SECTION : A [50 marks]
COMPULSORY: Attempt **ALL** questions

Question 1.

a. ***Direction: For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one circled, NO score will be awarded.*** **[25]**

i. Charles' law is based on the relationship between

A volume and density.
B pressure and volume.
C volume and temperature.
D pressure and temperature.

ii. The specific number of molecules in one gram-mole of a substance is the molecular weight in grams and is equal to

A 6.023×10^{23}.
B 60.23×10^{23}.
C 6.023×10^{22}.
D 60.23×10^{22}.

iii. Which group of ore does rock salt belong to?

A oxide ore
B halide ore
C sulphide ore
D carbonate ore

iv. Which of the following halogens is radioactive in nature?

A bromine
B astatine
C chlorine
D fluorine

v. The elements of group 3 to 12 are known as

A Halogens.
B Alkali Metals.
C Transition metals.
D Alkaline Earth Metals.

vi. Pema conducted an experiment using sulphur dioxide and oxygen to prepare sulphur trioxide. The type of reaction occurring in the experiment is

A exothermic and reversible.
B endothermic and reversible.
C exothermic and irreversible.
D endothermic and irreversible.

vii. Lower alcohols like methanol burn with a blue flame to form carbon dioxide and water in the presence of atmospheric oxygen. Such a type of reaction is called

A oxidation.
B combustion.
C dehydration.
D esterification.

viii. An inflated balloon bursts when you sit on it. This phenomenon involves

A Boyle's law.
B Charles' law.
C Ideal Gas law.
D Avogadro's law.

ix. The volume occupied by one mole of carbon dioxide at STP is

A 44.8 L.
B 22.4 L.
C 11.2 L.
D 5.6 L.

x. An impure metal is heated in a vessel. The metal forms vapour which condenses in a receiver while the non-volatile impurities are left behind in the vessel. The process described in the statement above is

A liquation.
B reduction.
C distillation.
D oxidative refining.

xi. The correct electronic configuration of fluoride ion is

A 2, 7.
B 2, 8.
C 2, 8, 7.
D 2, 8, 8.

xii. All of the following substances are ferromagnetic in nature **EXCEPT**

A iron.
B zinc.
C nickle.
D cobalt.

xiii. An example of an exothermic reaction is

A melting of ice.
B heating of iodine.
C burning of methane.
D evaporation of water.

xiv. Dorji places a balloon inside the refrigerator that has a temperature of 10^{o} C. Interpret the value in Kelvin.

A 263K
B 273K
C 283K
D 293K

xv. The percentage composition of oxygen in H_2SO_4 is

A 16.3%.
B 32.6%.
C 48.9%.
D 65.3%.

xvi. What would be the relative molecular mass of $CuSO_4$? [At.wt of Cu=64]

A 159
B 160
C 161
D 162

xvii. The information given below shows the uses of element 'X'.

- window frames
- electric transmission, cables/wire
- extraction of metal like chromium and manganese

The element 'X' is

A iron.
B nickle.
C copper.
D aluminium.

xviii. The periodic property of halogens which increases from fluorine to iodine is

A atomic size.
B electron affinity.
C electronegativity.
D ionisation energy.

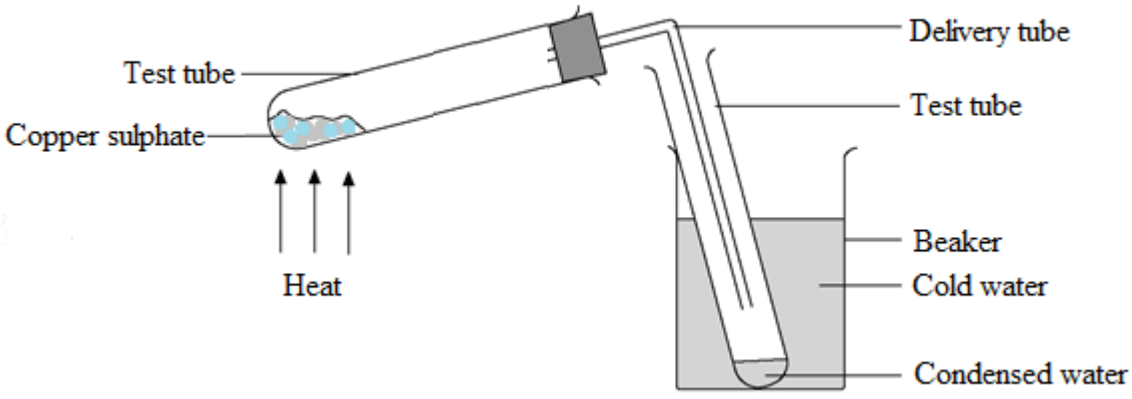
xix. The following chemical equation represents a chemical process.

