FOR OFFICIAL USE

Centre No.	Subject No.	Grade	Paper No.	Group No.	Marker's No.

Total

[C012/SQP053]

Intermediate 2 Chemistry

Specimen Question Paper

Time: 2 hours

NATIONAL QUALIFICATIONS

Fill in these boxes and read what is printed below.

Full name of centre

Town

First name and initials

Surname

Date of birth
Day Month Year

Candidate number

Number of seat

Section 1 (questions 1 to 27)

Check that the answer sheet provided is for Chemistry Intermediate 2.

Fill in the details required on the answer sheet.

Rough working, if required, should be done only on this question paper, or on the rough working sheet provided—**not** on the answer sheet.

Instructions for the completion of **Section 1** are given on pages two and three.

Section 2 (questions 28 to 42)

All questions should be attempted.

The questions may be answered in any order but all answers are to be written in this answer book, and must be written clearly and legibly in ink.

Rough work, if any should be necessary, as well as the fair copy, is to be written in this book.

Rough work should be scored through when the fair copy has been written.

Additional space for answers and rough work will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this booklet.

Necessary data will be found in the Intermediate 2 Chemistry Data Booklet (1999 Edition). **[This will be provided in 1999.]**

SCOTTISH QUALIFICATIONS AUTHORITY

SECTION 1

In questions 1 to 25 of this part of the paper, an answer is given by indicating the choice A, B, C or D by a stroke made in INK in the appropriate place in Part 1 of the answer sheet—see the sample question below.

For each question there is only ONE correct answer.

This part of the paper is worth 30 marks.

SAMPLE QUESTION

To show that the ink in a ball-pen consists of a mixture of dyes, the method of separation would be

A fractional distillation

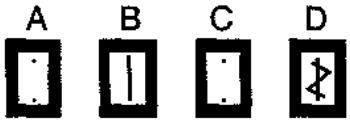
B chromatography

C fractional crystallisation

D filtration.

The correct answer is B—chromatography. A **heavy** vertical line should be drawn joining the two dots in the appropriate box in the column headed **B** as shown **in the example on the answer sheet.**

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and put a vertical stroke in the box you now consider to be correct. Thus, if you want to change an answer **D** to an answer **B**, your answer sheet would look like this:



If you want to change back to an answer which has already been scored out, you should **enter a tick (✓)** to the RIGHT of the box of your choice, thus:

In Questions 26 and 27 of this part of the paper, an answer is given by circling the appropriate letter (or letters) in the answer grid provided.

In some questions, two letters are required for full marks.

If more than the correct number of answers is given, marks will be deducted.

In some cases, the number of correct responses is NOT identified in the question.

A total of 5 marks is available in this part of the paper.

SAMPLE QUESTION

A CH_4	B H_2	C CO_2
D CO	E C_2H_5OH	F C

(*a*) Identify the hydrocarbon.

(A)	B	C
D	E	F

The one correct answer to part (*a*) is A. This should be circled.

(*b*) Identify the **two** elements.

A	(B)	C
D	E	(F)

As indicated in this question, there are **two** correct answers to part (*b*). These are B and F. Both answers are circled.

(*c*) Identify the substance(s) which can burn to produce **both** carbon dioxide and water.

(A)	B	C
D	(E)	F

There are **two** correct answers to part (*c*). These are A and E.

Both answers are circled.

If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and circle the answer you now consider to be correct. Thus, in part (*a*), if you want to change an answer A to an answer D, your answer sheet would look like this:

~~(A)~~	B	C
(D)	E	F

If you want to change back to an answer which has already been scored out, you should enter a tick (✓) in the box of the answer of your choice, thus:

✓ ~~(A)~~	B	C
~~(D)~~	E	F

SECTION 1

This section contains 25 multiple choice questions and 2 grid questions.

1. Which gas is an element?

A Ammonia

B Carbon dioxide

C Fluorine

D Methane

2. Which change is **not** an example of a chemical reaction?

A Iron rusting

B Ice melting

C Methane burning

D Neutralising acid

3. Vinegar can be made by dissolving ethanoic acid in water.

Which term describes the water used in making the vinegar?

A Solute

B Saturated

C Solvent

D Solution

4. Many chemical processes involve catalysts.

Identify the process in which the catalyst could be an enzyme.

A Hydration of ethene

B Hydrolysis of starch

C Cracking of hydrocarbons

D Formation of alkenes from alkanes

5. Which is the formula for magnesium sulphate?

A MgS

B $MgSO_3$

C $MgSO_4$

D $Mg(HSO_4)_2$

6. The element boron contains two types of atoms, of mass numbers 10 and 11.

This tells us that

A the relative atomic mass of boron will be between 10 and 11

B the relative atomic mass of boron will be less than 10

C the boron atom of mass number 10 will be more reactive than that of mass number 11

D the boron atom of mass number 11 will have more electrons in the atom than that of mass number 10.

7. In which compound do **both** ions have the same electron arrangement as argon?

A Magnesium oxide

B Sodium sulphide

C Calcium bromide

D Calcium sulphide

8. Copper is a good conductor of electricity because

A the atoms are free to vibrate

B the atoms are in close contact

C the atoms have the electron arrangement 2, 8, 18, 1

D electrons can move readily from one atom to the next.

9. An atom is neutral because

A the number of electrons equals the sum of the numbers of protons and neutrons

B the number of neutrons equals the sum of the numbers of electrons and protons

C the number of protons equals the number of neutrons

D the number of electrons equals the number of protons.

10. Which molecule has the smallest gram formula mass?

A Methane

B Nitrogen

C Carbon monoxide

D Carbon dioxide

11. When methane burns in a plentiful supply of air, the products are

A carbon monoxide and water vapour

B carbon and water vapour

C carbon dioxide and hydrogen

D carbon dioxide and water vapour.

12. Glycerol can be obtained from a fat by

A hydrolysis

B electrolysis

C condensation

D esterification.

13. $C_6H_{12}O_6$ $C_{12}H_{22}O_{11}$

The above formulae represent two different

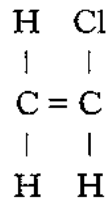
A isomers

B hydrocarbons

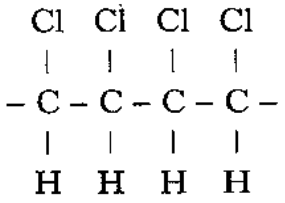
C alkanols

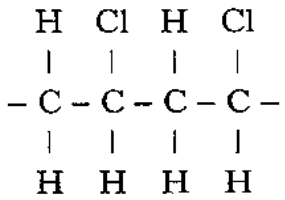
D carbohydrates.

