AMRITA VIDYALAYAM

AMRITA VIDYALAYAM
PUSHP VIHAR, NEW DELHI
SESSION 2023-24
PRE-BOARD EXAMINATION

CLASS: XII **SUBJECT: CHEMISTRY**

TIME ALLOWED: 3 HOURS **MAX. MARKS: 70**

GENERAL INSTRUCTIONS:

1. All questions are compulsory. There are 33 questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, two options in CBQ in Section D and all three questions in Section E. You must attempt only one of the choices in such questions.

SECTION – A

1. Which of the following is an example of a solid solution? 1
(a) sea water (b) sugar solution
(c) smoke (d) 22 carat gold

2. Which of the following B group vitamins can be stored in our body? 1
(a) Vitamin B_1 (b) Vitamin B_2 (c) Vitamin B_6 (d) Vitamin B_{12}

3. A first order reaction is 50% completed in 1.26×10^{14} s. How much time would it take for 100% completion? 1
(a) 1.26×10^{15} s (b) 2.52×10^{14} s
(c) 2.52×10^{28} s (d) infinite

4. A reaction involves two reactants. The rate of reaction is directly proportional to the concentration of one of them and inversely proportional to the other. The overall order of the reaction will be 1
(a) two (b) one
(c) zero (d) none of these

5. The magnetic moment of transition metal ion is 5.92 BM (spin-only formula). The number of unpaired electrons in the metal ion is 1
(a) 5 (b) 4
(c) 3 (d) 2

6. The element in the first transition series that exhibits the maximum number of oxidation states is 1
(a) titanium (b) zinc
(c) chromium (d) manganese

7. Chloroform on exposure to air in the presence of light produces
(a) phosphoryl chloride (b) phosphine
(c) phosgene (d) phosphorus oxytrichloride

8. The C-O-H bond angle in alcohol is 1
(a) slightly greater than 109.28° (b) slightly less than 109.28°
(c) slightly greater than 120° (d) slightly less than 120°

9. What would be the reactant and reagent used to obtain 2,4- Dimethyl pentan-3-ol? 1
(a) Propanal and propyl magnesium bromide
(b) 3-Methylbutanal and 2-Methylmagnesium
(c) 2-Dimethylpropanone and methyl magnesium iodide
(d) 2-Methylpropanal and isopropyl magnesium iodide

10. Benadryl a well-known drug contains the following group 1
(a) primary amine (b) secondary amine
(c) tertiary amine (d) diazonium group

11. Aromatic ketones can be obtained from benzene using 1
(a) Cannizzaro's reaction (b) Fridel Carfts reaction
(c) Reimer Tiemann reaction (d) Stephen's reaction

12. Toluene can be converted to benzaldehyde by 1
(a) CrO_2Cl_2/CS_2 (b) $CrO_3/(CH_3CO)_2O$
(c) side chain halogenation/hydrolysis (d) all of the above

ASSERTION AND REASON BASED MCQs

Directions: In the following questions,
A statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Mark the correct choice as.
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is NOT the correct explanation of A
(C) A is true but R is false
(D) A is false and R is true **OR** Both A and R are false.

13. **Assertion:** Conductivity of an electrolyte depends upon the size of the ions produced and their solvation. 1
Reason: Conductivity of an electrolyte does not depend upon temperature.

14. **Assertion:** The elements which give the greatest number of oxidation states occur in or near the middle of the series. 1
Reason: The lowest common oxidation state of transition elements is +2.

15. **Assertion:** A racemic mixture is represented by fixing *dl*- or (±)- before the name. 1
Reason: Aryl halides are extremely reactive towards nucleophilic substitutions.

16. **Assertion:** The analgesic and antipyretic aspirin is prepared by the acetylation of salicylic acid. 1
Reason: The acidity of phenol can be explained in terms of the stability of phenoxide ion.

SECTION - B

17. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%. 2

18. Explain order of reaction. Find out the unit for rate constant for 2nd order reaction. 2

19. (i) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral. Why? 2
(ii) $[Fe(H_2O)_6]^{3+}$ is strongly paramagnetic whereas $[Fe(CN)_6]^{3-}$ is weakly paramagnetic. Explain.

20. (i) Allyl chloride can be distinguished from vinyl chloride by NaOH and silver nitrate test. Comment. 2
(ii) Alkyl halide reacts with lithium aluminium hydride to give alkane. Name the attacking reagent which will bring out this change.

21. Write the structure of the following. 2
(i) 1-Bromo-4-sec.butyl-2-methylbenzene
(ii) 1–Chloro–4–(2–methylpropyl) benzene

OR

(i) 1–Chloromethyl–3–(2,2–dimethylpropyl) benzene
(ii) 1–Bromo–3,3–dimethyl–1–phenylbutane

SECTION - C

22. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume. 3

$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$

Experiment	Time/s^{-1}	Total pressure/atm
1	0	0.5
2	100	0.6

Calculate the rate of the reaction when total pressure is 0.65 atm.

OR

During nuclear explosion, one of the products is ^{90}Sr with half-life of 28.1 years. If 1μg of ^{90}Sr was absorbed in the bones of a newly born baby instead of calcium, how much of it will remain after 10 years and 60 years if it is not lost metabolically.

