

1977

Chemistry

Higher II

SCOTTISH CERTIFICATE OF EDUCATION

CHEMISTRY

Higher Grade—Paper II

Tuesday, 10th May—1.30 p.m. to 4.00 p.m.

Marks may be deducted for bad spelling, and bad punctuation, and for writing that is difficult to read.

Working should be shown in all answers involving calculations.

Necessary data will be found in the book of Mathematical Tables and Science Data.

[85 / 231]

1. From the information given in the following table which of the pairs of atoms are isotopes?

| <i>Atom</i> | <i>Number of neutrons in nucleus</i> | <i>Nuclear charge</i> |
|-------------|--|-----------------------|
| 1 | 50 | 36 |
| 2 | 50 | 37 |
| 3 | 49 | 38 |
| 4 | 52 | 38 |

A 1 and 2
B 2 and 3
C 2 and 4
D 3 and 4

2. Which of the following ions will be deflected most in a mass spectrometer?

A Mass number 12, charge 1+
B Mass number 12, charge 2+
C Mass number 16, charge 1+
D Mass number 16, charge 2+

3. Which of the processes outlined below is most likely to result in the production of magnesium?

A Electrolysis of an aqueous solution of magnesium chloride
B The passing of hydrogen over heated magnesium oxide
C Electrolysis of molten magnesium chloride
D The addition of calcium to an aqueous solution of magnesium chloride

4. Which of the following pairs would be expected to react together with the greatest release of energy?

A Potassium and bromine
B Caesium and fluorine
C Lithium and iodine
D Sodium and chlorine

5. When sodium hydroxide solution is electrolysed, hydrogen is released at the negative electrode, but not sodium. The best explanation of this from the following four options is that

A the $\text{H}^+(\text{aq})$ ion moves faster than $\text{Na}^+(\text{aq})$
B $\text{H}^+(\text{aq})$ accepts an electron more readily than $\text{Na}^+(\text{aq})$
C there is more $\text{H}^+(\text{aq})$ in the solution than $\text{Na}^+(\text{aq})$
D the sodium which is released reacts with the water to give off hydrogen.

6. A thermosetting polymer differs from a thermoplastic polymer

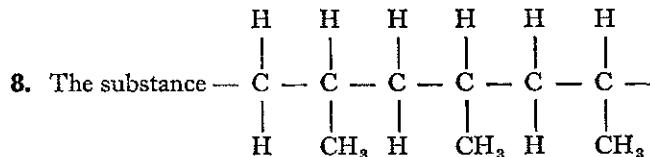
- A because it is a branched chain hydrocarbon
- B because it is formed by addition polymerisation
- C because it is not resoftened on heating
- D for none of these reasons.

Questions 7 and 8 refer to the following classes of polymers:

- A natural addition polymers
- B natural condensation polymers
- C synthetic addition polymers
- D synthetic condensation polymers.

Place each of the following in its appropriate class:

7. Cellulose.



9. 12 g of magnesium is added to 1 litre of M copper(II) sulphate solution. Which of the following statements represents one of the results of this reaction?

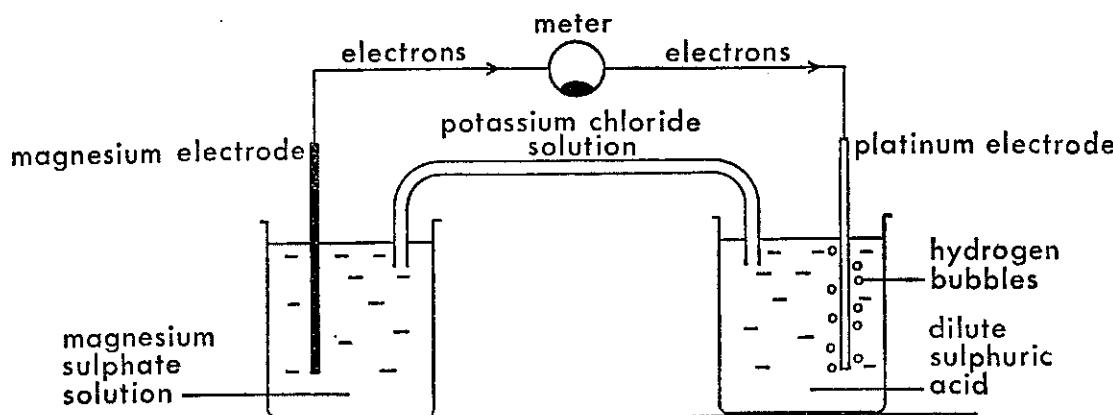
- A The resulting solution is colourless.
- B All the magnesium dissolves.
- C 63.5 g of copper is displaced.
- D 2 moles of copper are displaced.

10. Dilute sulphuric acid (2M) is dropped on to a mixture of copper turnings and copper(II) carbonate. Which of the following would be the most likely composition of the gas evolved?

- A Carbon dioxide only
- B Hydrogen only
- C Hydrogen and carbon dioxide
- D Carbon dioxide and sulphur dioxide

[Turn over

Questions 11 and 12 refer to the cell shown in the diagram below:



11. Which of the following statements best accounts for the direction of the electron flow?

- A The magnesium gives up electrons forming Mg^{2+} ions.
- B OH^- ions give up electrons to the magnesium electrode.
- C SO_4^{2-} ions give up electrons to the magnesium electrode.
- D Cl^- ions give up electrons to the magnesium electrode.

12. Which of the following statements best accounts for the evolution of hydrogen at the platinum electrode?

- A SO_4^{2-} ions are reducing H^+ ions.
- B OH^- ions are supplying electrons to H^+ ions.
- C The platinum atoms are being oxidised by H^+ ions.
- D The electrode is supplying electrons to H^+ ions.

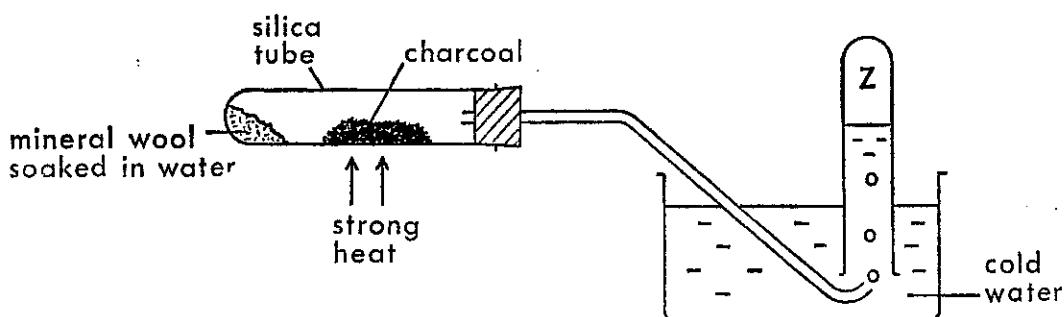
13. Which of the following is a monatomic substance held together by van der Waals' forces?

