

**PRACTICE PAPER - 5 2020-21 CHEMISTRY THEORY (043)**

**MM:70**

**Time: 3 Hours**

**General Instructions:**

**Read the following instructions carefully.**

- a) There are 33 questions in this question paper. All questions are compulsory.
- b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
- c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
- d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
- e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
- f) There is no overall choice. However, internal choices have been provided.
- g) Use of calculators and log tables is not permitted.

**SECTION A (OBJECTIVE TYPE)**

**1. Read the passage given below and answer the following questions: (1x4=4)**

Inspection of a wide variety of crystals leads to the conclusion that all can be regarded as conforming to one of the seven regular figures. These basic regular figures are called seven crystal systems. To which system a given crystal belongs to is determined by measuring the angles between its faces and deciding how many Axes are needed to define the principal features of its shape. A French mathematician, Bravais, showed that there are only 14 possible three-dimensional lattices. These are called **Bravais lattices**.

**The following questions are multiple choice questions. Choose the most appropriate answer:**

- (i) Which of the following unit cell is common to all seven crystal systems?
    - (a) Primitive .
    - (b) Body centred.
    - (c) Face centred.
    - (d) End centred.
  
  - (ii) Which of the following crystal system has all the three edge lengths equal?
    - (a) Tetragonal.
    - (b) Hexagonal.
    - (c) Monoclinic.
    - (d) Cubic.
- OR**
- (ii) Which of the following crystal system has all the three axial angles equal?
    - (a) Tetragonal.
    - (b) Hexagonal.
    - (c) Monoclinic.
    - (d) Triclinic.
  
  - (iii) Which of the following crystal system has all type of unit cell variations?
    - (a) Monoclinic.
    - (b) Cubic.
    - (c) Orthorhombic.
    - (d) Triclinic.
  
  - (iv) Graphite crystallizes into which of the following type of crystal system?
    - (a) Cubic.
    - (b) Hexagonal.
    - (c) Monoclinic.
    - (d) Tetragonal.

**2. Read the passage given below and answer the following questions: (1x4=4)**

In adsorption, the substance is concentrated only at the surface and does not penetrate through the surface to the bulk of the adsorbent, while in absorption, the substance is uniformly distributed throughout the bulk of the solid. For example, when a chalk stick is dipped in ink, the surface retains the color of the ink due to adsorption of colored molecules while the solvent of the ink goes deeper into the stick due to absorption. On breaking the chalk stick, it is found to be white from inside.

**In these questions (Q. No (i)-(iv) , a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.**

- a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
  - b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
  - c) Assertion is correct statement but reason is wrong statement.
  - d) Assertion is wrong statement but reason is correct statement.
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- (i) Assertion: Adsorption is a surface phenomenon.  
Reason: Change in Enthalpy during adsorption is always positive.
  - (ii) Assertion: In sorption both adsorption and absorption can take place simultaneously.  
Reason: Desorption is opposite of adsorption.
  - (iii) Assertion: Adsorption is accompanied by decrease in entropy of the system.  
Reason: When a gas is adsorbed, the freedom of movement of its molecules becomes restricted.
  - (iv) Assertion: Chemisorption is also called activated adsorption.  
Reason: Chemisorption involves a high energy of activation

**OR**

Assertion: Easily liquefiable gases with lower critical temperatures are readily adsorbed.  
Reason: van der Waals' forces are stronger near the critical temperatures.

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Following questions (No. 3 -11) are multiple choice questions carrying 1 mark each:

3. The conductivity of electrolytic (ionic) solutions depends on:
- The nature of the electrolyte added.
  - Size of the ions produced and their solvation.
  - The nature of the solvent and its viscosity.
  - All of these.
4. Which of the following reaction suggest the presence of 5- OH group in glucose?
- Heating with HI
  - Bromine water
  - HCN
  - Acetic anhydride

**OR**

Glucose forms six membered cyclic hemiacetal structure with bond between :

- C-1 & C-4
- C-1& C-6
- C-1 & C-5
- C-2 & C-5

5. Which of the following shows positive deviation from Raoult's law ?

- Phenol-Aniline
- Acetone-Chloroform
- Nitric acid-water
- Ethanol-Acetone

6. Which of the following is not a transition metal ?

- Zn
- Hg
- Cd
- All of these.

**OR**

Which of the following d-block element has the lowest enthalpy of atomization ?

