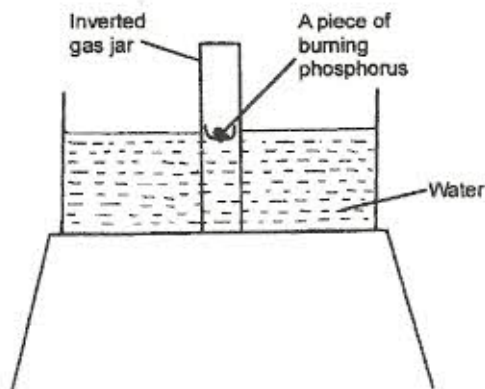


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1. (a) What is meant by isomerism? (1 mark)
(b) Draw and name two isomers of butene. (2 marks)

2. The diagram below represents a set-up that was used to show that part of air is used during burning



- (a) Given that the phosphorus used was in excess, draw a diagram of the set up at the end of the experiment (When there was no further observable change). (1 mark)
(b) Suggest one modification that should be made on the apparatus if the percentage of the air used is to be determined. (1 mark)
3. 60cm^3 of oxygen gas diffused through a porous partition in 50 seconds. How long would it take 60cm^3 of sulphur (IV) oxide gas to diffuse through the same partition under the same conditions? (S = 32.0, O = 16.0) (3 marks)

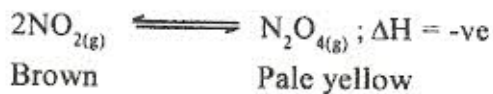
4. (a) Complete the nuclear equation below (1 mark)



- (b) State one:
(i) use of radioisotopes in agriculture. (1 mark)
(ii) danger associated with exposure of human beings to radioisotopes. (1 mark)
5. The atomic numbers of elements C and D are 19 and 9 respectively. State and explain the electrical conductivity of the compound CD in:
(a) solid state (1½ marks)
(b) aqueous state (1½ marks)

6. In an experiment to study the properties of concentrated sulphuric acid, a mixture of the acid and wood charcoal was heated in a boiling tube.
- (a) Write the equation of the reaction that took place in the boiling tube. (1 mark)
- (b) Using oxidation numbers, show that reduction and oxidation reactions took place in the boiling tube. (2 marks)
7. A group of compounds called chlorofluorocarbons have a wide range of uses but they also have harmful effects on the environment.
- State one
- (a) use of chlorofluorocarbons (1 mark)
- (b) harmful effect of chlorofluorocarbons on the environment (1 mark)
8. When 94.5g of hydrated barium hydroxide, $\text{Ba}(\text{OH})_2 \cdot n\text{H}_2\text{O}$ were heated to constant mass, 51.3g of anhydrous barium hydroxide were obtained. Determine the empirical formula of the hydrated barium hydroxide.
(Ba = 137.0; O=16.0, H = 1.0) (3 marks)

9. At 20°C , NO_2 and N_2O_4 gases exist in equilibrium as shown in the equation below



State and explain the observation that would be made when:

- (a) a syringe containing the mixture at 20°C is immersed in ice-cold water (1½ marks)
- (b) the volume of the gaseous mixture in a syringe is reduced (1½ marks)
10. Name the process which takes place when:
- (a) solid carbon (IV) oxide (dry ice) changes directly into gas (1 mark)
- (b) a red litmus paper turns white when dropped into chlorine water (1 mark)
- (c) propene gas molecules are converted into a giant molecule (1 mark)
11. (a) Water from a town in Kenya is suspected to contain chloride ions but not sulphate ions. Describe how the presence of the chloride ions in the water can be shown. (2 marks)
- (b) State one advantage of drinking hard water rather than soft water. (1 mark)

