrow$

OR

Give reasons for the following

(a) Alkali metals impart colour to the flame.

(b) Explain why alkali and alkaline earth metals cannot be obtained by chemical reduction methods?

Q. 14 Explain: [2]

(i) Alkali metals are soft and can be cut with help of a knife.

(ii) Potassium is more reactive than sodium.

Q. 15 [2]

(i) How would you distinguish between $BeSO_4$ and $BaSO_4$?

(ii) Which is thermally most stable alkaline earth metal carbonate among $MgCO_3$, $CaCO_3$, $SrCO_3$, $BaCO_3$? Why?

Q.16 Calculate the number of atoms in each of the following: [2]

(i) 52 mol of Ar (ii)52 u of He

Q. 17 Arrange benzene, hexane and ethyne in decreasing order of acidic behavior. Also give reasons for this behaviour. [2]

Q. 18 State the difference between classical smog and photochemical smog. [2]

Q. 19 50 kg of $N_2(g)$ & 10.0 kg of $H_2(g)$ are mixed to produce $NH_3(g)$, identify the limiting reagent. Also, calculate the amount of NH_3 formed. [3]

Q. 20 (i) Calculate the wavelength in nanometers, of visible light having a frequency of $4.37\times10^{14}\ s^{-1}$. [3]

(ii) What are frequency and wavelength of a photon emitted during a transition from n = 6 to n = 1 state in the hydrogen atom.

Q. 21 (i) Explain why the following electronic configuration is not possible: [3]

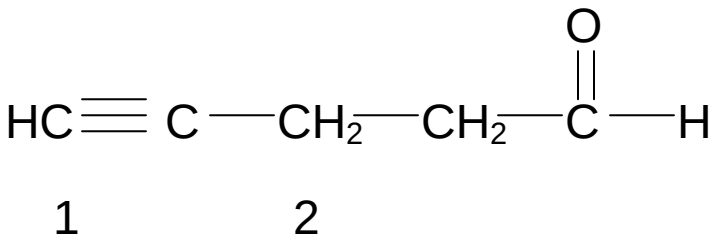
$$n=1, l=0, m_l=+1, m_s=+\frac{1}{2}$$

(ii) Write electric configurations of Cu & Cu^{2+}.

Q. 22 (i) Draw the resonating structures of carbon dioxide molecule. [3]

(ii) Why is NF_3 trigonal pyramidal while BF_3 is trigonal planar, though both are tetra atomic molecules?

(iii) State the hybridization of carbon atoms numbered 1 & 2:



Q. 23 How much volume of 0.1M CH_3COOH should be added to 50 mL of 0.2M of CH_3COONa solution to prepare a buffer solution of pH=4.91(Given pK_a of CH_3COOH is 4.76) [3]

Q. 24 (i) Calculate the concentration of hydroxyl ion in 0.1 M solution of NH_4OH having $K_b = 1.8\times10^{-5}$. [3]

(ii) K_{sp} value of two sparingly soluble salts $Ni(OH)_2$ and AgCN are 2×10^{-15} and 6.0×10^{-17} respectively. Which salt is more soluble?

Q. 25 Ajit had a very important cricket match but after 1 hour practicing, he was feeling very weak and so his mother gave him some glucon-D. After 10 minutes, he started feeling better and went back for playing. [3]

(a) What made Ajit energetic after drinking Glucon-D? Give plausible reasons for this.

(b) What value do you get from this?

OR

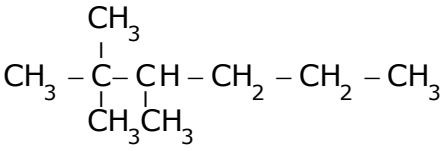
(a) Calculate the total number of electrons present in one mole of methane.

An atomic orbital has n = 3. What are the possible values of l and m_l ?

Q. 26. (i) Draw the structural isomers of pentane. [3]

(ii) Give the IUPAC names of the following compounds.

a)



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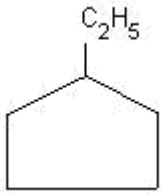
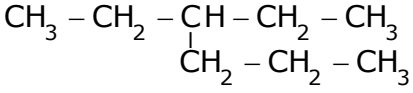


c)



Q. 27 (i) 0.2475 g of an organic compound gave on combustion 0.4950 g of carbon dioxide and 0.2025 g of water. Calculate the percentage of C and H in it. [3]

(ii) What will happen during Lassaigne's test for nitrogen if the compound also contains sulphur?

Q. 28 (i) 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 process? [5]

(ii) The equilibrium constant for the reaction is 10. Calculate the value of ΔG^{θ}. Given R = 8.0 J mol^{-1} K^{-1}; T = 300 K

OR

(i) Calculate lattice energy for the change

$Li^{+}(g)+Cl^{-}(g) \rightarrow LiCl(s)$

Given that:

$\Delta_{sub} H^{\theta}$ of Li $=160.67$ kJ/mol

$\Delta_{diss} H^{\theta}$ of $Cl_2 = 244.34$ kJ/mol

$\Delta_{ie} H^{\theta}$ of $Li(g) = 520.07$ kJ/mol

$\Delta_{eg} H^{\theta}$ of $Cl(g) = -365.26$ kJ/mol

$\Delta_f H^{\theta}$ of $LiCl(s) = -401.66$ kJ/mol

(ii)

For a reaction; $2A(g)+B(g) \rightarrow 2D(g)$

$\Delta U^{\theta} = -10.5$ kJ & $\Delta S^{\theta} = -34.1$ J

Calculate ΔG^{θ} for the reaction & predict whether the reaction is spontaneous or not at 298 K.

Q. 29 [5]

(i) What happens when borax solution is acidified. Write the chemical reactions for the reaction.

(ii) Explain why BF_3 exists whereas BH_3 does not?

(iii) SiO_2 is solid but CO_2 is a gas at room temperature.

OR

When a metal X is treated with NaOH a white precipitate (A) is obtained, which is soluble in excess of NaOH to give soluble complex (B). Compound (A) is soluble in dilute HCl to form compound (C).The compound (A) when heated strongly gives D which is used to extract metal. Identify (X), (A), (B), (C) & D. Write suitable equations to support their identities.

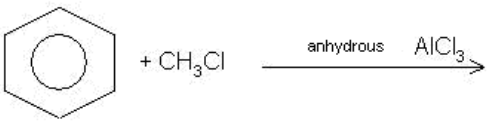
Q. 30 Complete the following reactions. [5]

(i) $CH_3CH_3 + O_2 \xrightarrow[\Delta]{(CH_3COO)_2Mn}$

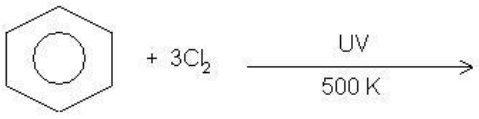
(ii) $CH_2\ Br-CH_2\ Br + Zn \rightarrow$

(iii) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2 + H_2O \xrightarrow{H^+}$

(iv)



(v)



OR

(i) Outline all the steps in the synthesis of the compound styrene from benzene.

(ii) Give the products of ozonolysis of mesitylene.