- A Potassium fluoride
- B Copper
- C Solid argon
- D Sodium

14. 18 g of an oxide of copper was strongly heated and hydrogen gas was passed over it. When the oxide was completely reduced, 16 g of copper remained. The atomic weights of copper and oxygen are approximately 64 and 16. A possible formula for the oxide (but without showing charges) could be

- A Cu_2O_3
- B CuO_2
- C Cu_2O
- D CuO .

15. Consider the experiment shown below in the diagram.



The silica tube is heated until all the air is driven off. Any further gas given off is collected at Z. This is likely to be

- A carbon monoxide
- B carbon dioxide
- C carbon monoxide + hydrogen
- D carbon dioxide + water.

16. A gas decolourises bromine water. From this observation it can be said with certainty that the gas is

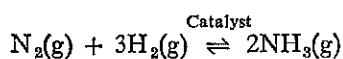
- A ethene
- B sulphur dioxide
- C a reducing agent
- D an unsaturated hydrocarbon.

17. When heated in air, a hard grey mineral gave off a colourless acidic gas which decolourised a solution of iodine in potassium iodide solution. The mineral could be

- A galena (a sulphide of lead)
- B haematite (an oxide of iron)
- C malachite (a carbonate of copper)
- D barytes (a sulphate of barium).

[Turn over

Questions 18, 19 and 20 refer to the manufacture of ammonia. The equation for the catalysed, reversible reaction is



18. The nitrogen for the process is most likely to be obtained by

- A passing air over heated copper
- B liquefying air and then fractionally distilling it
- C using the fact that oxygen is more soluble in water than is nitrogen
- D heating ammonium nitrite solution.

19. What is the effect of the catalyst?

- A It shifts the equilibrium to the right.
- B It lowers the activation energy.
- C It makes the reaction exothermic.
- D It decreases the rate of the reverse reaction.

20. Equilibrium is reached when

- A molecules of reactants cease to change into molecules of products
- B the sum of the concentrations of the reactants is equal to the concentration of the product
- C the concentrations of reactants and product are constant
- D the activation energy of the forward reaction is equal to that of the reverse reaction.

21. A mixture of sodium chloride and sodium sulphate is known to contain 0.5 moles of sodium ions and 0.2 moles of chloride ions. How many moles of sulphate ions are present?

- A 0.15
- B 0.20
- C 0.25
- D 0.30

22. Three unlabelled bottles contain samples of sodium carbonate, ammonium sulphate, and sodium nitrate. Which of the following procedures will positively identify them?

- A Test the flame colouration of the compounds.
- B Add dilute hydrochloric acid to a sample of each. Then add barium chloride solution to solutions of the compounds which gave no positive reaction.
- C Add barium chloride solutions to solutions of each compound. Then add sodium hydroxide solution to solutions of any of the compounds which gave no positive reaction.
- D Heat each solid with calcium oxide. Then add pieces of zinc to solutions of any of the compounds which gave no obvious reaction.

23. In the reaction between bromine water and sodium sulphite solution, which one of the following is oxidised?

- A OH^-
- B SO_3^{2-}
- C Na^+
- D Br^-

24. In sunlight green plants convert carbon dioxide and water into carbohydrate. This process is one in which

- energy is stored
- heat is given out
- chlorophyll is used up
- carbon dioxide is oxidised.

25. If a mixture of nitrogen and hydrogen is burned in air, which of the following compounds is most likely to be formed?

- Ammonia
- Water
- Nitric acid
- Ammonium nitrate

26. Dilute solutions of the following substances were placed in beakers provided with platinum electrodes. In which case would a metal definitely be produced at the negative electrode when a current is passed?

- Calcium hydroxide
- Potassium chloride
- Zinc nitrate
- Copper(II) sulphate

Questions 27, 28, and 29 refer to the compounds of which the molecular formulae and names are given

- C_3H_7OH (propanol)
- C_3H_7COOH (butanoic acid)
- $C_6H_{12}O_6$ (glucose)
- $CH_3CH=CH_2$ (propene).

27. Which of the above compounds gives a positive test with Fehling's (or Benedict's) solution?

28. Which of the above compounds gives a polymer by addition?

29. Which of the above compounds gives carbon dioxide on addition of sodium carbonate?

30. Electrolysis of molar solutions of the sodium halides gave the following products:

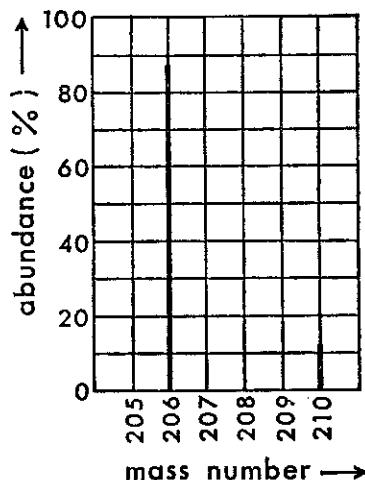
| Compound | Positive Electrode | Negative Electrode |
|-----------------|--------------------|--------------------|
| sodium fluoride | oxygen | hydrogen |
| sodium chloride | chlorine | hydrogen |
| sodium bromide | bromine | hydrogen |
| sodium iodide | iodine | hydrogen |

Which of the following conclusions can be made?

- Sodium fluoride is not an ionic compound.
- Of the above salts, sodium fluoride causes the greatest ionisation of water.
- Fluorine is the least reactive of the halogens.
- Fluoride ions will not part with their electrons easily.

[Turn over

31. $^{210}_{84}\text{Po}$ is an α -emitter with a half-life of 140 days. A sample of the isotope was placed in a mass-spectrometer and the chart below was obtained.



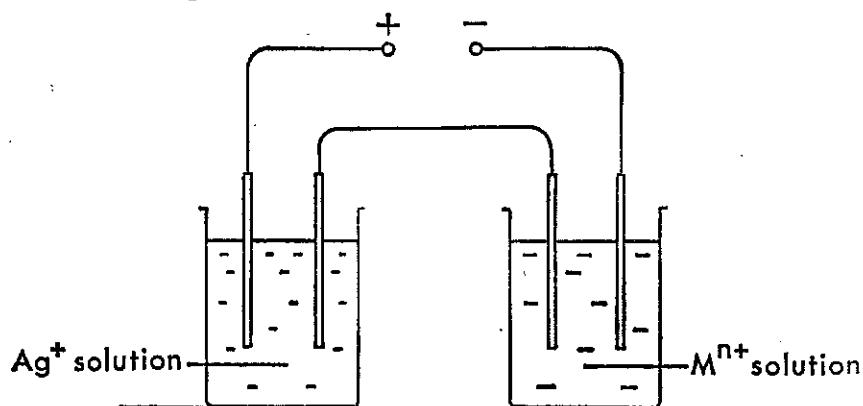
What is the age of the isotope?