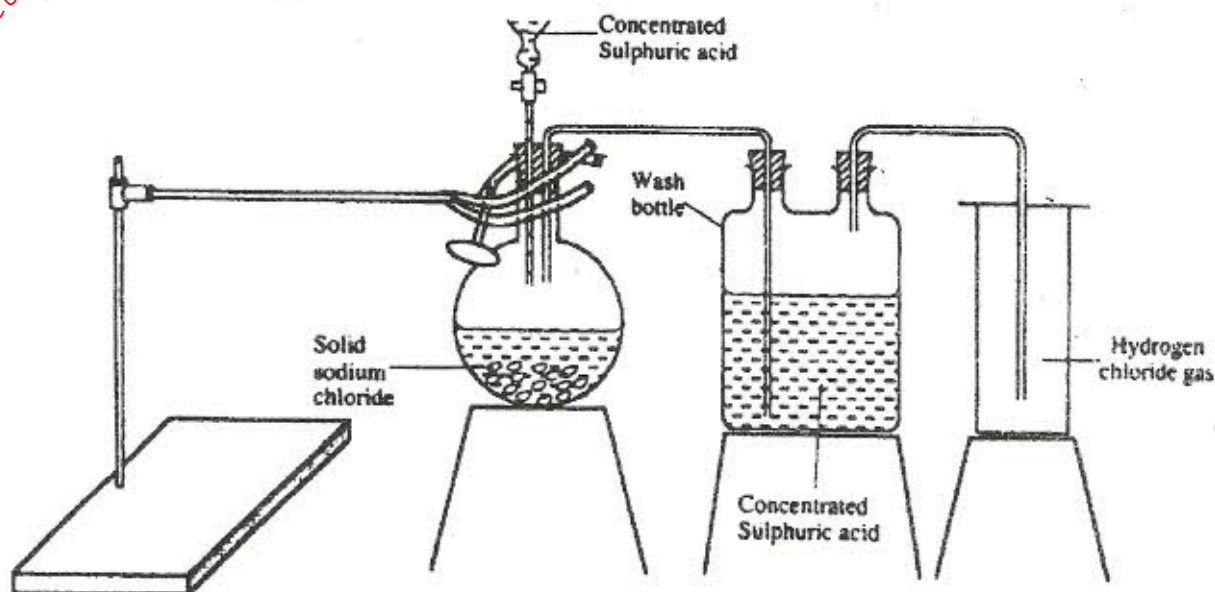
12. The table below shows the relative atomic masses and the percentage abundance of the isotopes L_1 and L_2 of element L.

	Relative atomic mass	% abundance
L_1	62.93	69.09
L_2	64.93	30.91

Calculate the relative atomic mass of element L.

(3 marks)

13. The diagram below represents the set-up that was used to prepare and collect hydrogen chloride gas in the laboratory.



- (a) State the purpose of concentrated sulphuric acid in the wash bottle (1 mark)
- (b) Write an equation for the reaction between dry hydrogen chloride gas and heated iron (1 mark)
- (c) Hydrogen chloride gas is dissolved in water to make hydrochloric acid. State one use of hydrochloric acid. (1 mark)

14. Below is a list of oxides

MgO , N_2O , K_2O , CaO , and Al_2O_3

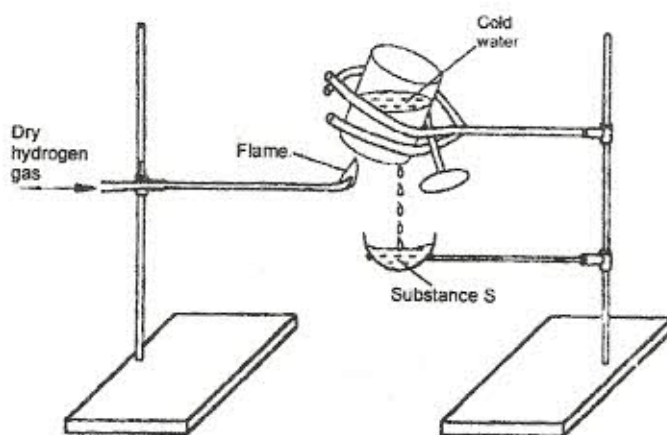
Select:

- (a) a neutral oxide (1 mark)
- (b) a highly water soluble basic oxide (1 mark)
- (c) an oxide which can react with both sodium hydroxide solution and dilute hydrochloric acid (1 mark)

15. Study the standard reduction potentials given below and answer the questions that follow.
(The letters are not the actual symbols of the elements).

