

Please check that this question paper contains **26** questions and **7** printed pages.

**CLASS-XI**  
**CHEMISTRY (THEORY)**

**Time Allowed : 3 Hours****Maximum Marks : 70****General Instructions :**

- (i) All questions are compulsory.
- (ii) Question number 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Question number 6 to 10 are short answer questions and carry 2 marks each.
- (iv) Question number 11 to 22 are also short answer questions and carry 3 marks each.
- (v) Question number 23 is a value based question and carries 4 mark.
- (vi) Question numbers 24 to 26 is long answer question and carries 5 mark.
- (vii) There is no overall choice. However, there is an internal choice in one question of 2 marks and one question of 3 marks and all the three questions of 5 marks. You have to attempt only one of the choices in such questions.
- (viii) Use log tables if required. Use of calculators is not permitted.

1. The following data are obtained when dihydrogen and dioxygen reacts together to form different compounds :

	Mass of dihydrogen	Mass of dioxygen
(i)	8g	64g
(ii)	8g	128g

State the law of chemical combination which is obeyed by the above experimental data.

- 2. Draw PV vs P curve for an ideal gas.
- 3. Identify the lewis bases amongst the following :  
 $\text{PH}_3$ ,  $\text{H}^+$ ,  $\text{AlH}_3$ ,  $\text{H}_2\text{O}$

4. Assign the position in terms of period and group to the element having outer electronic configuration  $ns^2np^1$ , where  $n = 6$
5. Why magnesium does not impart colour to the flame while calcium does ?
6. Applying aufbau principle, write the electronic configuration of element with  $Z = 21$ . Also, write the possible values of principle and azimuthal quantum numbers for the unpaired electron in the atom.
7. Using the valence shell electron pair repulsion (VSEPR) model, predict the shape of the following molecules :
  - (i)  $ClF_3$
  - (ii)  $H_2O$
8. Explain the following :
  - (i) Gallium has higher ionization enthalpy than aluminium
  - (ii)  $PbX_2$  is more stable than  $PbX_4$

**OR**

Give reasons :

- (i) Diamond is used as an abrasive
  - (ii) Conc.  $HNO_3$  can be transported in aluminium container
9. Draw the cis and trans structure of hex-2-ene. Which isomer will have higher boiling point and why ?
10. Among  $NH_3$ ,  $H_2O$  and  $HF$ , which would you expect to have highest magnitude of hydrogen bonding. Give reason to support your answer.
11. One litre of oxygen at STP is made to react with three litres of carbon monoxide at STP, according to the following reaction :
$$2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$$
Calculate the mass of each substance found after the reaction.  
Which one is the limiting reactant ?

12. Arrange the following as instructed :

- (i) O, S, Cl, F  
(decreasing order of electron gain enthalpy)
- (ii) F, Cl, Br, I  
(increasing order of reactivity)
- (iii)  $F^-$ , Ne,  $Na^+$ ,  $N^{3-}$   
(decreasing order of ionic radii)

13. (i) State the hybridization of Nitrogen in  $NH_3$ .
- (ii) Why is bond angle in ammonia less than the tetrahedral bond angle?
- (iii) Why is the resultant dipole moment of  $NH_3$  greater than  $NF_3$ ?

**OR**

- (i) Explain the paramagnetic nature of  $O_2$  on the basis of molecular orbital theory.
- (ii) Arrange the following in decreasing order of stability ( $O_2$ ), superoxide ion ( $O_2^-$ ) and peroxide ion ( $O_2^{2-}$ )

14. 35 ml of oxygen was collected at  $6^\circ C$  and 758 mm pressure. Calculate its volume at STP.

- (ii) What is the value of compressibility factor 'Z' for :
  - (a) Ideal gas
  - (b) Real gas above Boyle's temperature

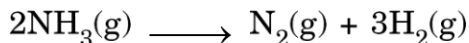
15. Calculate the work done by 1 mole of the gas in each of the following cases :

(Given :  $\log 5 = 0.6989$  and  $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$ )

- (i) For expansion of the gas from volume 1L to 5L against constant external pressure of 1 bar
- (ii) For reversible isothermal expansion of the gas from volume 1L to 5L at  $27^\circ C$ .
- (iii) For free expansion of the gas from 1L to 5L.

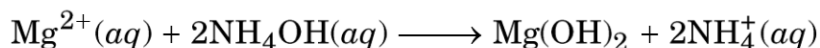
16. (i) Write the conditions in terms of  $\Delta H$  and  $\Delta S$  when a reaction would be always spontaneous.

(ii) The value of  $\Delta_f H^\circ$  for  $\text{NH}_3$  is  $-91.8 \text{ kJmol}^{-1}$ . Calculate enthalpy change for the following reaction:



17. The  $K_p$  for the reaction  $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$  is 640 mm at 775 K. Calculate the percentage dissociation of  $\text{N}_2\text{O}_4$  at equilibrium pressure of 160 mm.

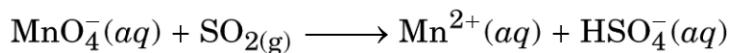
18. (i) Magnesium is precipitated from a solution of its salt by  $\text{NH}_4\text{OH}$  as per the following reaction :



If  $\text{NH}_4\text{Cl}$  is also added to the reaction mixture, precipitate of  $\text{Mg}(\text{OH})_2$  is not obtained. Explain.

