

Time : 2 hrs.




General Instructions :

Read the following instructions carefully.

- There are 35 questions in this question paper with internal choice.
- Section-A consists of 18 multiple-choice questions carrying 1 mark each.
- Section-B consists of 7 very short answer questions carrying 2 marks each.
- Section-C consists of 5 short answer questions carrying 3 mark each.
- Section-D consists of 2 case - based questions carrying 4 mark each.
- Section-E consists of 3 long answer questions carrying 5 mark each.
- All questions are compulsory.
- 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.

- Total number of atoms represented by the compound  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  is : 1  
a) 21      b) 8      c) 27      d) 5
- The quantum of light is : 1  
a) photon      b) neutron      c) electron      d) proton
- Which of the following species has highest negative electron gain enthalpy ? 1  
a)  $\text{F}^-$       b)  $\text{O}$       c)  $\text{O}^-$       d)  $\text{Na}^+$
- Which of the following hydrogen bonds is the strongest ? 1  
a)  $\text{F}-\text{H} \cdots \text{F}$       b)  $\text{O}-\text{H} \cdots \text{O}$   
c)  $\text{O}-\text{H} \cdots \text{F}$       d)  $\text{O}-\text{H} \cdots \text{N}$
- Which of the following represents the first law of thermodynamics ? 1  
a)  $q = \Delta U - w$       b)  $\Delta H = q + w$   
c)  $\Delta U = \Delta H + p \Delta v$       d)  $\Delta U = p \Delta v$
-   $\text{H}_2\text{SO}_4$  solution (pH = 2): its molarity is : 1  
a)  $\frac{1}{100}$       b)  $\frac{1}{50}$       c)  $\frac{1}{2}$       d)  $\frac{1}{200}$
- The correct option is for oxidation number of chlorine in bleaching powder ( $\text{CaOCl}_2$ ) 1  
a) 0, 0      b) +1, -1      c) -1, +1      d) -1, -1
- In the following bond line structure . number of  $3^\circ$  carbon atoms are : 1  
a) 1      b) 2  
c) 3      d) none of these  

-  Benzene molecule has : 1  
a) 6  $\sigma$  and 6  $\pi$  bonds      b) 16  $\sigma$  and 6  $\pi$  bonds  
c) 12  $\sigma$  and 3  $\pi$  bonds      d) 6  $\sigma$  and 3  $\pi$  bonds
- The number of significant figures in 0.0101 is : 1  
a) 3      b) 2      c) 4      d) 5
- Number of radial nodes in 3d subshell is : 1  
a) 0      b) 1      c) 2      d) 3
- Pick out the isoelectronic structures from the following : 1  
I.  $\text{CH}_3^+$       II.  $\text{H}_3\text{O}^+$       III.  $\text{NH}_3$       IV.  $\text{CH}_3^-$   
a) I and II      b) III and IV  
c) I and III      d) II, III and IV
- The magnetic quantum number, specifies : 1  
a) size of orbitals      b) shape of orbitals  
c) orientation of orbitals      d) none of them
- $\Delta H$  for the combustion of a compound is : 1  
a) positive      b) zero  
c) negative      d) may be positive or negative



15. Given below are two statements labelled as Assertion (A) and Reason (R). 1  
**Assertion (A):** pH of water increases with increases in temperature.  
**Reason (R) :** With increase in temperature,  $K_w$  of water increases.  
 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.
16. Given below are two statements labelled as Assertion (A) and Reason (R). 1  
**Assertion (A):** Oxidation number of C in HCHO is zero.  
**Reason (R) :** Formaldehyde is a covalent compound.  
 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.
17. Given below are two statements labelled as Assertion (A) and Reason (R). 1  
**Assertion (A):**  $\text{CH}_3\text{C}^+ = \text{O}$  between as electrophile.  
**Reason (R) :** In this species, O has two pairs of electrons.  
 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.
18. Given below are two statements labelled as Assertion (A) and Reason (R). 1  
**Assertion (A):** Acetylene is more acidic than ethylene.  
**Reason (R) :** Acetylene has sp character of carbon and, therefore, more s-character.  
 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.

#### SECTION - 'B'

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

19. Balance the redox reaction by ion electron method : 2  

$$\text{Zn} + \text{Na}_3\text{O}^- + \text{OH}^- \longrightarrow \text{ZnO}_2^{2-} + \text{NH}_3 + \text{H}_2\text{O}$$
20. In a reaction : 2  

$$\text{A} + \text{B}_2 \longrightarrow \text{AB}_2$$
  
 Identify the limiting reagent if any in the following reaction mixtures.  
 i) 300 atoms of A + 200 molecules of B.  
 ii) 2.5 mol of A + 5 mol of B.

OR

Calculate the amount of carbon dioxide that would be produced when 1 mole of carbon is burnt in air.