- Sc
- Ti
- V
- Mn

7. Butanenitrile on reaction with Na-Hg in ethanol gives:

- a) Propanamine
- b) Butanamide
- c) Butanamine
- d) Pentanamine

**OR**

Nitrobenzene on reaction with iron scrap & hydrochloric acid gives:

- a) Cyclohexanamine
- b) Aniline
- c) N-Methylaniline
- d) N-Ethyl - N-methylaniline

8. Which of the following is not a chelate ligand ?

- a) en
- b) ox
- c)  $\text{PPh}_3$
- d)  $\text{EDTA}^{4-}$

**OR**

The formula of the coordination compound Diamminechloridonitrito-N-platinum(II) is

- a)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}]\text{NO}_2$
- b)  $[\text{Pt}(\text{NH}_3)_2(\text{NO}_2)\text{Cl}]$
- c)  $[\text{Pt}(\text{NH}_3)\text{ClONO}]$
- d)  $[\text{Pt}(\text{NH}_3)_2\text{ClONO}_2]$

9. Which of the following is not true about Interstitial Compounds ?

- (a) They have high melting points, higher than those of pure metals.
- (b) They are very hard ..
- (c) They retain metallic conductivity.
- (d) They are chemically reactive.

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10. The synthesis of alkyl fluorides is best accomplished by heating an alkyl chloride/bromide in the presence of
- AgF
  - CoF<sub>2</sub>
  - SbF<sub>3</sub>
  - All of these.

11. Atoms of element B form hcp lattice and those of the element A occupy 2/3rd of tetrahedral voids. What is the formula of the compound ?
- A<sub>4</sub>B<sub>3</sub>
  - A<sub>3</sub>B<sub>4</sub>
  - AB<sub>3</sub>
  - A<sub>2</sub>B<sub>3</sub>

**In the following questions (Q. No. 12 - 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.**

- Assertion and reason both are correct statements and reason is correct explanation for assertion.
- Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- Assertion is correct statement but reason is wrong statement.
- Assertion is wrong statement but reason is correct statement.

12. Assertion: The amino acids, which can be synthesised in the body, are known as **nonessential amino acids**.

Reason: Histidine is a non essential amino acid.

13. Assertion: Peptization may be defined as the **process of converting a precipitate into colloidal sol**.

Reason: During peptization, the precipitate adsorbs one of the ions of the electrolyte on its surface.

14. Assertion: Aquatic species are more comfortable in cold waters rather than in warm waters.

Reason: Different gases have different  $K_H$  values at the same temperature

**OR**

Assertion: Nitric acid and water form maximum boiling azeotrope.

Reason: Azeotropes are binary mixtures having the same composition in liquid and vapour phase.

15 Assertion: Chloroethane is more reactive towards S<sub>N</sub>2 than bromoethane.

Reason: C-Br bond is weaker than C-Cl bond

16. Assertion: 4-Nitrophenol is more acidic than o-cresol.

Reason: Nitro group is electron withdrawing whereas methyl is electron donating group

**SECTION B**

**The following questions, Q.No 17 – 25 are short answer type and carry 2 marks each.**

17. What are the products formed when toluene is reacted with bromine in presence of iron. How would you separate the isomers form during the reaction. ?

**OR**

Carry out the following conversions in not more than two steps:

- (i) Benzene to Aniline
- (ii) Ethanol to fluoroethane

18. If N<sub>2</sub> gas is bubbled through water at 293 K, how many mill moles of N<sub>2</sub> gas would dissolve in 1 liter of water? Assume that N<sub>2</sub> exerts a partial pressure of 0.987 bar. Given that Henry's law constant for N<sub>2</sub> at 293 K is 76.48 kbar

19. Differentiate between homoleptic & heteroleptic complexes with an example of each type.

**OR**

Write any two postulates of Werner theory of coordination compounds .

20. The conversion of molecules X to Y follows second order kinetics. If concentration of X is increased to three times how will it affect the rate of formation of Y ?

**OR**

A first order reaction is found to have a rate constant,  $k = 5.5 \times 10^{-14} \text{ s}^{-1}$ . Find the half-life of the reaction.

21. Arrange each set of compounds in order of increasing boiling points.

- (i) Bromomethane, Bromoform, Chloromethane, Dibromomethane.
- (ii) 1-Chloropropane, Isopropyl chloride, 1-Chlorobutane.

22. (i) Preparation of ethers by acid catalysed dehydration of secondary or tertiary alcohols is not a suitable method. Give reason.

(ii) Why it is difficult to prepare pure amines by ammonolysis of alkyl halides?

23. (i) Fluorine exhibits only -1 oxidation state whereas other halogens exhibit + 1, + 3, + 5 and + 7 oxidation states also. Explain.

(ii) Why is dioxygen a gas but sulphur is a solid at room temperature?

