Total No. of Printed Pages—12

HS/XII/Sc/Ch/NC/20

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CHEMISTRY

(Theory)

(New Course)

Full Marks : 70

Time : 3 hours

General Instructions :

(i) Attempt all parts of a question together in one place.

(ii) All questions are compulsory.

(iii) Section—A : Question Nos. **1** to **5** are of Multiple-Choice Type, each of *1* mark.

(iv) Section—B : Question Nos. **6** to **12** are Short-answer Type Questions and carry *2* marks each.

(v) Section—C : Question Nos. **13** to **24** are also Short-answer Type Questions and carry *3* marks each.

(vi) Section—D : Question Nos. **25** to **27** are Long-answer Type Questions and carry *5* marks each.

(vii) There is no overall choice. However, an internal choice has been provided in two questions of *2* marks, four questions of *3* marks and all the three questions of *5* marks weightage. Students have to attempt only one of the choices in such questions.

(viii) Use of non-programmable ordinary scientific calculators and log table is allowed.

(ix) Mobile Phones and Pagers are not allowed inside the Examination Hall.

SECTION—A

Choose and write the correct answers for the following in the Answer Script :

1. To get *n*-type semiconductors, impurity to be added to silicon should have the following number of valence electrons

(a) 2

(b) 3

(c) 1

(d) 5 1

2. The coagulating power of an electrolyte for a sol decreases in the order

(a) $Na^+ > Ba^{2+} > Al^{3+}$

(b) $Ba^{2+} > Al^{3+} > Na^+$

(c) $Al^{3+} > Ba^{2+} > Na^+$

(d) $Al^{3+} > Na^+ > Ba^{2+}$ 1

3. Fe, Co and Ni are

(a) ferrimagnetic materials

(b) anti-ferromagnetic materials

(c) ferromagnetic materials

(d) diamagnetic materials 1

4. Which of the following reagents will give a primary alcohol on reacting with a Grignard reagent? 1

(a) Methanal

(b) Ethanal

(c) Propanone

(d) Benzaldehyde

5. Denaturation of proteins destroys

(a) primary structure of proteins

(b) secondary structure of proteins

(c) tertiary structure of proteins

(d) both secondary and tertiary structures of proteins 1

SECTION—B

6. A 5% solution of non-volatile solute in water has vapour pressure 745 mm at 373 K. Calculate the molar mass of the solute. 2

7. For a reaction, the first-order rate constant at 600 K is $1 \cdot 6 \times 10^{-5}\ s^{-1}$. If the activation energy is 209 kJ mol^{-1}, calculate the rate constant of the reaction at 700 K. 2

8. *Either*

(a) Transition metals and their many compounds act as a good catalyst. Why? 1

(b) Why does light green Fe^{2+} solution change to brown on exposure to air? 1

Or

(c) Write down the steps involved in the preparation of $KMnO_4$ from MnO_2. 2

9. *(a)* How will you distinguish between pentan-2-ol and pentan-3-ol? 1

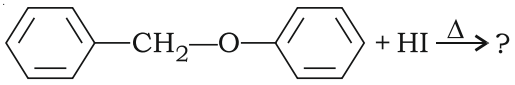
(b) Give the equation with conditions for the preparation of diethylether from ethanol. 1

10. *Either*

(a) Arrange the following compounds in increasing order of their acid strength : 1

$$H_2O,\ CH_3OH,\ C_2H_5OH,\ C_6H_5OH$$

(b) Write the product of the following reaction : 1



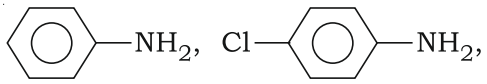
Or

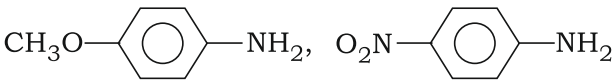
(c) Write the product of the following reaction with mechanism : 2

$$C_2H_5OH \xrightarrow[443\ K]{H_2SO_4} ?$$

11. *(a)* Aniline does not undergo Friedel-Crafts reaction. Give reason. 1

(b) Arrange the following in increasing order of basic strength : 1





12. *(a)* What do you mean by carbylamine reaction? What is its importance? 1

(b) Why aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis? 1

SECTION—C

13. *(a)* What type of defect can arise when solid is heated? 1

(b) An element has a body-centered cubic structure with cell edge of 288 pm. The density of the element is 7·2 g/cm^3. How many atoms are present in 208 g of the element? 2

14. *(a)* For cooking pulses, generally salt is added in the beginning. Give reason. 1

(b) What is the full form of RO water? Is it healthier to drink? 1

(c) Name two concentration terms which have no effect on temperature change. 1

15. *Either*

(a) Define half-life period of a chemical reaction. 1

(b) What is the overall order of the reaction

$$CHCl_3 + Cl_2 \rightarrow CCl_4 + HCl$$

with rate expression, $r = [CHCl_3][Cl_2]^{1/2}$? Is this reaction an elementary reaction? Give reason. 2

Or

(c) For a first-order reaction, prove that

$$t_{99\cdot9\%} = 10 \times t_{50\%}$$ 2

Or

$$t_{99\cdot9\%} = 10\, t_{1/2}$$

(d) Write Arrhenius equation and indicate the terms involved. 1

16. *(a)* Differentiate between colloidal sol and a gel. 1

(b) What is autocatalysis? 1

(c) How does adsorption of a gas depend on its critical temperature? 1

17. *Either*

(a) Define roasting of ores. For what type of ores is it used? 1

(b) State with equations how you will obtain 'blister' copper from copper 'matte'. 2

Or

(c) How will you extract zinc from zinc blende? Give all the equations involved. 2

