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Second Pre-board Examination, 2022-23

CHEMISTRY (Theory), CLASS -12

Time allowed: 3 hours

Maximum Marks: 70

General Instructions:

- (i) There are 35 questions and five sections in this question paper.
- (ii) All questions are compulsory.
- (iii) **Section A:** Questions 1 to 18 are multiple-choice questions and carry 1 mark each.
- (iv) **Section B:** Questions 19 to 25 are very-short-answer questions and carry 2 marks each.
- (v) **Section C:** Questions 26 to 30 are short-answer questions and carry 3 marks each.
- (vi) **Section D:** Questions 31 and 32 are case-based questions and carry 4 marks each.
- (vii) **Section E:** Questions 33 to 35 are long-answer questions and carry 5 marks each.
- (viii) There is no overall choice in the question paper. However, internal choices have been provided in some questions.
- (ix) The use of log table or calculator is **not** permitted.

SECTION A

This section contains 18 multiple-choice questions with only **one** correct answer. Each question of the section carries 1 mark. There is **no internal choice** in this section.

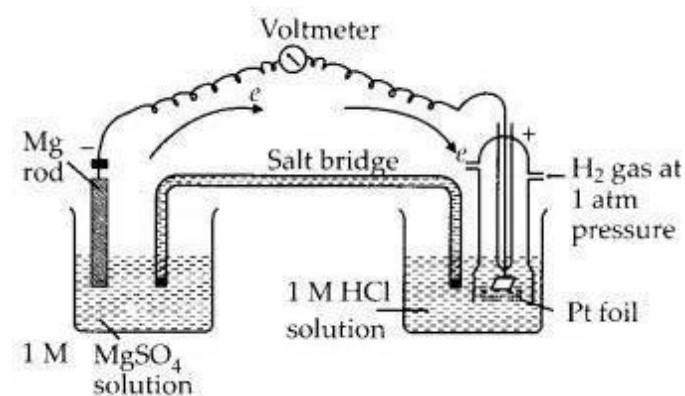
1. Faraday's law of electrolysis is related to

1

- (a) Atomic number of cation
- (b) Speed of cation
- (c) Speed of anion
- (d) Equivalent weight of electrolyte

2. The following cell is found to have the standard cell potential of 2.36 V. What will be standard reduction potential value of magnesium electrode?

1



- (a) 0 V
- (b) -1.36 V

(c)

2.36 V

(d) -2.36 V

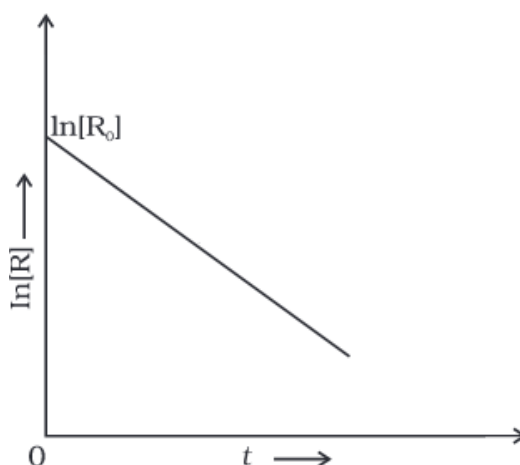
3. The molecularity of an elementary reaction cannot have which of the following values according to the collision theory? 1

- | | |
|-----------------------------|---------------------------|
| <p>(a) 2.5</p> <p>(c) 2</p> | <p>(b) 1</p> <p>(d) 3</p> |
|-----------------------------|---------------------------|

4. The rate law for the reaction, $A + B \rightarrow \text{Products}$ is: $\text{Rate} = k [A] [B]^2$. The rate of this reaction at 298 K is found to be $0.25 \text{ mol L}^{-1} \text{ s}^{-1}$. What is the rate constant of the reaction if $[A] = 1 \text{ mol L}^{-1}$ and $[B] = 0.2 \text{ mol L}^{-1}$? 1

- | | |
|--|---|
| <p>(a) $6.25 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$</p> <p>(c) $100 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$</p> | <p>(b) $0.16 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$</p> <p>(d) $16 \text{ L}^2 \text{ mol}^{-2} \text{ s}^{-1}$</p> |
|--|---|