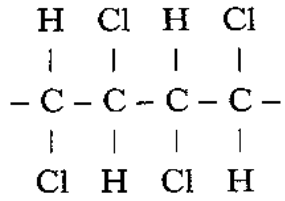
14. The structural formula for the monomer used to make PVC is

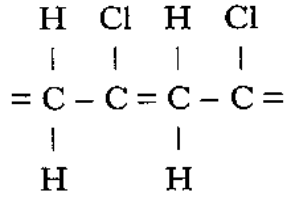


Which of the following is part of the PVC chain?

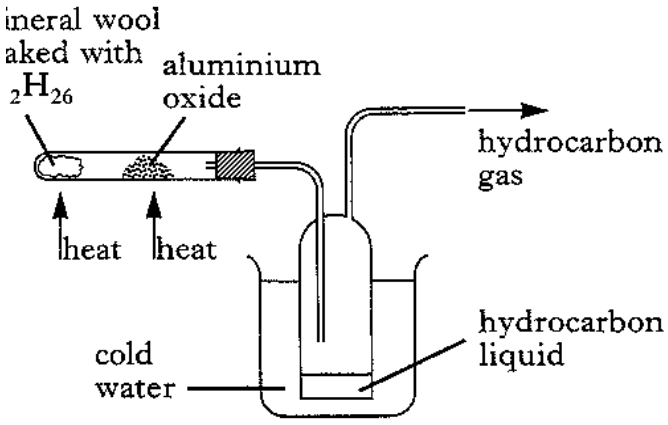
A


B


C


D


15.



Which of the following best represents the composition of the hydrocarbon liquid which is produced by cracking $C_{12}H_{26}$?

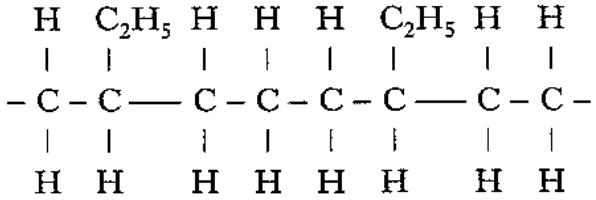
A A mixture of hydrocarbons from C_1 to C_4

B A mixture of hydrocarbons from C_5 to C_{11}

C A mixture of hydrocarbons from C_{13} to C_{24}

D C_6H_{14}

16. Part of a polymer is shown.



Which pair of alkenes was used as monomers?

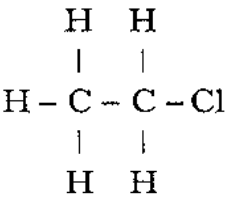
A Ethene and propene

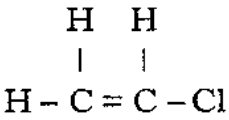
B Ethene and but-1-ene

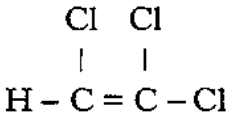
C Propene and but-1-ene

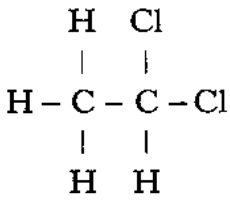
D Ethene and but-2-ene

17. Which compound has an isomer?

A 

B 

C 

D 

18. On complete hydrolysis, a peptide produced 5 amino acids represented by the letters P, Q, R, S and T. The following fragments were produced on partial hydrolysis:

Which sequence could be the correct arrangement of amino acids in the peptide?

A P–T–S–Q–R

B R–T–S–P–Q

C Q–P–T–S–R

D R–T–S–Q–P

19. Which substance dissolves in water to give a solution with a pH greater than 7?

A Sulphur dioxide

B Ammonia

C Sodium chloride

D Hydrogen chloride

20. Reactions can be represented using ionic equations. Which ionic equation shows a neutralisation reaction?

A $2H_2O(\ell) + O_2(g) + 4e^- \rightarrow 4OH^-(aq)$

B $H^+(aq) + OH^-(aq) \rightarrow H_2O(\ell)$

C $SO_2(g) + H_2O(\ell) \rightarrow 2H^+(aq) + SO_3^{2-}(aq)$

D $NH_4^+(s) + OH^-(s) \rightarrow NH_3(g) + H_2O(\ell)$

21. Which of the following pairs of solutions, when mixed, produce a precipitate?

A Copper(II) sulphate and sodium nitrate

B Barium chloride and sodium sulphate

C Calcium hydroxide and potassium chloride

D Sodium sulphate and dilute nitric acid

22. Excess of zinc oxide, zinc carbonate and zinc hydroxide all react with dilute hydrochloric acid. Which of the following does **not** occur in all three reactions?

A Water is formed.

B Zinc chloride solution is formed.

C A gas is evolved.

D The acid is neutralised.

23. Which metal reacts with hydrochloric acid to give hydrogen gas?

A Copper

B Gold

C Silver

D Zinc

24. Which metal can only be obtained by electrolysis of its molten ore?

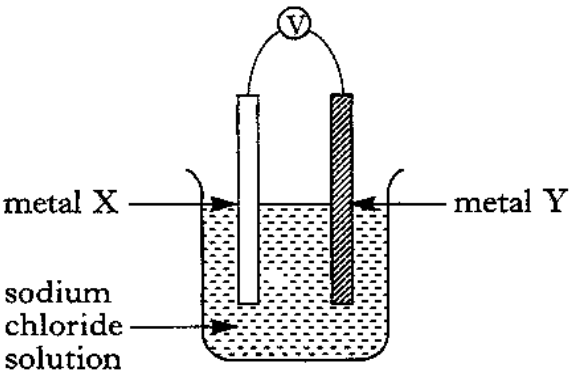
A Copper

B Iron

C Sodium

D Tin

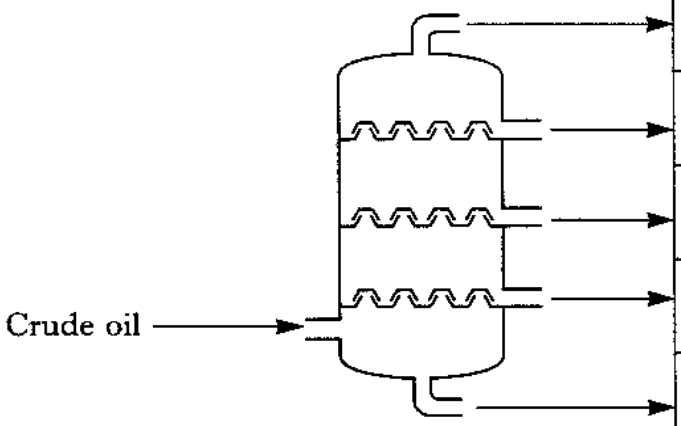
25. The apparatus below was set up.



