Time: 3 Hrs. M.M: 70

General Instructions:

(i) Question 1 to 5 one mark.

(ii) Question 6 to 10 each two mark.

(iii) Question 11 to 22 each three mark.

(iv) Question 23 is value based question and carry four marks.

(v) Questions 24 to 26 each five mark.

Section A

1. Which two elements among the following belong to the same period Al, Si, Ba and O?

2. Why liquids diffuse slowly as compared to gases?

3. A gas is filled into a bulb connected to an open limb manometer. The level of mercury in the open arm is 2.1 cm lower than that in the other arm of manometer. The atmospheric pressure is 720 mm. What is the pressure of the gas?

4. Heat capacity is an extensive property but specific heat is intensive property. Comment on the statement.

5. Boron forms no compounds in unipositive state but thallium in unipositive state is quite stable. Explain.

Section B

6. Cyanogen $(CN)_2$ is known as a pseudohalogen because it has some properties similar to halogens. It is composed of two CN's joined together. Do the two CN's join through the carbon or the nitrogen (i. e., C – N –N – C or N – C – C – N)?

7. CO_2 is heavier than N_2 and O_2 gases present in the air but it does not form the lower layer of the atmosphere. Explain.

8. Calculate

(i) mass of 2.5 g atoms of magnesium,

(ii) gram atom in 1.4 g of nitrogen (Atomic mass Mg = 24, N = 14)

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Or

Calculate the mass of

(i) 1 molecule of N_2,

(ii) 100 molecules of sucrose $\left(C_{12}H_{22}O_{11}\right)$.

9. What happens when (give chemical equation only)

(i) sodium is exposed to moist air?

(ii) sodium reacts with water?

10. Name one reaction in which water acts

(i) as an oxidising agent and

(ii) as a reducing agent?

Section C

11. The threshold wavelength for emitting photons from a metal is $6.0 \times 10^3 \ \overset{\circ}{A}$. What would be the wavelength of radiation to produce photoelectrons having twice the kinetic energy of those produced by radiation of wavelength $3 \times 10^3 \ \overset{\circ}{A}$?

12. The wavelength of the first line in the Balmer series is 656 nm. Calculate the wavelength of the second line and the limiting line in Balmer series.

13. A student while measuring pressure and volume of a gas at constant temperature forgot to record some of the observations as follows.

| Pressure (torr) | 100 | 125 | 200 | (–) |
| Volume (mL) | 80 | (–) | 40 | 32 |

Calculate the missing observations. Name the law used in your calculations.

14. Give the balanced equations for the reactions that form the basis for the following redox titrations

(i) Titration of potassium permanganate for estimation of ferrous ions.

(ii) Titration of iodine against sodium thiosulphate (iodimetric titration).

(iii) Iodometric titration for estimation of cupric ions.

15. The degree of dissociation of N_2O_4 into NO_2 at one atmospheric pressure and 313 K is 0.310. Calculate K_p of the dissociation reaction at this temperature. What will be the degree of dissociation at 10 atmospheric pressure at the same temperature?

Or

When 3.06 g of solid NH_4HS is introduced into a two-litre evacuated flask at $27°C$, 30% of the solid decomposes into gaseous ammonia and hydrogen sulphide.

(i) Calculate K_c and K_p for the reaction at $27°C$.

(ii) What would happen to the equilibrium when more solid NH_4HS is introduced into the flask?

16. What do you understood by hydrogen economy?

17. An organic acid contains C, H and O. A 4.21 mg sample of acid is completely burned. It gives 6.21 mg of carbon dioxide and 2.54 mg of water. What is the mass percentage of each element in the acid?

18. How does BF_3 react with
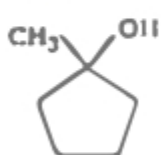
(i) ammonia

(ii) lithiumhydride

(iii) water?

19. Give the structure and IUPAC name of the alkenes formed from acid-catalysed dehydration of
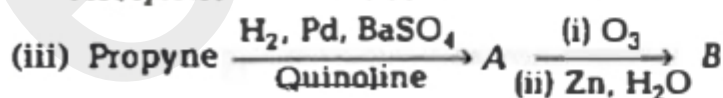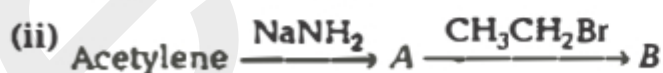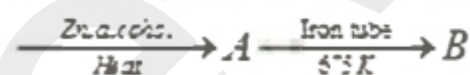
(i)
$$CH_3CH_2CHCH_2CH_3$$
$$|$$
$$OH$$

(ii)

(iii)
$$(CH_3)_3CCH_2OH$$
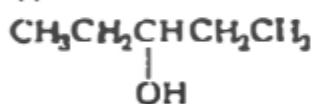
20. (i) 1, 1, 2, 2, –tetrachloroethane

$$\xrightarrow[\text{Heat}]{Zn.alcoh.} A \xrightarrow[\text{573 K}]{\text{Iron tube}} B$$

(ii) Acetylene $\xrightarrow{NaNH_2} A \xrightarrow{CH_3CH_2Br} B$

(iii) Propyne $\xrightarrow[\text{Quinoline}]{H_2, Pd, BaSO_4} A \xrightarrow[\text{(ii) Zn, H}_2O]{\text{(i) O}_3} B$

21. (i) Why $PbCl_4$ is less stable than $SnCl_4$?

(ii) What happens when silicon dioxide is treated with hydrogen fluoride? (Give reactions

only).

(iii) Why is $PbCl_4$ good oxidising agent?