5. To what order of a reaction does the following graph belong to? 1



- | | |
|---|---|
| <p>(a) Zero order reaction</p> <p>(c) Second order reaction</p> | <p>(b) First order reaction</p> <p>(d) Third order reaction</p> |
|---|---|

6. How does the increase in the pH affect the $\text{K}_2\text{Cr}_2\text{O}_7$ solution? 1

- (a) It cause the $\text{K}_2\text{Cr}_2\text{O}_7$ solution to release CrO_3 gas
- (b) It causes the coagulation of $\text{K}_2\text{Cr}_2\text{O}_7$ solution
- (c) It causes the $\text{K}_2\text{Cr}_2\text{O}_7$ solution to change its color from orange to yellow
- (d) It doesn't bring about any change in the $\text{K}_2\text{Cr}_2\text{O}_7$ solution

7. Which of the following elements can stabilize the higher oxidation states like +6, +7 and +8 of transition metals to the greatest extent? 1

- | | |
|---|---------------------------------------|
| <p>(a) Nitrogen</p> <p>(c) Chlorine</p> | <p>(b) Fluorine</p> <p>(d) Oxygen</p> |
|---|---------------------------------------|

8. How many moles of AgCl will be obtained when $\text{CoCl}_3 \cdot 4\text{NH}_3$ is treated with excess AgNO_3 solution? 1

- | | |
|---------------------------|---------------------------|
| <p>(a) 1</p> <p>(c) 3</p> | <p>(b) 2</p> <p>(d) 0</p> |
|---------------------------|---------------------------|

9. Identify the wrong statement for the coordination compound $[\text{CoCl}_2(\text{en})_2]^+$. 1

- (a) The *cis* isomer of the complex is optically active

- (b) The coordination number of cobalt in the complex is 6
 (c) The oxidation state of cobalt in the complex is +1
 (d) The complex has an octahedral shape

10. Name the main product obtained when an alkyl halide is reacted with silver cyanide. 1

- (a) Alkyl cyanide (b) Alkyl isocyanide
 (c) Aliphatic amide (d) Carboxylic acid

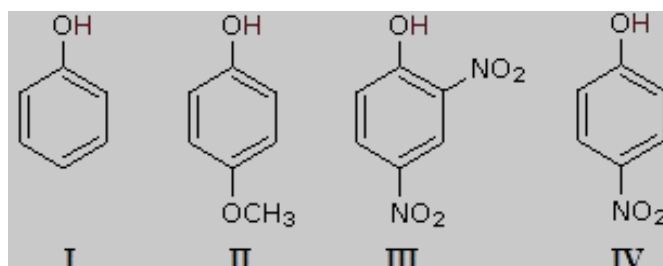
11. For the best yield of ether from Williamson's synthesis, the alkyl halide should preferably be: 1

- (a) Primary (b) Secondary
 (c) Tertiary (d) Acidified

- (a) Carbon-oxygen (b) Oxygen-hydrogen
 (c) Carbon-hydrogen (d) Carbon-carbon

12. The esterification of alcohols involves the breaking of which bond in alcohols? 1

13. The acidic strength of the following compounds decreases in the order: 1



- (a) II > I > III > IV (b) III > IV > I > II
 (c) I > IV > III > II (d) IV > III > I > II

14. The product $\text{CH}_3\text{—CH}_3$ obtained from $\text{CH}_3\text{—CHO}$ using hydrazine and ethylene glycol/potassium hydroxide is preceded by the formation of: 1

- (a) $\text{CH}_3\text{—C}\equiv\text{N}$ (b) $\text{CH}_3\text{—CONH}_2$
 (c) $\text{CH}_3\text{—CH=NH}$ (d) $\text{CH}_3\text{—CH=N—NH}_2$

For Questions 15 to 18, two statements are given - one labelled **Assertion (A)** and the other labelled **Reason (R)**. Select the correct answers to these questions from (i), (ii), (iii), and (iv) as given below: 1×4=4

- (i) Both Assertion (A) and Reason (R) are correct statements, and the Reason (R) is the correct explanation of the Assertion (A).
 (ii) Both Assertion (A) and Reason (R) are correct statements, but the Reason (R) is not the correct explanation of the Assertion (A).
 (iii) Assertion (A) is correct, but Reason (R) is an incorrect statement.
 (iv) Assertion (A) is incorrect, but Reason (R) is a correct statement.

