National
Qualifications
SPECIMEN ONLY

SQ06/N5/01

Chemistry
Section 1—Questions

Date — Not applicable

Duration — 2 hours

Instructions for completion of Section 1 are given on Page two of the question paper SQ06/N5/02.

Record your answers on the grid on Page three of your answer booklet.

Do NOT write in this booklet.

Before leaving the examination room you must give your answer booklet to the Invigilator. If you do not, you may lose all the marks for this paper.

SQA ©

SQ06N501

SECTION 1

1. Which of the following elements exists as a covalent network?

A Helium

B Nitrogen

C Silicon

D Sulfur

2. Which line in the table correctly describes an electron?

	Mass	*Charge*
A	negligible	+1
B	negligible	−1
C	1	+1
D	1	0

3. Solid ionic compounds do **not** conduct electricity because

A the ions are not free to move

B the electrons are not free to move

C solid substances never conduct electricity

D there are no charged particles in ionic compounds.

4. The shapes of some molecules are shown below.

Tetrahedral	Pyramidal	Bent	Linear

Phosphine is a compound of phosphorus and hydrogen. The shape of a molecule of phosphine is likely to be

A tetrahedral

B pyramidal

C bent

D linear.

Questions **5** and **6** refer to the table below.

The table shows information about some particles.

	Number of		
Particle	*protons*	*neutrons*	*electrons*
A	9	10	10
B	11	12	11
C	15	16	15
D	19	20	18

5. Identify the particle which is a negative ion.

6. Identify the particle which would give a lilac flame colour.

You may wish to use the data booklet to help you.

7. Which of the following statements correctly describes the concentrations of $H^+(aq)$ and $OH^-(aq)$ ions in pure water?

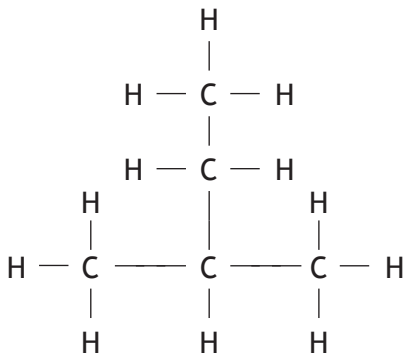
A The concentrations of $H^+(aq)$ and $OH^-(aq)$ ions are equal.

B The concentrations of $H^+(aq)$ and $OH^-(aq)$ ions are zero.

C The concentration of $H^+(aq)$ ions is greater than the concentration of $OH^-(aq)$ ions.

D The concentration of $H^+(aq)$ ions is less than the concentration of $OH^-(aq)$ ions.

8.



The name of the above compound is

A 2-ethylpropane

B 1,1-dimethylpropane

C 2-methylbutane

D 3-methylbutane.

9. Which of the following could be the molecular formula of a cycloalkane?

A C_6H_8

B C_6H_{10}

C C_6H_{12}

D C_6H_{14}

10. In which of the following reactions is oxygen used up?

A Combustion

B Neutralisation

C Addition

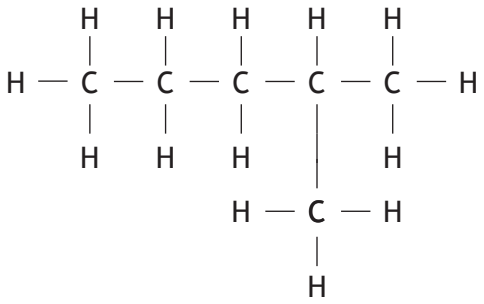
D Polymerisation

11. Which line in the table correctly shows the two families of compounds which react together to produce esters?

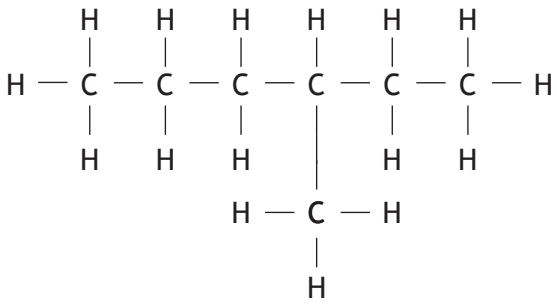
A	carboxylic acid	cycloalkane
B	alcohol	alkene
C	cycloalkane	alkene
D	carboxylic acid	alcohol

12. Which of the following molecules is an isomer of hept-2-ene?

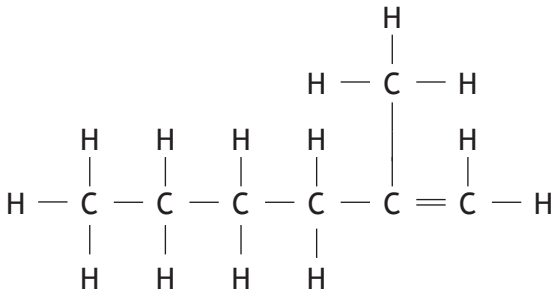
A



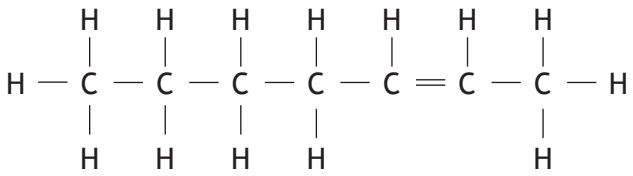
B



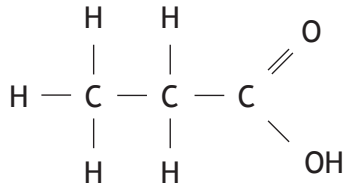
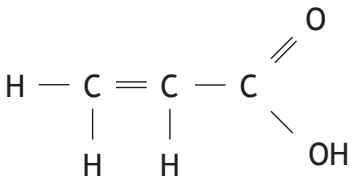
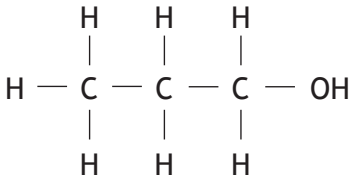
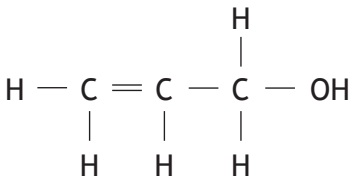
C



