OCR
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GCSE (9–1) Chemistry B (Twenty First Century Science) F

J258/01 Breadth in chemistry (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2.1

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)
- the Data Sheet

You may use:
- a scientific or graphical calculator

First name									
Last name									
Centre number						Candidate number				

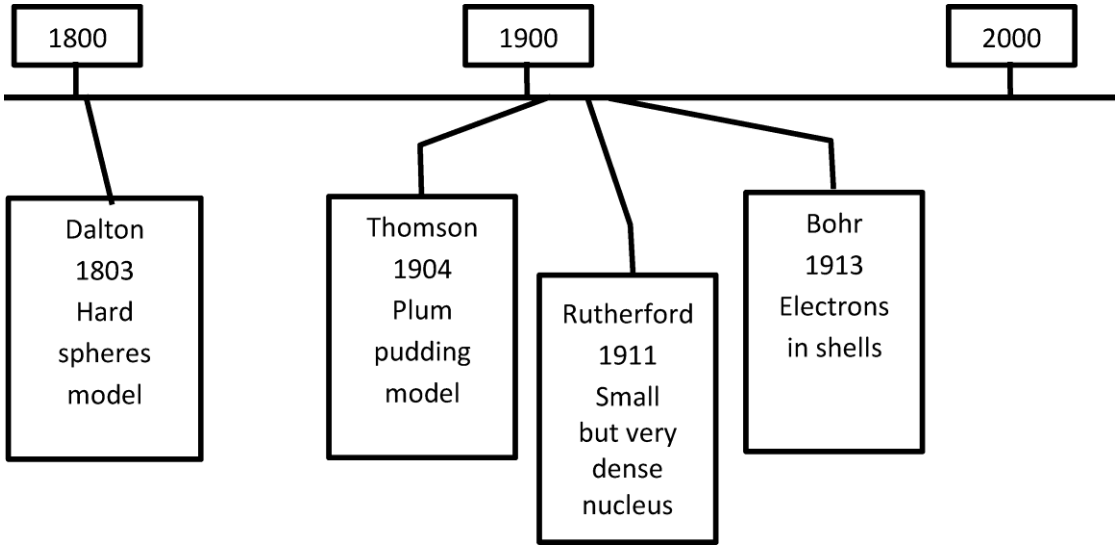
INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **24** pages.

Answer **all** the questions.

1 The models scientists use to describe atoms have changed over the last 200 years.

This timeline shows some of the main ideas.

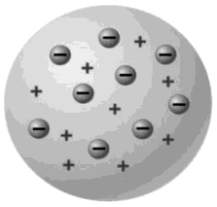


(a) Which scientist's model could be represented by a ball?

Put a (ring) around the correct answer.

Bohr **Dalton** **Rutherford** **Thomson** **[1]**

(b) Which scientist's model could be represented by this diagram?

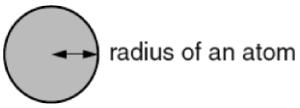


Put a (ring) around the correct answer.

Bohr **Dalton** **Rutherford** **Thomson** **[1]**

2 Jack does some research about Group 1 elements of the Periodic Table.

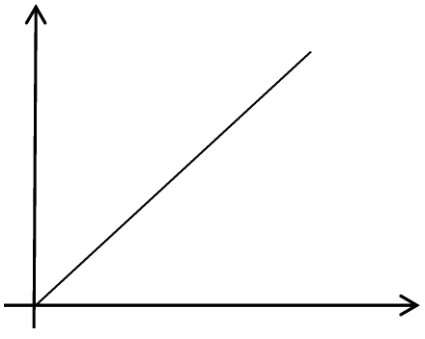
(a) He finds out the radius of the atoms of the first three elements in the group.

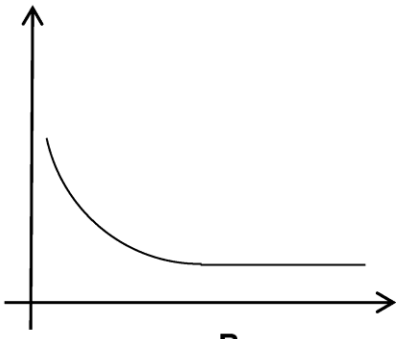


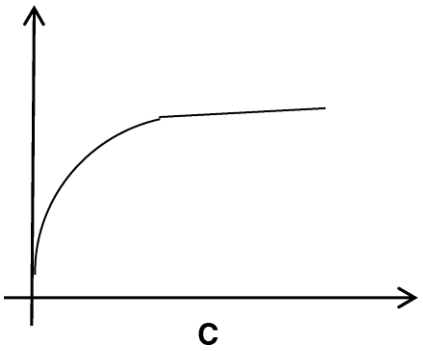
Element	Total number of electrons in each atom	Radius of atom (pm)
lithium	3	152
sodium	11	186
potassium	19	231

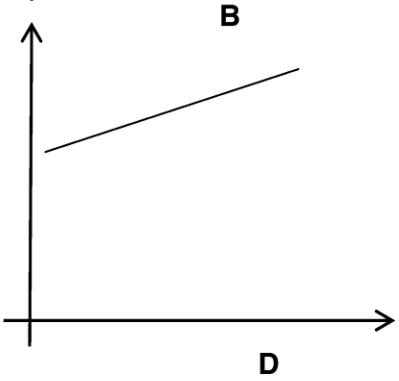
Which sketch graph, **A, B, C** or **D,** is the best representation of the trend shown by the data?

Explain how you used the data to make your choice.









Graph .....

Explanation .....

.....

.....

..... **[3]**

(b) Jack finds out the electron arrangement for the atoms of these elements.

