SAMPLE QUESTION PAPER

CHEMISTRY

Time : 3 hrs. **Maximum Marks : 80**

Note : (i) All questions in Section A are compulsory
(ii) Attempt only one out of three options in Section B, i.e., attempt either Part I or Part II or Part III in Section B.
(iii) marks for each question are indicated against it.
(iv) Use log tables if necessary.

Section A

1. What are the SI units of mass? (1)

2. How may moles of hydrogen gas are there in 11.2 liters of hydrogen gas at STP? (1)

3. Name a lyophilic colloid. (1)

4. What do the molecular solids have low melting points? (1)

5. Define enthalpy of formation. (1)

6. Why is lithium most difficult to be reduced? (1)

7. Define an isolated system. (1)

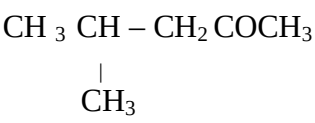
8. What is Le Chatelier's principle. (1)

9. Name the components of Bordeaux mixture. (1)

10. State two characteristic properties of transition elements which are different from group I elements. (1)

11. Give the structural formula of the product obtained on mono bromination of phenol. (1)

12. Write IUPAC name of the following compound. (1)



13. Derive the SI units for the following quantities (2)
    i) Force
    ii) Pressure

14. 10 g of a non-volatile solute in 100g of benzene raises its bioling point by 1 K. What is the molecular mass of the solute? K_f for benzene = 2.53 K g^{-1} mol^{-1} (2)

15. Glucose is formed according to the following reaction :
$6CO_2$ (g) + 6 H_2O (1) $\rightarrow$ $C_6H_{12}O_6$ (s) + $6O_2$ (g)
absorbing 2840 kJ of heat. How much energy will be given out by combustion of 1.08g of glucose? (2)

16. State Heisenberg's principle of uncertainty and give its mathematical relationship. (2)

17. The solubility of calcium sulphate in water is 4.9×10^{-3}M at 25^0C. Calculate the value of K_{sp} for $CaSO_4$ at this temperature

Given : $CaSO_4$ (s) $\rightleftharpoons$ Ca^{2+} (aq) + SO_4^{2-} (aq) (2)

18. Explain the variation of ionization energy down the group in a periodic table. State the relationship of ionization energy of an atom with its reactivity. (2)

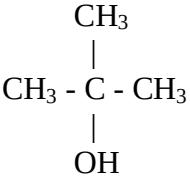
19. Paramagnetism of a substance can be calculated in terms of magnetic moment in Bohr Magneton (BM) by using the expression :
$\mu = [n\ (n+2)]^{½}$
The atomic number of chromium is 24. In which oxidation state the magnetic moment of its (Chromium) ion will be maximum and in which it will be zero? (n is the number of unpaired electrons). (2)

20 Write briefly about "Aldol condensation' and give an example. (2)

21. Differentiate between a gangue and slag. Give an example of a metallurgical step where stag, flux and gangue are involved simultaneously. (2)

22. Define the term isomerism. Give one example of each of the two types of isomerism. (2)

23. You are given three compounds A, B and C. A is $CH_3CH_2CH_2CH_2OH$, B is CH_3-CH-CH_2CH_3 and C is



How will you distinguish between A, B and C if you are given conc. HCI and anhydrous $ZnCl_2$ reagents only. Write the name of the test and the reactions involved. (2)

24. Normally each shell of an atom can accommodate a maximum of $2n^2$ number of electrons. Let us suppose the rule changes to $2n^3$. What shall be the configuration of element number 11 and what type of element it shall be as per allotment of its subshell? (2)

25. Given the reaction :
XeF_4 (g) + F (g) $\rightarrow$ XeF_6 (g)
Predict the change in hybridization and consequent, final shape of the molecule followed in the above reaction. (2)

26. Write a chemical equation showing the oxidation of hydrogen sulphide with the help of acidified potassium dichromate. (2)