(ii) Calculate the pH at which  $\text{Mg}(\text{OH})_2$  begins to precipitate from a solution containing 0.1M  $\text{Mg}^{2+}$  ions.  $K_{sp}$  of  $\text{Mg}(\text{OH})_2 = 1 \times 10^{-11}$ .

19. (i) Balance the following redox reaction in acidic medium :



(ii) Given the standard electrode potentials,

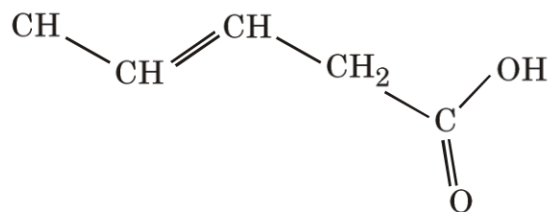
$$\text{K}^+/\text{K} = 2.93 \text{ V}, \text{Ag}^+/\text{Ag} = 0.88 \text{ V}, \text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}, \text{Hg}^{2+}/\text{Hg} = 0.79 \text{ V}$$

Arrange these metals in increasing order of their reducing power.

20. (i) When aqueous solution of borax is acidified with hydrochloric acid, a white crystalline solid is formed, which is soapy to touch. Name the solid formed. Is this solid acidic or basic in nature. Explain with the help of chemical equation.

(ii) Why is borazine also called 'inorganic benzene' ?

21. (i) Write the IUPAC name for the following compound :



(ii) Describe the basic principle of paper chromatography ?

(iii) Give one example of a mixture of liquids which can be separated by the process of fractional distillation.

22. (i) How can you apply green chemistry to reduce the use of chlorine in bleaching?

(ii) From where does ozone come in photochemical smog ?

(iii) Why is classical smog also called reducing smog ?

23. Gaurav, a brilliant football player, was suffering from muscle cramp, fatigue, irritability and headache since past few days. He feared that he would not be allowed to play in the coming up tournament. His coach consoled him and assured him that increase in the intake of potassium rich food in his diet would help him recover fast. Answer the following questions :

(i) What is the importance of potassium in the cell fluid ? (any two)

(ii) Name any other metal which is also involved in the transmission of nerve signals.

(iii) Write two values shown by Gaurav's coach.

24. When electromagnetic radiation of wavelength 306 nm falls on the surface of sodium, electrons are emitted with a kinetic energy of  $1.7 \times 10^5 \text{ Jmol}^{-1}$ .

What is the minimum energy needed to remove an electron from a sodium atom ?

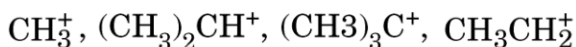
What is the maximum wavelength that will cause a photoelectron to be emitted ?

( $h = 6.626 \times 10^{-34} \text{ Js}$ )

**OR**

The angular momentum of an electron in the Bohr's orbit of hydrogen atom is  $4.22 \times 10^{-34} \text{kgm}^2\text{s}^{-1}$ . Calculate the wavelength of the spectral line when the electron falls from this level to the next lower level. Identify (a) the series of spectral line corresponding to this transition, and (b) spectral region in which the transition takes place.

25. Arrange the following carbocations in the order of decreasing stability :



How can inductive and hyperconjugation effect explain the stability of primary, secondary and tertiary carbocations. Draw the orbital diagram for methyl carbocation indicating the shape and hybridization involved.

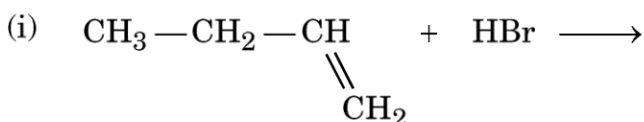
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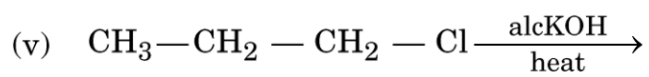
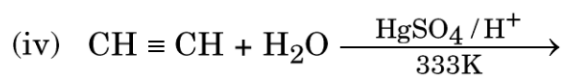
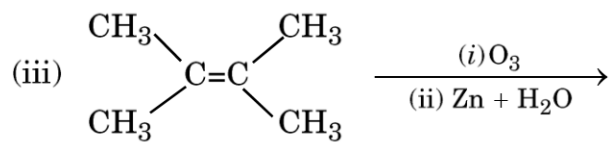
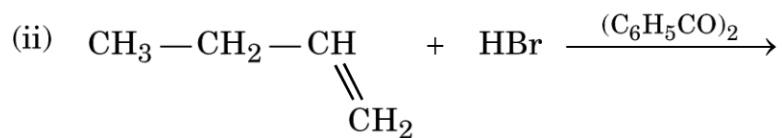
- (a) What conclusion would you draw if during Lassaigne's test a blood red colouration is obtained ? Discuss the principle underlying the estimation of phosphorus. Write the chemical formula of the yellow precipitate formed in the test for phosphorus.
- (b) 0.2 g of an organic compound containing phosphorus gave 1.877 g of ammonium phosphomolybdate (molar mass = 1877) by usual analysis. Calculate the percentage of phosphorus in the organic compound.

26. (i) Discuss the mechanism of halogenation of benzene.
- (ii) How will you convert benzene into :
- (a) p-nitrochlorobenzene
- (b) m-nitrochlorobenzene

**OR**

Complete the following reactions :





□□□