Element	Electron arrangement
lithium	2.1
sodium	2.8.1
potassium	2.8.8.1

Describe the similarities and differences between the electron arrangement in the atoms of these elements.

.....

.....

.....

..... **[3]**

(c) Jack uses the Periodic Table to make a prediction about the order of reactivity of the three elements.

Which order of reactivity for the three elements is correct?

Put a tick (✓) in the box next to the correct answer.

lithium > sodium > potassium ☐

lithium < potassium < sodium ☐

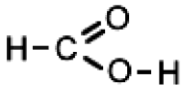
potassium > sodium > lithium ☐

lithium < sodium > potassium ☐ **[1]**

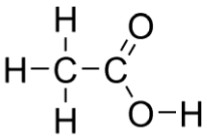
3 Some people have warts on their skin.

Warts can be removed by treating them with a corrosive solution of acids.

Two of the acids in the medicine are from the same family of compounds (homologous series).



methanoic acid



ethanoic acid

(a) The molecular formula of methanoic acid is CH_2O_2.

What is the molecular formula of ethanoic acid?

..... **[2]**

(b) How do the structures of the acids show that they belong to the same homologous series?

Put a tick (✓) in the box next to the correct answer.

Both are hydrocarbons. ☐

Both contain a double bond. ☐

Both contain carbon atoms. ☐

Both contain the same functional group. ☐ **[1]**

(c) Strong acids are **not** used in the medicine.

Methanoic acid and ethanoic acid are weak acids.

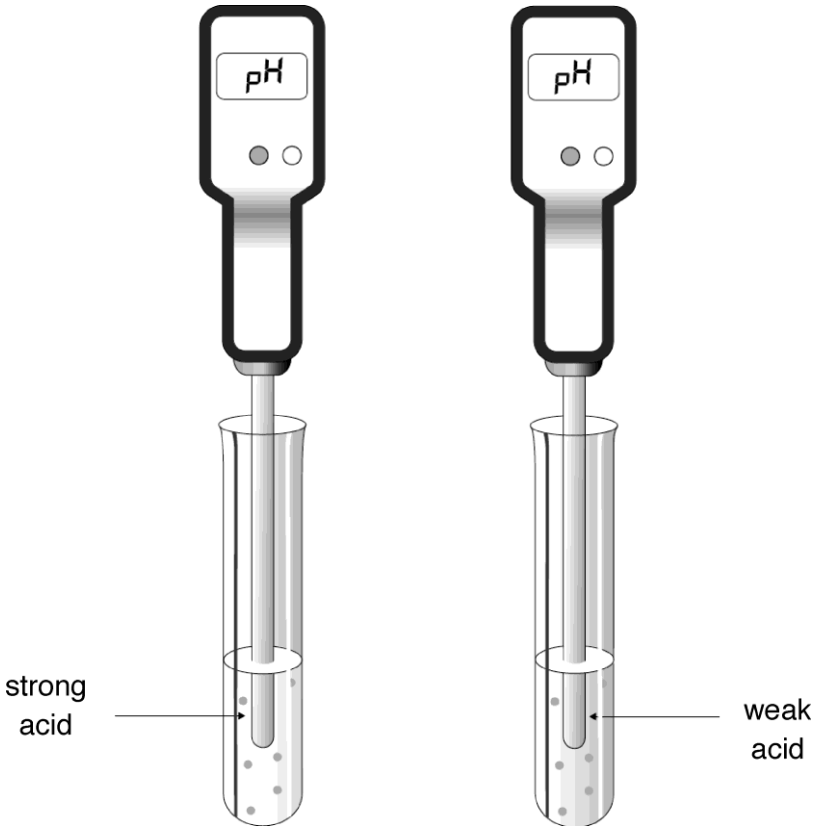
(i) What is the formula for a hydrogen ion?

Put a (ring) around the correct answer.

H_2 **H^-** **OH^-** **HCl** **H^+** **[1]**

(ii) Strong acids are more acidic than weak acids.

One way of telling the difference between a strong and a weak acid is testing the pH with a pH meter.



What results would you expect the pH meter to give for each acid?

.....

.....