- 15. Assertion (A)** : During the nitration of aniline, 47% of the product formed is meta-substituted.
Reason (R) : During the nitration of aniline, anilinium ion is formed that has the meta-directing —NH^+ group.

3

- 16.** **Assertion (A)** : Benzene diazonium chloride reacts with phenol in alkaline medium to form a coloured dye.
Reason (R) : Benzene diazonium chloride is resonance stabilized.
- 17. Assertion (A)** : Primary amines cannot form intermolecular hydrogen bonds.
Reason (R) : In primary amines, the nitrogen atom is directly bonded to two hydrogen atoms.
- 18. Assertion (A)** : Human beings are incapable of digesting cellulose.
Reason (R) : Cellulose is a polymer of fructose.

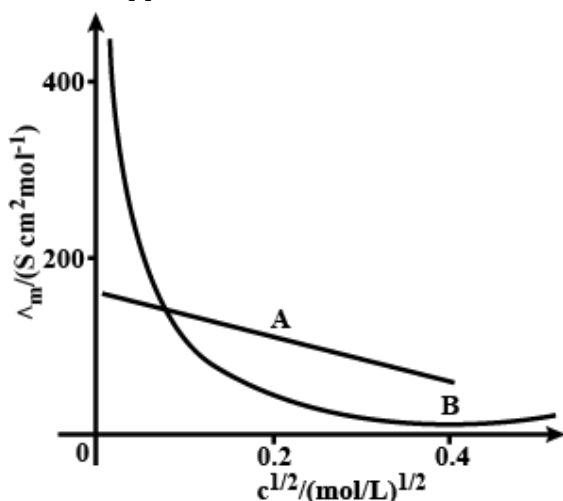
SECTION B

This section contains 7 very-short-answer questions with **internal choice** in two questions. Each question of the section carries 2 marks.

- 19.** State Kohlrausch's law of independent migration of ions and give its mathematical expression. 2

OR

The graph shows the variation of molar conductivities of two electrolytes, A and B with concentration. Identify the weak electrolyte and explain what accounts for its increase in molar conductivity as the concentration of its solution approaches zero. 2



- 20.** What are pseudo first order reactions? Give an example. 2
- 21.** A first order reaction takes 69.3 minutes for 50% completion. How much time will it take for 80% completion? ($\log 2 = 0.3010$, $\log 5 = 0.6990$, $\log 8 = 0.9030$) 2

22. What type of structural isomerism is exhibited by the following compounds? 1+1=2
(a) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$
(b) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$

23. What do you mean by: 1+1=2
(a) Racemic mixture
(b) Chiral carbon

OR

- Answer in brief: 1+1=2
(a) How does branching in carbon chain affect the boiling point of isomeric alkyl halides?
(b) In dihalobenzenes, the *para*-isomer has higher melting point than *ortho*- and *meta*-isomers. Why?

24. Give a chemical test to differentiate between: 1+1=2
(a) Benzoic acid and benzophenone
(b) Formaldehyde and benzaldehyde

25. What do you mean by denaturation of proteins? Give an example. 2

SECTION C

*This section contains 5 short-answer questions with **internal choice** in two questions. Each question of the section carries 3 marks.*

26. How many grams of ascorbic acid (vitamin C, $\text{C}_6\text{H}_8\text{O}_6$) must be dissolved in 75 g of acetic acid to lower its melting point by 1.5°C . The K_f for acetic acid is $3.9 \text{ K kg mol}^{-1}$ and the atomic masses are C = 12 u, H = 1 u, O = 16 u. 3

27. Write the IUPAC name of $[\text{Ni}(\text{CN})_4]^{2-}$ complex and explain why the complex is: 3
(a) Square planar in shape
(b) Diamagnetic in nature

OR

- Define the following terms: 1×3=3
(a) Ambidentate ligands
(b) Heteroleptic complex
(c) Spectrochemical series