	E^{\ominus} (volts)
$M^{2+}_{(aq)} + 2e \longrightarrow M_{(s)}$	-0.76
$N^{2+}_{(aq)} + 2e \longrightarrow N_{(s)}$	-2.37
$P^{+}_{(aq)} + e \longrightarrow P_{(s)}$	+0.80
$Q^{2+}_{(aq)} + 2e \longrightarrow Q_{(s)}$	-0.14

- (a) The standard reduction potential for $Fe^{2+}_{(aq)}$ is -0.44. Select the element which would best protect iron from rusting. (1 mark)
- (b) Calculate the E^{\ominus} value for the cell represented as $M_{(s)} | M^{2+}_{(aq)} || P^{+}_{(aq)} | P_{(s)}$. (2 marks)
16. When hydrogen sulphide gas was bubbled into an aqueous solution of iron (III) chloride, a yellow precipitate was deposited.
- (a) State another observation that was made (1 mark)
- (b) Write an equation for the reaction that took place (1 mark)
- (c) What type of reaction was undergone by hydrogen sulphide in this reaction? (1 mark)
17. The first step in the industrial manufacture of nitric acid is the catalytic oxidation of ammonia gas.
- (a) What is the name of the catalyst used? (1 mark)
- (b) Write the equation for the catalyst oxidation of ammonia gas (1 mark)
- (c) Nitric acid is used to make ammonium nitrate. State two uses of ammonium nitrate. (1 mark)
18. Study the diagram below and answer the question that follows.



Describe one chemical test that can be carried out to identify substance S. (2 marks)

19. (a) Starting from solid magnesium oxide, describe how a solid sample of magnesium hydroxide can be prepared (2 marks)

(b) Give one use of magnesium hydroxide (1 mark)

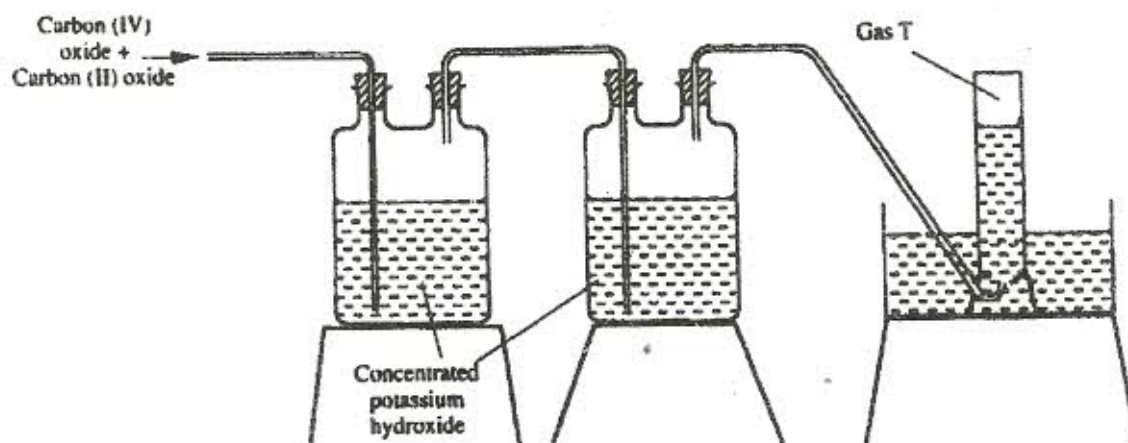
20. (a) Distinguish between a covalent bond and a co-ordinate bond (2 marks)

(b) Draw a diagram to show bonding in an ammonium ion (1 mark)
(N = 7, H = 1)

21. (a) Explain why the metals magnesium and aluminium are good conductors of electricity (1 mark)

(b) Other than cost, give two reasons why aluminium is used for making electric cables while magnesium is not. (2 marks)

22. The diagram below represents part of a set up used to prepare and collect gas T.



(a) Name two reagents that are reacted to produce both carbon (IV) oxide and carbon (II) oxide (1 mark)

(b) Write the equation for the reaction which takes place in the wash bottles (1 mark)

(c) Give a reason why carbon (II) oxide is not easily detected. (1 mark)

23. Explain why the boiling point of ethanol is higher than that of hexane (Relative molecular mass of ethanol is 46 while that of hexane is 86). (2 marks)

24. (a) Complete the table below to show the colour of the given indicator in acidic and basic solutions (1 mark)

Indicator	Colour in	
	Acidic solution	Basic solution
Methyl orange	Yellow
Phenolphthalein	colourless

