Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Tuesday 13 June 2023

Morning (Time: 1 hour 10 minutes)

Paper reference **1SC0/2CF**

Combined Science

PAPER 5

Foundation Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P72562A

N:1/1/

P 7 2 5 6 2 A 0 1 2 0

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows the structure of a molecule of each of four compounds, **A**, **B**, **C** and **D**.

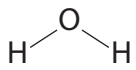
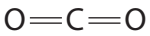
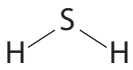
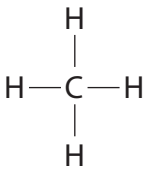
compound A	compound B	compound C	compound D
			

Figure 1

(a) The formula of a molecule of compound **A** is H_2O.

Give the formula of a molecule of compound **D**.

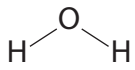
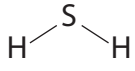
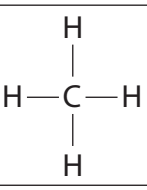
(1)

.....

(b) The names of two of the compounds in Figure 1 are shown below.

Draw one straight line from each name to the structure of a molecule of that compound.

(2)

name of compound	structure of molecule
carbon dioxide	
methane	
	
	

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

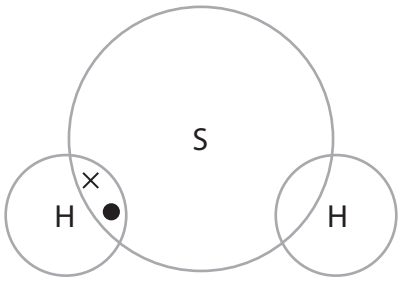
(c) Figure 2 shows information about the number of electrons in the outer shell of each of the different atoms in a molecule of compound **C**.

symbol of element	number of electrons in outer shell of the atom
H	1
S	6

Figure 2

Use the information in Figure 2 to complete the dot and cross diagram for a molecule of compound **C**.

(2)



(d) The atomic number of phosphorus, P, is 15.

One atom of phosphorus has a relative atomic mass of 31.

Give the number of protons, neutrons and electrons in this atom of phosphorus.

(3)

number of protons = ...

number of neutrons = ...

number of electrons = ...

(Total for Question 1 = 8 marks)

2 A student investigated the temperature change that took place when different salts were dissolved in water.

The student used the following method.

step 1 pour 50 cm^3 of water into a polystyrene cup and record the temperature of the water

step 2 find the mass of an empty boiling tube

step 3 add 2 spatula measures of a salt to the boiling tube and find its new mass

step 4 add the salt to the water

step 5 stir the mixture and record the temperature after 2 minutes.

Figure 3 shows the apparatus used.

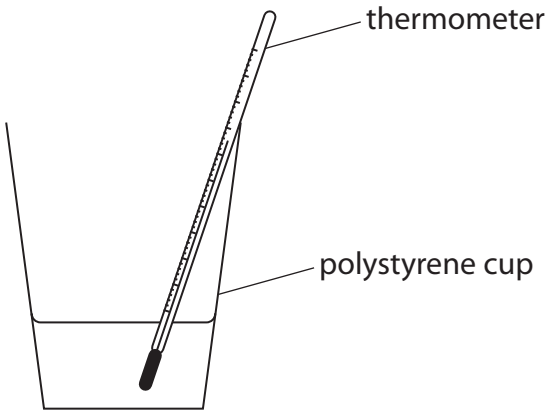


Figure 3

(a) For steps 2 and 3, the student obtained the mass measurements shown in Figure 4 for the first salt.

mass of empty boiling tube in g	22.52
mass of boiling tube + 2 spatula measures of a salt in g	24.16

Figure 4

Use the mass measurements in Figure 4 to calculate the mass of salt, in grams, added to the water.

(1)

.....

mass of salt = ... g

(b) The student repeated the method for three different salts, **A**, **B** and **C**.

The same mass of each salt was used.

Figure 5 shows the temperature readings obtained for the three different salts.

salt	starting temperature of the water in °C	temperature of the mixture after 2 minutes in °C	temperature change in °C
A	20.5	25.6	+5.1
B	20.5	19.8	–0.7
C	20.5	29.2	

Figure 5

(i) Calculate the temperature change for salt **C**.