- A 140 days
- B 280 days
- C 420 days
- D 840 days

32. Some starch solution was added to a solution of potassium iodate, followed by some potassium sulphite solution. The colourless mixture became dark blue only after 30 seconds. Which of the following statements explains why the blue colour did not appear immediately?

- A Too little starch solution was used.
- B The solutions were too concentrated.
- C The action between iodine and starch is slow.
- D The rate controlling step was slow.

Questions 33 and 34 refer to the experiment illustrated below:



The metals Ag and 'M' are deposited by electrolysis.

33. It took 54 hours to deposit 1 mole of Ag. How long would it take to deposit 1 mole of 'M'?

- A 54 n hours
- B 54 hours
- C $54/n$ hours
- D You cannot say without knowing the atomic weights of Ag and 'M'.

34. It took 30 minutes to deposit 1 g of Ag. How long would it take to deposit 1 g of 'M'?

- A 30 minutes
- B $30 n$ minutes
- C $30/n$ minutes
- D You cannot say without knowing the atomic weights of Ag and 'M'.

35. In the electrolysis of a solution of copper(II) sulphate using copper electrodes, the passage of one faraday of electricity (96 500 coulombs) results in the positive electrode

- A gaining 64 g mass
- B losing 64 g mass
- C gaining 32 g mass
- D losing 32 g mass.

36. Which of the following substances, when placed in a jelly containing an iron nail, will most quickly lead to the formation of iron(II) ions?

- A Starch
- B Sucrose
- C Calcium carbonate
- D Sodium chloride

37. Which of the following is the strongest reducing agent?

- A Zn(s)
- B H⁺(aq)
- C Cu(s)
- D Ag(s)

38. Which of the following properties would be expected to apply to the metal francium?

- A It will resist corrosion.
- B It will form a covalent chloride.
- C It will form a soluble hydroxide.
- D It will have a very stable nucleus.

[Turn over

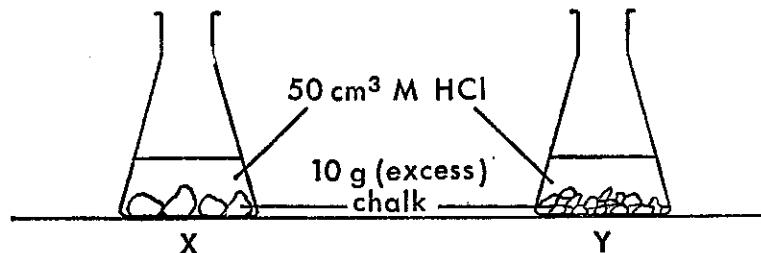
39. Consider the reaction



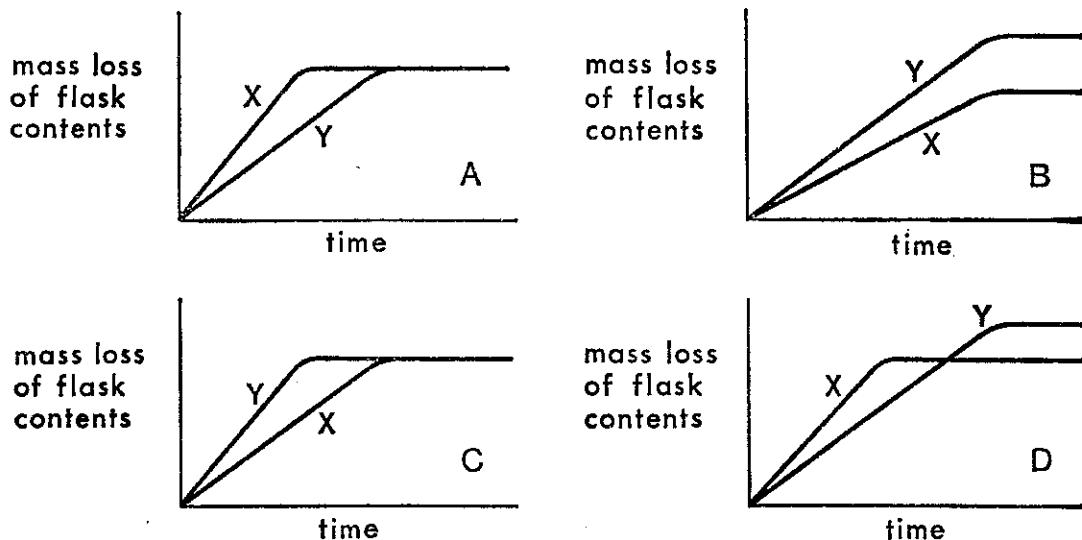
The complete decomposition of calcium carbonate by heat is prevented by

- A absorbing the carbon dioxide produced in alkali
- B removing calcium oxide as it is formed
- C carrying out the reaction in a closed vessel
- D reducing the pressure in the reaction vessel.

40. Consider the experiment illustrated below.



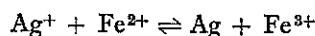
Which diagram shows data likely to be obtained from experiments X and Y?



41. The continuous use of large extractor fans greatly reduces the possibility of an explosion in a flour mill. This is mainly because

- A a build-up in the concentration of oxygen is prevented
- B local temperature rises are prevented by the movement of air
- C particles of flour suspended in the air are removed
- D the slow accumulation of carbon monoxide is prevented.

42. When 20 cm³ each of 0.1 M solutions of silver nitrate and iron(II) sulphate are mixed together a deposit of silver is formed, and an equilibrium is set up according to the equation:



Addition of which of the following molar solutions could lead to the silver dissolving?

