

**M – 2024**

Register Number :

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**Subject Code : 34****CHEMISTRY**

Time : 3 Hours 15 Minutes]

[Total No. of questions : 52]

[Max. Marks : 70]

**Instructions :**

1. Question paper has **five** Parts having **52** questions. **All** Parts are **compulsory**.
2. a) Part – **A** carries **20** marks. **Each** question carries **1** mark.  
b) Part – **B** carries **10** marks. **Each** question carries **2** marks.  
c) Part – **C** carries **18** marks. **Each** question carries **3** marks.  
d) Part – **D** carries **10** marks. **Each** question carries **5** marks.  
e) Part – **E** carries **12** marks. **Each** question carries **3** marks.
3. In Part – **A** questions, first attempted answer will be considered for awarding marks.
4. Write balanced chemical equations and draw neat labelled diagrams and graphs wherever necessary.
5. Direct answers to the numerical problems without detailed steps and **specific** unit for final answer will **not** carry any marks.
6. **Use** log tables and simple calculator if necessary. (**Use** of scientific calculator is not allowed).

**PART – A**

- I. Select the correct option from the given choices :

**(15×1=15)**

1) The SI unit of temperature is

A) °C

B) °F

C) K

D) Kg

2) The number of moles of solute present in one litre of solution is called

A) molality

B) molarity

C) mole fraction

D) mass percent

3) Isobars in the following pair is

A)  $^{35}_{17}\text{Cl}$  and  $^{37}_{17}\text{Cl}$ B)  $^{12}_6\text{C}$  and  $^{13}_6\text{C}$ C)  $^{14}_6\text{C}$  and  $^{14}_7\text{N}$ D)  $^{12}_6\text{C}$  and  $^{14}_6\text{C}$ **P.T.O.**

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4) Out of the options given below, choose the correct order of atomic/ionic radii of sodium (Na) atom and sodium ion ( $\text{Na}^+$ ) in pm

A) 95, 186

B) 186, 95

C) 95, 95

D) 186, 186



5) Which of the following angle corresponds to  $\text{sp}^2$  hybridisation ?

A)  $90^\circ$

B)  $120^\circ$

C)  $180^\circ$

D)  $109^\circ$

6) The molecule with an odd number of electron is

A) NO

B)  $\text{H}_2\text{O}$

C)  $\text{BCl}_3$

D)  $\text{PF}_5$

7)  $C_p$  and  $C_v$  are related as

A)  $C_p - C_v = R$

B)  $C_p + C_v = R$

C)  $\frac{C_p}{C_v} = R$

D)  $\frac{C_v}{C_p} = R$

8) A reaction,  $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$  is found to be exothermic with positive entropy change. The reaction will be

A) Spontaneous only at high temperature

B) Spontaneous only at low temperature

C) Non-spontaneous at any temperature

D) Spontaneous at all temperatures



9) For acidic solution, the correct one is

A)  $[\text{H}_3\text{O}^+] > [\text{OH}^-]$

B)  $[\text{H}_3\text{O}^+] = [\text{OH}^-]$

C)  $[\text{H}_3\text{O}^+] < [\text{OH}^-]$

D)  $[\text{H}_3\text{O}^+] \leq [\text{OH}^-]$



10) Dissociation of acetic acid in the following equilibrium,  
 $\text{CH}_3\text{COOH}_{(\text{aq})} \rightleftharpoons \text{H}^+_{(\text{aq})} + \text{CH}_3\text{COO}^-_{(\text{aq})}$  is suppressed by

A) decreasing the concentration of  $\text{H}^+$  ions

B) increasing the concentration of  $\text{H}^+$  ions

C) decreasing the concentration of  $\text{CH}_3\text{COO}^-$  ions

D) decreasing both concentrations of  $\text{H}^+$  and  $\text{CH}_3\text{COO}^-$  ions

11) Oxidation number of sodium in sodium chloride is

A) +2

B) +1

C) 0

D) -1





12) In the Lassaigne's test for nitrogen in an organic compound, the Prussian blue colour is obtained due to the formation of

- A)  $\text{Na}_4[\text{Fe}(\text{CN})_6]$  B)  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_4$   
C)  $\text{Fe}_2[\text{Fe}(\text{CN})_6]$  D)  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$

13) The first organic compound synthesised by F. Wohler in 1828 is

- A) Methane B) Acetic acid C) Urea D) Benzene

14) Arrange the following in the increasing order of their boiling points :

- i. Pentane  
ii. 2-methylbutane  
iii. 2, 2-dimethylpropane.