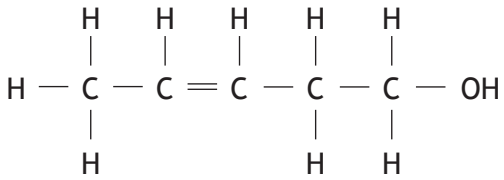
D



13. A student tested some compounds. The results are given in the table.

Compound	*pH of aqueous solution*	*Effect on bromine solution*
	4	no effect
	4	decolourised
	7	no effect
	7	decolourised

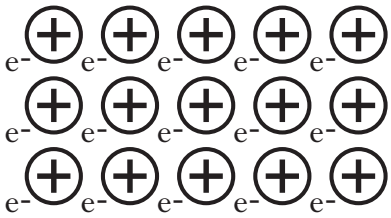
Which line in the table below shows the correct results for the following compound?



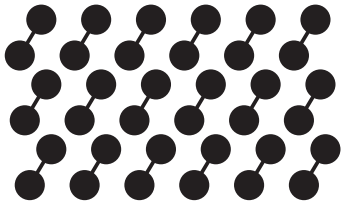
	pH of aqueous solution	*Effect on bromine solution*
A	4	decolourised
B	7	decolourised
C	4	no effect
D	7	no effect

14. Which of the following diagrams could be used to represent the structure of a metal?

A

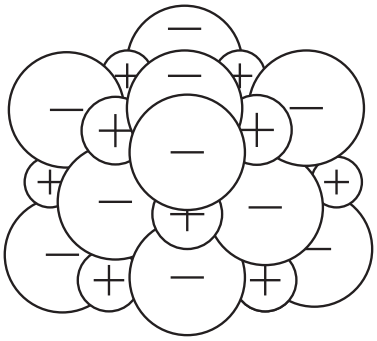


B



C

D



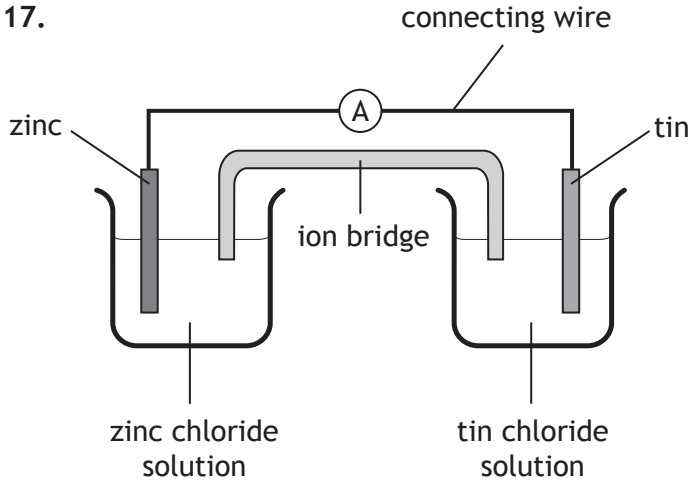
15. Which of the following metals does **not** react with dilute acid?

A Magnesium
B Calcium
C Copper
D Zinc

16. Which of the following metals can be extracted from its oxide by heat alone?

A Aluminium
B Iron
C Silver
D Zinc

17.



In the cell shown, electrons flow through

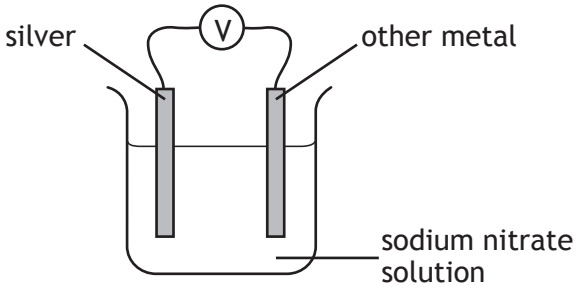
A the solution from tin to zinc

B the solution from zinc to tin

C the connecting wire from tin to zinc

D the connecting wire from zinc to tin.

18. Four cells were made by joining copper, iron, tin and zinc to silver.



The voltages are shown in the table.

Which line in the table below shows the voltage of the cell containing copper joined to silver?

You may wish to use the data booklet to help you.

Cell	*Voltage* (V)
A	1·6
B	1·2
C	0·9
D	0·5

19. The ion-electron equation for the oxidation and reduction steps in the reaction between magnesium and silver(I) ions are:

$Mg \longrightarrow Mg^{2+} + 2e^-$

$Ag^+ + e^- \longrightarrow Ag$

The overall redox equation is

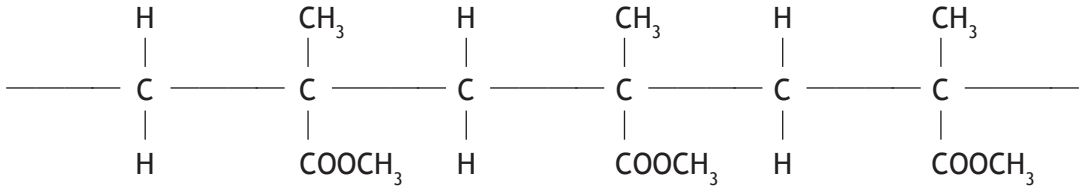
A $Mg + 2Ag^+ \longrightarrow Mg^{2+} + 2Ag$

B $Mg + Ag^+ \longrightarrow Mg^{2+} + Ag$

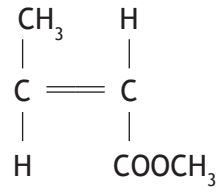
C $Mg + Ag^+ + e^- \longrightarrow Mg^{2+} + Ag + 2e^-$

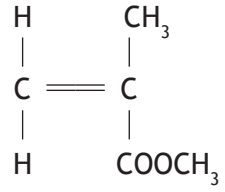
D $Mg + 2Ag \longrightarrow Mg^{2+} + 2Ag^+$.