- A Sulphuric acid
- B Iron(III) sulphate
- C Silver nitrate
- D Iron(II) sulphate

43. Which of the following could be used to oxidise an alcohol to the corresponding organic acid?

- A Phosphorus pentachloride
- B Aluminium oxide
- C Copper(II) oxide
- D Sodium

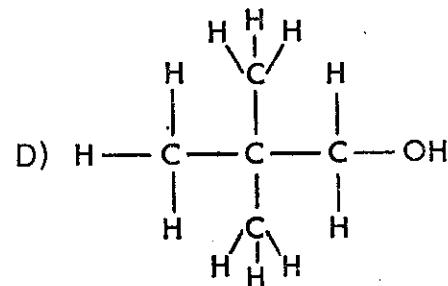
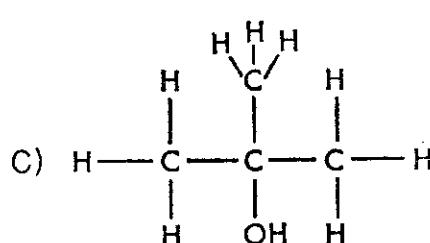
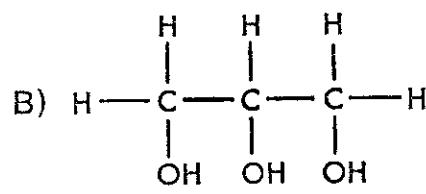
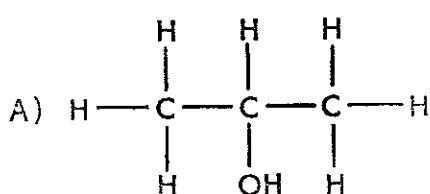
44. A gaseous hydrocarbon has a density of 1.88 grams per litre at standard temperature and pressure. The molecular formula is

- A C_2H_4
- B C_3H_6
- C C_4H_8
- D C_5H_{10}

45. Which of the following compounds is NOT an isomer of heptane?

- A 2,3-dimethylbutane
- B 2,3-dimethylpentane
- C 2,2-dimethylpentane
- D 2-methylhexane

46. Which of the following structures represents a tertiary alcohol?



47. Which of the following statements is not true of samples of both pure ethanoic (glacial acetic) acid and pure ethanol?

- A They are soluble in water.
- B They can be burned in oxygen.
- C They can be used to prepare esters.
- D Their aqueous solutions are electrical insulators.

[Turn over

48. Which series of radioactive transformations would produce an atom of the element with which you had started?

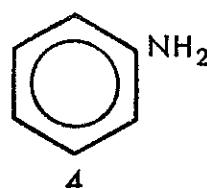
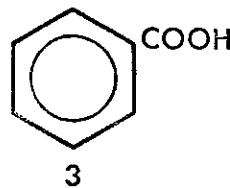
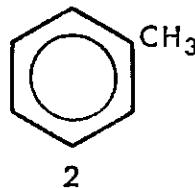
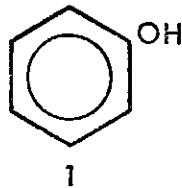
- A α, β, β
- B β, α, α
- C α, β, γ
- D α, β , neutron capture

In questions 49 and 50 more than one response may be correct.

Answer

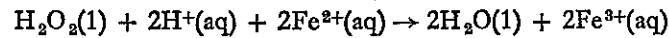
- A if responses 1, 2, and 3 are correct
- B if responses 1 and 3 are correct
- C if responses 2 and 4 are correct
- D if 4 only is correct
- E if some other response or combination of responses is correct.

49. A sample of coal tar contains the following substances:



Which of the above substances, when shaken with sodium hydroxide solution, is/are much more soluble in the alkali than in water?

50. In the presence of hydrogen ions, hydrogen peroxide reacts with iron(II) ions. The overall equation for this reaction is:



From this equation it can be inferred that, under the given conditions,

- 1 hydrogen peroxide oxidises iron(II) ions
- 2 hydrogen ions oxidise iron(II) ions
- 3 hydrogen peroxide gives off oxygen on treatment with acid
- 4 iron(II) ions can only be oxidised to iron(III) ions in the presence of hydrogen peroxide.

[END OF QUESTION PAPER]

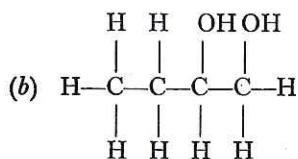
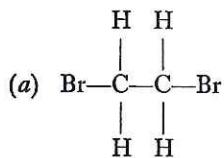
PART A

All questions should be attempted. It should be noted, however, that some questions contain a choice.

It is suggested that about one hour be spent on this part of the paper.

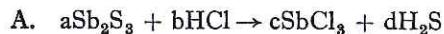
Marks

1. Give the systematic names of the following compounds:—



(2)

2. EITHER



Balance the equation and write down the values for a, b, c and d.

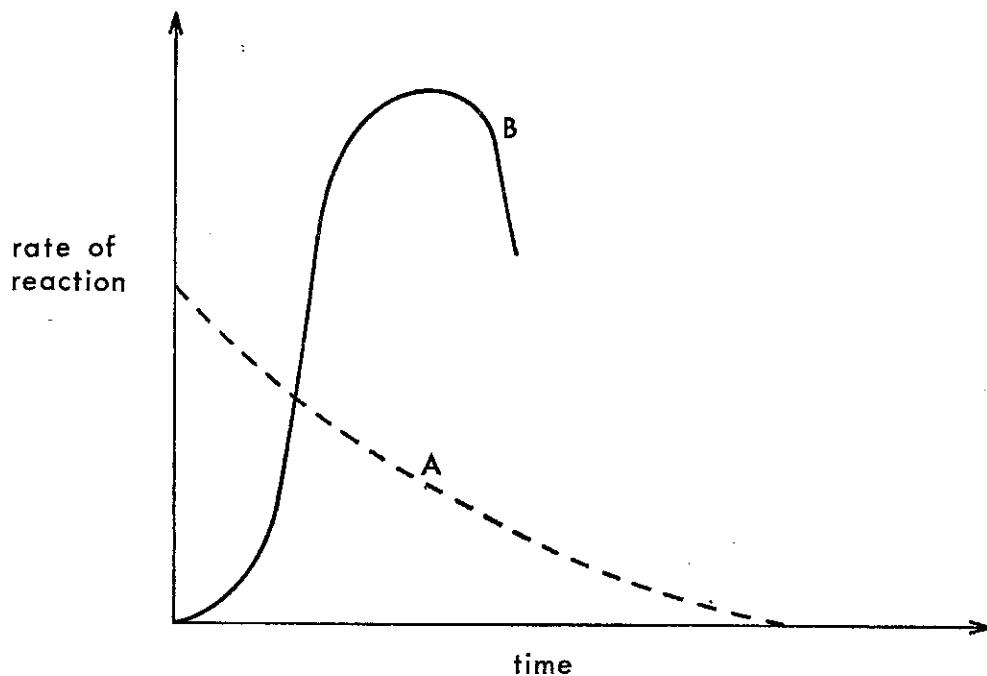
(2)

OR

B. Hydrazine (N_2H_4) is widely used in industry to remove dissolved oxygen from boiler water. Its ability to act as an oxygen scavenger depends on its rapid oxidation to nitrogen and water in aqueous solution. Write a balanced equation for this reaction.