(d) Write the names and formulae of two ores of iron. 1

18. *(a)* Which state of sulphur exhibits paramagnetism and why? 1

(b) Dry chlorine gas does not act as a bleaching agent. Give reason. 1

(c) Draw the structure of $HClO_4$. 1

19. What are lanthanoids? Give their general electronic configurations. What is lanthanoid contraction? 3

20. *Either*

(a) Calculate the coordination number of Co in $[Co(en)_3]^{3+}$. 1

(b) Write the IUPAC name of $[Ag(NH_3)_2][Ag(CN)_2]$. 1

(c) What is crystal field splitting? 1

Or

(d) Write the structures of the geometrical isomers of $[Co(NH_3)_3Cl_3]$. 1

(e) Explain why $[Co(NH_3)_6]^{3+}$ is an inner orbital complex, whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. (Atomic nos. of Co and Ni are 27 and 28, respectively) 2

21. *(a)* Write the products of the following reactions : 1

(i) $C_2H_5I + KNO_2 \rightarrow ?$

(ii) $C_2H_5I + AgCN \rightarrow ?$

(b) Write the reaction with conditions for conversion of 2-methylpropene into 1-bromo-2-methylpropane. 1

(c) How do the bond lengths in C—X bonds (X = F, Cl, Br, I) vary and why? 1

22. *(a)* What do you mean by non-reducing sugar? Give an example. 1

(b) Define denaturation of proteins. 1

(c) What is invert sugar? Why is it so called? 1

23. *Either*

(a) Write the equation for the preparation of low-density and high-density polythene. 2

(b) Give the common name and IUPAC name of the monomer of natural rubber. 1

Or

(c) What do you mean by homopolymer and copolymer? Give an example of each. 2

(d) Name a copolymer which is used for making non-breakable plastic crockery. 1

24. *(a)* Give example of the following (any *two*) : 1

Antacid, Antipyretic, Analgesic, Antibiotic

(b) What are preservatives? Give an example. 1

(c) What environmental problem is related to the use of highly branched alkyl detergents? 1

SECTION—D

25. *Either*

(a) Fluorine has only –1 oxidation state, but other halogens have oxidation states as +1, +3, +5 and +7 also. Give reasons. 1

(b) Give the structure of PCl_5 molecule in gaseous or liquid state. Are all the P—Cl bonds equivalent? Justify your answer. 2

(c) Write the manufacture of HNO_3 by Ostwald's process with stepwise equations. 2

Or

(d) H—P—H bond angle in PH_3 is less than H—N—H bond angle in NH_3. Give reason. 1

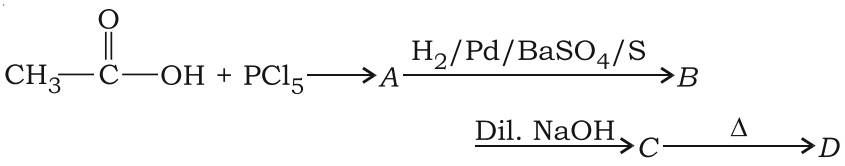
(e) Draw the structure of H_3PO_2 and account for its reducing behaviour on the basis of its structure. 2

(f) Mention the theory and conditions required to maximize the yield of ammonia for its synthesis by Haber's process. 2

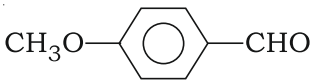
26. *Either*

(a) How does formic acid differ from other carboxylic acids? 2

(b) Identify the compounds *A* to *D* in the following sequence of reactions : 2



(c) Give the IUPAC name of



1

Or

(d) How will you distinguish between propanal and propanone? 1

(e) Convert toluene to 3-nitrobenzoic acid. 1

(f) Complete the following reaction and name the products :

$$2CH_3OH \xrightarrow[\text{Mild}]{[O]} 2A \xrightarrow[\Delta]{50\%\ KOH} CH_3OH + B$$ 2

(g) With chemical equation and conditions, name an aldehyde which can produce primary alcohol with Grignard's reagent. 1

27. *Either*

(a) Why limiting molar conductivity of CH_3COOH cannot be determined experimentally? 1

(b) How many coulombs of charge are required to produce 20·0 g of calcium from calcium chloride? 2

(c) The conductivity of 0·00241 *M* acetic acid is $7{\cdot}896 \times 10^{-5}$ S cm^{-1}. Calculate its molar conductivity and its degree of dissociation. (Given λ°_{m} for acetic acid = 390·5 S cm^2 mol^{-1}) 2

Or

(d) Calculate E°_{cell} and ΔG° for the reaction

$$Cu^{2+}(aq) + Fe(s) \rightleftharpoons Fe^{2+}(aq) + Cu(s)$$

Given that

$$E^{\circ}_{Cu^{2+}/\,Cu} = +0{\cdot}34\,V$$

$$E^{\circ}_{Fe^{2+}/\,Fe} = -0{\cdot}44\,V$$ 2

(e) Can a nickel spatula be used to stir a solution of copper sulphate? Give reason for your answer : 1½

$$E^{\circ}_{Ni^{2+}/Ni} = -0{\cdot}25\ V$$

$$E^{\circ}_{Cu^{2+}/Cu} = +0{\cdot}34\ V$$

(f) Calculate λ_m at 298 K of NH_4OH at infinite dilution, given

$$\lambda^{\circ}(OH^{-}) = 174\ S\ cm^2\ mol^{-1}$$

$$\lambda^{\circ}(Cl^{-}) = 66\ S\,cm^2\ mol^{-1}$$

$$\lambda^{\circ}(NH_4Cl) = 130\ S\ cm^2\ mol^{-1}$$ 1½

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