$6CO_2 + 12H_2O + \text{'A'} \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

What is 'A'?

A heat energy
B light energy
C electrical energy
D chemical energy

xx. A chemistry teacher demonstrated an experiment as shown in the figure below:



Copper sulphate turns white on heating. How can you regain the colour of the copper sulphate?

A by adding base
B by adding acid
C by adding alkali
D by adding water

xxi. Chenzom wanted to find out the product formed when chemical 'A' reacts with 'B'. However, she found that the reaction was too slow. Which of the following conditions would help her to increase the rate of reaction?

A using a catalyst
B using a promoter
C decreasing the temperature
D decreasing the concentration

xxii. Police use breath analyzer to detect the level of alcohol in drivers. Which property of alcohol is used in breath analyzers?

A reducing property
B oxidising property
C denaturing property
D dehydrating property

xxiii. What inference can you draw when the plunger of the syringe filled with air is pushed in?

A pressure increases, volume decreases
B pressure decreases, volume increases
C pressure increases, volume increases
D pressure decreases, volume decreases

xxiv. In the extraction of aluminium, cryolite is added to alumina. Why is cryolite used?

A to increase the boiling point
B to decrease the boiling point
C to decrease the melting point
D to increase the melting point

xxv. Which of the following element would you choose to change the colour of water to pale green?

A iodine
B bromine
C chlorine
D fluorine

b) **Match each item under Column A with the most appropriate item in Column B. Rewrite the correct pairs by writing the alphabet against the number in the space provided.** **[5]**

Column A	Column B
i. Used to determine the total pressure of the mixture.	a. irreversible reaction
ii. $N_2 + 3H_2 \rightleftharpoons 2NH_3$ + Energy	b. endothermic
iii. Decomposition of HgO	c. stress
iv. Heating of ore in absence of air	d. Charles' law
v. Change in temperature, pressure and concentration.	e. roasting
	f. reversible reaction
	g. Dalton's law
	h. exothermic
	i. calcination

i.
ii.
iii.
iv.
v.

c) **Fill in the blanks by writing suitable word(s).** **[5]**

i. Increasing the rate of a reaction by a catalyst without undergoing a permanent change is called _____.

ii. The formula which can give the simple whole number ratio of an atom is _____.

iii. The halogen used in tooth paste is _____.

iv. Carbon dioxide and hydrogen contain equal number of molecules according to _____ law.

v. When alcohol reacts with carboxylic acid, the type of reaction is _____.

d) **Correct the following statements by changing only the underlined word(s).** **[5]**

i. The study of quantitative relationship based on the chemical formula and equation is called <u>quantitative analysis</u>.

ii. The vapour density of SO_2 is <u>64</u>.

iii. At 50^{o}C the activity of enzymes decline due to <u>optimum temperature</u>.

iv. The reagent used for dissolving noble metals is <u>sulphuric acid</u>.

v. A mixture of 95% ethanol and 5% methanol is known as <u>illicit alcohol.</u>

i.
ii.
iii.
iv.
v.

e) **Answer the following questions.** **[5]**

i. Few drops of ammonium hydroxide is added to copper sulphate solution. What would be the colour of the precipitate formed?

ii. What will be the co-ordination number of Cu in the complex compound $[Cu(NH_3)_4]^{2+}$?

iii. Draw the structural formula of ethanol.

iv. What will be the value of enthalpy of combustion in the reaction given below?

$$C + O_2 \longrightarrow CO_2$$

v. In a reversible reaction (exothermic), what condition will produce a shift to the right if the volume is kept constant?

f) **Write down the difference between the following pairs.** **[5]**

i. Haber process and Contact process (catalyst used)

Haber process	Contact process

ii. Pepsin and lipase (functions)

Pepsin	Lipase

iii. Combination and precipitation (definition)

Combination	Precipitation

iv. Iron and Aluminium (Principle ore)

Iron	Aluminium

v. Boyle's law and Charles' law (formula)

Boyle's law	Charles' law

SECTION: B [50 marks]

*Attempt **ANY FIVE** Questions.*

Question 2.

a. The atomic numbers of the elements of group 17 of modern periodic table are listed below. Study the data carefully and answer the questions that follow: **[3]**

Group 17 element	**F**	**Cl**	**Br**	**I**	**At**
Atomic number	9	17	35	53	85

i) Name the volatile liquid and volatile solid.

ii) An element with four isotopes.

iii) An element which bursts into flames if bubbled through water.

b. i) Calculate the number of moles in 2.7g of aluminium. **[2]**

ii) Define the following: **[2]**

1. Dynamic equilibrium

2. Ligand

c. Pema added 2 ml of hydrogen peroxide in a test tube. She added a few crystals of manganese dioxide to it. **[3]**

i) What type of reaction can be observed?

ii) What is the role of manganese dioxide?

iii) Mention **two** uses of hydrogen peroxide.