(2)

3.

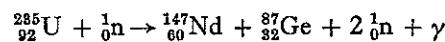


(a) Write the letters A and B in your examination book and opposite each write the type of reaction described by the appropriate curve:

explosive chain reaction; non chain reaction

2

(b) During the fission of uranium suppose that one of the processes which may occur is:—



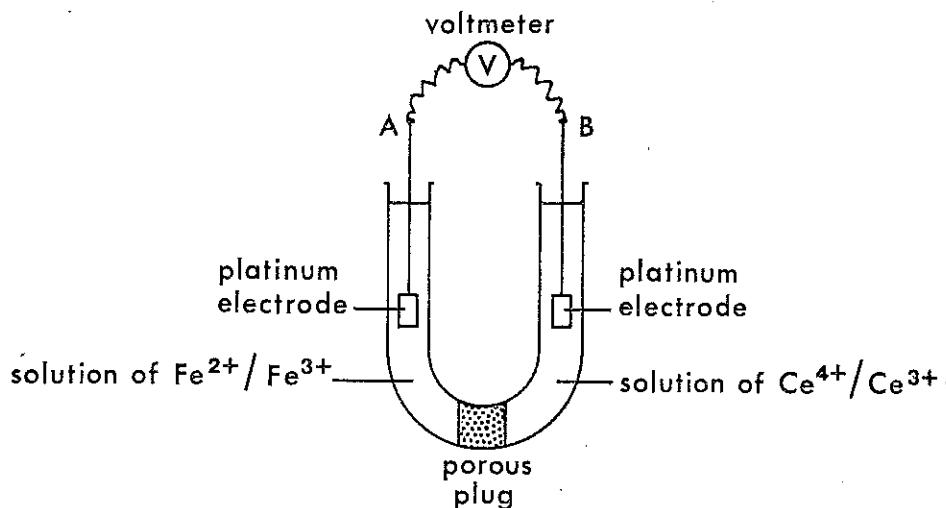
Which of the above curves would fit this hypothetical reaction? Explain your choice.

2

(4)

[Turn over

4. In a laboratory experiment the following apparatus was set up:—



The half reaction $\text{Ce}^{4+}(\text{aq}) + \text{e} \rightarrow \text{Ce}^{3+}(\text{aq})$ has a Standard Reduction Electrode Potential of +1.44 V. Use this information and that on page 40 of your Data Book to answer the following questions:

(a) In the above cell, if all ionic concentrations are equal, in which direction will electrons flow in the external circuit? 1
 (b) Assuming standard conditions, what reading will appear on the voltmeter? 1
 (c) Write a balanced equation for the complete redox reaction occurring in the apparatus. 1
 (3)

5. EITHER

A. A piece of copper was electro-plated with silver by passing a current of 5 amperes through the plating cell for 6 minutes 26 seconds.

(i) Give the equation representing the deposition of silver. 1
 (ii) Calculate the mass of silver deposited. 3

(4)

OR

B. A cube of aluminium has a side of length 10 cm. If each cm^3 aluminium has a mass of 2.7 g, calculate the number of atoms of aluminium in the cube. (4)

6. (a) Place the following compounds in order of base strength beginning with the strongest: ammonia; aniline; ethylamine. 1

(b) Write an equation for the action of ethylamine on water. 1

(c) Why are amino acids described as amphoteric? 2

(d) What would be formed when glycine ($\text{NH}_2\text{CH}_2\text{COOH}$) reacts with: 2

(i) methanol, and

(ii) hydrochloric acid? 2

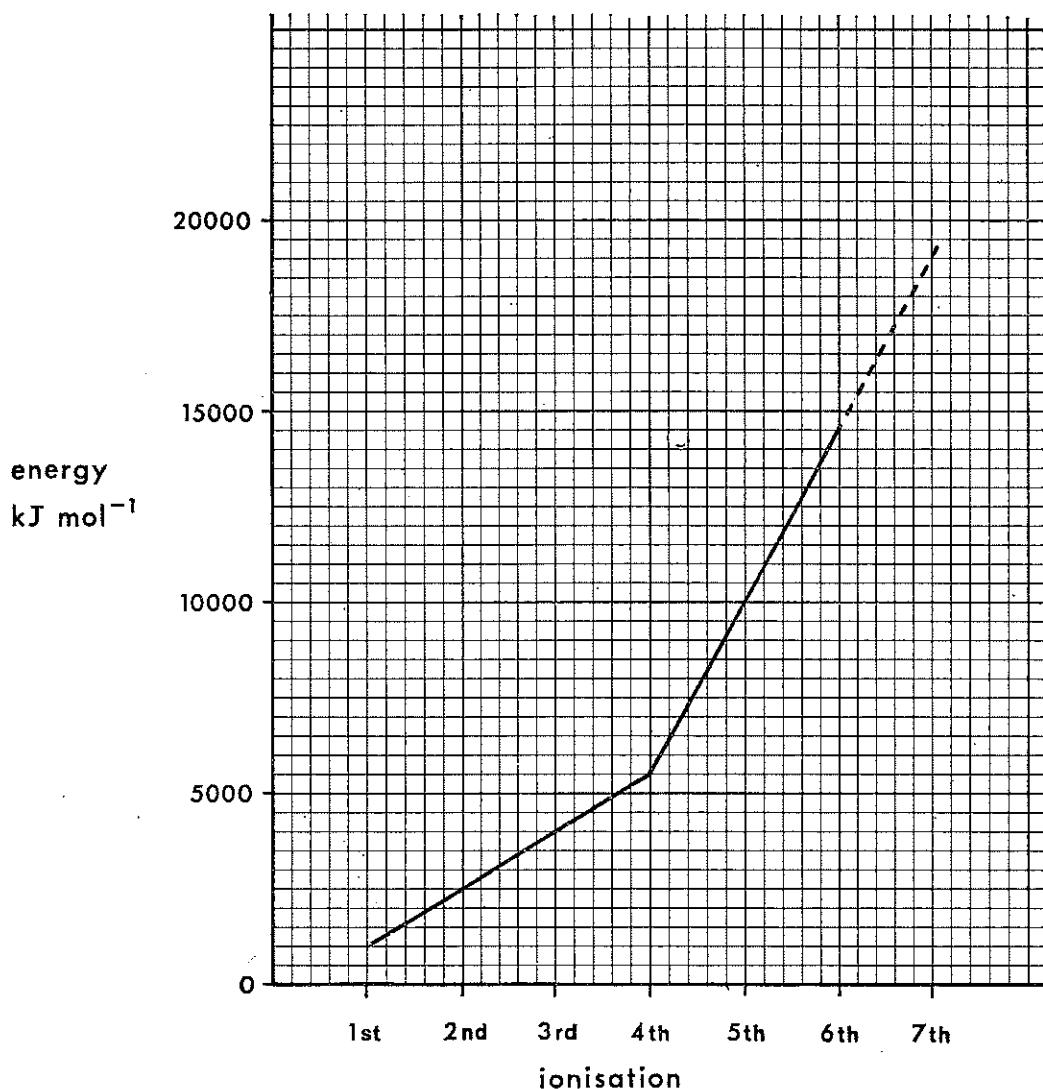
(6)