24. Aldehydes are generally more reactive than ketones towards nucleophilic addition reactions. Explain.

25. Arrange the following in increasing order of their basic strength (Aqueous medium):

- (i) C<sub>2</sub>H<sub>5</sub>NH<sub>2</sub>, C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub>, NH<sub>3</sub>, (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>NH
- (ii) CH<sub>3</sub>NH<sub>2</sub>, (CH<sub>3</sub>)<sub>2</sub>NH, (CH<sub>3</sub>)<sub>3</sub>N, C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub>

**SECTION C**

**Q.No 26 -30 are Short Answer Type II carrying 3 mark each.**

**26. Explain giving reasons:**

- (i) Transition metals and many of their compounds show paramagnetic behavior.
- (ii) The enthalpies of atomization of the transition metals are high.
- (iii) Transition metals and their many compounds act as good catalyst.

**OR**

Give examples and suggest reasons for the following features of the transition metal chemistry:

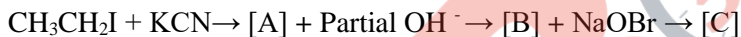
- (i) The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.
- (ii) Transition metals generally form coloured compounds.
- (iii) Manganese exhibits the highest oxidation state of +7 among the 3rd series of transition elements.

**27. Account for the following:**

- (i) Ethylamine is soluble in water whereas aniline is not.
- (ii) Aniline does not undergo Friedel-Crafts reaction.
- (iii) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

**OR**

Give the structures of A, B and C in the following reactions:



**28.** 18 g of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , (Molar mass = 180g/mol) is dissolved in 1 kg of water in a saucepan. At what temperature will water boil at 1.013 bar?  $K_b$  for water is  $0.52 \text{ K kg mol}^{-1}$ .

**29.** Write the mechanism of acid catalyse hydration of ethene to yield ethanol.

**30.** What is meant by crystal field splitting energy? On the basis of crystal field theory, write the electronic configuration of  $d^4$  in terms of  $t_{2g}$  and  $e_g$  in an octahedral field when

- (i)  $\Delta_o > P$
- (ii)  $\Delta_o < P$

**SECTION D**

**Q.No 31 to 33 are long answer type carrying 5 marks each.**

- 31. (a)** How are  $\text{XeO}_3$  and  $\text{XeOF}_4$  prepared?  
**(b)** Arrange the following in the order of property indicated for each set:  
(i)  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{I}_2$  - increasing bond dissociation enthalpy.  
(ii)  $\text{HF}$ ,  $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$  - increasing acid strength.  
(iii)  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{AsH}_3$ ,  $\text{SbH}_3$ ,  $\text{BiH}_3$  – increasing base strength.

OR

- (a) Draw the structure of  
(i) Hypochlorous acid.  
(ii) Chlorous acid.  
(b) What happens when Sulphur dioxide gas is passed through an aqueous solution of a Fe (III) salt?  
(c) How the supersonic jet aeroplanes are responsible for the depletion of ozone layers?

- 32. (a)** Give reasons for the following observations :  
(i) Haloarenes are less reactive than haloalkanes towards nucleophilic substitution reactions.  
(ii) Treatment of alkyl chloride with aqueous KOH leads to the formation of alcohol but in the presence of alcoholic KOH, alkene is the major product.  
(b) Write chemical equations when methyl chloride is treated with  $\text{AgNO}_2$ .

OR

- (a) Write the chemical tests to distinguish between the following pairs of compounds :  
(i) Ethanol and Ethanoic acid  
(ii) Ethanal and Propanal.  
(b) Write the products formed when ethanal reacts with the following reagents :  
(i)  $\text{CH}_3\text{MgBr}$  and then  $\text{H}_3\text{O}^+$ .  
(ii)  $\text{Zn-Hg/conc. HCl}$ .  
(iii) dilute  $\text{NaOH}$  & heat .

- 33. (a)** Represent the cell in which the following reaction takes place :  
 $\text{Mg(s)} + 2\text{Ag}^+(0.0001\text{M}) \rightarrow \text{Mg}^{2+}(0.130\text{M}) + 2\text{Ag(s)}$   
Calculate its  $E_{\text{cell}}$  if  $E_{\text{cell}}^0 = 3.17 \text{ V}$ . ( Given  $\log 1.3 = 0.1139, \log 5 = 0.698$  ).  
(b) Distinguish between molecularity and order of a reaction. (Any two points).

OR

(a) The conductivity of  $0.001028 \text{ mol L}^{-1}$  acetic acid is  $4.95 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its dissociation constant if  $\Lambda_m^0$  for acetic acid is  $390.5 \text{ S cm}^2 \text{ mol}^{-1}$ .

(b) Show that for a first order reaction, the time required for half the change (half-life period) is independent of initial concentration.