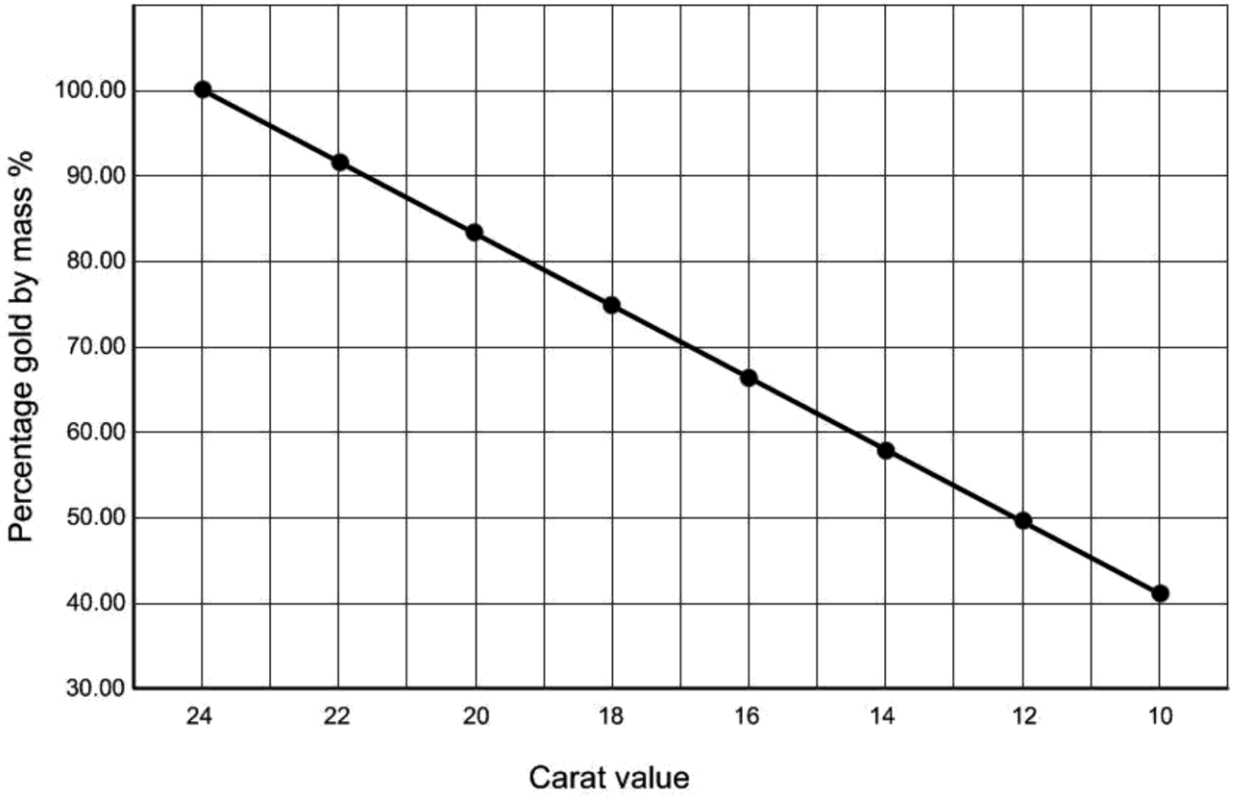
..... **[2]**

4 The purity of gold is measured in carats.

24 carat gold is almost pure gold.

Gold with lower carat values contains other metals.

The graph shows how the percentage of gold by mass is related to its carat value.



(a) A 2.5 g sample of gold contains 1.9 g of gold.

(i) What percentage of gold does the sample contain?

Show your working.

Percentage of gold =.....**[2]**

(ii) What is the sample's carat value?

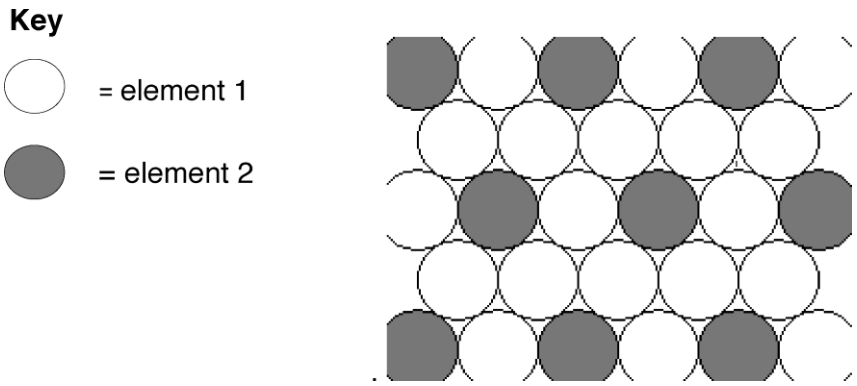
Use your answer to part **(i)** and the graph to help you answer.

Carat value =.....**[1]**

(b) 22 carat gold is an alloy which contains approximately 92% gold atoms.

The other 8% contains silver atoms and copper atoms.

Mia finds this diagram of the atoms in an alloy on the internet.



Explain why this diagram does **not** fit the arrangement of atoms in 22 carat gold.

Include a calculation in your answer.

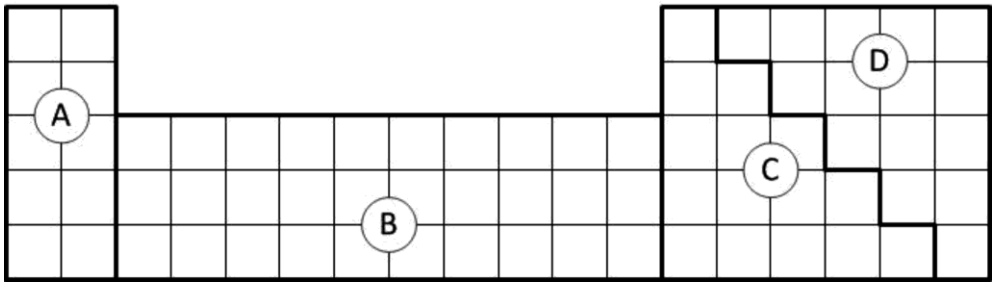
.....

.....

..... **[2]**

(c) Gold is a transition metal.

Which part of the Periodic Table, **A**, **B**, **C** or **D**, contains transition metals?

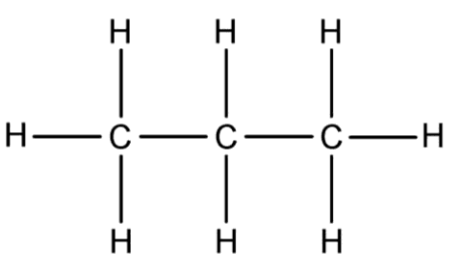


Answer.....**[1]**

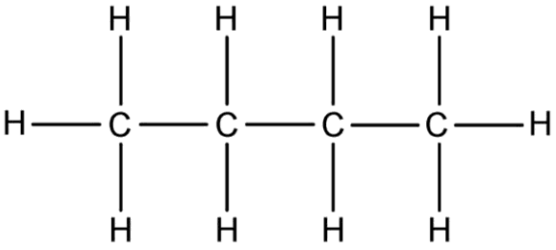
5 Crude oil is divided into fractions to make useful products.