7. EITHER

A. Use the information on bond energies given on page 38 of the Data Book to calculate the heat of reaction for the complete hydrogenation of 1 mole of ethyne. (5)

OR

B. The graph below shows the quantities of energy equivalent to successive ionisation potentials for an element X .



(a) In which group is element X in the Periodic Table? 1

(b) Explain the change in gradient of the graph. 2

(c) What energy is required to form a mole of $X^{2+}(\text{g})$ from $X(\text{g})$? 2
(5)

8. (a) Draw the structural formula of a dimer of ethyne. 2

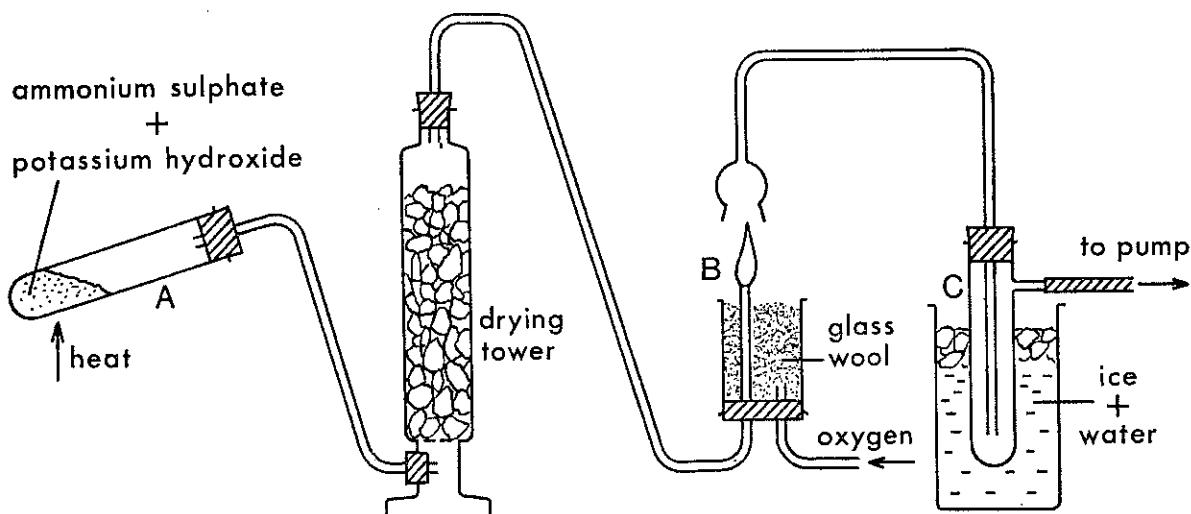
(b) Would this dimer decolourise bromine? Explain your answer. 1
(3)

[Turn over

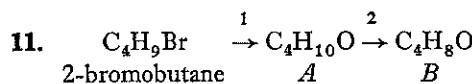
Marks

9. Gaseous hydrogen fluoride contains species of molecular weight 20, 40, 60, 80 and above.
Explain this phenomenon. (2)

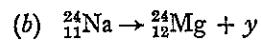
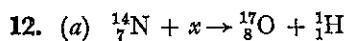
10. Consider the experiment shown below.



(a) What gas is burning at B? 1
(b) What product would you expect to collect in tube C? 1
(c) Write an ionic equation for the reaction occurring in tube A. 1
(3)



(a) Draw the structural formulae of compounds A and B. 2
(b) What reagents are necessary to carry out steps 1 and 2? 2
(4)



State the mass and charge of each of the particles x and y , and identify them. (2)

13. Explain why:

(a) an aqueous solution of potassium cyanide (KCN) has a pH greater than 7 and; 2
(b) on warming, the pH of potassium cyanide solution rises further. 2
(4)

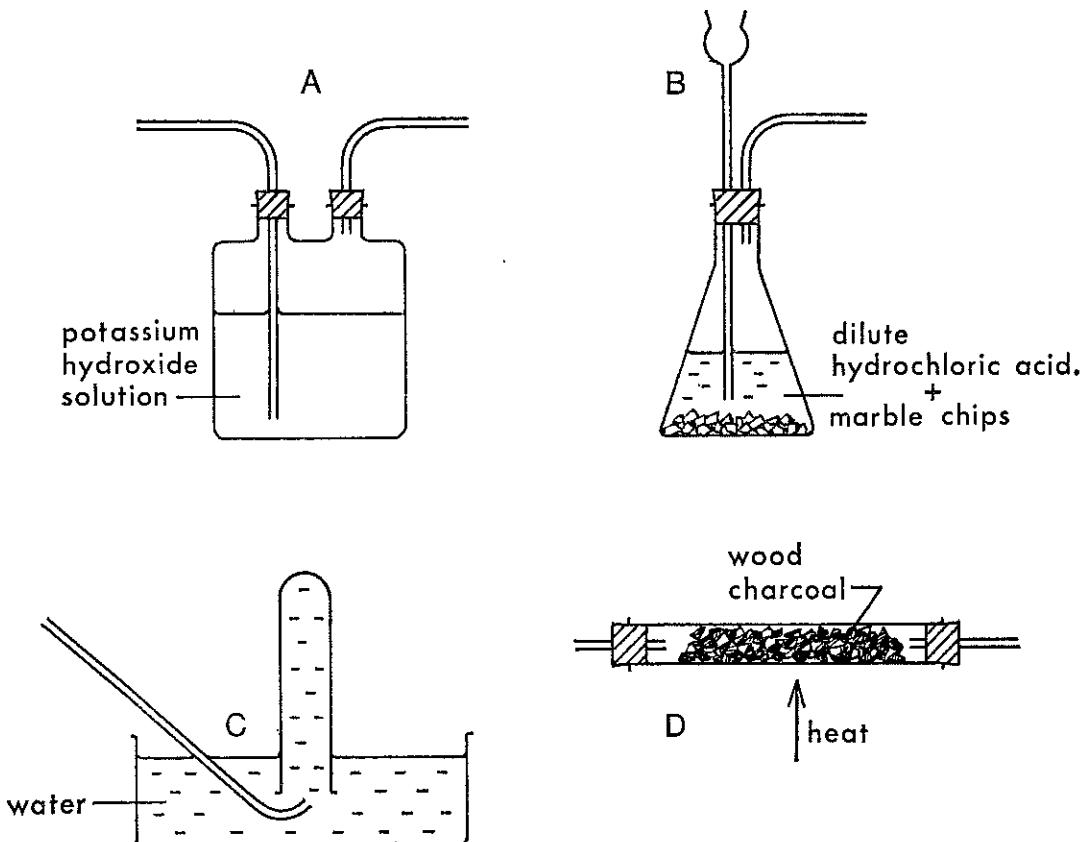
14. One volume of methane is burned in 4 volumes of oxygen in a closed vessel. What is the composition by volume of the resulting mixture at:

