SECTION A

*Questions no. **1** to **16** are Multiple Choice type Questions, carrying **1** mark each.* *16×1=16*

1. Identify the Freon from the following compounds :

(A) CCl_2F_2

(B) CCl_2Br_2

(C) $CH_2Cl - CHCl_2$

(D) $CHCl_2 - CHCl_2$

2. A conductivity cell contains electrodes made up of :

(A) Silver

(B) Copper

(C) Platinum

(D) Zinc

3. The value of K_H at 298 K for Ar(g), CO_2(g), HCHO(g) and CH_4(g) are 40·32, 1·68, $1\cdot 84 \times 10^{-5}$ and 0·416 kbar respectively. When these gases are arranged in increasing order of solubility, the correct order is :

(A) HCHO < CH_4 < CO_2 < Ar

(B) HCHO < CO_2 < CH_4 < Ar

(C) Ar < CO_2 < CH_4 < HCHO

(D) Ar < CH_4 < CO_2 < HCHO

4. Out of the following organic compounds, the one which will react with Lucas reagent at room temperature is :

(A) $CH_2 = CH - CH_2OH$

(B) $CH_3CH_2CH_2OH$

(C) $C_6H_5CH_2OH$

(D) $(CH_3)_3COH$

5. Glucose on reaction with hydrogen iodide gives :

(A) Gluconic acid

(B) n-Hexane

(C) Saccharic acid

(D) Hexanoic acid

6. Which of the following amines has the highest boiling point ?

(A) 2,2-Dimethyl propanamine

(B) 3-Methylbutanamine

(C) 2-Methylbutanamine

(D) Pentanamine

7. Which one of the following halides contains $C_{sp^2} - X$ bond ?

(A) Alkyl halide

(B) Allyl halide

(C) Benzyl halide

(D) Vinyl halide

8. If the half-life period of a first order reaction is 2772 s, then the rate constant of this reaction is :

(A) $2{\cdot}5 \times 10^{-4}\ s^{-1}$ (B) $2{\cdot}5 \times 10^{-3}\ s^{-1}$

(C) $25 \times 10^{-4}\ s^{-1}$ (D) $25 \times 10^{-3}\ s^{-1}$

9. The standard electrode potentials of 'P', 'Q' and 'R' are – 0·50 V, + 0·68 V and – 2·54 V respectively. The order of their reducing power is :

(A) $R > P > Q$ (B) $Q > P > R$

(C) $Q > R > P$ (D) $P < Q < R$

10. The transition element which shows both +1 and +2 oxidation states is :

(A) Sc

(B) Mn

(C) Cu

(D) Zn

11. A compound $CaCl_2 . 6H_2O$ undergoes complete dissociation in water. The Van't Hoff factor (i) is :

(A) 9

(B) 6

(C) 4

(D) 3

12. When phenyl ethyl ether is heated with HI, it produces :

(A) Phenol and ethyl iodide

(B) Iodobenzene and ethanol

(C) Benzene and ethanol

(D) Ethyl chloride and iodobenzene

For Questions number 13 to 16, two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

13. *Assertion (A) :* p-methoxyphenol is a stronger acid than p-nitrophenol.

Reason (R) : Methoxy group is electron-donating group whereas nitro group is electron-withdrawing.

14. *Assertion (A) :* The molecularity of the reaction $H_2 + Br_2 \rightarrow 2HBr$ appears to be 2.

Reason (R) : Two molecules of the reactants are involved in the given elementary reaction.

15. *Assertion (A) :* Actinoids show a wide range of oxidation states.

Reason (R) : Actinoids are radioactive in nature.

16. *Assertion (A) :* Presence of $-NO_2$ group at ortho and para positions decreases the reactivity of haloarenes towards nucleophilic substitution reactions.

Reason (R) : Nitro group decreases the electron density over the benzene ring.

P.T.O.

SECTION B

17. (a) Define Fuel cell. Write two advantages of fuel cell over ordinary cell. *2*

OR

(b) Predict the products of electrolysis in each of the following : *2*

(i) A dilute solution of H_2SO_4 with platinum electrodes

(ii) An aqueous solution of $CuCl_2$ with platinum electrodes

18. By giving reasons, explain how the rate of the reaction for a given reaction will be affected when : *2*

(a) the temperature at which the reaction was taking place is decreased.

(b) a catalyst is added.