Which of the following pairs of metals would give the highest reading on the voltmeter?

	Metal X	Metal Y
A	Iron	Zinc
B	Magnesium	Silver
C	Zinc	Copper
D	Zinc	Silver

26. Distillation of crude oil produces several fractions.



Fraction	Number of carbon atoms per molecule
A	1–4
B	4–10
C	10–16
D	16–20
E	20+

(*a*) Identify the fraction which is used as a fuel for jet aircraft.

A
B
C
D
E

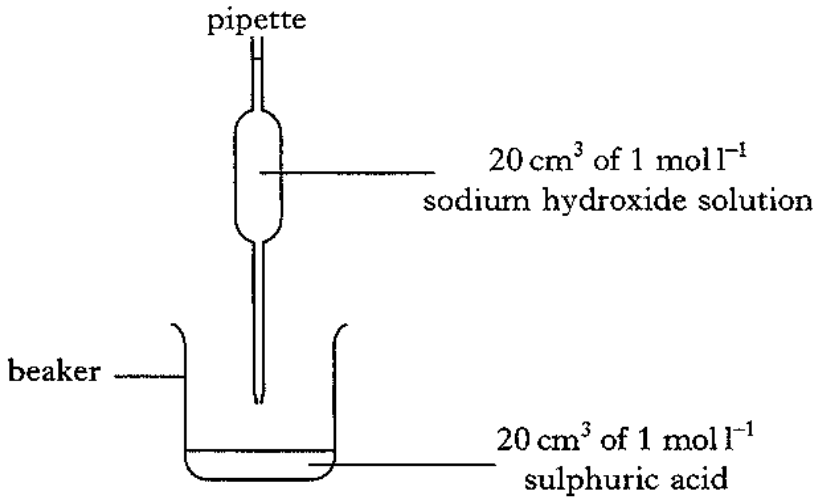
(*b*) Identify the fraction with the lowest boiling point.

A
B
C
D
E

(*c*) Which fraction contains pentane?

A
B
C
D
E

27. Ann added $20\,cm^3$ of $1\ mol\,l^{-1}$ sodium hydroxide solution to $20\,cm^3$ of $1\ mol\,l^{-1}$ sulphuric acid.



Identify the statement(s) which can be applied to this experiment.

A	The number of $H^+(aq)$ ions in the beaker decreased.	A
B	The pH of the solution decreased.	B
C	The number of $SO_4^{2-}(aq)$ ions in the beaker decreased.	C
D	Water molecules formed during the reaction.	D
E	A precipitate formed during the reaction.	E
F	The final solution contained equal numbers of $H^+(aq)$ and $OH^-(aq)$ ions.	F

must not write in this margin

Marks

SECTION 2

50 marks are available in this section of the paper

28. Hydrogen peroxide can be used to clean contact lenses. In this process, the enzyme catalase is added to break down hydrogen peroxide.

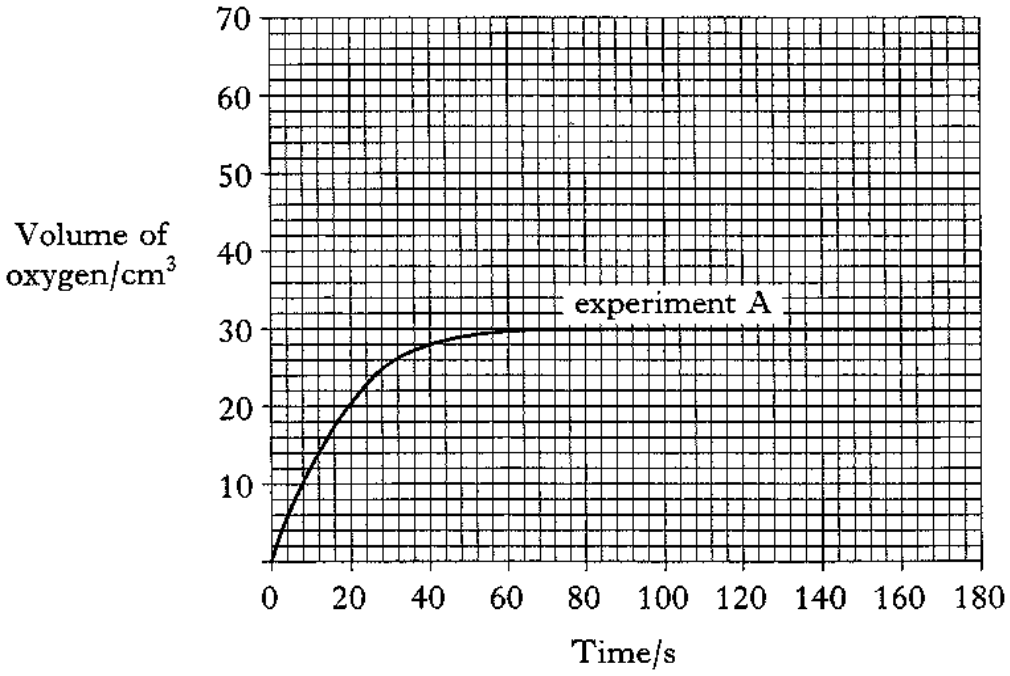
The equation for the reaction is:

$$2H_2O_2(aq) \rightarrow 2H_2O(\ell) + O_2(g)$$

The rate at which oxygen gas was given off was measured in two laboratory experiments. The same volume of hydrogen peroxide at the same temperature was used in each experiment.

Experiment	Concentration of H_2O_2/moles per litre	Catalyst used
A	0·2	yes
B	0·4	yes

The curve obtained for experiment A is shown.



(*a*) Calculate the average rate of the reaction in cm^3 per second (cm^3s^{-1}) over the first 40 s.

_____

_____ **1**

Question 28 (continued)

Marks

(*b*) Add a curve to the graph to show the result of experiment B. **1**

(*c*) State another way in which the rate of the reaction could be increased.

_____

_____

_____ **1**

(*d*) Draw a labelled diagram of the apparatus which you could use to carry out this experiment.

2

(5)

must not write in this margin

Marks

29. There are two different types of lithium atom, $^{6}_{3}\text{Li}$ and $^{7}_{3}\text{Li}$.

(*a*) What name is used to describe the different types of lithium atom?