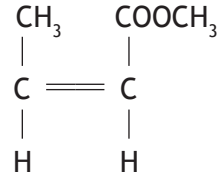
20. The structure below shows a section of an addition polymer.

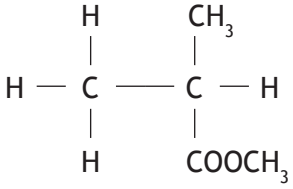


Which of the following molecules is used to make this polymer?

A 

B 

C 

D 

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]

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N5

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Mark

SQ06/N5/02

Chemistry
Section 1—Answer Grid and Section 2

Date — Not applicable

Duration — 2 hours

* S Q 0 6 N 5 0 2 *

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day	Month	Year
D D	M M	Y Y

Scottish candidate number

Total marks — 80

SECTION 1 — 20 marks

Attempt ALL questions in this section.

Instructions for completion of Section 1 are given on Page two.

SECTION 2 — 60 marks

Attempt ALL questions in this section.

Read all questions carefully before attempting.

Use **blue** or **black** ink. Do NOT use gel pens.

Write your answers in the spaces provided. Additional space for answers and rough work is provided at the end of this booklet. If you use this space, write clearly the number of the question you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your fair copy.

Before leaving the examination room you must give this booklet to the Invigilator. If you do not, you may lose all the marks for this paper.

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SECTION 1— 20 marks

The questions for Section 1 are contained in the booklet Chemistry Section 1—Questions. Read these and record your answers on the grid on Page three opposite.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

2. There is **only one correct** answer to each question.

3. Any rough working should be done on the additional space for rough working and answers sheet.

Sample Question

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

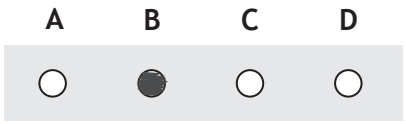
A fractional distillation

B chromatography

C fractional crystallisation

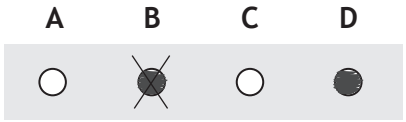
D filtration.

The correct answer is **B**—chromatography. The answer **B** bubble has been clearly filled in (see below).

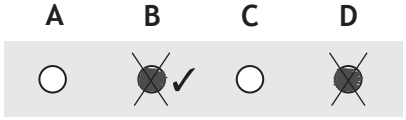


Changing an answer

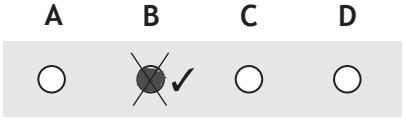
If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:



or



SECTION 1—Answer Grid

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

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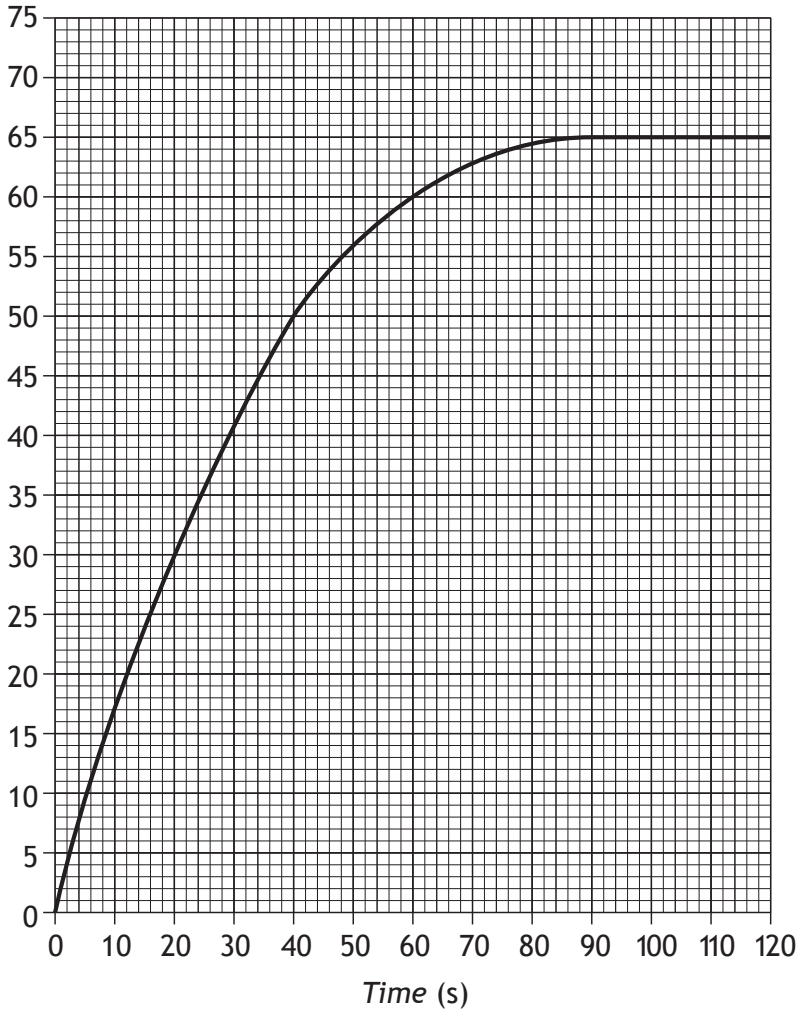
SECTION 2— 60 marks

Attempt ALL questions.

MARKS | DO NOT WRITE IN THIS MARGIN

1. Graphs can be used to show the change in the rate of a reaction as the reaction proceeds.

The graph shows the volume of gas produced in an experiment over a period of time.



(a) State the time, in seconds, at which the reaction stopped. **1**

1. (continued)

(b) Calculate the average rate of reaction, in cm^3s^{-1}, for the first 20 seconds. **2**

Show your working clearly.

(c) The graph shows that the rate of reaction decreases as the reaction proceeds.

Suggest a reason for this. **1**

Total marks 4

2. The group 7 element bromine was discovered by Balard in 1826.
Bromine gets its name from the Greek 'bromos' meaning stench.