27. State the following laws and give the mathematical expression for each law :
    (i) Boyle's law
    (ii) Charles' law
    (iii) Dalton's law of partial pressures (3)

28. State the modern periodic law. Write the special names given to elements of group 1,2, 17 and 18. (3)

29. (i) What is diazotization? Explain giving an example
    (ii) Describe the preparation of sulphanilic acid form aniline. Write its zwitter ionic structure. (3)

30. Molar mass of NaCl is 58.5g mol^{-1}. Calculate the number of moles of Na Na^+ ions and Cl^- ions and also their masses in 11.7g of NaCl. (3)

31. A galvanic cell consists of metallic Zn plate immersed in 0.1 M $Zn(NO_3)_2$ solution and metallic plate of lead in 0.02 M $Pb(NO_3)$ solution. Given $E^0Zn^{2+} \rightarrow Zn = -0.76$ V, $E^0Pb^{2+} \rightarrow Pb = -0.13$ V
    a) Write the half-cell reactions
    b) Write the overall reaction of the cell
    c) Calculate the e.m.f. of the cell (3)

32. Write one reaction each for the preparation of the following. Also write one use of each product.
    (i) Bleaching power
    (ii) Caustic soda
    (iii) Quick lime (3)

33. (i) Which of the following acid is more acidic? Explain giving reasons.
    CH_3 COOH and Cl-CH_2COOH
    (ii) Explain why is the boiling point of an acid greater than the corresponding haloalkane. (4)

34. (i) What do you understand by entropy? In what way is the total entropy change related to spontaneity of a system and to a system in equilibrium.
    (ii) Entropy change from liquid water to steam at 373K is 109J mol^{-1} K^{-1}. What is the enthalpy change for the transition of liquid water to steam at 373 K. (4)

35. Valence shell electron pair repulsion theory can be used to predict the shapes of molecules. Using this theory :
    (i) explain the shapes acquired by BF_3 and CH_4
    (ii) explain why HOH bond angle in H_2O is slightly less than the tetrahedral angle 109.5. (4)

Section B

PRT I : OPTION 1 (Agricultural Chemistry)

1.	Define composting.	1 mark
2.	List two points of differences between micro nutrients and macro nutrients.	1 mark
3.	What can be done to overcome the dangerous effects of modern agriculture?	1 mark
4.	Why do we need biological nitrogen fixation?	2 mark
5.	Define soil. List four major soil groups of India.	2 mark
6.	Give the classification of pesticides based on target organisms.	3 mark

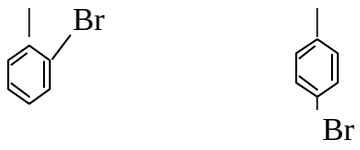
PRT II : OPTION 2 (Bio Chemistry)

1.	Give two examples of polysaccharides.	1 mark
2.	Write two properties which are common to chemical catalysts and enzymes.	1 mark
3.	List two differences between enzymes and catalysts.	1 mark
4.	Define lipids. List 3 different types of lipids.	2 mark
5.	Why are fats a better source of energy than glucose?	2 mark
6.	List 3 functions of DNA.	3 mark

PRT II : OPTION 3 (Environmental Chemistry)

1.	Define water pollution.	1 mark
2.	Why is chlorination not the most desirable method of disinfecting polluted water?	1 mark
3.	What are the effects of detergents on fresh water bodies?	1 mark
4.	What are anthropogenic pollutants?. Give two examples each of primary and secondary pollutants.	2 mark
5.	Why is it impossible for a nuclear reactor to blow up like a bomb? Explain.	2 mark
6.	How is global warming caused? List four consequences of green house effect.	3 mark