_____ **1**

(*b*) Complete the table to show the numbers of protons, neutrons and electrons in an atom of $^{7}_{3}\text{Li}$.

Particle	Number
protons	
neutrons	
electrons	

1

(2)

write in margi

Marks

30. Silicon forms compounds with chlorine and with oxygen.

(*a*) (i) The formula for a molecule of silicon chloride is $SiCl_4$.
Show how the outer electrons of the silicon and chlorine atoms are shared to form the bonds.

1

(ii) What name is given to this shape of molecule?

_____ **1**

(*b*) Silicon chloride reacts with water as shown in the equation

$$SiCl_4(\ell) + H_2O(\ell) \rightarrow HCl(g) + SiO_2(s)$$

Balance this equation. **1**

(*c*) Why does silicon oxide have a high melting point?

_____

_____

_____ **1**

(4)

must not write in this margin

Marks

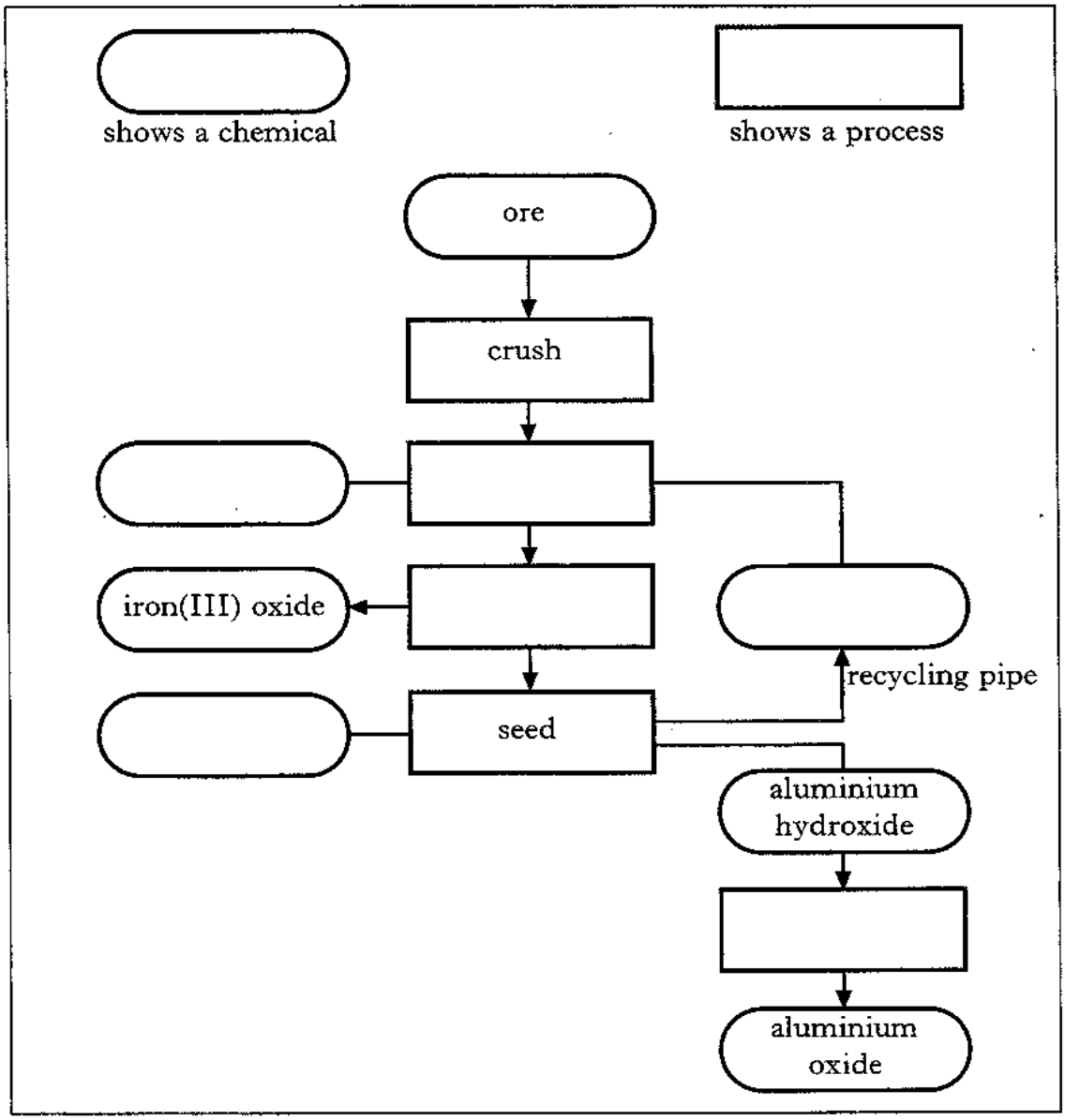
31. This first step in the industrial extraction of aluminium is to obtain aluminium oxide from the ore called bauxite.

The ore is crushed. It is then digested, under pressure, with sodium hydroxide solution. The resulting mixture is filtered and the residue (containing large amounts of iron(III) oxide) is removed.

The filtrate is seeded with a little aluminium hydroxide in order to produce **large** amounts of aluminium hydroxide. Sodium hydroxide solution is also formed.

The aluminium hydroxide passes to a rotary kiln where it is roasted to form pure aluminium oxide.

(*a*) Complete the following flow chart, in order to summarise the production of aluminium oxide.

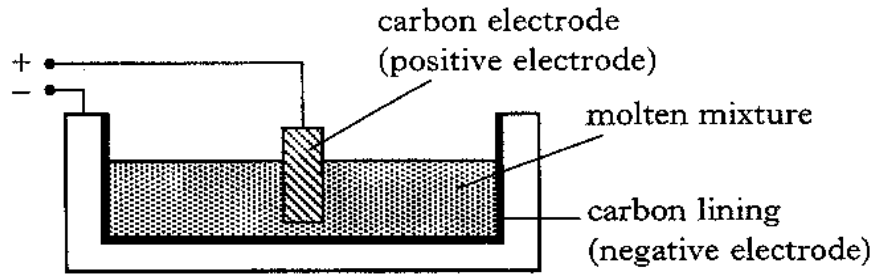


2

Question 31 (continued)

Marks

(*b*) Electricity is then used to obtain aluminium from a molten mixture containing the aluminium oxide.



(i) Why does the mixture need to be kept molten?

_____

_____

_____ **1**

(ii) Why is aluminium formed at the negative electrode?