19. Give one point of difference between the following : *2*

(a) Starch and Cellulose

(b) Primary and Secondary structure of protein

20. Visha diluted the solutions of two electrolytes 'P' and 'Q'. She observed that Λ_m of 'P' increased 1·5 times whereas Λ_m of 'Q' increased 25 times. Which of the two is a strong electrolyte ? Justify your answer by graphically explaining the behaviour of 'P' and 'Q'. *2*

21. (a) Aniline cannot be prepared by Gabriel phthalimide synthesis. Give reason.

(b) Name the reaction which can be used to distinguish chemically between ethanamine and N-methylethanamine. *2*

SECTION C

22. Give reasons for the following : *3*

(a) t-butyl bromide on reaction with sodium methoxide gives alkene as main product and not ether.

(b) *o*-nitrophenol is steam volatile while *p*-nitrophenol is not.

(c) Alcohol is less acidic than phenol.

23. Calculate emf of the following cell at 298 K : *3*

$Mg(s) | Mg^{2+}\ (0{\cdot}001\ M) \| Cu^{2+}\ (0{\cdot}0001\ M) | Cu(s)$

Given : $E^{o}_{cell} = 2{\cdot}71$ V, $\log 10 = 1$

24. Ethanamine reacts with benzoyl chloride to form a product 'X'. Give the structure and IUPAC name of 'X'. Can 'X' undergo Hoffmann bromamide degradation reaction ? If yes, then give the structure of the product. If no, then give reason. *3*

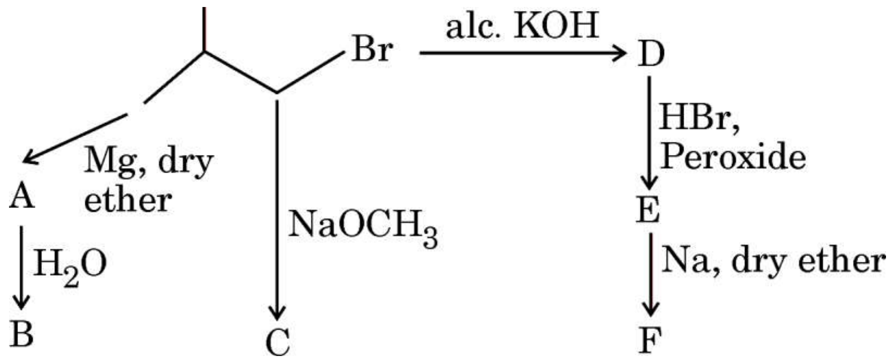
25. (a) Write IUPAC name of the complex $[CoBr_2(en)_2]^+$.

(b) Write the hybridization of the complex $[NiCl_4]^{2-}$ and predict its magnetic behaviour. [Atomic mass : Ni = 28]

(c) What type of isomerism is shown by the complex $[Co(NH_3)_5 Br] SO_4$? *3*

P.T.O.

26. (a) Identify 'A' to 'F' in the following reaction sequence : *3*



OR

(b) What happens when : *3*

(i) ethyl chloride is treated with KCN ?

(ii) ethyl bromide is treated with NaI in dry acetone ?

(iii) ethyl bromide is treated with silver fluoride ?

27. Give plausible explanation for each of the following : *3*

(a) Propanal is more reactive towards addition of HCN than propanone.

(b) Alpha (α)-hydrogens of aldehydes and ketones are acidic in nature.

(c) A base has to be added for an effective reaction of carbonyl compounds with HCN.

28. The following results have been obtained during the kinetic studies of the reaction :

$$2A + B \rightarrow C + D$$

Experiment	[A]/mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D (mol L^{-1} min^{-1})
1	0·1	0·1	$6{\cdot}0 \times 10^{-3}$
2	0·3	0·2	$7{\cdot}2 \times 10^{-3}$
3	0·3	0·4	$2{\cdot}88 \times 10^{-1}$
4	0·4	0·1	$2{\cdot}40 \times 10^{-2}$

What is the rate law ? What is the order of reaction with respect to each reactant and the overall order of reaction ? *3*

P.T.O.

SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

29. One of the most distinctive properties of transition metal complexes is their wide range of colours. This means that some of the visible spectrum is being removed from white light as it passes through the sample, so the light that emerges is no longer white. The colour of the complex is complementary to that which is absorbed. The complementary colour is the colour generated from the wavelength left over. If green light is absorbed by the complex, it appears red. Table given below, gives the relationship between different wavelengths of the light absorbed and the colour observed.