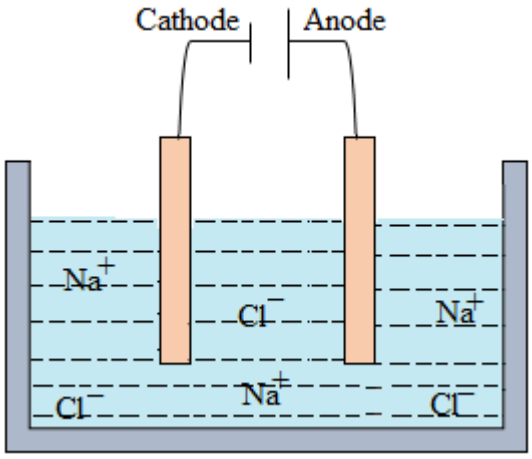
Question 3.

a. During Dorji's birthday, 10 balloons were filled with 6L of hydrogen gas. The pressure inside was reduced to 1 atmosphere and the balloon expanded to occupy a volume of 20L.

i) Calculate the initial pressure exerted on the balloon. **[3]**

ii) State the law of Conservation of Energy. **[1]**

b. The diagram given below shows the electrolysis of molten sodium chloride.
Answer the questions that follow:



i) Name the ions which will migrate to the cathode and anode respectively. **[1]**

ii) Write the reaction at the cathode and the anode. **[2]**

Cathode	Anode

iii) Mention **two** differences between Mashing and Hydrolysis with special reference to the temperature and product formed. **[2]**

Mashing	Hydrolysis

iv) Complete the equation given below: **[1]**

$$C_6H_{12}O_6 \xrightarrow{\text{zymase}} \underline{\qquad\qquad} + 2CO_2$$

Question 4.

a. An acid of phosphorus has the following percentage composition:
2.47% H, 38.27% P, 59.26% O.

i) Determine its empirical formula. **[2]**

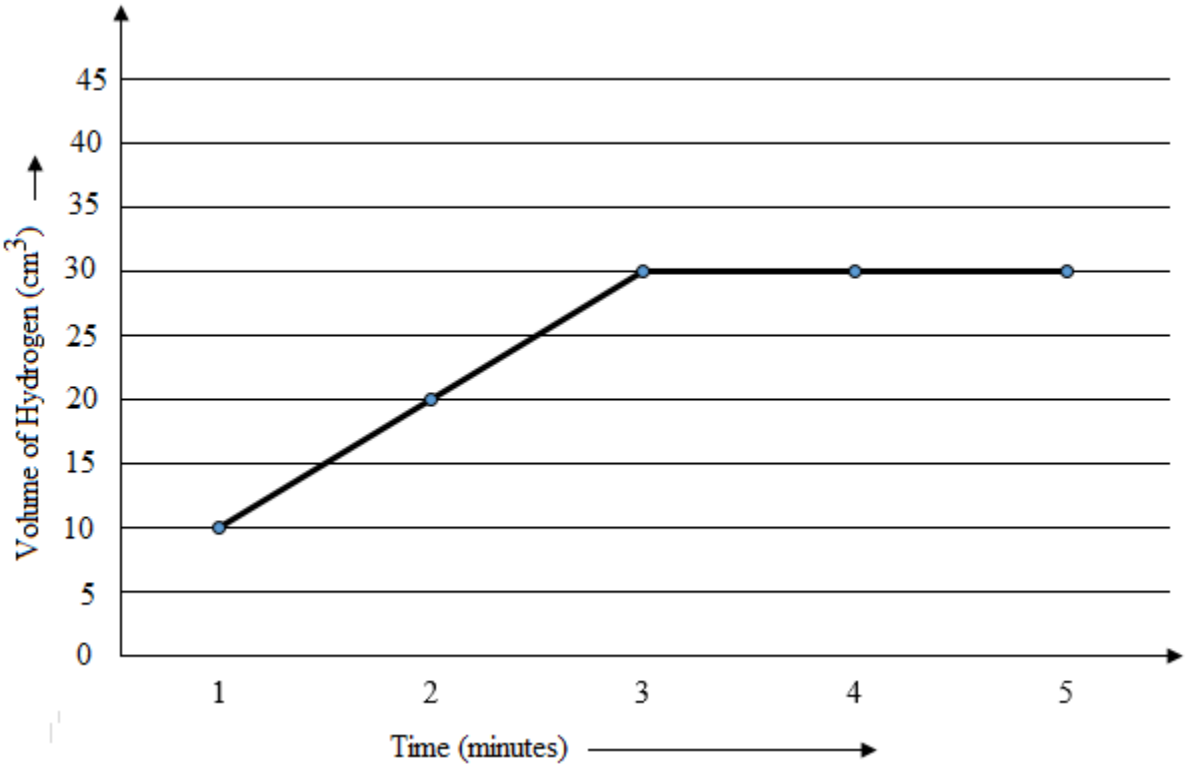
ii) Calculate the molecular formula of the compound. **[2]**

b. Give reasons for the following.