_____

_____

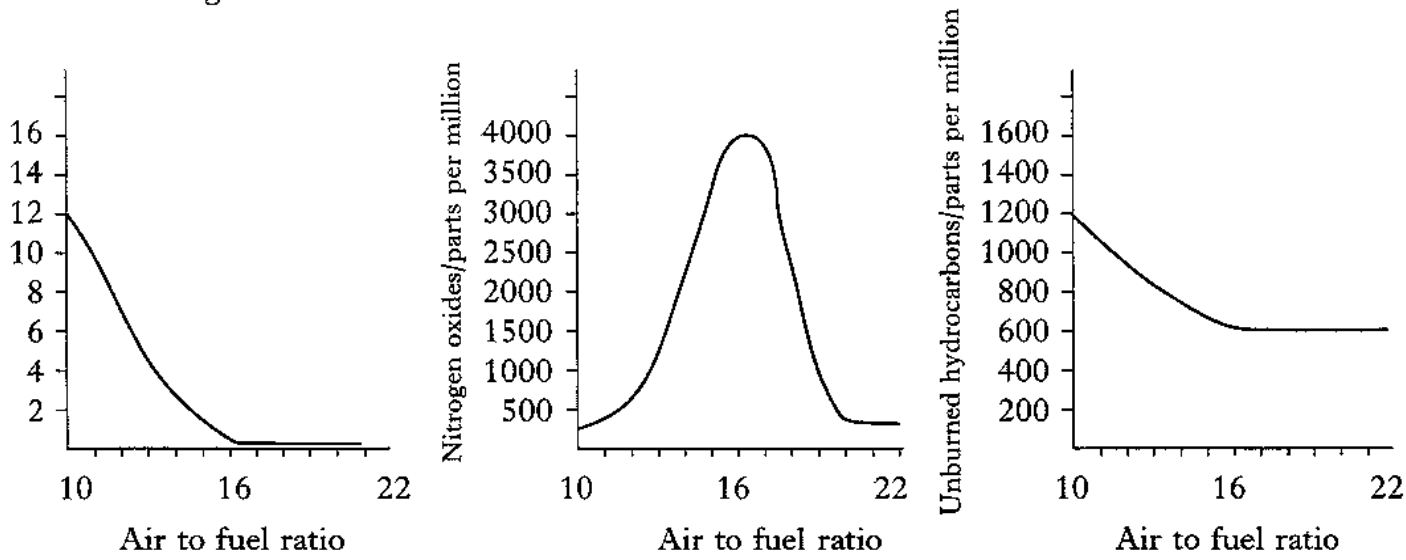
_____ **1**

(iii) Aluminium oxide has a gram formula mass of 102 g.
What term is used to describe the gram formula mass of a substance?

_____ **1**

(5)

32. The following graphs show how the concentrations of some gases in car exhaust fumes vary with the air to fuel ratio of the mixture which is burned in the engine.



Candidate must not write in this margin

Marks

(*a*) Suggest why the carbon monoxide concentration approaches zero as the air to fuel ratio increases.

1

(*b*) Many car engines use an air to fuel ratio of 13.
Which of the gases has the highest concentration in car exhaust fumes using this air to fuel ratio?

1

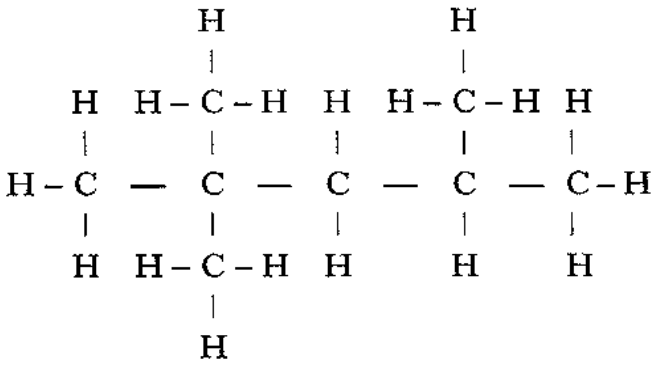
(*c*) Use the information from the graphs to give the advantage of increasing the air to fuel ratio from 18 to 20.

1

Question 32 (continued)

Marks

(*d*) In petrol-engined cars, one of the hydrocarbons found in the fuels has the structural formula shown.



State the systematic name for this hydrocarbon.

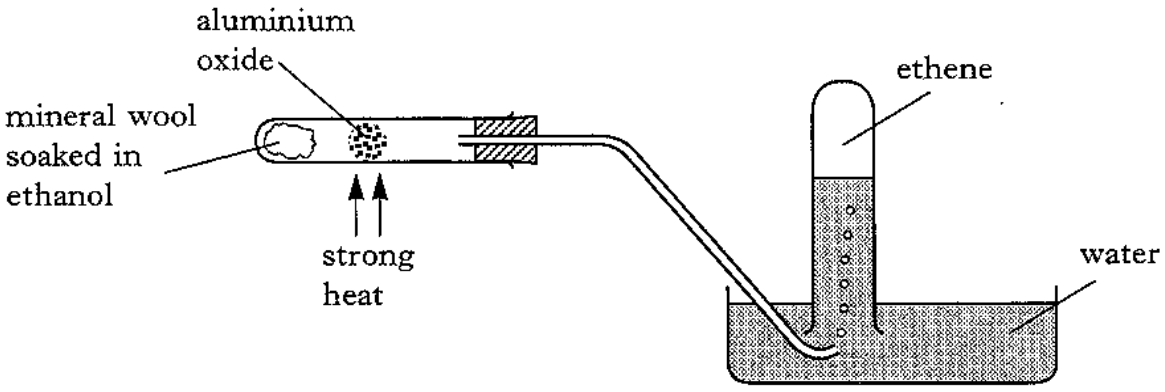
_____ **1**

(4)

must not write in this margin

Marks

33. The diagram below shows how ethene can be prepared in the laboratory.

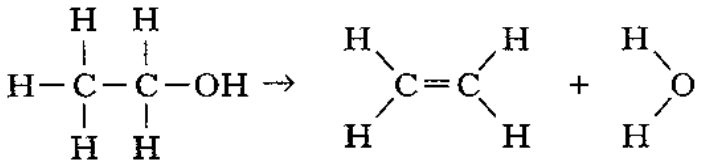


(*a*) Explain why it is necessary to remove the delivery tube from the water before heating is stopped.

_____

_____ **1**

(*b*) The equation for the reaction is



What is the maximum mass of ethene which can be produced from 4·6 g of ethanol?

(Show your working clearly.) **2**

Question 33 (continued)

Marks

(*c*) (i) In industry, ethene is used to make a plastic.
Name this plastic.