23. A copper-silver cell is set up. The copper ion concentration is 0.10 M. The concentration of silver ion is not known. The cell potential when measured was 0.4222 V. Determine the concentration of silver ions in the cell. (Given: $E^oAg^+/Ag = +0.80$ V, $E^oCu^{2+}/Cu = +0.34$ V). 3

24. Draw the structure and name the product formed if the following alcohol are oxidized assume that an excess of oxidizing agent is used. 3
(i) Butanol (ii) 2-butenol (iii) 2-methyl-1-propanol

25. Give simple chemical tests to distinguish between the following pairs of compounds. 3
(i) Propanal and Propanone
(ii) Acetophenone and Benzophenone
(iii) Phenol and Benzoic acid

26. Convert the following. 3
(i) Benzoic acid from ethyl benzene
(ii) Ethanoic acid to propanoic acid
(iii) Benzaldehyde from benzoyl chloride

27. Give the reasoning for the following. 3
(i) Alkyl amines are more basic than ammonia.
(ii) Aniline doesn't undergo Friedel crafts reaction.
(iii) CH_3CONH_2 is weaker base than CH_3-CH_2-NH_2.

28. Complete the following reactions. 3
(i) $C_6H_5NH_2 + CHCl_3 + alc.KOH \longrightarrow$
(ii) $C_6H_5N_2Cl + H_3PO_2 + H_2O \longrightarrow$
(iii) $C_6H_5NH_2 + conc.\ H_2SO_4 \longrightarrow$

SECTION - D

29. **Read the following text and answer the following questions:** 4
Solutions freeze at lower temperatures than pure liquids. This phenomenon is exploited in "de-icing" schemes that use calcium chloride or urea to melt ice on raods and sidewalks, and in the use of ethylene glycol as an "antifreeze" in automobile radiators. Seawater freezes at a lower temperature than ordinary water, and so the Arctic and Antarctic oceans remain unfrozen even at temperatures below 0°C.

(i) What are colligative properties?
(ii) What is the other name for freezing point depression constant.
(iii) When mercuric iodide is added to an aqueous solution of KI, the freezing point is faised. Give reason.

OR

(iii) A solution of glucose in water has a boiling point of 100.20°C. Calculate the freezing point of the same solution. K_f and K_b for water are 1.86 K $Kgmol^{-1}$ and 0.512 K $kgmol^{-1}$ respectively.

30. **Read the following text and answer the following questions:** 4
The *f*-block elements, i.e., in which the last electrons enter the *f*-subshell are called inner transition elements. These include lanthanoids (58-71) and actinoids (90-103). Lanthanoids show limited number of of oxidation state, *viz.*, +2, +3 and +4 (out of which +3 is most common). This is because of large energy gap between 4*f*, 5*d* and 6*s* subshells. The dominant oxidation state of actinoids is also +3 but they show a number of other oxidation states also, e.g., uranium (Z=92) and plutonium (Z=94) show +3, +4, +5 and +6 oxidation states etc. This is due to small energy difference between 5*f*, 6*d* and 7*s* subshells of the actinoids. Depending upon the reaction conditions, any number of electrons from 5*f*, 6*d* and 7*s* subshells can participate.

(i) Write the general electronic configuration of inner transition elements.
(ii) Mention the reason for multiple oxidation states shown by actinoids.

(iii) Explain lanthanoid contraction and its consequences.

OR

(iii) (a) Europium (II) is more stable than cerium (II), why?
(b) Lanthanoids and actinoids ions are generally coloured. Why?

SECTION - E

31. (i) Explain how rusting of iron is envisaged as setting up of an electrochemical cell. 5

(ii) For the reaction:

$2AgCl\ (s) + H_2\ (g)(1atm) \longrightarrow 2Ag\ (s) + 2H^+\ (0.1M) + 2Cl^-\ (0.1M)$

Std. Gibb's enthalpy is -43600 Jat 25°C. Calculate the emf of the cell.

OR

(i) Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging.

(ii) The conductivity of 0.001 mol L^{-1} solution of CH_3COOH is 3.905×10^{-5} Scm^{-1}. Calculate its molar conductivity, degree of dissociation and dissociation constant. Given $\Lambda\circ(H^+) = 349.6\ scm^2mol^{-1}$ and $\Lambda\circ(CH_3COO^-) = 40.9\ scm^2mol^{-1}$.

32. (i) For the complex $[Fe(en)_2(Cl_2]\ Cl$, identify the following. 5

(a) Oxidation number of iron.
(b) Hybrid orbitals and shape of the complex.
(c) Magnetic behaviour of the complex.
(d) Number of its geometrical isomers.
(e) Whether there may be optical isomer also.
(f) Name of the complex.

(ii) State a reason for each of the following situations.
(a) Co^{2+} is easily oxidized to Co^{3+} in presence of a strong ligand.
(b) *CO is a stronger complexing reagent then* NH_3.

OR

Write the name, the structure and the magnetic behaviour of each one of the following complexes.

(i) $[Pt(NH_3)_2Cl(NO_2)]$ (ii) $[Co(NH_3)_4Cl_2]Cl$ (iii) $[Ni(CO)_4]$
(iv) $K_4[Mn(CN)_6\}$ (v) $[Co(NH_3)_5\ Cl]Cl_2$

33. Arrange the following. 5

(i) In increasing order of basic strength:
Aniline, p-nitroaniline and p-toluidine

(ii) In decreasing order of basic strength:
$C_6H_5NH_2$, $C_6H_5NHCH_3$, $C_6H_5CH_2NH_2$

(iii) In decreasing order of basic strength:
$C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$ and NH_3

(iv) In increasing order of boiling point:
C_2H_5OH, $(CH_3)_2NH$, $C_2H_5NH_2$

(v) In increasing order of solubility in water:
$C_6H_5NH_2$, $(C_2H_5)_2NH$, $C_2H_5NH_2$.

OR

Convert the following.

(i) Benzene to Aniline

(ii) Benzyl chloride to 2-phenyl ethanamine

(iii) Aniline to benzene nitrile

(iv) Aniline to benzyl alcohol

(v) Nitromethane to dimethylamine