Bromine consists of a mixture of two isotopes, $^{79}_{35}Br$ and $^{81}_{35}Br$.

(a) What is meant by the term isotope? **1**

(b) Complete the table for $^{79}_{35}Br$. **1**

Isotope	*Number of protons*	*Number of neutrons*
$^{79}_{35}Br$		

(c) The relative atomic mass of an element can be calculated using the formula:

$$\frac{(\text{mass of isotope A} \times \% \text{ of isotope A}) + (\text{mass of isotope B} \times \% \text{ of isotope B})}{100}$$

A sample of bromine contains 55% of the isotope with mass 79 and 45% of the isotope with mass 81.

Calculate the relative atomic mass of bromine in this sample. **2**

Show your working clearly.

2. (continued)

(d) In 1825 bromine had been isolated from sea water by Liebig who mistakenly thought it was a compound of iodine and chlorine.

Using your knowledge of chemistry, comment on why Liebig might have made this mistake. **3**

Total marks 7

3. (a) Sulfur dioxide gas is produced when fossil fuels containing sulfur are burned.

When sulfur dioxide dissolves in water in the atmosphere "acid rain" is produced.

(Circle) the correct phrase to complete the sentence. **1**

Compared with pure water, acid rain contains { a higher / a lower / the same } concentration of hydrogen ions.

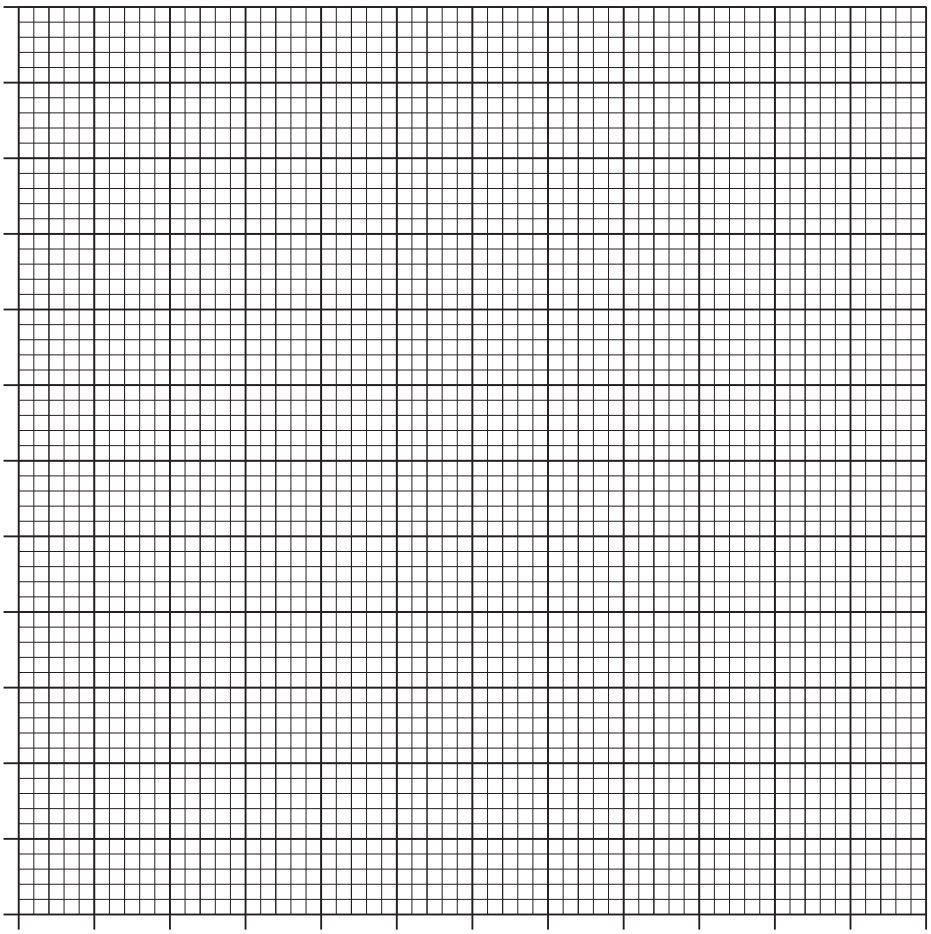
(b) The table shows information about the solubility of sulfur dioxide.

Temperature (°C)	0	20	30	40	50	60
Solubility (g/100cm^3)	22·0	10·0	6·0	3·0	2·0	1·5

(i) Draw a line graph of solubility against temperature.

Use appropriate scales to fill most of the graph paper. **3**

(Additional graph paper, if required, will be found on *Page twenty-seven*.)



3. (b) (continued)

(ii) Using your graph, estimate the solubility of sulfur dioxide, in g/100 cm^3, at 10 °C. **1**

Total marks 5

MARKS | DO NOT WRITE IN THIS MARGIN

4. A student investigated the reaction of carbonates with dilute hydrochloric acid.

(a) In one reaction lithium carbonate reacted with dilute hydrochloric acid.

The equation for the reaction is:

$$Li_2CO_3(s) + HCl(aq) \rightarrow LiCl(aq) + CO_2(g) + H_2O(\ell)$$

(i) Balance this equation. **1**

(ii) Identify the salt produced in this reaction. **1**

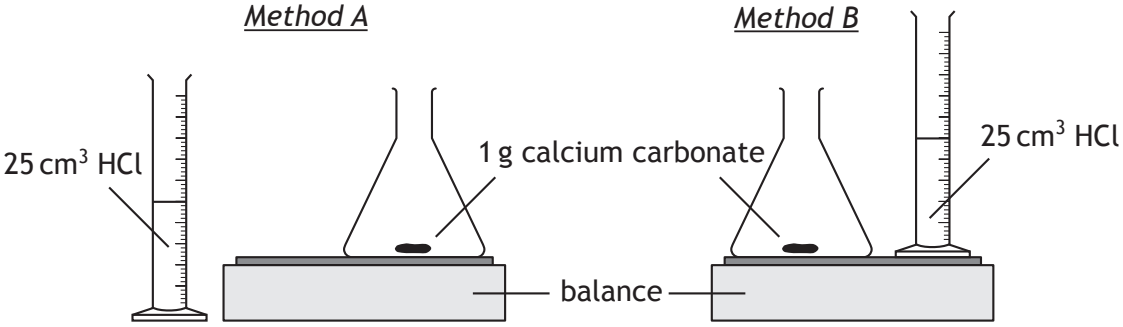
(b) In another reaction 1 g of calcium carbonate reacted with excess dilute hydrochloric acid.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(\ell)$$

(i) Calculate the mass, in grams, of carbon dioxide produced. **3**

4. (b) (continued)

(ii) The student considered two methods to confirm the mass of carbon dioxide gas produced in this reaction.