Include a sign to show if the temperature change is an increase or a decrease.

(2)

.....

temperature change = ... °C

(ii) Explain which salt produces the biggest exothermic change.

(2)

.....

.....

.....

.....

(c) Explain why a polystyrene cup is a better container to use for this investigation than a glass beaker.

(2)

.....

.....

.....

.....

(Total for Question 2 = 7 marks)

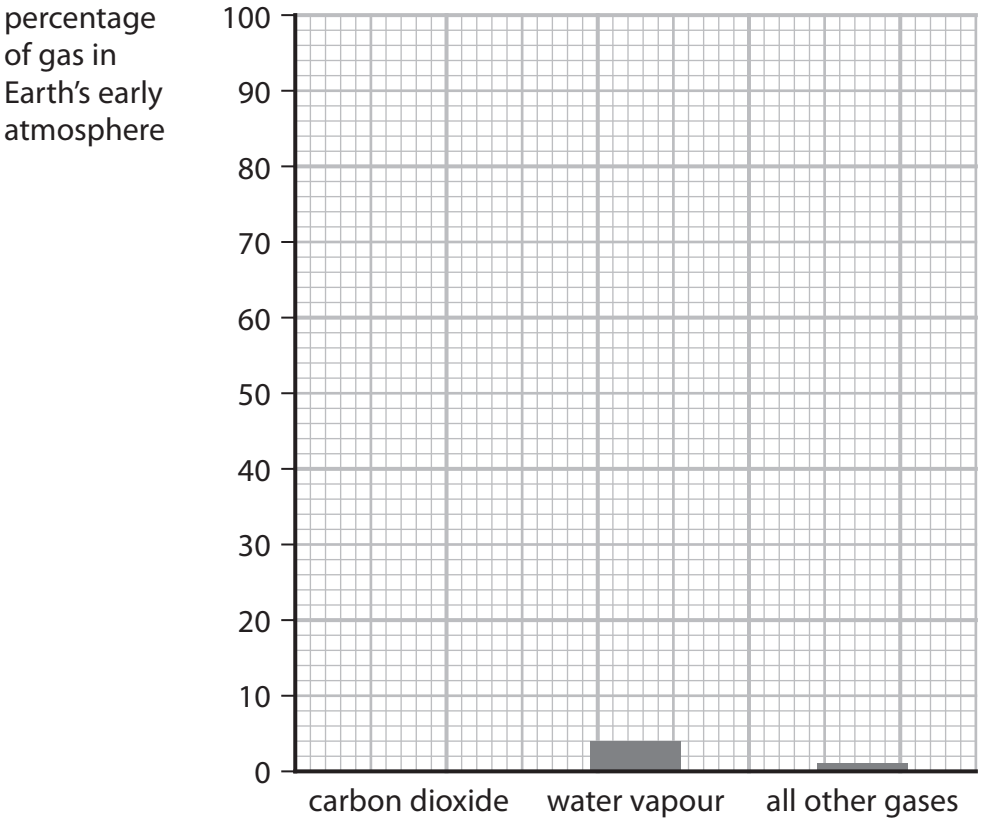
3 A scientist produced the information in Figure 6 about the Earth's atmosphere and the Earth's average surface temperature.

Earth's atmosphere 3 billion years ago		Earth's atmosphere today	
gas	**%**	**gas**	**%**
carbon dioxide	95	nitrogen	78.00
water vapour	4	oxygen	21.00
all other gases	1	carbon dioxide	0.04
		all other gases including water vapour	0.96
average surface temperature 3 billion years ago		**average surface temperature today**	
above 400 °C		20 °C	

Figure 6

(a) Complete the bar chart showing the composition of the Earth's atmosphere 3 billion years ago by adding a bar to show the percentage of carbon dioxide.

(1)



(b) (i) Use words from the box to complete the following sentence.

(1)

has decreased	has increased	has stayed the same

Over the past 3 billion years the average surface temperature of the Earth

.....