22. Calculate the pH of a solution formed by mixing 0.2 M NH_4Cl and 0.1 M NH_3. The pK_b of ammonia is 4.75.

Section C

23. Anil and Subha are science students. They want to prepare 51 g of NH_3 by combining dinitrogen and dihydrogen. They have 153 g of hydrogen. According to Anil's view for this, they have to mix 25.5 kg of nitrogen to the hydrogen while Subha suggestion was that they have to mix 42 g of nitrogen to the hydrogen.

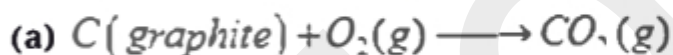**(i)** According to you whose suggestion was correct and why?

(ii) Which is the limiting reagent here?

(iii) Find the excess reagent.

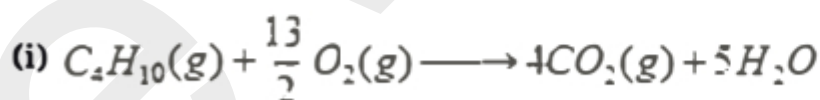**(iv)** Comment on the values associated with Anil and Subha?

Section D

24. **(i)** Predict whether $\Delta H > \Delta U$ or $\Delta H < \Delta U$ or $\Delta H = \Delta U$ for

(a) $C(graphite) + O_2(g) \longrightarrow CO_2(g)$

(b) $PCl_5(g) \longrightarrow PCl_3(g) + Cl_2(g)$

(ii) Determine the value of ΔH and ΔU for the reversible isothermal evaporation of 90.0 g of water at $100°C$. Assume that water vapour behaves as an ideal gas and heat of evaporation of water is 540 $cal\ g^{-1}$. (R = 2.0 cal $mol^{-1}\ K^{-1}$).

Or

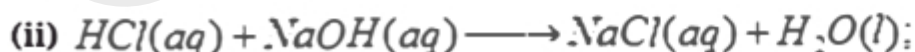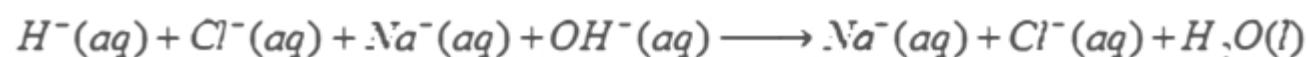Fill in the blanks:

(i) $C_4H_{10}(g) + \dfrac{13}{2} O_2(g) \longrightarrow 4CO_2(g) + 5H_2O$

$\Delta H = -2878 kJ$

ΔH is the enthalpy of ...... of butane gas.

(ii) $HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$;

$\Delta H = -57.1 kJ$ in real terms,

$H^-(aq) + Cl^-(aq) + Na^-(aq) + OH^-(aq) \longrightarrow Na^-(aq) + Cl^-(aq) + H_2O(l)$

ΔH is the enthalpy of ..... of hydrochloric acid and sodium hydroxide solutions.

(iii) $\underset{(graphite)}{C(s)} \longrightarrow C(g)$; $\Delta H = 716.7 kJ$;
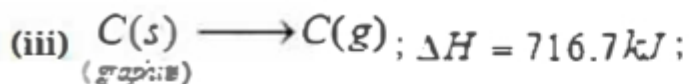
ΔH is the enthalpy of ...... of graphite.

(iv) $\underset{(diamond)}{C(s)} \longrightarrow C(g)$; $\Delta H = 714.8 kJ$
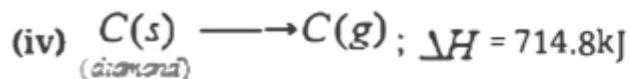
ΔH is the enthalpy of .... of diamond
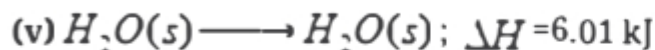
(v) $H_2O(s) \longrightarrow H_2O(s)$; $\Delta H = 6.01$ kJ

ΔH is the enthalpy of .... of ice.

(vi) $H_2O(l) \longrightarrow H_2O(s)$; $\Delta H = -6.01$ kJ

ΔH is the enthalpy of .... of water

(vii) $H_2O(l) \longrightarrow H_2O(g)$; $\Delta H = 40.7$ kJ

ΔH is the enthalpy of .... of water
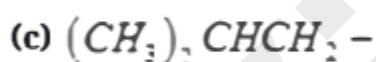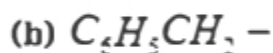
(viii) $H_2O(g) \longrightarrow H_2O(l)$; $\Delta H = -40.7$ kJ
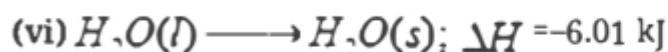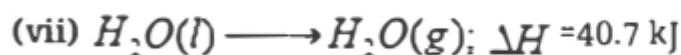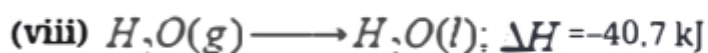
ΔH is the enthalpy of .... of steam

25. (i) What is a functional group?

(ii) Give the name of each of the following groups

(a) $C_6H_5 -$

(b) $C_6H_5CH_2 -$

(c) $(CH_3)_2 CHCH_2 -$

(iii) A compound is formed by the substitution of two chlorine atoms for two hydrogen atoms in propane. What is the number of structural isomers possible?

26. An unsaturated hydrocarbon 'A' adds two molecules of H_2, and on reductive ozonolysis gives butane – 1, 4 – dial, ethanal and propanone. Give the structure of 'A', write its IUPAC name and explain the reactions involved.

Or

Treatment of 2 – bromobutane with hot and alcoholic potash gives a mixture of three isomeric alkenes A, B and C. Reactions of the minor product A with trioxygen and then with Zn/ H_2O gives methanal and propanal in equimolar amounts.

Both B and C give the same single product, ethanal with trioxygen and then water. Write down the structures of the compounds A, B and C. Describe the type of isomerism shown by B and C and explain how it arises?