BIRLA SCHOOL, PILANI (RAJ.)
2023-24
CHEMISTRY

Max. Marks: 70   **Class: XII**   **Duration: 3 Hrs**

General Instructions: **Read the following instructions carefully :**
a) There are **35** questions in this question paper with internal choice.
b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
d) SECTION C consists of 5 short answer questions carrying 3 marks each.
e) SECTION D consists of 2 case- based questions carrying 4 marks each.
f) SECTION E consists of 3 long answer questions carrying 5 marks each.
g) **All questions are compulsory.**
h) **Use of log tables and calculators is not allowed.**

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Phenols can be distinguished from alcohols by :

   a. Fehling Solution   b. Neutral $FeCl_3$

   c. Tollen's reagent   d. 2,4-DNP
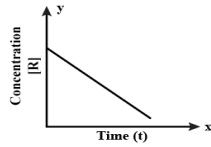
2. Name the reaction which can convert chlorobenzene to toluene :

   a. Fittig reaction   b. Wurtz reaction

   c. Swarts reaction   d. Wurtz-Fittig reaction

3. Which of the following statement is wrong ?

   a. d-Block Elements belong to groups 3 to 12.

   b. All transition elements are metals.

   c. All elements of the d-block are transition elements.

   d. d-block elements are present in between s and p block elements in the periodic table

4. Consider the reaction $R \xrightarrow{k} P$. The change in concentration of R with time is shown in the following plot. Predict the order of the reaction :

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a. Zero order reaction   b. First order reaction

c. Second order reaction   d. Third order reaction

5. How many grams of Ag will be deposited if 5 F quantity of electricity is passed through aqueous solution

of $AgNO_3$? [Atomic mass of Ag = 108 u]

a. 270 g   b. 540 g   c. 180 g   d. 135 g

6. The activation energy in a chemical reaction is defined as :

a. The difference in energies of reactants and products.

b. The sum of energies of reactants and products.

c. The difference in energy of intermediate complex with the average energy of reactants and products.

d. The difference in energy of intermediate complex and the average energy of reactant.

7. An organic compound **A** on reduction gives compound **B** which on reaction with chloroform and potassium hydroxide forms Phenylisocyanide with offensive smell. The compound **A** is :

a. Nitromethane   b. Methylamine

c. Nitrobenzene   d. Aniline

8. Colourless complex ion in the following is:

a. $[Cu(NH_3)_4]^{2+}$ b. $[Zn(NH_3)_4]^{2+}$

c. $[Fe(H_2O)_6]^{3+}$ d. $[Fe(CN)_6]^{3-}$

9. The compound which reacts fastest with Lucas reagent at room temperature is:

a. Butan-1-ol   b. Butan-2-ol

c. 2-Methylpropan-1-ol   d. 2-Methylpropan-2-ol

10. Which of the following is used as Hinsberg's reagent ?

a. $C_6H_5NHCH_3$ b. $C_6H_5SO_2Cl$

c. $C_6H_5COCH_3$ d. $C_6H_5SO_3H$

11. The IUPAC name of $CH_3COCH(CH_3)_2$ is:

a. 2- Methylbutan-3- one   b. 1,1-Dimethylpropanone

c. 3- Methylbutan-2- one   d. 3,3-Dimethylpropanone

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12. A reaction in which reactants (R) are converted into products (P) follows second order kinetics. If concentration of R is increased by four times, what will be the increase in the rate formation of P ?

   a. 16   b. 8

   c. 4   d. 12

`13. Co-ordination number of Ni in $[Ni(C_2O_4)_3]^{4-}$ is:

   a. 3   b. 4

   c. 5   d. 6

14. If formaldehyde and KOH are heated, then we get :

   a. Methane   b. Methyl alcohol

   c. Ethyl formate   d. Acetylene

Given below are two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below:

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 but R is true.

15. **Assertion (A)**: p-nitrophenol is more acidic than phenol.

Reason (R): Nitro group helps in the stabilisation of the phenoxide ion by dispersal of negative charge due to resonance.

16. **Assertion (A)**: All naturally occuring α− amino acids except glycine are optically active.

Reason (R): Most naturally occurring amino acids have L-configuration.

17. **Assertion (A)**: Cu^{2+} ions are more stable than Cu^+ ions in aqueous solutions.

Reason (R): Cu^+ ion has higher hydration enthalpy than Cu^{2+}.

18. **Assertion (A)**: N-methyl acetamide undergoes Hofmann bromamide reaction.

Reason (R): In Hofmann bromamide reaction ,the amine formed has one carbon atom less than the parent 1^0 amide .

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short and carry 2 marks each.

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19. The decomposition of Cl_2O_7 at 500K in the gas phase to Cl_2 and O_2 is a first order reaction. After One minute at 500K, the pressure of Cl_2O_7 falls from 0.08 to 0.04 atm. Calculate the rate constant in s^{-1}.
[Given Log 2 =0.3010, Log 3=0.4771, Log 4=0.6021]
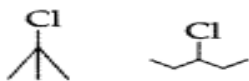
20. Account for the following:
    a. There are 5 - OH groups in glucose
    b. Glucose is a reducing sugar

OR

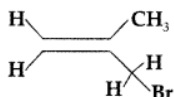What happens when D – glucose is treated with the following reagents :
    a. HI   b. HNO_3

21. a. In the following pair of halogen compounds, which compound will react faster by S_N1 mechanism?

    b. Write the IUPAC name of the following :

22. $[Fe(H_2O)_6]^{3+}$ is strongly paramagnetic whereas $[Fe(CN)_6]^{3-}$ is weakly paramagnetic. Explain.

23. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.