MARKING SCHEME
CHEMISTRY

Q.No.	Expected value points for each step	Distribution of marks
1.	Kilogram kg	1 mark
2.	0.5 mol	1 mark
3.	Gum, gelatin or starch (any one) or any other suitable example	1 mark
4.	due to weak binding forces	1 mark
5.	Correct definition	1 mark
6.	Because the reduction potential of lithium is minimum or its oxidation potential is maximum.	1 mark
7.	Correct definition	1 mark
8.	Correct statement	1 mark
9.	$CuSO_4$ (aq) + CaO	1 mark
10.	i) Variable oxidation state ii) Form colored ions or any two correct differences	½ mark ½ mark
11.	OH Br or OH Br 	1 mark
12.	4 – methyl – 2-pentanone	1 mark
13.	(i) Force = mass x acceleration = $kg.ms^{-2}$ or N (ii) Pressure = $\frac{Force}{Area} = \frac{N}{m^2} = Nm^{-2}$ or $kg\ m^{-1}s^{-2}$	½ mark ½ mark
14.	$M_B = K_f \frac{W_B}{W_A} \times \frac{1000}{\hat{e}\ T_b}$ $M_B = (2.53\ kg\ mol^{-1}) \frac{10g}{100g} \times \frac{1000}{1K}$ $= 253g\ mol^{-1}$	½ mark 1 mark ½ mark

(Correct result with correct unit)

15. Correct value for enthalpy of combustion of glucose by reversing the reaction
= -2840 KJ ½ mark

No. of moles of glucose = $\frac{1.08}{180}$

Now the heat evolved by the combustion of 1 mol (180g) of glucose = 2840 kJ ½ mark

By the combustion of 1.08g of glucose the energy given out = 2840 kJ x $\frac{1.08g}{180g}$ ½ mark

= 17.04 kJ ½ mark

16. Correct statement of uncertainty principle 1 mark

$\hat{e}\ x\ \hat{e}\ p \geq \frac{h}{4\pi}$ 1 mark

17. For the reaction $K_{sp} = [Ca^{2+-}]\ [SO_4^{2-}]$. ½ mark

From the equation we see that when $4.9x10^{-3}$ mol of $CaSO_4$ dissolves to makes IL of a saturated solution, the reacting ionic concentration are

$[Ca^{2+-}] = 4.9 \times 10^{-3}$ M or 4.9×10^{-3} mol L^{-1} ½ mark

$[SO_4^{2-}] = 4.9 \times 10^{-3}$ M or 4.9×10^{-3} mol L^{-1} ½ mark

$K_{sp} = [Ca^{2+}]\ [SO_4^{2-}] = (4.9 \times 10^{-3}$ mol $L^{-1}) \times (4.9 \times 10^{-3}$ mol $L^{-1})$

$= 2.4 \times 10^{-5}$ mol^2 L-2 ½ mark

18. Ionization energy decreases down the group because outermost electrons are weakly held. 1 mark

Lesser ionization energy, more reactivity. 1 mark

19. Magnetic moment will be maximum in Cr^{2+} 1 mark

Magnetic moment will be zero in Cr^{6+} 1 mark

20. Aldol condensation is the condensation of aldehydes and/or ketones possessing at least one H-atom attached to a-carbon atom in the presence of an alkali. 1 mark

$2CH_3CHO \rightarrow CH_3CHOH.CH_2\,CHO \rightarrow CH_3CH = CHCHO + H_2\,O$ 1 mark

21. Slag is a fusible substance formed by the reaction of flux with the impurity (gangue). 1 mark

$CaCO_3 + FeSiO_3 \rightarrow CaSiO_3 + CO_2 + FeO$ 1 mark

22. Definition of isomerism ½ mark

Three types of isomerism with examples ½+½+½ mark

23. Correct equations of the test (Lucas Test) 1½ mark

Name of the test (Lucas Test) ½ mark

24. $1\ s^2\ 2s^2 2p^6 2d^1$ 1 mark

transition element 1 mark

25. sp^3 hybrid to d^2sp^3 1 mark

Changes from tetrahedral to octahedral 1 mark

26. $K_2Cr_2O_7 + H_2SO_4 + H_2S \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + SO_2$ 2 mark