- A)  $\text{iii} < \text{ii} < \text{i}$  B)  $\text{i} < \text{ii} < \text{iii}$  C)  $\text{ii} < \text{iii} < \text{i}$  D)  $\text{ii} < \text{i} < \text{iii}$

15) Alkenes are prepared from vicinal dihalides on treating with zinc, the reaction is known as

- A) dehalogenation B) dehydration  
C) dehydrohalogenation D) halogenation

II. Fill in the blanks by choosing the appropriate word from those given in the brackets :  
(constant, propan-2-ol, 4, 2-Bromopropane, zero, 2) (5×1=5)

16) Bond order in oxygen molecule ( $\text{O}_2$ ) is \_\_\_\_\_.

17) According to the first law of thermodynamics, "Energy of an isolated system is \_\_\_\_\_".

18) At 298 K, if pH of the solution is 10, then its pOH is \_\_\_\_\_.

19) Position isomer of propan-1-ol ( $\text{C}_3\text{H}_8\text{O}$ ) is \_\_\_\_\_.

20) The addition of HBr to propene gives \_\_\_\_\_.



### PART - B

(5×2=10)

III. Answer **any five** of the following. **Each** question carries **two** marks.

- 21) Define open system. Give an example for an open system.  
22) What are buffer solutions ? Give an example for an acidic buffer.  
23) What are isoelectronic species ? Select the isoelectronic pair from the following :  
 $\text{F}^-$ ,  $\text{Li}^+$ ,  $\text{O}^{2-}$ ,  $\text{H}^+$ .



24) Give reason :

- i) Dipole moment of  $\text{BeF}_2$  is zero.
- ii)  $\sigma$  bonds are stronger than  $\pi$  bonds.

25) Write any two differences between Bonding Molecular Orbital (BMO) and Antibonding Molecular Orbital (ABMO).

26) Using stock notation, represent the following compounds :

- i)  $\text{CuI}$
- ii)  $\text{Fe}_2\text{O}_3$

27) For the compound 2-Bromobutane, write the complete structural formula and bond-line formula.

28) What are nucleophiles ? Give an example.

29) Explain Wurtz reaction. Write the equation for the preparation of ethane by this method.



#### PART – C

IV. Answer **any three** of the following. **Each** question carries **three** marks. (3×3=9)

30) Define electron gain enthalpy. How does it vary across a period and down the group ?

31) What is hydrogen bonding ? Mention the types of hydrogen bonding.

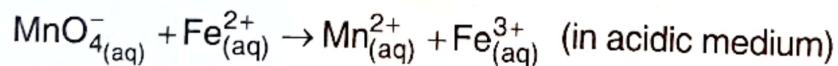
32) For  $\text{H}_2$  molecule,

- i) Write the electronic configuration.
- ii) Calculate the bond order.
- iii) State its magnetic property.



33) Explain  $sp$  hybridisation by taking  $\text{BeCl}_2$  as an example.

34) Balance the ionic equation by oxidation number method.



V. Answer **any three** of the following. **Each** question carries **three** marks. (3×3=9)

35) a) Round up 1.074547 upto three significant figures.

b) Define limiting reagent.



36) Write any three postulates of Bohr's atomic theory.

37) In  $2p$  orbital, identify the following :

- i) Number of angular nodes
- ii) Number of radial nodes
- iii) Total number of nodes.

- 38) Explain the measurement of  $\Delta U$  using bomb calorimeter.
- 39) State Le Chatelier's principle. What is the effect of temperature on equilibrium constant in exothermic and endothermic reaction ?
- 40) Define conjugate acid-base pair. Mention the conjugate acid of  $\text{NH}_3$  and conjugate base of  $\text{H}_2\text{O}$ .



