CBSE QUESTION PAPER

CHEMISTRY (Theory)
रसायन विज्ञान (सैद्धांतिक)
CLASS-XII

निर्धारित समय : 3घण्टे
Time allowed : 3hours

अधिकतम अंक : 70
Maximum Marks : 70
General Instructions:

(i) All questions are compulsory.

(ii) Marks for each question are indicated against it.

(iii) Questions number 1 to 8 are very short-answer questions and carry 1 mark each.

(iv) Questions number 9 to 18 are short-answer questions and carry 2 marks each.

(v) Questions number 19 to 27 are also short-answer questions and carry 3 marks each.

(vi) Questions number 28 to 30 are long-answer questions and carry 5 marks each.

(vii) Use Log Tables, if necessary. Use of calculators is not allowed.

1. What is the number of atoms in a body-centred cubic unit cell of a crystal?  
   किसी क्रिस्टल के काय-केन्द्रित (अंत-केन्द्रित) घनीय एकक सेल में परमाणुओं की संख्या कितनी होती है?

2. What is an emulsion?  
   इम्लशन क्या होता है?

3. Which one has higher electron gain enthalpy with negative sign, sulphur or oxygen?  
   सल्फर अथवा ऑक्सीजन में किसकी इलेक्ट्रॉन अन्तर्गत अधिक चिह्न के साथ अधिक होती है?

2
4. Give the IUPAC name of the following compound:

```
H          CH₃
/ \        / \      
H          H
      \    /      
     CH₃/BR      
```

5. Write the structural formula of 3-oxopentanal.

```
3-oxopentanal का संरचना सूत्र लिखिये।
```

6. Name two metals which occur in nature as oxides.

```
दो ऐसे धातुओं के नाम बताइए जो प्रकृति में ऑक्साइड के रूप में पाई जाती हों।
```

7. Arrange the following compounds in an increasing order of their basic strength in aqueous solutions:

```
NH₃, RNH₂, R₂NH, R₃N
```

8. Write the name of an antacid which is often used as a medicine.

```
एक ऐसे प्रति-अम्ल (एंटासिड) का नाम लिखिये जो प्रायः औषधि के रूप में प्रयोग होता हो।
```

9. Differentiate between molality and molarity of a solution. What is the effect of rise in temperature on molality and molarity of the solution?

```
विलयन की मोललता और मोलरता में अंतर स्पष्ट कीजिए।एक विलयन की मोललता और मोलरता पर ताप बढ़ने का क्या प्रभाव पड़ता है?
```

10. Describe the role of the following:

(i) NaCN in the extraction of silver

(ii) CO in the purification of nickel
11. Corrosion is essentially an electrochemical phenomenon. With the help of a diagram explain the reactions occurring during the corrosion of iron kept in open atmosphere.

OR

Define the term molar conductivity and indicate how molar conductivity of a substance changes with change in concentration of a weak electrolyte and a strong electrolyte in its solution.

12. Draw the structures of the following molecules:
   (i) BrF₃
   (ii) H₂S₂O₇

13. State reasons for the following observations:
   (i) The enthalpies of atomisation of transition elements are quite high.
   (ii) There is a greater horizontal similarity in the properties of the transition elements than of the main group elements.
14. Give a chemical equation for each of the following reactions:

(i) Williamson synthesis
(ii) Reimer – Tiemann reaction

15. Explain the mechanism of each of the following processes:

(i) Acid catalysed dehydration of an alcohol
(ii) Hydration of ethene to yield ethanol

16. Name two water soluble vitamins, state their sources and the diseases caused due to their deficiency in diet.

17. What are the following substances?

(i) Invert sugar
(ii) Polypeptides

18. State reasons for the following occurrences:

(i) Soaps do not do the cleansing in hard water.
(ii) Synthetic detergents are preferred to soaps in washing machines.
19. Silver crystallises in face-centred cubic unit cells. Each side of the unit cell has a length of 409 pm. What is the radius of silver atom? (Assume that each face atom is touching the four corner atoms in the unit cell.)

20. Calculate the equilibrium constant for the reaction equilibrium

\[ \text{Fe} \ (s) + \text{Cd}^{2+} \ (aq) \rightleftharpoons \text{Fe}^{2+} \ (aq) + \text{Cd} \ (s) \]

Given: \( E^{\circ}_{\text{Cd}^{2+/\text{Cd}}} = -0.40 \ \text{V} \); \( E^{\circ}_{\text{Fe}^{2+/\text{Fe}}} = -0.44 \ \text{V} \)

21. Calculate the freezing point depression for 0.0711 m aqueous solution of sodium sulphate, if it is completely ionised in solution. If this solution actually freezes at \(-0.320^\circ C\), what is the value of Van‘t Hoff factor for it at the freezing point? (\( K_f \) for water is 1.86 \( ^\circ C \) mol\(^{-1}\))

22. Describe what is observed when

(i) an electric current is passed through a colloidal solution.
(ii) a beam of light is passed through a colloidal solution.
(iii) an electrolyte such as NaCl, is added to hydrated ferric oxide sol.

(i) एक कोलोइडी विलयन में से विद्युत-धारा प्रवाहित की जाती है।
(ii) एक कोलोइडी विलयन में से प्रकाश पुंज गुजरता है।
(iii) जलमोरित फेरिक ऑक्साइड के सॉल में NaCl जैसा एक विद्युत-अत्यधिक डाला जाता है।
23. Explain the following observations:

(i) With the same d-orbital configuration (d^4) Cr^{2+} ion is a reducing agent while Mn^{3+} ion is an oxidising agent.

(ii) Cu^{+} ion is not stable in aqueous solutions.