(ii) The Earth's atmosphere 3 billion years ago contained much more water vapour than today's atmosphere.

Explain what happened to the water vapour.

(2)

.....

.....

.....

.....

(c) Scientists think that the decrease in percentage of carbon dioxide was partly due to this gas being used in the growth of primitive plants.

(i) Carbon dioxide was used in the growth of primitive plants and produced oxygen.

Give the name of the process in plants that takes in carbon dioxide and produces oxygen.

(1)

.....

(ii) Which of the following tests would show that a gas is oxygen?

(1)

☒ **A** put a lighted splint into the gas and it burns with a pop

☒ **B** put a glowing splint into the gas and it relights

☒ **C** put a lighted splint into the gas and it relights

☒ **D** put a glowing splint into the gas and it burns with a pop

(d) Many people are concerned by the increasing amount of carbon dioxide in the atmosphere.

(i) The amount of carbon dioxide in the atmosphere is measured in parts per million (ppm).

Figure 7 shows the amount of carbon dioxide in the atmosphere in June 2001 and in June 2021.

	amount of carbon dioxide in ppm
June 2001	371.17
June 2021	416.56

Figure 7

Calculate the increase in the amount of carbon dioxide, in ppm, from June 2001 to June 2021.

Give your answer to the nearest whole number.

(2)

.....

.....

.....

increase in amount of carbon dioxide = ... ppm

(ii) State **one** possible effect that could be caused by the increasing amount of carbon dioxide in the atmosphere.

(1)

.....

.....

(Total for Question 3 = 9 marks)

4 Chlorine is an element in group 7 of the periodic table.

(a) What name is given to group 7 of the periodic table?

(1)

- ☒ **A** alkali metals
- ☒ **B** halogens
- ☒ **C** noble gases
- ☒ **D** transition metals

(b) Chlorine reacts with sodium to form sodium chloride.

(i) Write the word equation for this reaction.

(2)

..... → .....

(ii) Chlorine, Cl_2, is made of simple molecules.

Describe what is meant by the term **molecule**.

(2)

.....

.....

.....

.....

(iii) Sodium, like all metals, conducts electricity.

Explain how sodium conducts electricity.

(2)

.....

.....

.....

.....

(iv) Sodium chloride contains sodium ions, Na^+, and chloride ions, Cl^-.

Use this information to state the formula of sodium chloride.

(1)

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

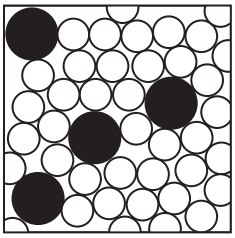
DO NOT WRITE IN THIS AREA

(v) Sodium chloride is made of a giant structure of ions.

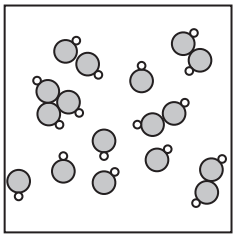
Which diagram shows the arrangement of particles in sodium chloride?

(1)

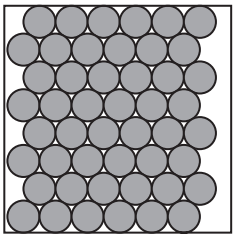
☒ **A**



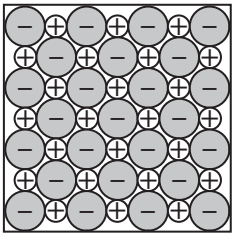
☒ **C**



☒ **B**



☒ **D**



(vi) Sodium chloride solution conducts electricity.

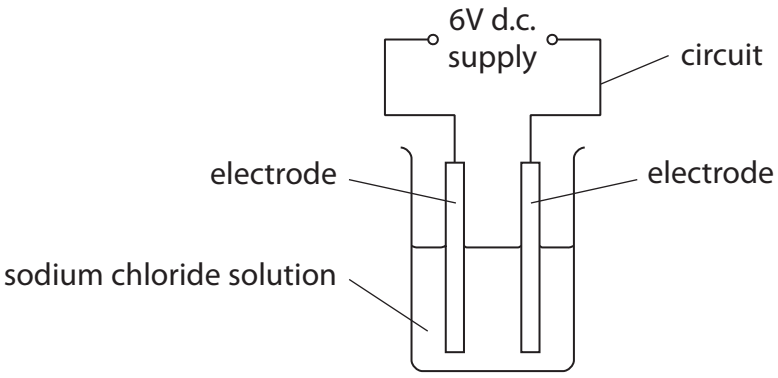


Figure 8

State what can be put into the circuit in Figure 8 to show that a current is flowing.