_____ **1**

(ii) Many plastics are not biodegradeable.
What does this mean?

_____

_____ **1**

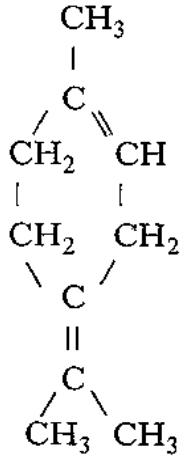
(5)

must not write in this margin

Marks

34. Terpenes are important in the perfume industry. One example is called terpinolene, an unsaturated hydrocarbon with the molecular formula $C_{10}H_{16}$.

The structural formula is shown.



(*a*) What is meant by an unsaturated hydrocarbon?

_____

_____ **1**

(*b*) Experimentally, you can show that terpinolene is unsaturated by testing it with bromine water.

What safety precaution should be taken while carrying out this reaction?

_____

_____

_____ **1**

(2)

write in t
margin

Marks

35. The label shows the ingredients found in a plum jam.

PLUM JAM

plums—flavour
glucose and sucrose—sweeteners
citric acid—fruit acid
sodium citrate—acidity regulator
water—solvent

(*a*) Describe a chemical test which could be used to distinguish between glucose and sucrose.

_____

_____

_____

_____ **2**

(*b*) Citric acid is a weak acid.
What is meant by a weak acid?

_____

_____ **1**

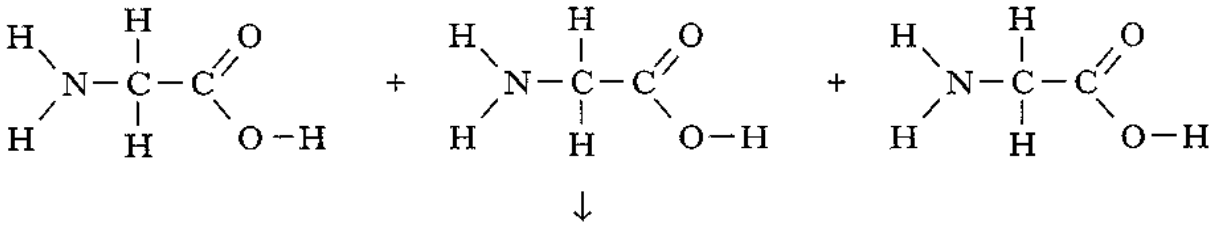
(3)

must not write in this margin

Marks

36. Proteins are polymers formed when amino acids react. Glycine is an example of an amino acid.

(*a*) Draw the part of the protein molecule which is formed by the three glycine molecules linking together.



1

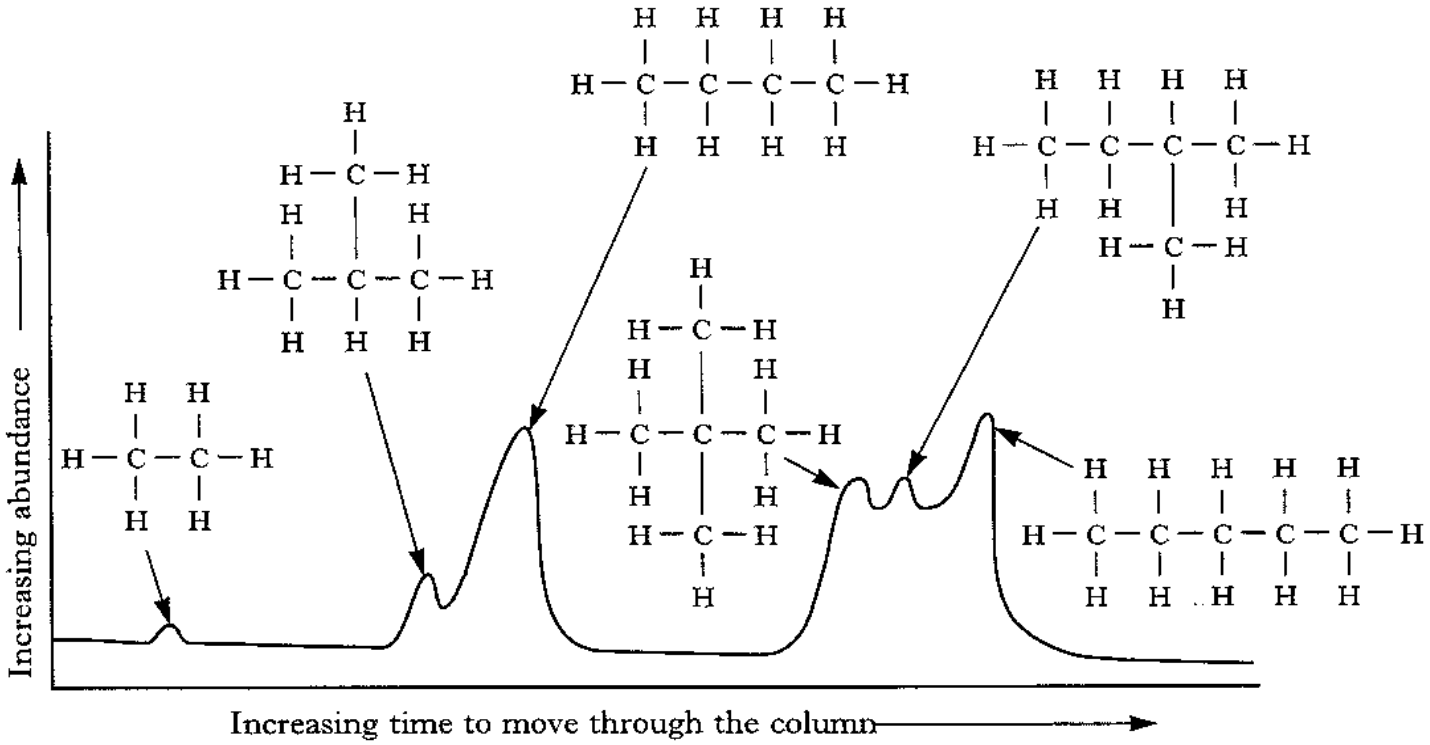
(*b*) Name this type of polymerisation.

_____ **1**

(2)

37. The hydrocarbons present in a mixture can be separated using chromatography. The mixture is vapourised and is then passed through a special column. Different hydrocarbons move through the column at different speeds.

The following graph was obtained.



Candida must n write in margi

Marks

(*a*) Make **two** general statements linking the structure of the hydrocarbon with the length of time taken to pass through the column.