(a) 130 °C, and
(b) 20 °C? (4)

Marks

15. Arrange the following pieces of apparatus so that they can be used to convert carbon dioxide to carbon monoxide.

DO NOT DRAW THE APPARATUS, but answer by putting the letters in order, e.g. *A, B, C, D.*



(2)

[Turn over

PART B

All three questions should be attempted. Each question contains a choice.
Candidates are advised to spend about $1\frac{1}{2}$ hours on this part.

16. Answer EITHER A. OR B.

A. TIN.

The main source of tin is the ore cassiterite or tinstone, SnO_2 . After preliminary treatment the concentrated ore is heated in a furnace with coke at about $1200\text{ }^{\circ}\text{C}$. The molten tin runs to the bottom of the furnace and is tapped off.

Tin is a low melting (m.p. $232\text{ }^{\circ}\text{C}$) silvery-white metal which can exist in allotropic forms. Ordinary tin is called white tin and it has metallic properties but at temperatures below $13\text{ }^{\circ}\text{C}$ white tin changes slowly to grey tin in which each atom is joined covalently to four others. This transition alters the appearance of tin and at very low temperatures, around $-50\text{ }^{\circ}\text{C}$, the speed of this conversion is so great that tin objects can crumble to powder.

When heated in air tin forms tin(IV) oxide, SnO_2 . Heated tin also reacts with chlorine to form tin(IV) chloride, SnCl_4 , a colourless liquid (b.p. $114\text{ }^{\circ}\text{C}$) which fumes strongly in moist air.

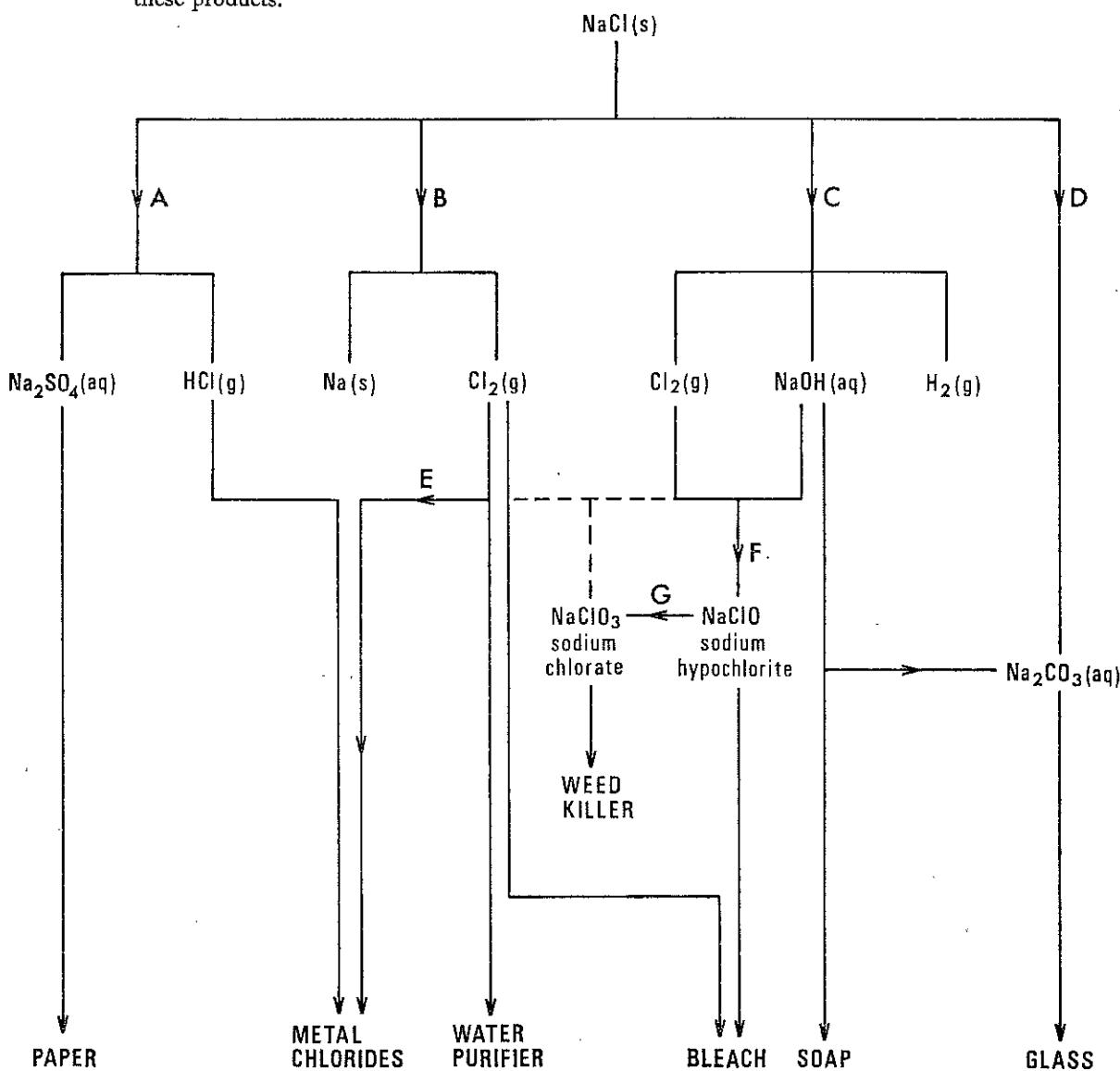
Tin is used extensively as a protective coating for steel, especially in making "tin cans". Copper and other metals are sometimes coated with tin. Tin is also used to make alloys such as pewter, bronze and solder.