One of the fractions in crude oil is LPG.

LPG contains propane and butane.



propane



butane

(a) What is the molecular formula of butane?

Answer .....**[1]**

(b) Look at the displayed formulae of butane and propane.

Propane and butane are **hydrocarbons**.

They are also **alkanes**.

Explain why propane and butane are both hydrocarbons and alkanes.

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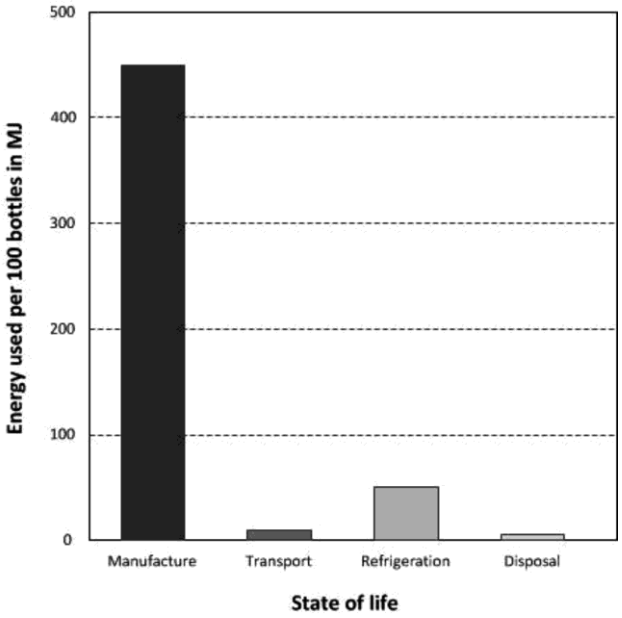
..... **[3]**

6 Disposable drink bottles are made from a polymer called PET.

This chart shows the energy used in millions of joules (MJ) for 100 PET bottles during their lifetime.



(a) Which statements about the chart are true and which are false?

Put a tick (✓) in the correct column for each statement.

	True (✓)	False (✓)
Five times as much energy is used for refrigeration as disposal.		
The energy of manufacture is more than 10 times greater than for transport.		
Refrigeration uses less than 15% of the energy used for manufacture.		

[3]

(b) One way of using waste PET bottles is to burn them as fuel.

Burning 100 bottles gives out 120 MJ of energy.

Does this provide enough energy to manufacture 100 new PET bottles?

Use data from the graph to support your answer.

.....

.....

..... **[2]**

7 100 years ago, Fritz Haber was the first scientist to successfully react nitrogen gas from the air with hydrogen to make a compound.

(a) Haber made sure his reaction was in a closed system, with no leaks.

What would happen to the yield if there were leaks in the system?

Explain your answer.

.....

.....

..... **[2]**

(b) A student repeats Haber's experiment.

He works out the theoretical yield for making some ammonia.

(i) 14.0 g of nitrogen was reacted with excess hydrogen to produce ammonia. Here is the equation for the reaction.

$$\mathbf{N_2 + 3H_2 \rightleftharpoons 2NH_3}$$

Calculate the theoretical yield of ammonia.

- Relative formula mass of N_2 = 28.0
- Relative formula mass of NH_3 = 17.0

Theoretical yield = ... g **[3]**

(ii) He separates the ammonia at the end of the reaction and measures its mass.

The table shows his results.

Mass of container and ammonia at the end (g)	59.5
Mass of container (g)	51.0
Mass of ammonia (g)	8.5

Calculate the **percentage yield** of ammonia.

Percentage yield ..... % **[2]**

(c) The reaction is very slow.

Haber used a catalyst to speed up the rate of reaction.

(i) Which statements about catalysts are true?

Put ticks (✓) in the boxes next to the **two** correct answers.

A catalyst changes the reaction temperature. ☐

A catalyst increases the time taken for the reaction. ☐

A catalyst is used up quickly. ☐

A catalyst lowers the activation energy. ☐

The same catalyst can be used in more than one reaction. ☐ **[2]**

(ii) Haber changed other conditions to make the reaction faster.

Suggest **two** other changes to conditions that would make the reaction faster.

.....

.....

..... **[2]**

(d) Ammonia is used to make fertilisers for agriculture.

Ammonia provides nitrogen compounds to make crops grow faster.

Which **two** other important elements do fertilisers provide?

Put (rings) around the **two** correct answers.

chlorine **phosphorus** **potassium** **sodium** **sulfur** **[2]**

8 Salts are made by reacting an acid with a metal or a metal compound.

(a) Draw lines to connect the **reactants** to the correct **salt formed**.

Reactants	Salt formed
	zinc sulfate
zinc hydroxide and nitric acid	magnesium sulfate
magnesium and hydrochloric acid	zinc nitrate
	magnesium chloride

[2]

(b) When magnesium reacts with hydrochloric acid, a gas is also made.

What is the name of the gas?

Put a (ring) around the correct answer.

chlorine **hydrogen** **nitrogen** **oxygen** **[1]**

(c) Sundip makes a solution of zinc chloride by reacting solid zinc carbonate with dilute hydrochloric acid.

She adds too much solid zinc carbonate to the reaction mixture.

She needs to remove the excess solid.

What separation technique should she use?

Put a (ring) around the correct answer.

crystallisation **distillation** **evaporation** **filtration** **[1]**

9 Beth has some solids without labels.

(a) Beth does some tests to find out what ions the solids contain.

She thinks the solids contain copper ions and chloride ions.