(1)

.....

(c) Figure 9 shows a flow diagram of how hydrochloric acid can be made.

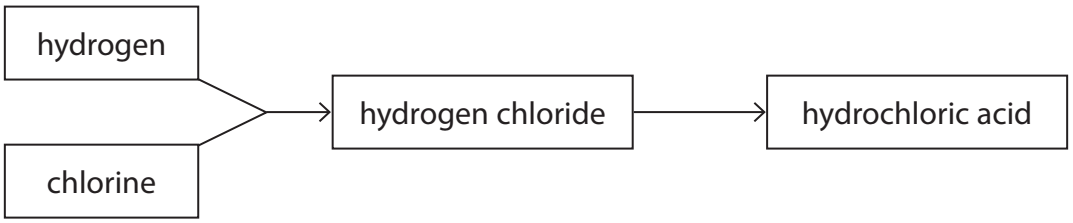


Figure 9

(i) Balance the equation for the reaction between hydrogen and chlorine to form hydrogen chloride.

(1)

$H_2 + Cl_2 \rightarrow$ ..... HCl

(ii) State how hydrogen chloride can be converted into hydrochloric acid.

(1)

.....

.....

(Total for Question 4 = 12 marks)

5 A student used the apparatus shown in Figure 10 to investigate the reaction between marble chips and dilute hydrochloric acid.

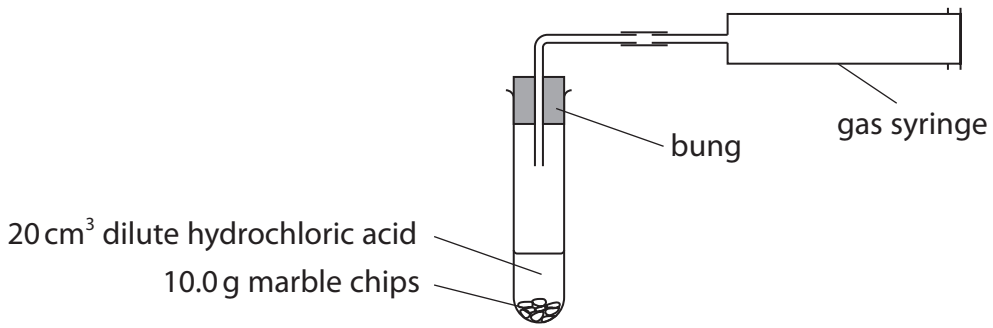


Figure 10

The student recorded the volume of gas every minute as shown in Figure 11.