i) Carbon and sulphide ores are converted into oxide ores. **[1]**

ii) Roasting is opposite of calcination. **[1]**

c. Sonam conducted an experiment on the action of HCl on magnesium ribbon. The concentration of HCl was taken as 0.5 mol/cm³. The result obtained is shown in the graph below.



Answer the questions with reference to the above graph.

i) Why does the curve become flat after some time? **[1]**

ii) Mention **two** ways of increasing the rate of reaction. **[1]**

iii) Write the balanced chemical equation for the above reaction. **[2]**

Question 5.

a. From the equation:

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$$

i) Calculate the volume of hydrogen gas obtained from 100g of zinc at STP. [At.wt of Zn= 65] **[2]**

ii) Chemical reaction involves change in energy. Explain the statement. **[1]**

b. Answer the following questions based on the equation given below.

$$H_2 + I_2 + \text{heat} \rightleftharpoons 2HI$$

i) What will happen to the dynamic equilibrium if the volume of the container is increased and pressure is lowered? **[1]**

ii) What will happen to the reaction if the temperature is raised? **[1]**

iii) What will happen if a catalyst is added to the reaction? **[1]**

c. Keeping the temperature constant, a container was filled with air and pressure applied on it.

i) Explain the above relation in terms of Dalton's law of partial pressure. **[2]**

ii) The chemical equation given below are the examples of: **[2]**

1. $CH_3CH_2CH_2OH \xrightarrow{\text{Excess of } H_2SO_4} CH_3{-}CH{=}CH_2 + H_2O$

2. $CH_3{-}\overset{\overset{O}{\|}}{C}{-}OH + HO{-}CH_2CH_3 \underset{}{\overset{\text{Conc. } H_2SO_4}{\rightleftharpoons}} CH_3{-}\overset{\overset{O}{\|}}{C}{-}O{-}CH_2{-}CH_3 + H_2O$

Question 6.

a. i) Mention any **two** variables of Ideal Gas law. **[1]**

ii) Complete the table given below. **[2]**

Gas	**Relative molecular mass**	**Mole**	**No. of molecules.**
Nitrogen dioxide			$6{\cdot}023 \times 10^{23}$
Oxygen		1 mole	

iii) Write down the electronic configuration for calcium in terms of s, p, d and f notation. **[1]**

b. i) In the Contact process, sulphur dioxide reacts with oxygen to form sulphur trioxide as shown in the equation below:

$2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3 + \text{energy}$

Is the reaction complete? Justify. **[2]**

ii) Represent propanol with its condensed formula. **[1]**

c. i) 20L of hydrogen and 30L of chlorine are compressed in a container with 2 atm and 22 atm respectively. What will be the total partial pressure exerted on these two gases? **[1]**

i) An element 'X' has the atomic number of 9. To which period and group does the element 'X' belong? **[1]**

iv) The transition metal responsible for the white colour of paper is titanium not zinc. Justify. **[1]**

Question 7.

a. i) A balloon filled with hydrogen gas is left inside a car, on a hot summer day. What would happen to the volume and pressure of hydrogen gas? **[1]**

ii) In the extraction of iron, the products formed in the blast furnace are pig iron and cast iron. From the two products, which would be the best for casting articles into different shapes? Justify. **[2]**

b. Bleaching is a process of removing the colours from coloured organic matter by using chemical agents.

$$\text{Raw wood pulp} \xrightarrow[\text{agent}]{\text{bleaching}} \text{Bleached wood pulp}$$

In the above equation, raw wood pulp is bleached using a bleaching agent.

i) Name the bleaching agent used. **[1]**

ii) Mention the bleaching property of the above element. **[1]**

iii) Complete the table given below which summarizes the effect of adding sodium hydroxide on various salt solutions. **[2]**

Salt solution	**Color of the ppt. formed**	**Name of the ppt.**
1. Copper sulphate		
2. Zinc sulphate		

c. When a candle burns in the presence of oxygen, the reaction is exothermic.
Using the above information, answer the following questions:

i) What is the value of ΔH? **[½]**

ii) Name the chemical process taking place. **[½]**

d. In the manufacture of ammonia, the forward reaction is exothermic.

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

i) Describe how the reactants are obtained? **[1]**

ii) Iron does not alter the position of equilibrium. However, it is used as a catalyst. Explain. **[1]**

Rough work

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