Draw lines to connect each **ion** with the correct **test and result.**

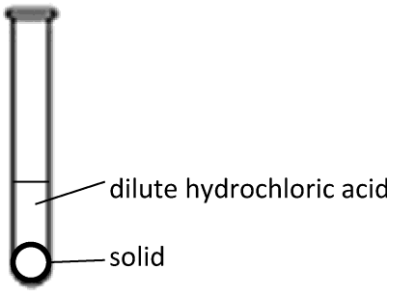
Ion	Test and result
	dilute sodium hydroxide gives a brown precipitate
chloride	dilute sodium hydroxide gives a green precipitate
copper	dilute sodium hydroxide gives a blue precipitate
	dilute silver nitrate gives a white precipitate
	dilute barium nitrate gives a yellow precipitate
	dilute barium sulfate gives carbon dioxide gas

[2]

(b) Beth uses this test to test for carbonate ions in a solid.

Test for carbonate ions: Add dilute hydrochloric acid, carbon dioxide is given off.

(i) Beth adds dilute hydrochloric acid to the solid in a test tube.



What will Beth **see** happen if carbon dioxide is made?

..... **[1]**

(ii) What should Beth use to test for carbon dioxide?

Put a (ring) around the correct answer.

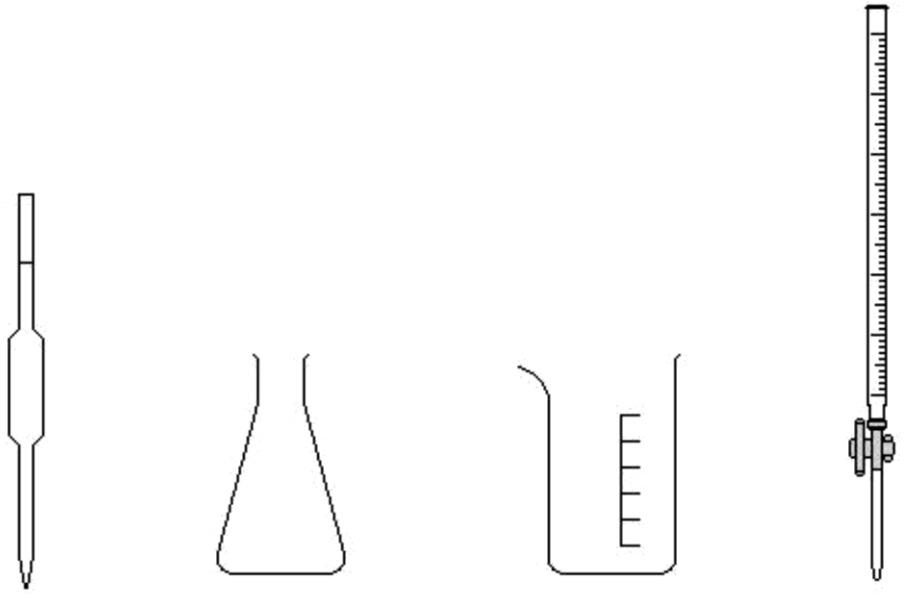
a glowing spill **lime water** **litmus paper** **universal indicator** **[1]**

10 Amir works in a lab that tests samples of vinegar to check their quality.

He finds out the concentration of the acid in some vinegar.

He uses a titration to find out how much dilute sodium hydroxide he needs to add to exactly react with 25.0 cm^3 of vinegar.

He has these pieces of apparatus, **A, B, C** and **D**.



(a) (i) Which piece of apparatus, **A, B, C** or **D**, should he use to measure the vinegar?

..... **[1]**

(ii) Which piece of apparatus, **A**, **B**, **C** or **D**, should he use to measure how much dilute sodium hydroxide he adds to the vinegar?

..... **[1]**

(b) Explain why Amir needs to use an indicator in the titration.

.....

.....

..... **[2]**

(c) Amir tests samples of vinegar from a vinegar factory,

The factory makes several batches of vinegar each week.
The batches are very large.

The vinegar is put into bottles.

Amir wants to make sure that the samples he tests are representative of all of the vinegar that the factory makes.

Describe how he should choose his samples to make sure they are representative of all the vinegar made.

.....

.....

..... **[2]**

(d) **(i)** Amir does another titration. This time he finds out how much dilute sodium hydroxide he needs to react with a sample of sulfuric acid.

He writes an equation for the reaction.

sodium hydroxide + sulfuric acid → sodium sulfate + water

Complete the balanced symbol equation for this reaction.

..... + ... H_2SO_4 → ..... + ...H_2O **[2]**

(ii) Amir finds that the concentration of the sulfuric acid is the same concentration as the sodium hydroxide.

Amir titrates the dilute sodium hydroxide with 25.0 cm^3 of the sulfuric acid.

Calculate the volume of dilute sodium hydroxide he uses to neutralise the sulfuric acid.

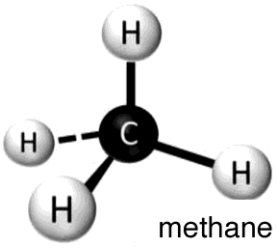
Use your answer from part **(i)**.

Volume of dilute sodium hydroxide = ... cm^3 **[2]**

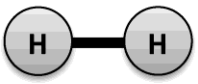
11 The surface of the planet Neptune is covered with clouds.

The clouds contain methane and hydrogen.

The diagrams show the arrangement of atoms in methane and hydrogen.



methane



hydrogen

(a) Compare the structures of methane and hydrogen.

Explain **one** similarity and **one** difference between methane and hydrogen.

Similarity .....

.....

Difference .....