(iii) Among the 3d series of transition elements, the largest number of oxidation states are exhibited by manganese.

24. Three geometrical isomers are possible for \([\text{Co(en)}(\text{H}_2\text{O})_2(\text{NH}_3)_2]^{3+}\). Draw molecular structures of these three isomers and indicate which one of them is chiral.

25. Complete the equations for the following reactions:

(i) \(\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} \\
\text{H}
\end{array} + \text{HBr} \rightarrow \begin{array}{c}
\text{CH}_3
\end{array}\)

(ii) \(\begin{array}{c}
\text{CH}_3
\end{array} + \text{HI} \rightarrow \begin{array}{c}
\text{H}
\text{H}
\text{H}
\end{array}\)

(iii) \(\begin{array}{c}
\text{OH}
\end{array} + \text{SOCl}_2 \rightarrow \begin{array}{c}
\text{H}
\text{H}
\end{array}\)
26. How are the following conversions carried out:

(i) Aniline to nitrobenzene
(ii) Ethanamine to N-ethylethanamide
(iii) Chloroethane to propan-1-amine

OR

Give one chemical test each to distinguish between the compounds in the following pairs:

(i) Methylamine and dimethylamine
(ii) Aniline and benzylamine
(iii) Ethylamine and aniline

27. Differentiate between the modes of formation of an addition polymer and a condensation polymer. Give one example of each of these formations.
28. (a) How are the following obtained:
   (i) Benzoic acid from ethylbenzene
   (ii) Benzaldehyde from toluene

(b) Complete each of the following reactions by giving the missing reactant, reagent or product:
   (i) \[ \text{C}_6\text{H}_5\text{COCl} \xrightarrow{\text{H}_2} \text{Pd-BaSO}_4 \quad \ldots \ldots \]
   (ii) \[ \text{Ar} / \text{R} \xrightarrow{\text{Anhydrous AlCl}_3} \]
   (iii) \[ \text{Ar} / \text{R} \xrightarrow{\ldots} \]

(a) How will you bring about the following conversions:
   (i) Ethanol to 3-hydroxybutanal
   (ii) Benzaldehyde to benzophenone

(b) An organic compound A contains 69.77% carbon, 11.63% hydrogen and the rest oxygen. The molecular mass of the compound is 86. It does not react with Tollen’s reagent but forms an addition compound with sodium hydrogen sulphite and gives a positive iodoform test. On vigorous oxidation it gives a mixture of ethanoic and propanoic acids. Derive the structure of compound A.
29. (a) Complete the following reaction equations:

(i) \( \text{XeF}_2 + \text{PF}_5 \rightarrow \)

(ii) \( \text{Cl}_2 (g) + \text{NaOH} (aq) \rightarrow \) (hot and conc.)

(b) Explain the following observations:

(i) +3 oxidation state becomes more and more stable from As to Bi in the group.

(ii) Sulphur in vapour state exhibits paramagnetism.

(iii) Fluorine does not exhibit any positive oxidation state.
(a) Complete the following reaction equations:

(i) \( \text{PCl}_5 + \text{H}_2\text{O} \) (excess) →

(ii) \( \text{F}_2 + \text{H}_2\text{O} \) →

(b) Explain the following observations:

(i) No distinct chemical compound of helium is known.

(ii) Phosphorus has a greater tendency for catenation than nitrogen.

(iii) In solutions of \( \text{H}_2\text{SO}_4 \) in water, the second dissociation constant \( K_{a_2} \), is less than the first dissociation constant \( K_{a_1} \).

30. (a) A reaction is of second order with respect to a reactant. How is the rate of reaction affected if the concentration of this reactant is

(i) doubled,

(ii) reduced to half?
(b) A first order reaction has a rate constant of 0.0051 min\(^{-1}\). If we begin with 0.10 M concentration of the reactant, what will be the concentration of the reactant left after 3 hours?

**OR**

(a) Define the following:
(i) Rate of a reaction
(ii) Elementary step in a reaction

(b) For a decomposition reaction, the values of rate constant \(k\) at two different temperatures are given below:
\[
\begin{align*}
k_1 &= 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 650 \text{ K} \\
k_2 &= 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 700 \text{ K}
\end{align*}
\]
Calculate the value of activation energy \((E_a)\) for this reaction. 
\((R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1})\)

(a) एक अभिक्रिया किसी अभिकारक के संदर्भ में द्वितीय कॉट की है । यदि इस अभिकारक का सांद्रण
(i) डगुलाना कर दिया जाए,
(ii) आधा कर दिया जाए,
तो अभिक्रिया की दर पर क्या प्रभाव पड़ेगा?

(b) एक प्रथम कॉट की अभिक्रिया का दर स्थिरांक 0.0051 min\(^{-1}\) है । यदि हम इसमें अभिकारक के 0.10 M सांद्रण के साथ प्रारंभ करें, तो 3 घंटे के पश्चात कितना अभिकारक सांद्रण रोश रह जाएगा?

अभ्यास

(a) निम्नलिखित को परिभाषित कीजिए:
(i) अभिक्रिया दर
(ii) अभिक्रिया में प्राथमिक (एलामेटरी) चरण

(b) एक अपपटन अभिक्रिया के लिए दो-भिन्न-भिन्न तापमान पर दर स्थिरांक \(k\) के मान नीचे दिए गए हैं:
\[
\begin{align*}
k_1 &= 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1}, 650 \text{ K पर} \\
k_2 &= 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1}, 700 \text{ K पर}
\end{align*}
\]
इस अभिक्रिया के लिए सक्रिय ऊर्जा \((E_a)\) के मान का परिकलन कीजिए।
\((R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1})\)