

**2020  
CHEMISTRY**

Total marks : 70

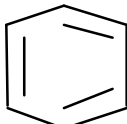
Time : 3 hours

**General instructions:**

- i) *Approximately 15 minutes is allotted to read the question paper and revise the answers.*
- ii) *The question paper consists of 30 questions. All questions are compulsory.*
- iii) *Marks are indicated against each question.*
- iv) *Internal choice has been provided in some questions.*

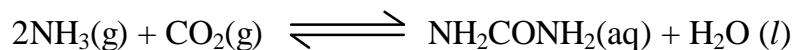
**N.B:** *Check that all pages of the question paper is complete as indicated on the top left side.*

1. The S.I unit of density is 1  
(a)  $\text{Kg Cm}^{-3}$  (b)  $\text{g Cm}^{-3}$   
(c)  $\text{Kg m}^{-3}$  (d) None of the above.
2. The number of orbital associated with the principal quantum number 2 is 1  
(a) 3 (b) 2  
(c) 4 (d) 8
3. Among  $\text{Mg}$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}$  and  $\text{Al}^{3+}$ , which of the following will have the smallest size? 1  
(a)  $\text{Mg}$  (b)  $\text{Mg}^{2+}$   
(c)  $\text{Al}$  (d)  $\text{Al}^{3+}$
4. The unit of dipole moment is 1  
(a) Debye (b)  $\text{m}^3$   
(c)  $\text{Cm}$  (d)  $\text{Nm}$
5. The general formula of alkyne is 1  
(a)  $\text{C}_n\text{H}_{2n+2}$  (b)  $\text{C}_n\text{H}_{2n+1}\text{X}$   
(c)  $\text{C}_n\text{H}_{2n-2}$  (d)  $\text{C}_n\text{H}_{2n-1}$
6. What is critical temperature? 1
7. What is pH of a solution? 1
8. State the first law of thermodynamics. 1

9. Write the IUPAC name of 1
- $$\begin{array}{c}
 \text{CH}_3 \\
 | \\
 \text{CH}_3 - \text{C} - \text{OH} \\
 | \\
 \text{CH}_3
 \end{array}$$
10. What is an electrophile? Give example. 1
11. Calculate the number of atoms in 52u of He. 2
12. a. Write the postulation of Bohr's atomic model. 2
- Or**
- b. What is dual behaviour of matter? Derive de-Broglie wave equation. 2
13. State Arrhenius concept of acids and bases. Give example. 2
14. a. Write the preparation of quicklime. Give its uses. 2
- Or**
- b. List two diagonal similarities of Beryllium and Aluminium. 2
15. a. What is functional group? Give example. 2
- Or**
- b. Write two isomers of pentane. 2
16. Complete the reaction. 2
- i)  $\text{CH}_3 - \text{CH}_2 - \text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4} ?$
- ii)  + 3H<sub>2</sub>  $\xrightarrow{\text{Ni}/\Delta} ?$
17. The mass of an electron is  $9.1 \times 10^{-31}$  Kg. If its kinetic energy is  $3.0 \times 10^{-25}$  J, calculate its wavelength. ( $h = 6.626 \times 10^{-34}$  JS). 3
18. What is electron gain enthalpy? Which of the following will have the most negative electron gain enthalpy: P, S, Cl, F and why? 3
19. What is viscosity and viscosity coefficient? What is the S.I unit of viscosity coefficient? 3

20. a. What is common ion effect and solubility product constant? Write the expression of solubility product constant for  $\text{BaSO}_4$ . 3  
**Or**
- b. Write the characteristics of equilibria involving physical process.
21. Define oxidation and reduction. Give example of redox reaction. 3
22. a. What is hard and soft water? Explain the removal of hardness of water by washing soda method. 3  
**Or**
- b. Write the preparation of dihydrogen. Write the chemical reaction and its uses.
23. Write the preparation of sodium carbonate by Solvay process. Give one of its uses. 3
24. Explain the structure of diborane ( $\text{B}_2\text{H}_6$ ). 3
25. a. What is the action of heat on borax? Write the chemical reaction. Why is boric acid considered as a weak acid? 3  
**Or**
- b. Write the chemical reaction of the following:
- i) Boric acid is added to water.
  - ii) Aluminium is treated with dilute  $\text{NaOH}$ .
  - iii)  $\text{BF}_3$  is reacted with ammonia.
26. Explain inductive effect and elimination reaction with example. 3
27. a. What is acid rain? Mention its damaging effect. 3  
**Or**
- b. What is photochemical smog? Mention one of its effect. How can it be controlled?
28. a. Write the conditions of molecular orbital theory. Draw the energy level diagram of  $\text{C}_2$  molecule. Write the electronic configuration and calculate the bond order. 2+1+1+1=5  
**Or**
- b. What is bond angle? On the basis of VSEPR theory, explain the shape of  $\text{CH}_4$  and  $\text{NH}_3$ . (1+2+2=5)

29. a. i) Define Gibb's free energy. Under what condition of Gibb's free energy the system is spontaneous?  
 ii) Find out the value of equilibrium constant for the following reaction at 298K:



Standard Gibb's energy change,  $\Delta_r G^\circ$  at the given temperature is  $-13.6 \text{ kJ mol}^{-1}$ ,  $\text{antilog}[2.38] = 2.4 \times 10^2$ .

**Or**

**2+3=5**

- b. i) State standard enthalpy of reaction and entropy.  
 ii) If water vapour is assumed to be a perfect gas, molar enthalpy change for vaporisation of 1 mol of water at 1 bar and  $100^\circ\text{C}$  is  $41 \text{ kJ mol}^{-1}$ , calculate the internal energy change when 1 mol of water is vaporised at 1 bar pressure and  $100^\circ\text{C}$ . ( $R=8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ ).

30. a. (i) How is benzene prepared in the laboratory? Give its chemical reaction.

- (ii) Explain the mechanism of nitration of benzene.

**1+1+3=5**

**Or**

- b. (i) What happens when alkene is oxidised in the presence of cold alkaline  $\text{KMnO}_4$  and acidic  $\text{KMnO}_4$ ? Give its chemical reaction.

- (ii) Explain the acidic character of alkyne.

**(2+3=5)**

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