28. How will you convert: 1×3=3
(a) Bromobenzene to toluene
(b) Propene to propan-1-ol
(c) Chlorobenzene to phenol

29. Write the reaction mechanism of acid-catalyzed dehydration of ethanol to form ethene. What product is formed when ethanol is heated with conc. H_2SO_4 at 413 K? 3

30. Write the chemical equations for the following reactions:

1×3=3

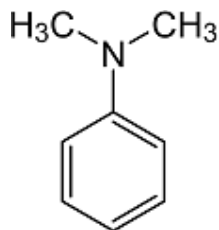
- (a) Gabriel phthalimide synthesis
- (b) Hoffmann bromamide degradation
- (c) Isocyanide test

OR

Answer the following questions:

1×3=3

- (a) The pK_b values of CH_3NH_2 , $\text{C}_6\text{H}_5\text{NH}_2$, and $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ are 3.38, 9.38, and 4.70 respectively. Arrange these amines in the increasing order of their basic strength.
- (b) Write the IUPAC name of the compound:



- (c) How would you explain aniline's inability to give Friedel-Craft reactions?

SECTION D

This section contains 2 case-based questions with **internal choice** in one of the sub-questions that follow the passages. Each question of the section carries 4 marks.

31. The solubility of gases in liquids increases with increase of pressure. William Henry made a systematic investigation of the solubility of a gaseous solute in a liquid solvent. According to Henry's law "the mass of a gas dissolved per unit volume of the solvent at a constant temperature is directly proportional to the pressure of the gas in equilibrium with the solution."

Dalton, during the same period, also concluded independently that the solubility of a gas in a liquid solution depends upon the partial pressure of the gas. If we use the mole fraction of gas in the solution as a measure of its solubility, then Henry's law can be modified as "the partial pressure of the gas in the vapour phase is directly proportional to the mole fraction of the gas in the solution."

- (a) On the basis of Henry's law explain why aquatic animals prefer not to come to the surface often.

1

OR

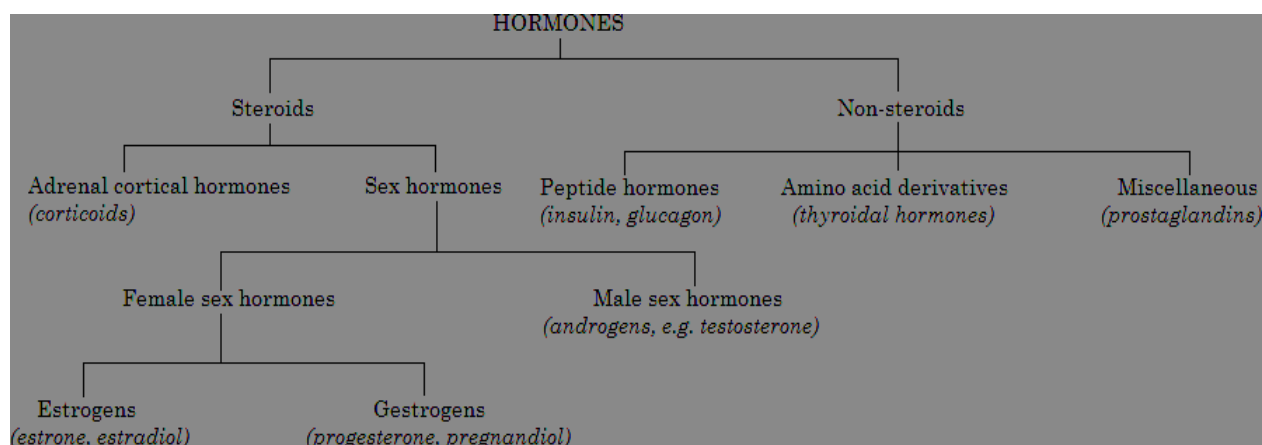
Diver's bends is a medical condition that results in the blockage of blood capillaries due to the formation of nitrogen bubbles in blood when a diver returns to the surface from deep water. How does the nitrogen gas get in the blood of the diver?