..... **[2]**

(b) **(i)** The table shows the boiling point and melting point of methane.

melting point (°C)	–182.5
boiling point (°C)	–161.5

Put one tick (✓) underneath the state symbol for methane on Earth.

	(s)	**(l)**	**(g)**	**(aq)**
State of methane on Earth (✓)				

[1]

(ii) The clouds also contain hydrogen

energy needed to break forces between hydrogen molecules	<	energy needed to break forces between methane molecules

Use the information in the box to predict the boiling point of hydrogen.

Put a (ring) around the correct answer.

–253 °C **–161 °C** **–120 °C** **+52 °C** **[1]**

(c) Methane is an alkane.

Which statements about methane are true?

Put ticks (✓) in the boxes next to the **two** correct answers.

Methane contains single covalent bonds. ☐

Methane has a melting point above room temperature. ☐

Methane is a carboxylic acid. ☐

Methane is an ionic compound. ☐

Methane is in the same family of compounds as ethane and propane. ☐ **[2]**

12 Methane and hydrogen can both be used in fuel cells for cars.

The table shows information about the reactions in a hydrogen/oxygen fuel cell and in a methane/oxygen fuel cell.

Fuel	Source of fuel	Products of reaction in fuel cell	Energy given out per mole of fuel (in kJ)
hydrogen	High temperature industrial process.	only water vapour	286
methane	Fossil fuel.	carbon dioxide and water vapour	890

(a) Use the information in the table to evaluate the advantages and disadvantages of using hydrogen and methane as fuels for a car fuel cell.

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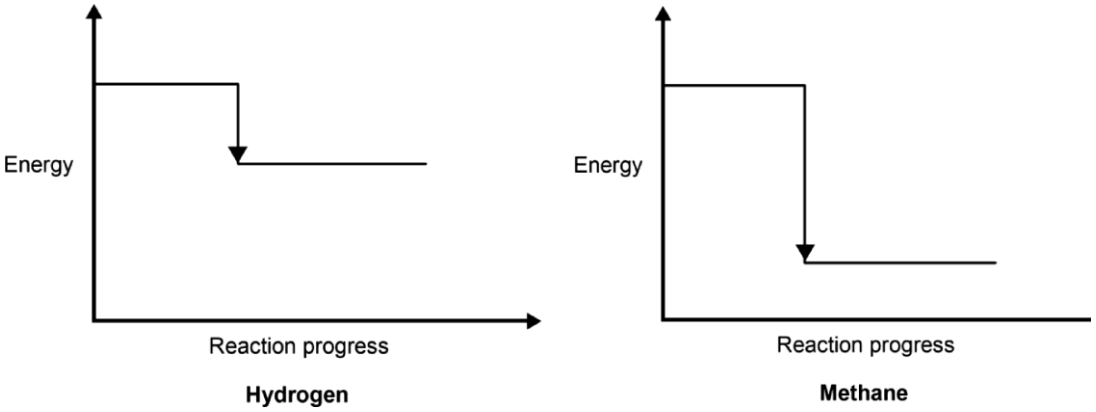
.....

.....

..... **[3]**

(b) The diagrams show the energy changes in the hydrogen and methane fuel cells.



Explain the shapes of the two diagrams.

Use the data in the table in your answer.

.....

.....

..... **[2]**

13 **(a)** Chlorine is used in the treatment of drinking water.

Describe how you would test a sample of gas to show that it is chlorine.

.....

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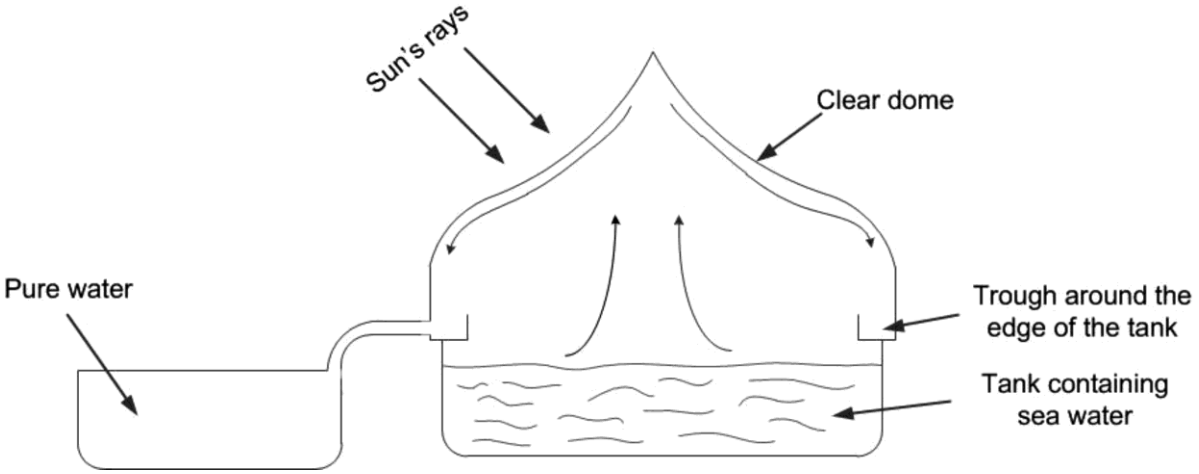
..... **[2]**

(b) A solar still can be used to make sea water safe to drink.

The diagram shows a cross-section through a solar still.



Describe how a solar still produces drinking water from sea water.

.....

.....

..... **[2]**

14 Scientists think that the composition of the early atmosphere changed slowly over many billions of years.

Scientists estimated the composition of the earliest atmosphere on Earth.