| | |
|--|---|
| (a) Write a balanced chemical equation for the conversion of tinstone to tin. | 1 |
| (b) (i) What type of chemical bonding do you think is present in tin(IV) chloride? | 1 |
| (ii) Explain what happens when tin(IV) chloride fumes in moist air. | 2 |
| (c) What in the text indicates the nature of the term "allotropic forms"? | 1 |
| (d) Draw a diagram to show the arrangement of the atoms in grey tin. | 1 |
| (e) (i) Explain why white tin metal is a conductor of electricity. | 2 |
| (ii) Is grey or white tin likely to be the better conductor of electricity? Give a reason for your answer. | 2 |
| (f) In some ancient cathedrals after very severe winter weather it was found that the tin organ pipes had developed "spots" and "growths", called "tin disease", and these were originally attributed to the devil. From the information in the passage what explanation can be offered for this phenomenon? | 2 |
| (g) A chemistry text states that "large quantities of tin are recovered from scrap tinplate by electrolysis". Make a labelled drawing of an apparatus that could be used to carry out this process. | 2 |
| (h) Tin is used to protect iron and copper from the effects of corrosion. Explain why tin offers better protection to copper than to iron. | 3 |
| (i) From the evidence in the passage, suggest one property of tin that makes it suitable for use in the alloy solder. | 1 |

(18)

OR

B. Sodium chloride is an extremely important compound as it can be used, directly or indirectly, to make a variety of substances. The accompanying flow-chart shows some of these products.



(a) Give the reactant and conditions for step A. 2

(b) Under what conditions, and by what means is:

- (i) step B carried out, and
- (ii) step C carried out?

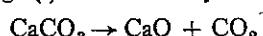
3

(c) Step D represents a method of manufacturing sodium carbonate called the Solvay process. This is a two-stage process:

(i) $\text{NaCl} + \text{NH}_3 + \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{NaHCO}_3 + \text{NH}_4\text{Cl}$

(ii) $2 \text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$

The carbon dioxide for stage (i) is obtained by roasting limestone:



From the information given above in part (c) suggest an economic method of regenerating the ammonia required for stage (i) and give the equation.

3

[Turn over

| | <i>Marks</i> |
|--|--------------|
| (d) Aluminium chloride can be formed by step <i>E</i> . Dry chlorine is passed over hot aluminium and a vapour of molecular weight 267 is formed which sublimes at 183 °C as anhydrous aluminium chloride. | |
| (i) From the above information suggest a formula for the vapour. | 1 |
| (ii) What does the sublimation temperature suggest about the bonding in aluminium chloride? | 1 |
| (iii) If the chlorine had not been dry which compound of aluminium would have been formed? Explain your answer. | 2 |
| (e) In what way does chlorine purify water? | 1 |
| (f) Reactions <i>F</i> and <i>G</i> can be described respectively by the equations: | |
| $\text{Cl}_2 + 2\text{OH}^- \rightarrow \text{ClO}^- + \text{Cl}^- + \text{H}_2\text{O}$ | |
| $3\text{ClO}^- \rightarrow \text{ClO}_3^- + 2\text{Cl}^-$ | |
| (i) Assuming total conversion, how many moles of chlorine could be obtained from 1 mole sodium chloride? | 1 |
| (ii) Hence deduce the number of moles of chlorate ion produced from this quantity of chlorine. | 1 |
| (g) Suggest two industrial uses for the hydrogen, for which no use is shown in the flow-chart. | 2 |
| (h) Name one major constituent which can be fused with sodium carbonate to form glass. | 1 |
| | (18) |

17. Answer EITHER A. OR B.

A. A chemist is supplied with an old sample of potassium sulphite which is known to contain potassium sulphate as an impurity. He has at his disposal dilute hydrochloric acid, distilled water, barium chloride solution, and the apparatus normally found in a chemistry laboratory.

(a) Describe how the chemist should proceed in order to find the percentage by weight of the potassium sulphate impurity in the sample.

Your answer should include:

- (i) a clear statement of the chemistry involved; 3
- (ii) balanced equations for the chemical reactions involved; 3
- (iii) experimental details; 6
- (iv) method of calculating results. 3

(b) Explain the importance of using distilled water rather than tap water in the experiment.

(17)

OR

B. A chemist working in a fully equipped chemistry laboratory is studying the reaction of iron(II) sulphide with hydrochloric acid—a reaction which produces a poisonous evil-smelling gas. He has available 5 M hydrochloric acid and iron(II) sulphide in both lump and powder form.

(a) Imagine that you have been asked to write out for him details of an experimental method he could follow to study the effect of varying the particle size of iron(II) sulphide in the reaction of this substance with hydrochloric acid, using appropriate apparatus and the chemicals available.

Your answer should give the following:

- (i) a labelled diagram of the apparatus to be used; 2
- (ii) a description of the procedure to be followed and the measurements to be taken; 5
- (iii) an outline of any precautions to be observed to ensure that the reaction was carried out safely. 1

| | <i>Marks</i> |
|---|--------------|
| (b) How would you change the experiment described in part (a) in order to investigate the effect of varying temperature on the reaction rate? | |
| Your answer should give the following: | |
| (i) a labelled diagram of the apparatus to be used; | 2 |
| (ii) a description of the procedure to be followed and the measurements to be taken. | 5 |
| (c) In the chemical industry the "poisoning" of a catalyst can have a very serious effect on a reaction. Explain why this is so. | 2 |
| | (17) |

18. Answer EITHER A. OR B.

A. Write an essay on "Fuels and Fuel Products".

Your answer should include reference to the following:

- (a) naturally occurring fuels, their formation and uses;
- (b) the chemical reasons for substances being used as fuels;
- (c) the combustion of fuels;
- (d) fuels and chemicals derived by the chemist from natural fuels, including an outline of the industrial processes involved;
- (e) the industrial importance and uses of derived fuels and chemicals;
- (f) advantages and disadvantages of various types of fuels.

(15)

OR

B. Write an essay on "Soaps and Synthetic Detergents".

Your answer should include reference to the following:

- (a) the structure of an ester;
- (b) naturally occurring esters which can be converted into soaps;
- (c) the structure of soap;
- (d) sources and structures of synthetic detergents;
- (e) action of soaps and synthetic detergents on grease or oil;
- (f) hard water and its effect on soaps and synthetic detergents;
- (g) the advantages and disadvantages of synthetic detergents compared with soaps.

(15)

[END OF QUESTION PAPER]