1

- (b) Three gases X, Y and Z are dissolved in water at a partial pressure of 6 bar, 4 bar and 8 bar respectively at a constant temperature. Which of the three will have the least solubility in water? Why? 1
- (c) Henry's law constant for the solubility of methane in benzene at 298 K temperature and 760 mm Hg pressure is 4.27×10^5 mm Hg. Determine the solubility of methane in benzene in terms of its mole fraction. 2

32. The communication between different cells in our body is established by certain chemicals called hormones, which act as *chemical messengers*. Hormones are a group of biomolecules which are produced in the endocrine or ductless glands and are carried to different parts of the body by the blood stream where they control various metabolic processes or show physiological activity. They are required only in very small amounts. Like fats and carbohydrates, they are not stored in the body but continuously being produced.

In mammals, the secretion of hormones is controlled by the pituitary gland located at the base of the brain. A general classification of hormones is given below.



- (a) Which hormone controls the blood sugar level in our body? 1
- (b) In what respect do hormones differ from vitamins? 1
- (c) Why hormones are considered chemical messengers? 1

OR

Which gland controls the secretion of hormones in humans? 1

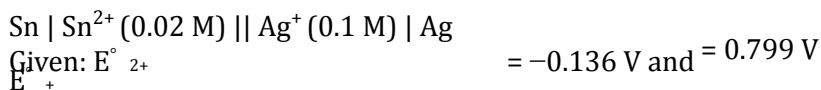
- (d) Name the hormone which is commonly referred to as „fight or flight“ hormone (Hint: It is the first hormone to be isolated and prepares humans and animals for emergency in many ways by raising the pulse rate, blood pressure, etc.). 1

SECTION E

This section contains 3 long-answer questions with **internal choice** in two of them. Each question of the section carries 5 marks.

33. Solve the following numerical questions: 3+2=5

- (a) Calculate the cell potential for the following cell at 25°C.



$\text{Sn} / \text{Sn}^{2+}$ Ag / Ag^+
 $(\log 2 = 0.3010)$

(b) The conductivity of 0.005 M NaI solution at 25°C is $6.065 \times 10^{-4} \Omega^{-1} \text{cm}^{-1}$. Calculate its molar conductivity.

34. Give reasons:

1×5=5

- (a) The compounds of Zn^{2+} are colorless.
- (b) Among the first transition series, chromium is the hardest metal.
- (c) Scandium doesn't show variable oxidation states.
- (d) Transition elements form interstitial compounds.
- (e) Zinc, cadmium and mercury are not considered as transition elements.

OR

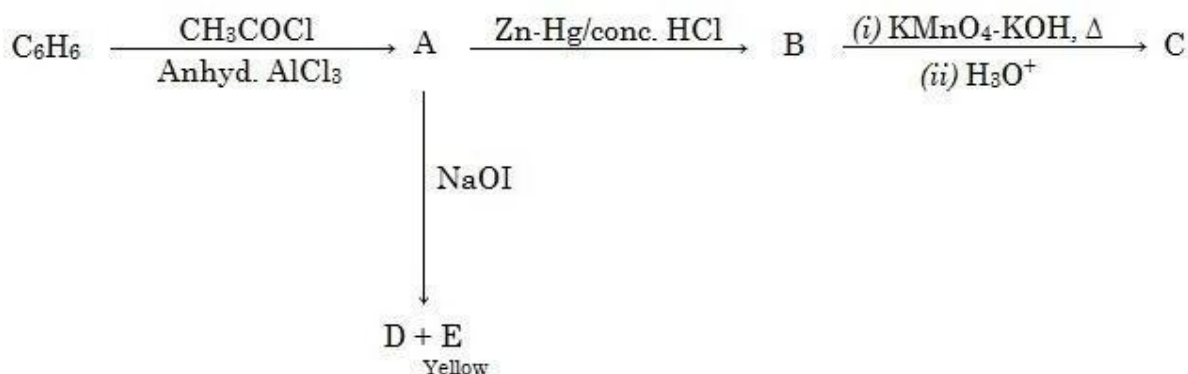
Answer the following questions:

3+1+1=5

- (a) What is lanthanide contraction? Mention its cause and any two consequences.
- (b) Cerium, in its +4 oxidation state, is oxidizing in nature. Why?
- (c) Write the balanced ionic equation for the oxidation of iodide in the presence of alkaline potassium permanganate.

35. Write the structures of A, B, C, D and E in the following reactions:

5



OR

Write the main product of the following reactions:

1×5=5