24. Enumerate the factors that affect the rate of a chemical reaction.

25. What happens when (**Any two**) :
    a. Propanone is treated with CH_3MgBr and then hydrolysed.
    b. Toluene undergoes vigorous oxidation with alkaline $KMnO_4$.
    c. Benzoic acid reacts with ammonia.

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26. Explain the following with an example (i) Kolbe's reaction.
                                    (ii) Reimer-Tiemann reaction.
                                    (iii) Williamson ether synthesis.

27. Write the IUPAC name of $K_4[Mn(CN)_6]$ and discuss the hybridization, geometry, magnetic character and spin of the given complex.

28. State Henry's law correlating the pressure of a gas and its solubility in a solvent and mention two applications of the law.
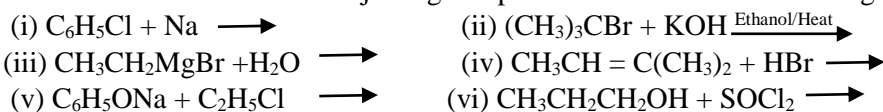
OR

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Write two differences between a solution showing positive deviation and a solution showing negative deviation from Raoult's law.

29. Give reasons for **any 3** of the following observations:
    a. Aniline is acetylated before nitration reaction.
    b. pKb of aniline is lower than the m-nitroaniline.
    c. Aniline does not undergo Friedel-Crafts reaction.
    d. Ethylamine is soluble in water whereas aniline is not.

30. Write the structure of the major organic product in each of the following reactions:
    (i) $C_6H_5Cl + Na \longrightarrow$
    (ii) $(CH_3)_3CBr + KOH \xrightarrow{\text{Ethanol/Heat}}$
    (iii) $CH_3CH_2MgBr + H_2O \longrightarrow$
    (iv) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$
    (v) $C_6H_5ONa + C_2H_5Cl \longrightarrow$
    (vi) $CH_3CH_2CH_2OH + SOCl_2 \longrightarrow$

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

31. Proteins are the most abundant biomolecules of the living system. They are required for growth and maintenance of body. All proteins are polymers of α-amino acids and are connected to each other by peptide linkage. There are 20 different amino acids, each with a different – R group, commonly found, in the proteins of living things. The human body can synthesis 10 out of the 20 amino acids found in the proteins. When a protein in its native form, is subjected to physical changes like change in temperature or chemical changes like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This is called denaturation of protein.
The denaturation causes change in secondary and tertiary structures but primary structures remains intact. Examples of denaturation of protein are coagulation of egg white on boiling, curdling of milk, formation of cheese when an acid is added to milk.

Answer the following questions:

a. What are essential and non-essential amino acids? Give one example of each.
b. Define peptide linkage.
c. What is the effect of denaturation on structure of proteins ?

32. The vapour pressure of solution decreases when a non-volatile solute is added to a volatile solvent. There are many properties of solutions which are connected with this decrease of vapour pressure. The properties which depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution are called colligative properties. Relative lowering of vapour pressure is an example of colligative property.
**Answer the following questions:**
a. Vapour pressure of water at 293K is 17.5 mm Hg. Calculate the vapour pressure of water at 293K when 25g of glucose is dissolved in 450 g of water.?
b. Why is the vapour pressure of solution lower than that of pure solvent ?

c. Name two colligative properties other than relative lowering of vapour pressure.

SECTION E

The following questions are long answer type and carry 5 marks each. One question has an internal choice.
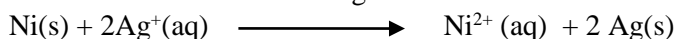
33.a. Calculate the emf of the following cell at 298 K :   (2+1+1+1)

$$2\,Cr(s) + 3Fe^{2+}(0.1M) \longrightarrow 2\,Cr^{3+}\,(0.01\,M) + 3\,Fe(s)$$
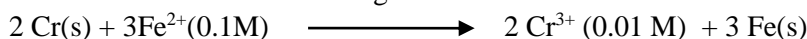
[Given $E^0Cr^{3+}/Cr= -0.74$ V and $E^0Fe^{2+}/Fe= -0.44$ V ; Log 10=1,Log 2 =0.3010]

  b. State Kohlrausch law of independent migration of ions.

  c. Calculate ΔG^0 for the following cell :

  $$Ni(s) + 2Ag^+(aq) \longrightarrow Ni^{2+}\,(aq) + 2\,Ag(s)$$

  Given $E^0cell = 1.05$ V, 1 F = 96500 C mol^{-1}

  d. In operation of a Galvanic cell,at one of its electrode oxidation takes place.What is the name of
   this electrode and what is its polarity ?

34.a.Illustrate (**Any Two**) of the given name reactions with an example :   (2+2+1)

    (i)Rosenmund reduction (ii)Aldol Condensation (iii)Hell Volhard Zelinsky reaction

  b.Write the product of the given reactions :

    (i)$CH_3CH_2CN + C_6H_5MgBr \longrightarrow$

    (ii) $CH_3COCH_3 + NH_2OH \longrightarrow$
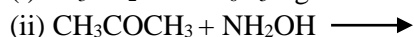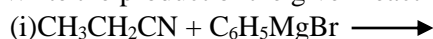
  c.Identify the missing reagent in the given reaction : $CH_3COONa \xrightarrow{\ ?\ } CH_4 + Na_2CO_3$

35. a.What is the effect of temperature on the rate constant of a reaction ?   (1+1+1+2)

   b.How order and molecularity are different for complex reactions ?

   c.Rate = $k[A]^2[B]^{1/2}$ .What is the order of the reaction ?

   d.A first order reaction has rate constant $2 \times 10^{-3}s^{-1}$.How long will 6 g of this reactant take to reduce to
    2 g ?

  [Given Log 10 = 1; Log 2 = 0.3010 ; Log 3 = 0.4771 ;Log 4 = 0.6021]

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