2022
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 to ensure that all pages of the question paper is complete as indicated on the top left side.

1.   Arrange these elements in increasing order of metallic character: Si,A*l*,Mg,Na,P.   **1**
        (a)   P<Si<A*l*<Mg<Na   (b)   Si<A*l*<P<Mg<Na
        (c)   Mg<Na<Si<P<A*l*   (d)   Na<Mg<A*l*<Si<P.

2.   The hybridization of carbon involved in acetylene is   **1**
        (a) sp^3 (b) sp^2 (c)   sp   (d) dsp^2.

3.   The entropy change of a spontaneous process always   **1**
        (a)   increases   (b)   decreases
        (c)   keeps changing   (d)   remains unchanged.

4.   pH higher than 7, means hydronium ion concentration is   **1**
        (a) 10^{-7}M (b) $<10^{-7}$M   (c) $>10^{-7}$M   (d) $\geq 10^{-7}$M

5.   The cyclic polymerization of ethyne gives   **1**
        (a)   phenol   (b)   benzene
        (c)   ethane   (d)   propyne.

6.   State the law of definite proportion.   **1**

7.   What will be the subshell notation if n=3, *l*=2?   **1**

8.   Define surface tension. Write its S.I unit.   **1**

9.   Write the general electronic configuration of p-block element.   **1**

10. Write the IUPAC name of   **1**

$$\begin{array}{c} CH_3 \\ | \\ CH_3-C-OH \\ | \\ CH_3 \end{array}$$

11. **a.** A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96g. What is its empirical formula?

                              Or   **2**

    b. How many moles of methane are required to produce 22g of $CO_2(g)$ after combustion?

12. State Heisenberg's uncertainty principle. Write its mathematical expression.   **2**

13. Write the conjugate acid and conjugate base of the following:
    Cl^-, H_3O^+ **2**

14. **a.** List two diagonal similarities of Li and Mg.

                              Or   **2**

    b. Why does the solubility of alkaline earth metal hydroxide in water increase down the group?

15. **a.** What are zeolites? Write one use.

                              Or   **2**

    b. Why is graphite a conductor of electricity? Write one use of graphite.

16. What is Wurtz reaction? Give chemical reaction.   **2**

17. The mass of an electron is 9.1×10^{-31}kg. If its kinetic energy is 3.0×10^{-25}J. Calculate its wavelength. ($h = 6.626 \times 10^{-34}$JS).   **3**

18. What is ionization enthalpy? Why has nitrogen higher ionization enthalpy than oxygen?   **3**

19. On a ship sailing in pacific ocean where temperature is 23.4°C, a balloon is filled with 2L air. What will be the volume of the balloon when ship reaches India, where temperature is 26.1°C?   **3**

20. Derive the relationship between K_p and K_c for an equilibrium reaction.   **3**

21.   **a.**   What is combination reaction and decomposition reaction? Give
              one example each.
                              Or   **3**
      b.   What is redox reaction? Justify the reaction:
              $2Na(s) + H_2(g) \rightarrow 2NaH(s)$ is a redox reaction.

22.   **a.**   What is heavy water? What are hydrides? Write the different types
              of hydrides.
                              Or   **3**
      b.   How is dihydrogen prepared in the laboratory? Write the chemical
              reaction and its uses.

23.   Write the preparation of sodium bicarbonate. Give chemical reaction.
      Mention one use.   **3**

24.   Explain the following: **3**
      i)   Boric acid is considered as a weak acid.
      ii)   Carbon monoxide is poisonous.

25.   **a.**   What are inductive effects? Give the examples.
                              Or   **3**
      b.   Explain hyperconjugation effect with an example.

26.   Define electrophile and nucleophile. Give the example.   **3**

27.   **a.**   What is smog? How is classical smog different from photochemical
              smog?
                              Or   **3**
      b.   What is green chemistry? List two achievements of green chemistry.

28.   a.   i) Write any four postulates of VSEPR theory.
              ii)Explain the structure of CH_4 and H_2O on the basis of VSEPR theory.
                              Or   **5**
      b.   What is bond order? Draw the energy level diagram of C_2 molecule.
              Write its electronic configuration and calculate its bond order.

29. **a.** i) Derive the relation between C_p and C_v.

ii) The combustion of one mole of benzene takes place at 298K and 1 atm. After combustion, $CO_2(g)$ and $H_2O(l)$ are produced and 3267 KJ of heat is liberated. Calculate the standard enthalpy of formation, $\Delta_f H$ of benzene. Standard enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are -393.5 KJ mol^{-1} and -285.83 KJ mol^{-1} respectively.

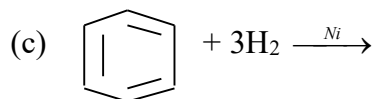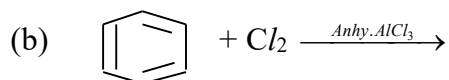**Or**   5

b. i) Define Gibb's free energy. Predict the spontaneity of a process when $\Delta G = 0$, and $\Delta G = $ negative.

ii) The enthalpy change (ΔH) for the reaction -
$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) \text{ is } -92.38 \text{KJ at 298K. What}$$
is ΔU at 298K?

30. **a.** i) Explain Friedel Crafts acylation reaction with an example.

ii) How is benzene hexachloride prepared? Give the chemical reaction.

Or   5

b. i) Explain acidic character of alkyne.

ii) Complete the following reaction:

(a) $CH_2=CH_2 + H_2O \xrightarrow{dil.KMnO_4 / 273K}$

(b) $+ Cl_2 \xrightarrow{Anhy.AlCl_3}$

(c) $+ 3H_2 \xrightarrow{Ni}$

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