Method A	*Method B*
1. Add the acid from the measuring cylinder to the calcium carbonate in the flask.	1. Weigh the flask with the calcium carbonate and the acid in the measuring cylinder together.
2. Weigh the flask and contents.	2. Add the acid from the measuring cylinder to the calcium carbonate in the flask and replace the empty measuring cylinder on the balance.
3. Leave until no more bubbles are produced.	3. Leave until no more bubbles are produced.
4. Reweigh the flask and contents.	4. Reweigh the flask, contents and the empty measuring cylinder together.

Explain which method would give a more reliable estimate of the mass of carbon dioxide produced during the reaction. **2**

Total marks 7

MARKS DO NOT WRITE IN THIS MARGIN

5. Antacid tablets are used to treat indigestion which is caused by excess acid in the stomach.

Different brands of tablets contain different active ingredients.

Name of active ingredient	magnesium carbonate	calcium carbonate	magnesium hydroxide	aluminium hydroxide
Reaction with acid	fizzes	fizzes	does not fizz	does not fizz
Cost per gram (pence)	16·0	11·0	7·5	22·0
Mass of solid needed to neutralise 20 cm^3 *of acid* (g)	0·7	1·2	0·6	0·4
Cost of neutralising 20 cm^3 of acid (pence)		13·2	4·5	8·8

(a) Write the **ionic** formula for aluminium hydroxide. **1**

(b) (i) Complete the table to show the cost of using magnesium carbonate to neutralise 20 cm^3 of acid. **1**

(ii) Which **one** of the four active ingredients would **you** use to neutralise excess stomach acid? **1**

Explain your choice.

Total marks 3

6. Read the passage below and answer the questions that follow.

Potassium Permanganate ($KMnO_4$)—The Purple Solution

Potassium permanganate's strong oxidising properties make it an effective disinfectant. Complaints such as athlete's foot and some fungal infections are treated by bathing the affected area in $KMnO_4$ solution.

In warm climates vegetables are washed in $KMnO_4$ to kill bacteria such as E. coli and S. aureus. Chemists use $KMnO_4$ in the manufacture of saccharin, ascorbic acid (vitamin C) and benzoic acid.

Baeyer's reagent is an alkaline solution of $KMnO_4$ and is used to detect unsaturated organic compounds. The reaction of $KMnO_4$ with alkenes is also used to extend the shelf life of fruit. Ripening fruit releases ethene gas which causes other fruit to ripen. Shipping containers are fitted with gas scrubbers that use alumina or zeolite impregnated with $KMnO_4$ to stop the fruit ripening too quickly.

$$C_2H_4 + 4KMnO_4 \longrightarrow 4MnO_2 + 4KOH + 2CO_2$$

The scrubbers indicate when they need to be replaced because the purple colour changes to brown as the $KMnO_4$ is used up.

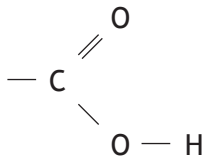
The passage on potassium permanganate was taken from an article by Simon Cotton on "Soundbite molecules" in "Education in Chemistry" November 2009.

(a) Suggest a pH for Baeyer's reagent. **1**

(b) Name the gas removed by the scrubbers. **1**

(c) Name a chemical mentioned in the passage which contains the following functional group. **1**

Total marks 3



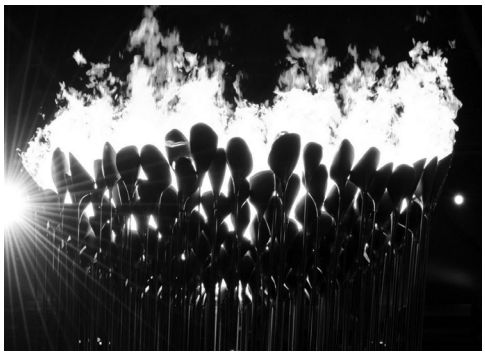
7. In the 2012 London Olympics, alkanes were used as fuels for the Olympic flame.

(a) The torches that carried the Olympic flame across Britain burned a mixture of propane and butane.

Propane and butane are members of the same homologous series.

What is meant by the term homologous series? **1**

(b) Natural gas, which is mainly methane, was used to fuel the flame in the Olympic cauldron.



(i) Draw a diagram to show how **all** the outer electrons are arranged in a molecule of methane, CH_4. **1**

7. (b) (continued)

(ii) Methane is a covalent molecular substance.

It has a low boiling point and is a gas at room temperature.

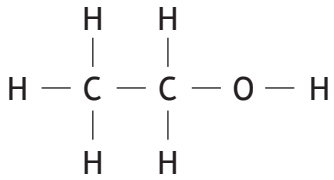
Explain why methane is a gas at room temperature. **1**

Total marks 3

8. Car manufacturers have developed flexible fuel engines for vehicles. These vehicles can run on ethanol or petrol or a mixture of both.

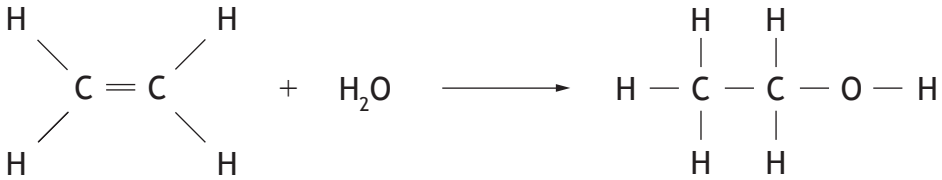
Ethanol can be produced from ethene which comes from cracking crude oil. It can also be made by fermenting glucose which is obtained from crops such as sugar cane and maize.