Coordination Entity	Wavelength of light absorbed (nm)	Colour of light absorbed	Colour of coordination entity
$[CoCl(NH_3)_5]^{2+}$	535	Yellow	Violet
$[Co(NH_3)_5(H_2O)]^{3+}$	500	Blue-green	Red
$[Co(NH_3)_6]^{3+}$	475	Blue	Yellow-orange
$[Co(CN)_6]^{3-}$	310	Ultra-Violet (U.V.)	Pale Yellow
$[Cu(H_2O)_4]^{2+}$	600	Red	Blue
$[Ti(H_2O)_6]^{3+}$	498	Blue-green	Violet

(a) What is spectrochemical series ? Write the relationship between Δ_t and Δ_o. *2*

(b) (i) Arrange $[Co(CN)_6]^{3-}$, $[Co(NH_3)_6]^{3+}$ and $[Cu(H_2O)_4]^{2+}$ in increasing order of wavelength of light absorbed. *1*

OR

(b) (ii) On the basis of crystal field theory, write the electronic configuration of d^5 ion if $\Delta_o < P$. *1*

(c) Define crystal field splitting energy. *1*

30. Reduce carbohydrates, increase protein to check diabetes, older people may need greater carbohydrates reduction. An average Indian derives 61 – 64% of energy from consumption of food rich in carbohydrates. A study published in the Journal of Diabetes Care has recommended reducing this to 49 – 56% for remission or prevention of Type 2 diabetes, one of the leading cause of death worldwide. Along with reducing carbohydrate intake, the study suggests that one should also increase protein intake up to 14 – 20% of the total energy consumption. Fat should contribute not more than 21 – 27% of the total energy consumption. In simple words, 50% of the plate should consist of fruits and green vegetables, 25% carbohydrates, 25% food rich in protein. Type 1 diabetes is due to deficiency of insulin.

Answer the following questions :

(a) Write any two functions of carbohydrates. *2*

(b) What are monosaccharides ? *1*

(c) (i) Write the name of the deficiency diseases caused due to the lack of Vitamin D. *1*

OR

(c) (ii) Name the hormone which maintains the glucose level within narrow limit in the blood. *1*

SECTION E

31. (a) (i) Define osmotic pressure. Why is it considered as a colligative property ?

(ii) The vapour pressure of two pure liquids A and B at 400 K are 450 and 700 mmHg respectively. Find out the composition of liquid mixture if the total vapour pressure of mixture is 600 mmHg. *2+3*

OR

(b) (i) What type of deviation from Raoult's law is expected when phenol and aniline are mixed with each other ? What change in the net volume of the mixture and enthalpy is expected ?

(ii) Boiling point of water at 750 mmHg is 99·48°C. How much sucrose ($M = 342\ g\ mol^{-1}$) is to be added to 500 g of water such that it boils at 100°C ? [K_b for water = $0{\cdot}52\ K\ kg\ mol^{-1}$] *2+3*

32. (a) (i) An organic compound 'P' ($C_8H_{10}O$) on oxidation gave compound 'Q'. The compound 'Q' can also be obtained from a reaction of benzene with acetyl chloride in the presence of anhydrous $AlCl_3$. 'Q' on treatment with I_2 in aq. NaOH gave 'R' and a yellow compound 'S'. Identify 'P', 'Q', 'R' and 'S'.

(ii) Give the structure(s) of the product(s) when benzaldehyde is heated in the presence of conc. KOH. *4+1*

OR

(b) (i) Carry out the following conversions :

(I) Propanone to Propane

(II) Acetophenone to Benzoic acid

(III) Benzyl chloride to Phenylethanoic acid

(ii) Give a simple chemical test to distinguish between the following pairs of compounds :

(I) Benzaldehyde and Phenol

(II) Butanal and Butan-2-one *3+2*

33. (a) (i) Write the chemical equations involved in the preparation of potassium permanganate from pyrolusite ore (MnO_2).

(ii) Give reasons for the following :

(I) Sc (Atomic No. 21) salts are white.

(II) $E^{o}_{Cu^{2+}|Cu}$ is positive whereas $E^{o}_{Mn^{2+}|Mn}$ is negative.

(III) Transition metals have high enthalpies of atomisation. *2+3*

OR

(b) (i) Complete and balance the following chemical equations :

(I) $Cr_2O_7^{2-}(aq) + H_2S(g) + H^+ \longrightarrow$

(II) $Cu^{2+}(aq) + I^-(aq) \longrightarrow$

(ii) Give reasons :

(I) Separation of mixture of lanthanoids is difficult.

(II) Chromium has higher melting point than manganese.

(III) It is difficult to obtain oxidation state greater than two for Zn. *2+3*