1 _____

_____

2 _____

_____ **2**

(*b*) Draw an arrow on the graph to show the expected position of the peak for propane. **1**

(3)

must not write in this margin

Marks

38. Graeme was comparing the properties of hydrochloric acid (a strong acid) with those of ethanoic acid (a weak acid).

Equal volumes of acid solutions were used in each test. Graeme's results for hydrochloric acid are shown in the following table.

Test	Hydrochloric	Ethanoic
(i) pH	2	lower same higher
(ii) Conductivity/mA	97	lower same higher
(iii) Speed of reaction with magnesium/cm^3 gas min^{-1}	57	lower same higher
(iv) Volume of strong alkali required for neutralisation/cm^3	50	lower same higher

(*a*) Circle the appropriate words in the table to show how the test results for ethanoic acid compare with those for hydrochloric acid. **2**

(*b*) Apart from keeping the volumes equal, suggest **two** other factors which Graeme would need to control during his experiment.

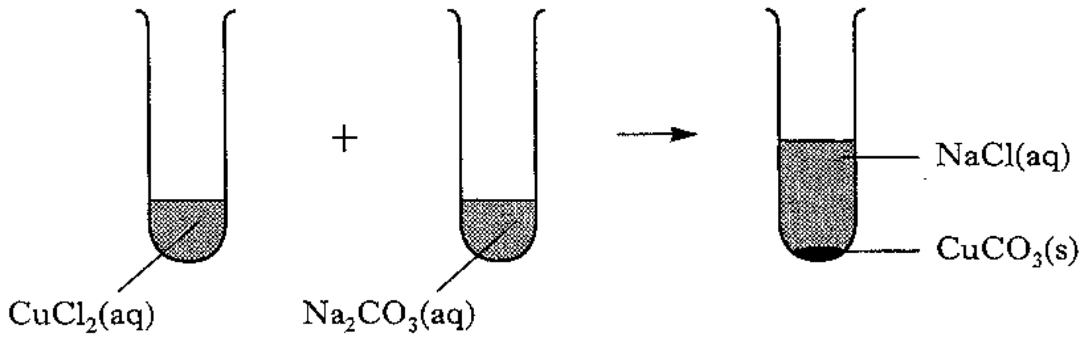
_____

_____ **1**

(3)

Marks

39.



(*a*) Name the **two** spectator ions in the above reaction.

____

______________________________ **1**

(*b*) Write an ionic equation for the formation of copper(II) carbonate.
Show only the reacting ions and the product.

______________________________ **1**

(2)

must not write in this margin

Marks

40. Archaeologists found some corroded silver coins and a badly rusted sword.

(*a*) The silver coins were restored by wrapping them in zinc foil in a beaker of salt solution.

What type of reaction took place?

_____

_____ **1**

(*b*) The iron blade of the sword was attached to its handle by a copper band.

Explain why, although the copper was uncorroded, the iron had rusted badly.

_____

_____

_____

_____ **2**

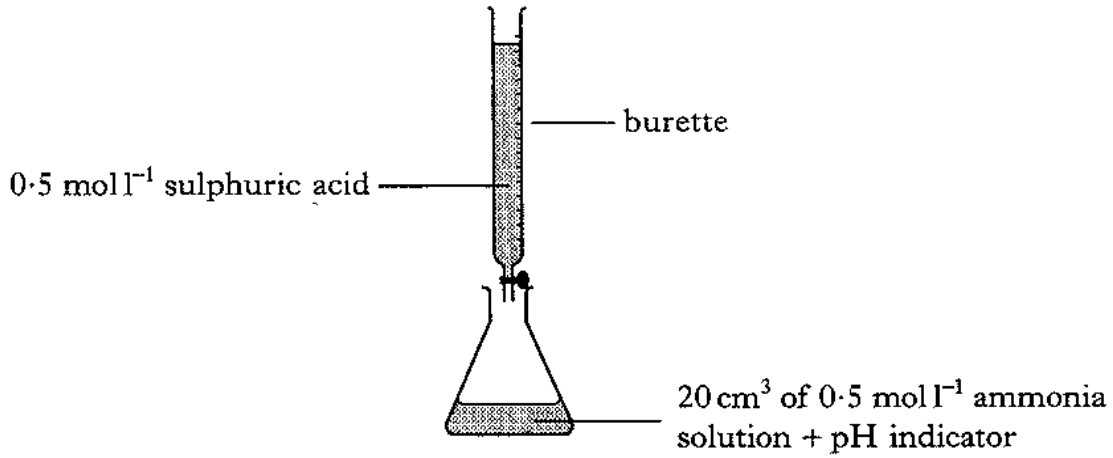
(3)

write in margin

Marks

41. Laura wanted to prepare ammonium sulphate.

She carried out a titration using 0·5 mol l^{-1} sulphuric acid and 0·5 mol l^{-1} ammonia solution.



The equation for the reaction is

$$2NH_3(aq) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$$

(*a*) Calculate the volume of sulphuric acid Laura used to neutralise the ammonia solution.

2

(*b*) The indicator was removed from the ammonium sulphate solution by filtering the solution through charcoal.

How would Laura then obtain a sample of solid ammonium sulphate from the solution?

_____

_____

1

(*c*) State a use for ammonium sulphate.

_____

_____

1

(4)

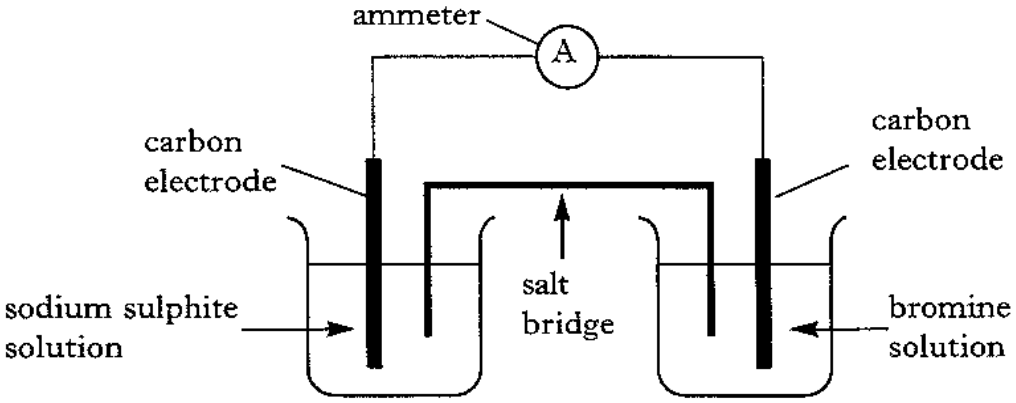
must not write in this margin

Marks

42. Sodium sulphite solution reacts with bromine solution. The sulphite ions are oxidised. The ion-electron equation for the oxidation reaction is:

$$SO_3^{2-}(aq) + H_2O\ (\ell) \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$$

This reaction takes place in the cell shown.