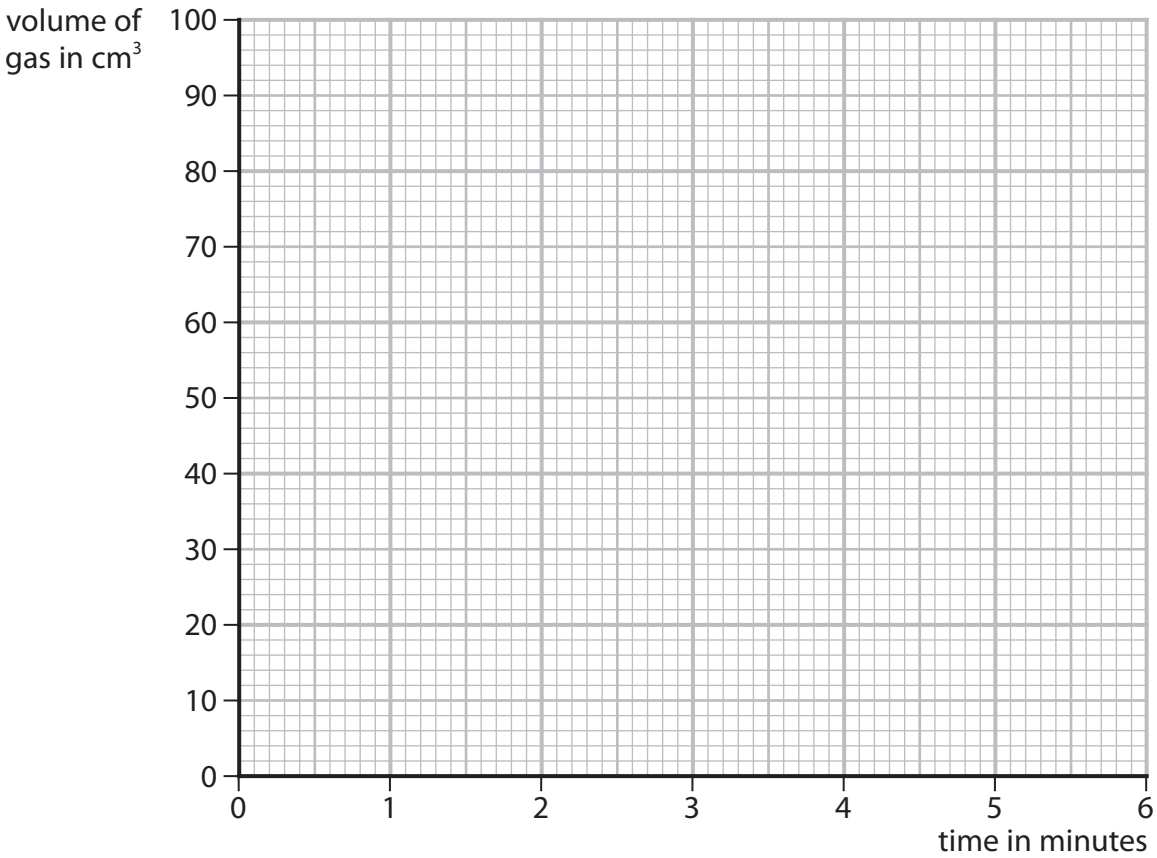
time in minutes	0	1	2	3	4	5	6
volume of gas in cm³	0	52	78	91	97	100	100

Figure 11

(a) On the grid, plot the results shown in Figure 11.

Draw a curve of best fit.

(3)



(b) Rate of reaction can be calculated using

$$\text{rate of reaction} = \frac{\text{volume of gas produced in 1 minute}}{\text{1 minute}}$$

Figure 12 shows the rates of reaction calculated from the results of this experiment.

The rate of reaction for the time interval 2 to 3 minutes is missing.

time interval	0 to 1 minute	1 to 2 minutes	2 to 3 minutes	3 to 4 minutes	4 to 5 minutes
rate of reaction in $cm^3\ min^{-1}$	52	26		6	3

Figure 12

(i) Calculate the rate of reaction for the time interval 2 to 3 minutes.

(1)

.....

rate of reaction = ... $cm^3\ min^{-1}$

(ii) State and explain what happens to the rate of reaction as the acid reacts with the marble chips in this experiment.

(3)

.....

.....

.....

.....

.....

(c) The student repeated the experiment using the same volume of acid and the same mass of marble chips but used smaller marble chips.

All other conditions remained the same.

The student found that the reaction with the smaller marble chips was faster to start with but produced the same volume of gas.

Using this information, draw a line on the grid to show the results for the reaction with the smaller marble chips.

Label this line 'C'.

(2)

(d) Which of the following changes would make the reaction faster?

(1)

- ☒ **A** use a larger boiling tube
- ☒ **B** use a larger volume of the dilute acid
- ☒ **C** use a more concentrated acid
- ☒ **D** use a smaller boiling tube

(e) State what could be used to measure time in the investigation.

(1)

.....

(Total for Question 5 = 11 marks)

6 Figure 13 shows some information about some group 1 metals.

group 1 metal	atomic number	relative atomic mass
lithium	3	7
sodium	11	23
potassium	19	39
rubidium	37	85
caesium	55	133

Figure 13

(a) Explain, in terms of their electronic configurations, why these metals are placed in group 1 of the periodic table.