21. State the following : 2  
 a) Hund's rule of maximum multiplicity  
 b) Aufbau rule

OR

State the following :

- a) (n+1) rule  
 b) Azimuthal quantum number
22. Predict the formula of the stable binary compounds that would be formed by the following pairs of elements : 2  
 a) Silicon and oxygen  
 b) Phosphorus and fluorine



23.  $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$   $\Delta_r H^\circ = -92.4 \text{ KJ}$   
 What is the standard enthalpy of formation of  $NH_3$ ? 2
24. Which of the following do and which do not make sense?  
 $7p, 2d, 3s^3, 3p^3, 4f$  2
25. Draw the cis and trans structure of hex-2-ene. Which isomer will have higher boiling point and why? 2

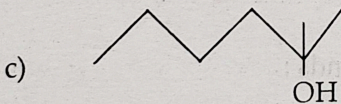
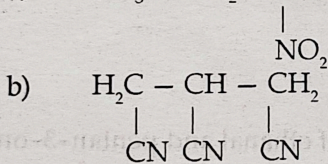
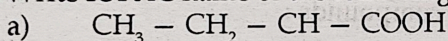
### SECTION - 'C'

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

26. How will you convert? 3
- a) Benzene to 666                      b) Ethene to Benzene  
 c) Methane to Ethane
- OR
- a) Benzene to Acetophenone              b) Ethane to Methane  
 c) Benzene to chlorobenzene
27. Calculate (i) the total number of neutrons and (ii) total mass of neutrons in 7 mg of  $C^{14}$  (assume mass of neutron = mass of hydrogen atom). 3
28. Classify the following molecules /ions as nucleophiles or electrophiles. 3  
 $HS^-, BF_3, CH_3CH_2O^-, (CH_3)_3N, Cl^+, CH_3C^+ = O$
29. a) First electron gain enthalpy of an element is written with negative sign while the second with positive. Why? 3  
 b) Electron gain enthalpy of fluorine is lower than chlorine. Why?
30. What is the wavelength of light emitted when the electron in hydrogen atom undergoes transition from an energy level with  $n = 4$  to an energy level with  $n = 2$ ? 3

OR

Write IUPAC name of the following compounds :



### SECTION - 'D'

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

31. For the sparingly soluble salts, an equilibrium is established between the undissolved solid salt and ions of the dissolved salt. For a solution of the salt live  $A_x B_y$ . 4
- $A_x B_y = x A^{y+} + y B^{x-}$   
 $K_{sp} = [A^{y+}]^x [B^{x-}]^y$
- For precipitation to occur, the ionic product must be greater than  $K_{sp}$ .
- Answer the following questions :
- a) the solubility of  $A_2 X_3$  is  $Y \text{ mol dm}^{-3}$ . What is its solubility product?  
 b) For a salt of weak acid and weak base having  $K_a = K_b$ . What will be the pH at  $25^\circ \text{C}$ ?  
 c)  $K_{sp}$  for  $A_2 B_3$  salt is  $1.1 \times 10^{-23}$ . Calculate its solubility.

OR

What is the minimum, concentration of  $\text{OH}^-$  ion required to precipitate  $\text{Fe}(\text{OH})_3$  from a 0.001 M solution of  $\text{FeCl}_3$  ( $K_{sp}$  of  $\text{Fe}(\text{OH})_3 = 1 \times 10^{-36}$ ).

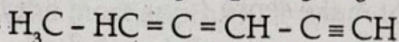
32. In order to explain the characteristic geometrical shapes of polyatomic molecules, pooling introduced the concept of hybridisation. The orbitals undergoing hybridisation should have nearly same energy. There are various types of hybridisations involving s, p and d type of orbitals. The type of hybridisation gives the characteristics shape of the molecule or ion. 4



Answer the following questions:

a) What is the hybridisation of each carbon atom ?

1 2 3 4 5 6

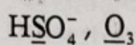


b) What is the shape of  $\text{PCl}_5$  molecule ?

c) Draw the structure of  $\text{XeF}_2$  and also write the No. of lone pair of electrons.

OR

Write the hybridisation on underlined atom in the following molecule / ion.



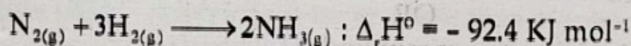
### SECTION - 'E'

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

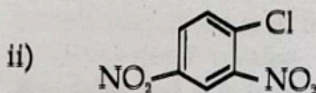
33. a) Write the increasing order of bond order in  $\text{O}_2$ ,  $\text{O}_2^+$ ,  $\text{O}_2^-$  and  $\text{O}_2^{2-}$ . 1  
 b) What will be the conjugate bases for the bronsted acids :  $\text{HF}$  and  $\text{HCO}_3^-$ ? 1  
 c) Calculate the entropy change in surroundings when 1.00 mol of  $\text{H}_2\text{O}$  (l) is formed under standard condition.  $\Delta_r H^\circ = -286 \text{ KJ mol}^{-1}$ . 3

OR

- a) Explain why  $\text{BeH}_2$  molecule has a zero dipole moment although the Be-H bonds are polar.  
 b) The  $\text{pK}_a$  of acetic acid and  $\text{pK}_b$  of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the pH of ammonium acetate solution.  
 c) Define the standard enthalpy of formation. What is the standard enthalpy of formation of  $\text{NH}_3$  gas ?



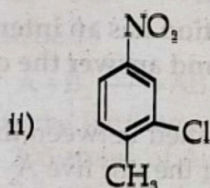
34. a) Write IUPAC name of the following compounds : 2  
 i)  $\text{HC} \equiv \text{C} - \text{HC} = \text{CH} - \text{CH}_3$



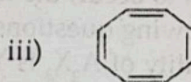
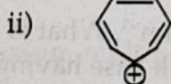
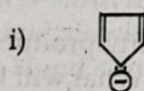
- b) An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of 'A'. 3

OR

- a) Write IUPAC name of the following compounds :  
 i)  $\text{HC} \equiv \text{C} - \text{HC} = \text{C} = \text{CH}_2$



- b) What is Huckle rule ? Identify the following compounds are aromatic or not aromatic.



35. Answer the following :

5

- a) Wurtz Reaction  
 b) What is Hess law ?  
 c) What is lattice enthalpy ?  
 d) What is photoelectric effect ?  
 e) What is hyper conjugation ?

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