(a) The structure of ethanol is shown below.



Circle the functional group in this molecule. **1**

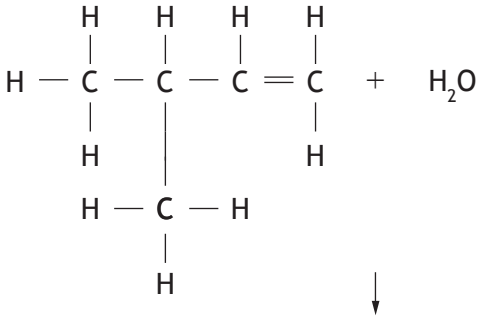
(b) Ethanol is produced from ethene as shown.



ethene ethanol

(i) Name the **type** of chemical reaction taking place. **1**

(ii) Draw a structural formula for a product of the following reaction. **1**



8. (continued)

(c) Suggest **one** disadvantage of producing ethanol from crops. **1**

(d) Ethanol can be used to produce ethanoic acid.

(i) Draw a structural formula for ethanoic acid. **1**

(ii) To which family of compounds does ethanoic acid belong? **1**

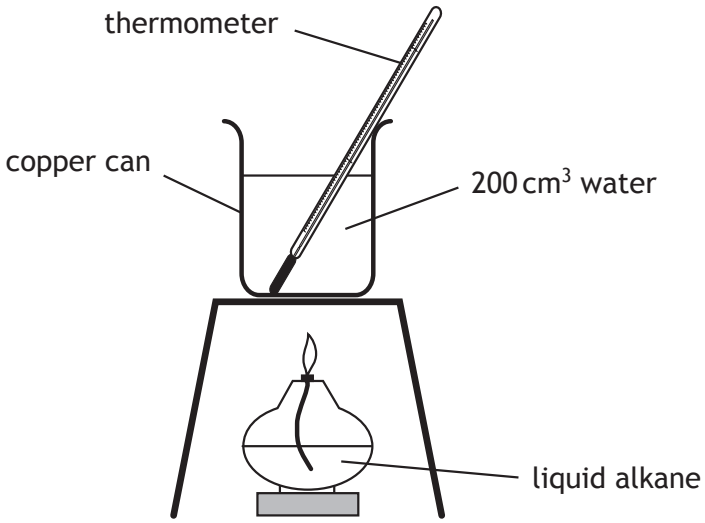
Total marks 6

MARKS | DO NOT WRITE IN THIS MARGIN

9. Alkanes burn, releasing energy.

(a) What name is given to any chemical reaction which releases energy? **1**

(b) A student investigated the amount of energy released when an alkane burns using the apparatus shown.



The student recorded the following data.

Mass of alkane burned	1 g
Volume of water	200 cm^3
Initial temperature of water	15 °C
Final temperature of water	55 °C
Specific heat capacity of water	4·18 $kJ\,kg^{-1}\,°C^{-1}$

(i) Calculate the energy released, in kJ. **3**

You may wish to use the data booklet to help you.

Show your working clearly.

9. (b) (continued)

(ii) Suggest **one** improvement to the student's investigation. **1**

(c) The table gives information about the amount of energy released when one mole of some alkanes are burned.

Name of alkane	*Energy released when one mole of alkane is burned* (kJ)
methane	891
ethane	1560
propane	2220
butane	2877

(i) Describe the relationship between the amount of energy released and the number of carbon atoms in the alkane molecule. **1**

(ii) Predict the amount of heat released, in kJ, when one mole of pentane is burned. **1**

Total marks 7

10. The essential elements for plant growth are nitrogen, phosphorus and potassium.

A student was asked to prepare a dry sample of a compound which contained **two** of these elements.

The student was given access to laboratory equipment and the following chemicals.

Chemical	*Formula*
ammonium hydroxide	NH_4OH
magnesium nitrate	$Mg(NO_3)_2$
nitric acid	HNO_3
phosphoric acid	H_3PO_4
potassium carbonate	K_2CO_3
potassium hydroxide	KOH
sodium hydroxide	NaOH
sulfuric acid	H_2SO_4
water	H_2O

Using your knowledge of chemistry, comment on how the student could prepare their dry sample. **3**

You may wish to use the data booklet to help you.

MARKS | DO NOT WRITE IN THIS MARGIN

11. Urea, H_2NCONH_2, can be used as a fertiliser.

(a) Calculate the percentage of nitrogen in urea. **3**
Show your working clearly.

(b) Other nitrogen based fertilisers can be produced from ammonia.
In industry, ammonia is produced in the Haber process using a catalyst.

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

Suggest why a catalyst may be used in an industrial process. **1**

Total marks 4

MARKS | DO NOT WRITE IN THIS MARGIN

12. Technetium-99m is used in medicine to detect damage to heart tissue.

It is a gamma-emitting radioisotope and is injected into the body.

(a) The half-life of technetium-99m is 6 hours.

How much of a 2 g sample of technetium-99m would be left after 12 hours? **2**

(b) Suggest one reason why technetium-99m can be used safely in this way. **1**

(c) Technetium-99m is formed when molybdenum-99 decays.

The decay equation is:

$$^{99}_{42}\text{Mo} \rightarrow {}^{99}_{43}\text{Tc} + \text{X}$$

Identify **X**. **1**

Total Marks 4

MARKS | DO NOT WRITE IN THIS MARGIN

13. The concentration of chloride ions in water affects the ability of some plants to grow.

A student investigated the concentration of chloride ions in the water at various points along the river Tay.

The concentration of chloride ions in water can be determined by reacting the chloride ions with silver ions.

$$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$$

A 20 cm^3 water sample gave a precipitate of silver chloride with a mass of 1·435 g.

(a) Calculate the number of moles of silver chloride, AgCl, present in this sample. **2**

Show your working clearly.