Earth's earliest atmosphere

Gas	Percentage composition (%)
carbon dioxide	1.9
water vapour	95.8
other gases	2.3

Estimated surface temperature = 700–1100 °C

Scientists also estimated the composition of the atmosphere shortly before the first plant life existed.

Atmosphere just before the first plant life

Gas	Percentage composition (%)
carbon dioxide	89.8
water vapour	2.1
other gases	

(a) Explain the change in the percentage of water vapour shown in the tables.

.....

.....

..... **[2]**

(b) Plants caused further changes to the composition of gases in the atmosphere.

Predict the effect that plants had on the percentage of carbon dioxide in the atmosphere.

Explain your reasoning.

.....

.....

..... **[2]**

15 Metal extraction produces a lot of waste. The zinc ions from this waste could leak into watercourses and contaminate soil.

Alpine Penny-cress is a plant that grows on waste heaps that contain toxic zinc ions. The cress plants take up the zinc ions and store them in their leaves.

(a) Explain how the planting of Alpine Penny-cress could be used to recycle zinc.

.....

.....

..... **[1]**

(b) Explain how growing these plants could reduce risk.

.....

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..... **[2]**

(c) Alpine Penny-cress takes up zinc ions from contaminated soil very well. Oilseed rape cannot take up zinc.

The table shows data on Alpine Penny-cress and oilseed rape.

Plant	Height (cm)	Dry mass per plant (g)	Plants (per m^2)	Time to fully grown (days)
Alpine Penny-cress	25	1	20	100
Oilseed rape	125	2	50	85

Scientists have put genes from Alpine Penny-cress into the oilseed rape plant.

Explain what effect this modified oilseed rape plant could have on the uptake of zinc ions in contaminated soil.

.....

.....

..... **[2]**

(d) The Alpine Penny-cress contains toxic zinc ions.

Beth decides to do some experimental research to find out whether the Alpine Penny-cress can be used as grazing for sheep.

What research would she need to do to find out if the Alpine Penny-cress is safe for sheep to eat?

.....

.....

..... **[2]**

(e) Beth does some tests to find out which metal ions are in some other samples of mining waste, samples: **A, B** and **C**.

She adds dilute sodium hydroxide, NaOH, to a solution of the metal ions. These are her results.

Mining waste sample	After adding a few drops of NaOH	After adding excess NaOH
A	white precipitate	precipitate dissolves
B	blue precipitate	no further change.
C	no precipitate	

What conclusions can Beth make about the metal ions in the mining waste?

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..... **[3]**

END OF QUESTION PAPER

Summary of updates

Date	Version	Details
October 2021	2.1	Updated copyright acknowledgements.

OCR
Oxford Cambridge and RSA

F

…day June 20XX – Morning/Afternoon

GCSE (9–1) Chemistry B (Twenty First Century Science)

J258/01 Breadth in chemistry (Foundation Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 90

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.
5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

11. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Chemistry B:

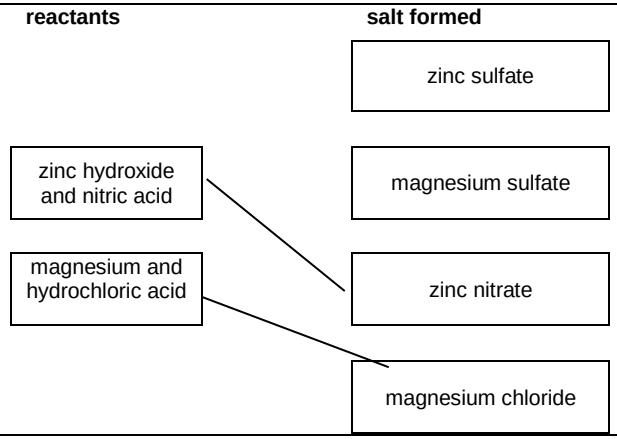
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

Question			Answer	Marks	AO element	Guidance
1	(a)		Dalton ✓	1	1.1	
	(b)		Thomson ✓	1	1.1	
2	(a)		**D** ✓ the more electrons, the larger the radius / both increase idea ✓ does not go through the origin / data for radius starts at 150 / data for number of electrons starts at 3 ✓	3	2.1 2.1 3.1b	
	(b)		they all have one electron in their outer shell ✓ they all have different numbers of shells / down the group have more shells ✓ the number of electrons in the inner shells is different / some have full shells of 8 electrons / gives numbers of shells ✓	3	2.1	
	(c)		potassium > sodium > lithium ✓	1	1.2	
3	(a)		$C_2H_4O_2$ shows correct number of each atom ✓ shows molecular formula ✓	2	2.1	**ALLOW** CH_3COOH / C_2H_4OO for marking point 1 only
	(b)		both contain the same functional group ✓	1	1.1	
	(c)	(i)	H+ ✓	1	1.1	
		(ii)	idea that strong acid has a lower pH than a weak acid / gives values for both with strong acid below weak acid ✓ both are below 7 / gives both pH values below 7 ✓	2	2.2	

Question			Answer	Marks	AO element	Guidance
4	**(a)**	**(i)**	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 76 (%) award 2 marks** 1.9/2.5 ✓ (x 100) = 76 (%) ✓	**2**	**2.2**	
		(ii)	18 ✓	**1**	**2.2**	**ALLOW ECF** from **(a)(i)**
	(b)		19 ÷ 28 x 100 = 68 % less than 92 % ✓ only one other type of atom shown/gold contains two other types of atom ✓	**2**	**2.2** **3.1a**	
	(c)		B ✓	**1**	**1.1**	
5	**(a)**		C_4H_{10}	**1**	1.1	**DO NOT ALLOW** C4H10 / C^4H^{10} **ALLOW** $H_{10}C_4$
	(b)		propane and butane contain carbon and hydrogen (atoms) ✓ only ✓ has (carbon to carbon) single bonds only / contains single (covalent) bonds only ✓	**3**	1.1	**DO NOT ALLOW** is a mixture of carbon and hydrogen (only) **DO NOT ALLOW** contains carbon and hydrogen molecules 'only' must be linked to first marking point and is not independent **ALLOW** has no (carbon to carbon) double bonds (1) **ALLOW** they are saturated compounds (1) **ALLOW** has general formula $C_nH_{(2n+2)}$ (1) **IGNORE** has the maximum amount of hydrogen atoms