### PART – D

VI. Answer **any two** of the following. **Each** question carries **five** marks. (2×5=10)

41) a) How do you detect the presence of carbon and hydrogen in an organic compound by copper oxide method ?

b) Mention any two methods of purification of organic compounds.

42) a) What is resonance effect ? Give an example each for groups showing +R and -R effect.

b) Name the species formed during

i) Homolytic cleavage of covalent bond.

ii) Heterolytic cleavage of covalent bond.

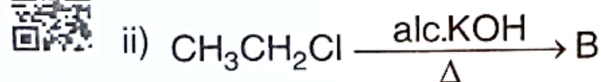
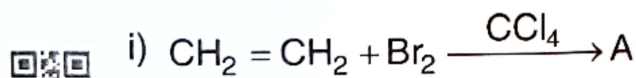


43) a) Draw the Sawhorse projection formulae of eclipsed and staggered conformations of ethane. Which conformation is most stable ?

b) How is acetylene (Ethyne) prepared from calcium carbide ?

44) a) Explain the mechanism of nitration of benzene.

b) Identify the products A and B in the following reactions :



### PART – E

VII. Answer **any four** of the following. **Each** question carries **three** marks. (4×3=12)

45) Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% oxygen by mass.  
(Given : Atomic mass of iron is 56u and oxygen is 16u)

46) Calculate the mass percentage of all the elements present in the compound carbon dioxide.

(Given : Atomic mass of C = 12 u and O = 16u)

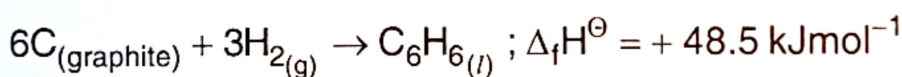
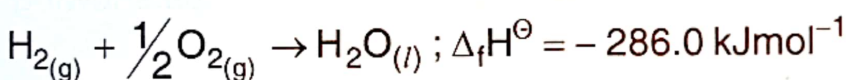
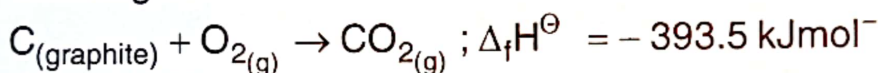
- 47) Calculate the energy of one mole of photons of radiation whose frequency is  $5 \times 10^{14}$  Hz.  
(Given :  $h = 6.626 \times 10^{-34}$  Js, Avogadro number =  $6.022 \times 10^{23} \text{ mol}^{-1}$ ).

- 48) A microscope using suitable photons is employed to locate an electron in an atom within a distance of  $0.1 \text{ \AA}$ . What is the uncertainty involved in the measurement of velocity ?

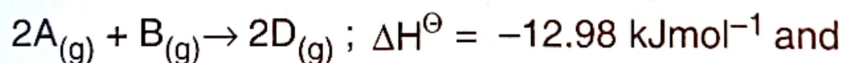
(Given : Mass of electron =  $9.11 \times 10^{-31} \text{ kg}$ )



- 49) Calculate the standard enthalpy of combustion ( $\Delta_c H^\ominus$ ) of benzene from the following data :



- 50) For the reaction,

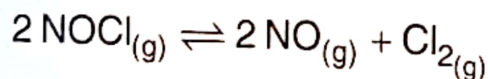


$\Delta S^\ominus = -44.1 \text{ JK}^{-1}\text{mol}^{-1}$  at 298 K. Calculate  $\Delta G^\ominus$  for the reaction and predict whether the reaction is spontaneous or non-spontaneous.

- 51)  $K_a$  of HF is 0.00068. Calculate the dissociation constant of its conjugate base ( $K_b$ ) at 298 K.



- 52) For the equilibrium,



the value of the equilibrium constant,  $K_c$  is  $3.75 \times 10^{-6}$  at 1069 K. Calculate the  $K_p$  for the reaction at the same temperature.

(Given :  $R = 0.0831 \text{ bar L mol}^{-1}\text{K}^{-1}$ )