27. Correct statement of each law + correct mathematical expression for each law (½+½) x 3 mark

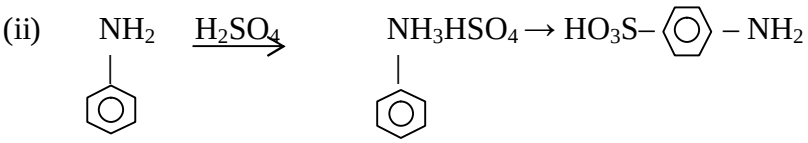
28. Correct statement of modern periodic law. 1 mark

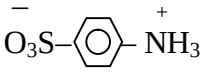
Group 1 = alkali Group 2 = alkaline

Group 17 = halogens Group 18 = noble gases ½ x 4

29. (i) Correct description of diazotization ½ mark

example ½ mark

(ii)  1 mark

Zwitter ion  ½ mark

30. No. of moles of NaCl = $\frac{11.7\text{g}}{58.5\text{g mol}^{-1}}$ = 0.2 mol 1 mark

Correct No. of moles of Na^+ = $\frac{11.7g}{58.5g\ mol^{-1}}$ = 0.2 mol ½ mark

Correct No. of moles of Cl^- = $\frac{11.7g}{58.5g\ mol^{-1}}$ = 0.2 mol ½ mark

Mass of Na^+ ion = $\frac{11.7g}{58.5g\ mol^{-1}}$ x 23 = 4.6 g ½ mark

Mass of Cl^- ion = $\frac{11.7g}{58.5g\ mol^{-1}}$ x 35.5 = 7.1 g ½ mark

31. (a) At anode ½ mark

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

At cathode ½ mark

$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$

(b) Overall reaction : $Zn(s) + Pb^{2+}(aq) \rightarrow Zn^{2+}(aq) + Pb(s)$ ½ mark

(c) $E^0cell = E^0cathode - E^0anode = -0.13V-(-0.76V) = 0.63V$ ½ mark

Nernst eqn for the cell $Ecell = E^0cell - \frac{0.0591}{n} \log \frac{[Zn^{2+}]}{[Pb^{2+}]}$ ½ mark

$= 0.63\ V - \frac{0.0591}{2} \log \frac{[0.1\ M]}{[0.02\ M]} = 0.63V - 0.0295 \log 5$ ½ mark

$= 0.6094\ V$

32. (i) $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$ ½ mark

as bleaching agent. ½ mark

(ii) $Na_2CO_3 + Ca(OH_2) \rightarrow CaCO_3 + 2NaOH$ ½ mark

Used in manufacture of soap, paper, artificial silk (any one) ½ mark

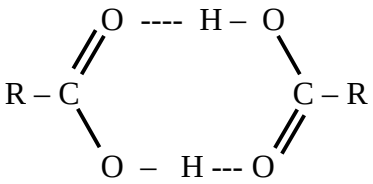
(iii) $CaCO_3 \xrightarrow{1273K} CaO + CO_2$ ½ mark

It is used in manufacture of bleaching powder and glass; used in tanning industry; for purification of sugar, used in cement industry (any one) ½ mark

33. (i) $ClCH_2COOH$ is a stronger acid ½ mark

Discussion on electron donating effect of $-CH_3$ group (+I effect) and electron attracting effect of –Cl group (-I effect) 1½ mark

(ii) Correct explanation giving dimer structure of an acid



2 mark

34. (i) Definition of entropy in terms of randomness. 1 mark

(Spontaneous) Irreversible : $\Delta S_{total} > 0$ ½ mark

(Equilibrium) Reversible : $\Delta S_{total} = 0$ ½ mark

(ii) H_2O (1,373K) $\rightleftharpoons$ H_2O (g, 373K) ½ mark

$S_{vap} = \frac{\Delta H}{T}$ or 109 J mol^{-1} K^{-1} = $\frac{\Delta H}{373\ K}$ 1+½ mark