Question			Answer	Marks	AO element	Guidance
6	(a)		F T T ✓✓✓	3	2.2	
	(b)		(no because) the energy involved in manufacture is greater than 120 MJ ✓ energy involved in manufacture is more than 400 MJ / quotes a value 420-480 MJ ✓	2	3.1a	
7	(a)		yield would be lower ✓ because reactants/products would escape / reaction is reversible ✓	2	1.1	
	(b)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 17 (g) award 3 marks** ratio of N_2 : NH_3 = 1:2 ✓ $\frac{\text{amount of ammonia}}{17.0}$ = 2 x 14/28 ✓ amount of ammonia = 2 x 14/28 x 17 = 17 (g) ✓	3	2.2 1.2 2.2	
		(ii)	correct substitution. 8.5 ÷ 17.0 (ECF) x 100 ✓ correct computation: 50 % ✓	2	2.2	**ALLOW ECF** from **(b)(i)**

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	A catalyst changes the reaction temperature. ☐ A catalyst increases the time taken for the reaction. ☐ A catalyst is used up quickly. ☐ A catalyst lowers the activation energy. ✓ The same catalyst can be used in more than one reaction. ✓	2	1.1	
		(ii)	increase in pressure ✓ increase in temperature ✓	2	1.1	
	(d)		potassium ✓ phosphorus ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
8	(a)			2	1.1	
	(b)		hydrogen ✓	1	1.1	
	(c)		filtration ✓	1	1.2	
9	(a)		copper → dilute sodium hydroxide gives a blue precipitate ✓ chloride → dilute silver nitrate gives a white precipitate ✓	2	1.1	
	(b)	(i)	fizzing / bubbles ✓	1	1.2	
		(ii)	lime water ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
10	(a)	(i)	**A** ✓	1	1.2	
		(ii)	**D** ✓	1	1.2	
	(b)		changes colour/shows end point ✓ at the end point / when neutralisation happens / when enough NaOH has been added ✓	2	1.2 2.2	
	(c)		sample every batch ✓ take samples from throughout the batch / lots of samples of each batch / random choice of bottles from each batch ✓	2	1.2	
	(d)	(i)	$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$ ✓✓	2	1.2	one mark for correct symbols one mark for correct balancing
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 50 (cm^3) award 2 marks** ratio of NaOH to H_2SO_4 = 2:1 ✓ therefore volume of NaOH = 2 x 25 = 50 (cm^3) ✓	2	2.2	**ALLOW ECF** from **(d)(i)**
11	(a)		hydrogen is an element / only contains hydrogen atoms/ contains all the same type of element / contains 2 atoms per molecule whereas methane is a compound / contains carbon and hydrogen atoms/ contains two types of atoms / contains 5 atoms per molecule / contains more atoms per molecule ✓ both contain hydrogen atoms / both are simple molecules / both covalently bonded ✓	2	2.2	
	(b)	(i)	(g) ✓	1	1.1	
		(ii)	-253° C ✓	1	2.1	
	(c)		methane contains single covalent bonds ✓ methane is in the same family ….. ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
12	(a)		hydrogen needs a high temperature to produce/ uses energy in production / methane is a finite fossil fuel / will run out idea ✓ hydrogen only produces water which is not a pollutant / does not produce carbon dioxide / methane produces carbon dioxide which is a pollutant ✓ methane gives out more energy (per mole) ✓	3	2.1 3.1b 3.1b	
	(b)		both give out energy /exothermic ✓ 890 ÷ 286 = approx. 3 therefore 3x more energy is given out by methane therefore energy gap 3x larger ✓	2	2.2	
13	(a)		(blue) Litmus paper ✓ goes red then white / red then bleaches ✓	2	1.1	
	(b)		water evaporates (from sea water) by the heat from the sun ✓ water condenses (on the sides of the dome) and collects in the trough ✓	2	1.1	
14	(a)		water vapour condensed/turned into a liquid/became oceans ✓ because the Earth cooled/surface temperature fell ✓	2	2.1	
	(b)		carbon dioxide percentage decreases ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
			plants use carbon dioxide for photosynthesis/to make glucose ✓		1.1	

Question			Answer	Marks	AO element	Guidance
15	(a)		zinc is recovered at the end of the process/ a way of making zinc from waste ✓	1	3.2a	
	(b)		zinc ions are toxic if they enter drinking water/water supplies ✓ risk is reduced if zinc ions are stored in plants ✓	2	3.2a	
	(c)		any **TWO** from: larger plants therefore take up more zinc ✓ more plants grow per m^2 therefore absorb more zinc per m^2 ✓ plants grow more quickly therefore more zinc can be removed in a shorter time ✓	2	3.1b	
	(d)		find out amount/ concentration of zinc ions in Alpine Penny-cress ✓ find out tolerance of sheep for zinc ions / whether zinc ions get into wool/meat ✓	2	3.3a	
	(e)		**A** contains zinc (ions) ✓ **B** contains copper (ions) ✓ **C** does not contain any (identifyable) metal ions ✓	3	3.2b	

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website

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