(*a*) On the diagram, indicate the direction of the flow of electrons through the wire. **1**

(*b*) The salt bridge completes the circuit.
Why is an electric current able to flow through the salt bridge?

_____

_____

_____ **1**

(*c*) In the reaction, the bromine solution is reduced.
Write the ion-electron equation for this reaction.

_____ **1**

(3)

[END OF QUESTION PAPER]

FOR OFFICIAL USE

Total

Intermediate 2 Chemistry
Specimen Question Paper

NATIONAL QUALIFICATIONS

ANSWER SHEET

Full name of school or college

Town

First name and initials

Surname

Date of birth
Day Month Year

Candidate number

Number of seat

Using ink, indicate your choice of answer by a single stroke **joining the two dots** in the box, as in the following example:

A B C D

	A	B	C	D
1	·	·	·	·
2	·	·	·	·
3	·	·	·	·
4	·	·	·	·
5	·	·	·	·
6	·	·	·	·
7	·	·	·	·
8	·	·	·	·
9	·	·	·	·
10	·	·	·	·
11	·	·	·	·
12	·	·	·	·
13	·	·	·	·

	A	B	C	D
14	·	·	·	·
15	·	·	·	·
16	·	·	·	·
17	·	·	·	·
18	·	·	·	·
19	·	·	·	·
20	·	·	·	·
21	·	·	·	·
22	·	·	·	·
23	·	·	·	·
24	·	·	·	·
25	·	·	·	·

Using ink, indicate your choice of answer(s) by **circling the appropriat letter(s)** as in the following example

	A	B	C
	D	(E)	F

26a	A	B	C
	D	E	F
b	A	B	C
	D	E	F
c	A	B	C
	D	E	F
27	A	B	C
	D	E	F

[C012/SQP053]

Intermediate 2 Chemistry

Specimen Marking Instructions

NATIONAL QUALIFICATIONS

SCOTTISH QUALIFICATIONS AUTHORITY

Intermediate 2 Chemistry

Marking Scheme

Section 1 (All questions are worth 1 mark)

1	C	6	A	11	D	16	B	21	B
2	B	7	D	12	A	17	D	22	C
3	C	8	D	13	D	18	D	23	D
4	B	9	D	14	B	19	B	24	C
5	C	10	A	15	B	20	B	25	B

Grid Questions

26 a) C 27 A & D 1 mark each

b) A

c) B

Section 2

28 a) $0.7\ cm^3\ s^{-1}$ **1 mark**
(No deduction for no units but deduct ½ for wrong units)

b) Curve should start at zero and end at 60 cm^3 and lie wholly above exp A curve **1 mark**

c) Increase temperature **1 mark**

d) Suitable Diagram **(1 mark)** Labels **(1 mark)** **2 marks**

29 a) Isotopes **1 mark**

b) p = 3 n = 4 e = 3 **All correct for 1 mark**

30 a) (i) Diagram of outer electrons **1 mark**

(ii) Tetrahedral **1 mark**

b) Balanced equation $SiCl_4+2H_2O \longrightarrow 4\ HCl + SiO_2$ **All correct for 1 mark**
(or multiple of this)

c) It has a covalent network structure **1 mark**

31 a) Deduct ½ mark for each mistake **2 marks**

b) (i) It will only conduct when molten **1 mark**

(ii) Aluminium ions are positively charged **1 mark**

(iii) A mole **1 mark**

32 a) More complete combustion takes place or more oxygen is present to burn the fuel **1 mark**

b) Nitrogen oxides **1 mark**

c) This reduces the nitrogen oxide concentration **1 mark**

d) 2, 2, 4 – trimethylpentane **1 mark**

33 a) To prevent water being drawn up into the hot test tube and cracking it or to prevent suck back **1 mark**

33 b) 1 mole ethanol gives 1 mole ethene (½ mark)

46g (½ mark) gives 28g (½ mark)

4.6g gives 2.8g (½ mark) **2 marks**

c) (i) Polythene or polyethene **1 mark**

(ii) They will not rot or will not break down naturally or equivalent **1 mark**

34 a) An unsaturated hydrocarbon contains carbon to carbon double bonds **1 mark**

b) Wear safety glasses or handle bromine water in fume cupboard **1 mark**

35 a) Add Benedicts solution to both ½ mark
Place in hot water bath ½ mark
Glucose turns Benedicts orange/red ½ mark
Sucrose does not ½ mark **2 marks**

b) A weak acid is an acid which is only partially ionised in solution **1 mark**

36 a) Correctly joined glycines **1 mark**

b) Condensation **1 mark**

37 a) 1 For hydrocarbons with the same number of carbons, the more branched the hydrocarbon the shorter the time taken to pass through the column **1 mark**

2 The greater the number of carbons in the hydrocarbon, the longer the time taken to pass through the column **1 mark**

b) An arrow marking any position which lies between that of ethane and that of butane **1 mark**

38 a) Higher (½ mark)
Lower (½ mark)
Lower (½ mark)
Same (½ mark) **2 marks**

b) Concentration of acids should be same (½ mark)
Temperature of acids same (½ mark) **1 mark**

39 a) Sodium ions and chloride ions — both for **1 mark**
or both Na^+ and Cl^-

b) $Cu^{2+} + CO_3^{2-} \longrightarrow CuCO_3$ — **1 mark**

40 a) Redox or displacement or reduction — **1 mark**

b) Iron is above copper in electrochemical series — **1 mark**
therefore electrons flow from the iron to the copper — **1 mark**

41 a) $\frac{C_1xV_1}{C_2xV_2} = \frac{n_1}{n_2}$ or other appropriate formula (½ mark)

$\frac{0.5x20}{0.5xV_2} = \frac{2}{1}$ (½ mark)

$V_2 = 10\ cm^3$ (1 mark)
(Deduct ½ mark for no units or wrong units) — **2 marks**

b) Evaporate the solution and allow the salt to crystallise — **1 mark**

c) It can be used as a fertiliser — **1 mark**

42 a) Electron flow shown from left to right only on wires — **1 mark**

b) Ions flow through it — **1 mark**

c) $Br_2 + 2e^- \longrightarrow 2Br^-$ — **1 mark**

[END OF MARKING INSTRUCTIONS]