Or ΔH + 109 J mol^{-1} K^{-1} x 373 K = 40.8 kj mol^{-1-} ½ mark

(½ mark for correct result with unit)

35. (i) BF_3 – triangular + explanation ½+½ mark

CH_4 – tetrahedral + explanation ½+½ mark

(ii) The oxygen atom in H_2O has two bond pairs and two lone pairs. Therefore, two of the four vertices of a tetrahedron are occupies by lone pairs. Because of the lone pair bond pair repulsion, the bond angle in H_2O is slightly less than 109.5^0. 2 marks

SECTION B

PART I : OPTION 1 (Agricultural Chemistry)

1. Composting is a biological process in which micro organisms decompose organic matter in the presence/absence of oxygen, and lower the carbon nitrogen ratios of refuse. 1 mark

2. Any two points of differences ½ +1½ mark

3. Cheapest and permanent solution to overcome the dangerous effects of modern agriculture is to do sustainable farming or organic farming or natural farming. 1 mark

4. In our country there is a big gap between consumption and production of nitrogenous fertilizers. Hence we have a import fertilizers. Under such circumstances the biological nitrogen fixation provides the answer to meet the nitrogen requirement of leguminous and pulse crops. 2 mark

5. Correct definition of soil. 1 mark

   Four major soil groups of India are : Alluvial soil, black soil, red soil and laterite soil. ¼ x4 = 1 mark

6. Correct classification 3 mark

PART II : OPTION 2 (Biochemistry)

1. Starch, cellulose and glycogen (any two) ½ x 2 = 1 mark

2. Any two properties like both are not consumed during course of reaction, they do not cause reaction to take place or any other property. ½ x 2 = 1 mark

3. Any two differences like enzymes exhibit high specificity where as catalyst are more general and can act on various similar substrate, the rate of an enzymatic reaction is proportional to the amount of enzyme where as this is not so with catalyst or any other difference. ½ x 2 = 1 mark

4. Correct definition of lipids ½ mark

   Three different types of lipids are : simple lipids, compound lipids and derived lipids. ½ x 3 = 1½ mark

5. Because the energy released by the oxidation of one molecule of fatty acid is far more higher (at least twice) than that released by oxidation of glucose. 2 mark

6. Any three functions. 1 x 3 = 3

PART III : OPTION 3 (Environmental Chemistry)

1. Water pollution is any physical, chemical or biological change in a water body that has an undesirable effect on living organisms. 1 mark

2. Because chlorine reacts with organic matter to produce highly toxic chlorinated hydrocarbon which can cause cancer. 1 mark

3. Detergents contain phosphates with promote algal growth in a water body leading to eutophiction. 1 mark

4. Pollutants added to the environment through human activities are termed anthropogenic pollutants. 1 mark
   Examples of primary pollutants : CO_2, CO from burning of fuel; SO_2 and oxides of nitrogen from vehicular combustion and thermal power station (any two) ¼ x 2 = ½ mark

   Examples of secondary pollutants : SO_3, H_2SO_4,NO_2 (any two) ¼ x 2 = ½ mark

5. The nuclear fuel that is used in a reactor contains a low concentration of fissionable U-235 (only 3%). Since the critical mass required for a self sustaining fission reaction is not available, the probability of nuclei hitting fissionable nuclei is low. Thus the reaction continues in a slow fashion. Also coolants are used to slow down the reaction. 2 mark

6. If proportion of green house gases increase in the atmosphere, heat trapped by them will raise the temperature of the earth causing global warming. 1 mark
   Consequences of green hose effect :
   1. Rise in sea level
   2. Drought
   3. Reduced plant growth
   4. Encourage growth of pests
   5. Water shortage.

   (any four) ½ x 4= 2 marks