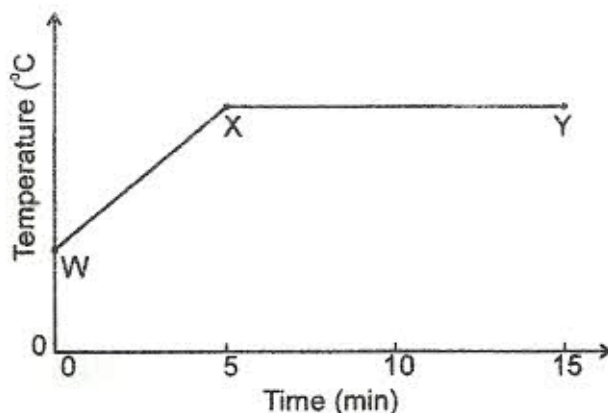
- (b) How does the pH value of 0.1M potassium hydroxide solution compare with that of 0.1M aqueous ammonia? Explain (2 marks)

25. Study the properties of substances V_1 to V_4 in the table below and answer the questions that follow.

Substance	Solubility in water	Solubility in petrol	Melting point ($^{\circ}\text{C}$)	Boiling point ($^{\circ}\text{C}$)
V_1	Insoluble	Soluble	-30	250
V_2	Insoluble	Insoluble	1535	3000
V_3	Insoluble	Soluble	16.8	44.8
V_4	Insoluble	Soluble	75	320

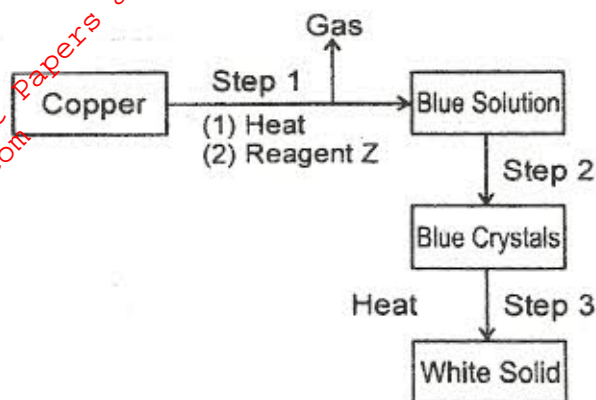
- (a) Which of the substances are liquids 24°C ? (1 mark)
- (b) Describe how a mixture containing V_2 and V_4 can be separated. (2 marks)

26. The graph below shows a curve obtained when water at 20°C was heated for 15 minutes.



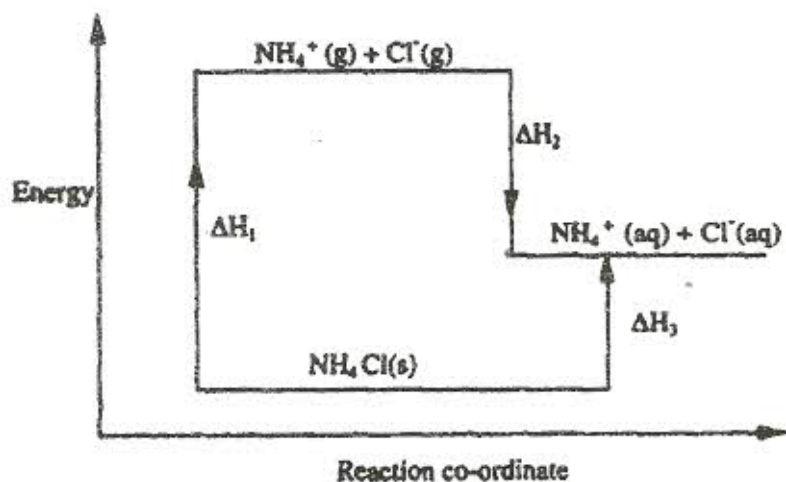
- (a) What happens to the water molecules between points W and X? (1 mark)
- (b) In which part of the curve does change of state occur? (1 mark)
- (c) Explain why the temperature does not rise between points X and Y (1 mark)

27. Study the flow chart below and answer the questions that follow



- (a) Name reagent Z. (1 mark)
- (b) Describe the process which takes place in step 2. (1 mark)
- (c) Identify the white solid. (1 mark)

28. Study the diagram below and answer the questions that follow.



- (a) What do ΔH_1 and ΔH_2 represent? (2 marks)
- (b) Write an expression to show the relationship between ΔH_1 , ΔH_2 , and ΔH_3 . (1 mark)