(b) Using your answer to part (a), calculate the concentration, in mol l^{-1}, of chloride ions in this sample. **2**

Show your working clearly.

Total marks 4

[END OF SPECIMEN QUESTION PAPER]

MARKS | DO NOT WRITE IN THIS MARGIN

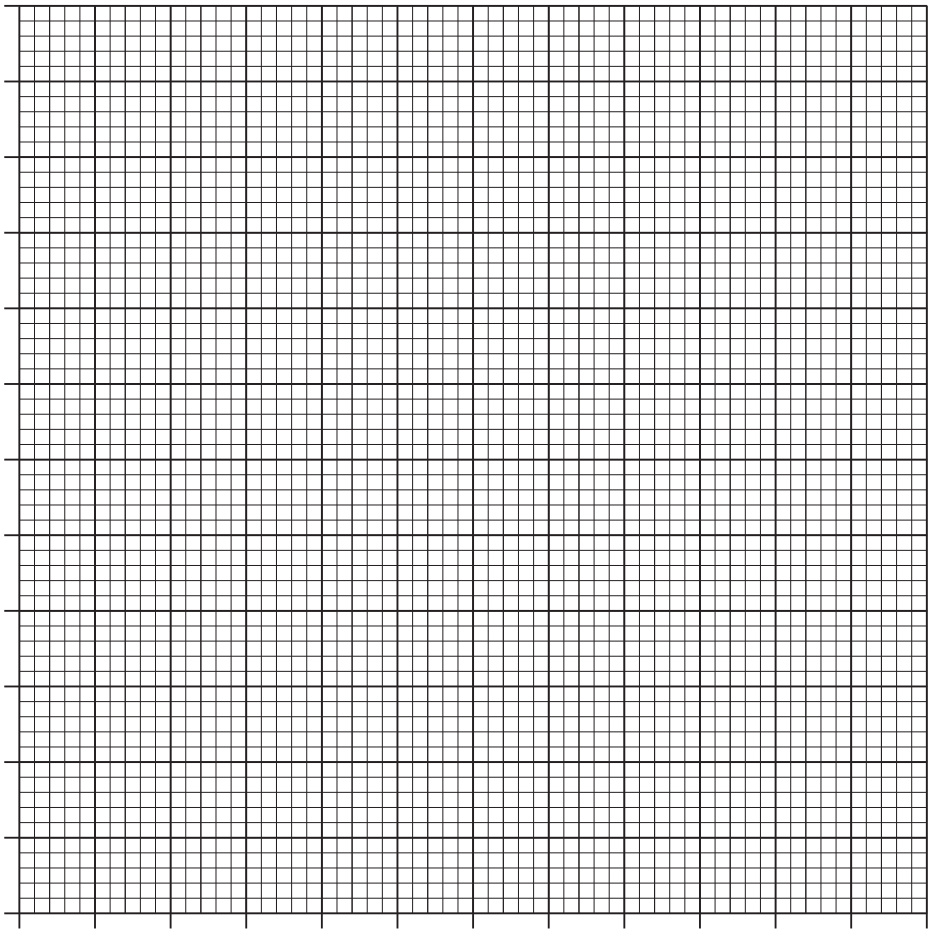
ADDITIONAL SPACE FOR ROUGH WORKING AND ANSWERS

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ROUGH WORKING AND ANSWERS

ADDITIONAL SPACE FOR ANSWERS

Additional graph paper for Question 3 (b) (i)



National
Qualifications
SPECIMEN ONLY

SQ06/N5/01 **Chemistry**

Marking Instructions

These Marking Instructions have been provided to show how SQA would mark this Specimen Question Paper.

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Part One: General Marking Principles for National 5 Chemistry

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question. The marking schemes are written to assist in determining the 'minimal acceptable answer' rather than listing every possible correct and incorrect answer.

(a) Marks for each candidate response must <u>always</u> be assigned in line with these General Marking Principles and the specific Marking Instructions for the relevant question.

(b) Marking should always be positive, ie marks should be awarded for what is correct and not deducted for errors or omissions.

(c) There are no half marks awarded.

(d) Where a candidate makes an error at an early stage in a multi-stage calculation, credit should normally be given for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.

(e) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including unit) on its own.

(f) Where a wrong answer (for which no credit has been given) is carried forward to another step, credit will be given provided the end result is used correctly.

Part Two: Marking Instructions for each question

Section 1

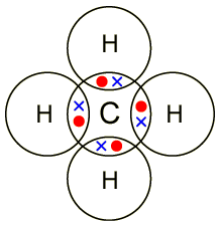
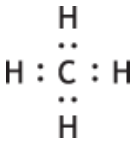
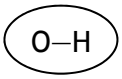
Question	Response	Mark
1	C	1
2	B	1
3	A	1
4	B	1
5	A	1
6	D	1
7	A	1
8	C	1
9	C	1
10	A	1
11	D	1
12	C	1
13	B	1
14	A	1
15	C	1
16	C	1
17	D	1
18	D	1
19	A	1
20	B	1

Section 2

Question			Expected response	Max mark	Additional guidance
1	**a**		86-88 seconds	1	
1	**b**		$\frac{30-0}{20}$ = 1·5 no units required 1·5 on its own = 2 marks	2	Correct method but incorrect arithmetic = 1 mark Incorrect values used but method correct = 1 mark
1	**c**		Less reactants or concentration of reactants decreases or reactants are used up or less chance of particles colliding or equivalent answer	1	
2	**a**		Atoms with same atomic number/number of protons/positive particles and different mass number/number of neutrons	1	
2	**b**		Protons = 35 Neutrons = 44	1	Both required
2	**c**		(79 × 55) + (81 × 45) / 100 = 79·9 79·9 on its own 80 with working	2	correct substitution of mass and percentage = 1 mark 80 on its own = 0 marks

Question			Expected response	Max mark	Additional guidance
2	**d**		**3 marks:** The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved. The student shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	3	**2 marks:** The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) which is/are relevant to the situation, showing that the problem is understood. **1 mark:** The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **0 mark**: the student has demonstrated no understanding of the chemistry involved. There is no evidence that the student has recognised the area of chemistry involved or has given any statement of relevant chemistry principle. This mark would also be given if the candidate merely restates the chemistry given in the question.
3	**a**		Higher	1	
3	**b**	**i**	Both axes labels with units 1 mark Both scales 1 mark Graph drawn accurately 1 mark Allow ½ box tolerance and one plotting error	3	Bar graph max 2 marks Max 2 marks if less than half graph paper is used in either axis
3	**b**	**ii**	Value must match candidate's graph If no graph drawn 16 ± 1	1	
4	**a**	**i**	$Li_2CO_3 + 2HCl \rightarrow 2\ LiCl + CO_2 + H_2$ Or correct multiples	1	

Question			Expected response	Max mark	Additional guidance
4	**a**	**ii**	Li Cl formula/words/circled /highlighted in equation	1	
4	**b**	**i**	1/100 = 0·01 1 mark 1:1 ratio 1 mark 0·01 × 44 = 0·44 1 mark Units not required 1 mole gives 1 mole 1 mark 100 g gives 44 g 1 mark 1 g gives 44/100 = 0·44 1 mark 0·44 on its own 3 marks	3	Any other correct method.
4	**b**	**ii**	Method **B** 1 mark Gas is lost in method A before starting mass taken or gas is lost before all acid is added or no total mass of all reactants at the start of experiment or equivalent response 1 mark	2	1 mark for each part
5	**a**		$Al^{3+}(OH^{-})_3$	1	Charges of ions must be given
5	**b**	**i**	16 × 0·7 = 11·2	1	
5	**b**	**ii**	Named active ingredient with appropriate reason. eg • magnesium hydroxide — cheapest/doesn't fizz • aluminium hydroxide — need to take least amount	1	
6	**a**		Any value above 7	1	
6	**b**		ethene	1	

Question			Expected response	Max mark	Additional guidance
6	c		Ascorbic acid or Vitamin C or benzoic acid	1	
7	a		Group/family/chemicals with same general formula **and** same/similar (chemical)properties	1	Both parts required for 1 mark
7	b	i	Diagram showing carbon with four hydrogen atoms: each of the four overlap areas must have two electrons in or on overlap area (cross, dot, petal diagram) Does not need to show tetrahedral shape. eg   	1	
7	b	ii	Weak bond attraction between molecules or Weak intermolecular attractions	1	Do not accept — Weak bonds/ weak covalent bonds
8	a		 or Name of functional group or OH written beside question and not circled		
8	b	i	addition or hydration	1	Do not accept addition polymerisation

Question			Expected response	Max mark	Additional guidance
8	**b**	**ii**	Correct shortened/full structural formula for 3-methylbutan-1-ol or 3-methylbutan-2-ol	1	
8	**c**		A lot of land used for crops to make ethanol and not feed people or just as harmful to the environment as gasoline or low yield or deforestation	1	
8	**d**	**i**	Correct shortened or full structural formula for ethanoic acid or Correct mixture of full and shortened formula	1	
8	**d**	**ii**	Carboxylic acid / alkanoic acid		Do not accept - acid
9	**a**		Exothermic		Do not accept - combustion
9	**b**	**i**	33·44 on its own = 3 marks $E_H = cm\Delta T = 4{\cdot}18 \times 0{\cdot}2 \times 40 = 33{\cdot}44$ and using concept $cm\Delta T$ with c = 4·18 1 mark using data correctly ie 0·2 and 40 °C 1 mark final answer 1 mark	3	33·4 or 33 would be accepted

Question			Expected response	Max mark	Additional guidance
9	**b**	**ii**	Any one from: heat insulation repeat to get average move burner nearer to can remove tripod and clamp can stir water thermometer not touching copper can use clay triangle on tripod or any reasonable answer	1	One answer
9	**c**	**i**	As the number of carbons increases the energy released increases or As the number of carbons decreases the energy released decreases or The energy increases / decreases as the number of carbons increases / decreases	1	Do not accept As the energy released increases the number of carbons increases As the energy released decreases the number of carbons decreases
9	**c**	**ii**	Any value from 3520 to 3550	1	

Question			Expected response	Max mark	Additional guidance
10			**3 marks:** The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved. The student shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	3	**2 marks:** The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) which is/are relevant to the situation, showing that the problem is understood. **1 mark:** The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **0 mark**: the student has demonstrated no understanding of the chemistry involved. There is no evidence that the student has recognised the area of chemistry involved or has given any statement of relevant chemistry principle. This mark would also be given if the candidate merely restates the chemistry given in the question.
11	**a**		gfm = 60 1 mark 28/60 × 100 1 mark Final answer 46·6% 1 mark 46·6 / 46·7 / 47 on its own 3 marks	3	Allow follow through from incorrect gfm Do not allow 46 on its own
11	**b**		Speeds up reaction or Less energy/temperature/ heat required or equivalent response	1	Do not accept on their own: • can be reused • not used up • saves money • cheaper • more economical
12	**a**		number of half-lives is 2 1 mark ¼ of 2 = 0·5 g 1 mark 0·5 g 2 marks	2	Allow follow through if number of half-lives is incorrect

Question			Expected response	Max mark	Additional guidance
12	**b**		short half-life or would not last long in the body or gamma would go right through body or equivalent response	1	
12	**c**		beta or β or $^{0}_{-1}e$ or $^{0}_{-1}\beta$	1	Do not accept electron
13	**a**		gfm 143·5g 1 mark 1·435 / 143·5 = 0·01 mol 1 mark 0·01 mol on its own 2 marks	2	Allow follow through if gfm incorrect
13	**b**		Answer from part (a) / 0·02 1 mark Correct answer 1 mark 0·01 / 0·02 1 mark = 0·5 mol l^{-1} 1 mark 0·5 mol l^{-1} on its own 2 marks	2	Allow follow through from answer to part (a) If correct relationship but volume not converted to litres eg 0·01/20 max 1 Mark

[END OF SPECIMEN MARKING INSTRUCTIONS]