(2)

.....

.....

.....

.....

(b) Which row shows two correct properties of group 1 metals?

(1)

		properties of group 1 metals	
☒	**A**	compounds are white in colour	high density
☒	**B**	low melting points	compounds are blue in colour
☒	**C**	soft enough to be cut by a knife	low melting points
☒	**D**	high density	conduct electricity

(c) The word equation for the reaction of potassium with bromine is

potassium + bromine → potassium bromide

Add the missing state symbol and balance the equation for this reaction.

(2)

..... K(.....) + Br_2(g) → ..... KBr(s)

(d) A sample of potassium contains three isotopes, potassium-39, potassium-40 and potassium-41.

Explain the meaning of the term **isotopes**.

(2)

*(e) The reactivity of the group 1 metals increases from lithium to caesium.

Often, teachers demonstrate the reactions of lithium, sodium and potassium with water.

These reactions can be used to predict the behaviour and reactions of rubidium and caesium with water.

Describe the reactions of each of the group 1 metals with water including the predicted behaviour and reactions of rubidium and caesium.

You may use word equations in your answer.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

BLANK PAGE

The periodic table of the elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Pearson Edexcel

Mark Scheme (Results)

Summer 2023

Pearson Edexcel GCSE
In Combined Science (1SC0)
Paper 2CF

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2023
Publications Code 1SC0_2CF_2306_MS

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

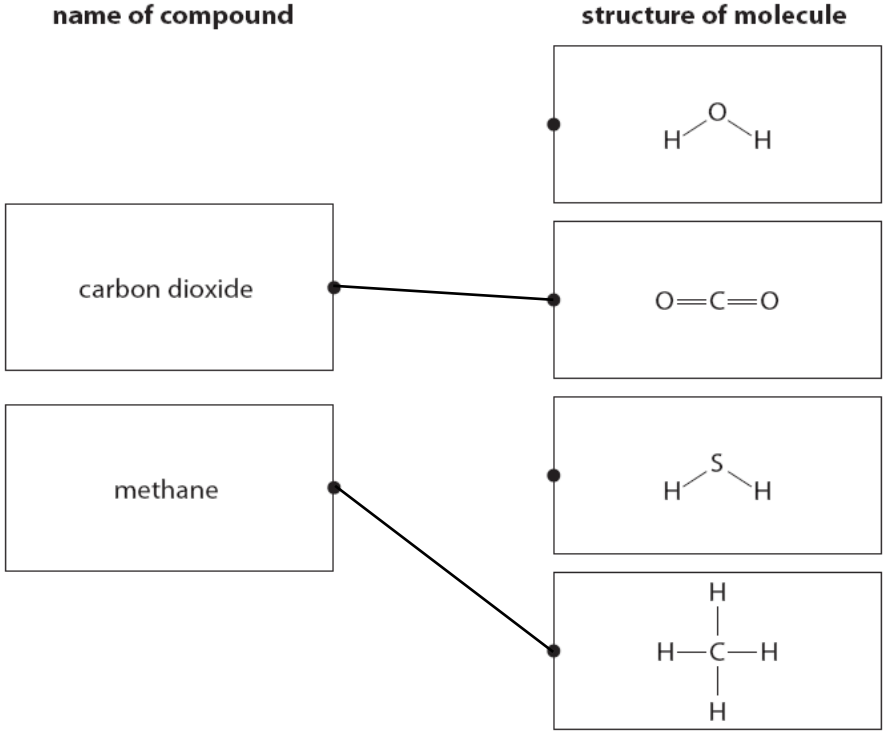
When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

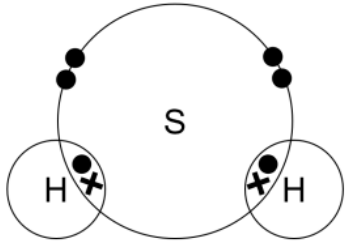
Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Paper 2CF Foundation Tier

Question number	Answer	Additional guidance	Mark
1(a)	CH_4	allow H_4C / C_1H_4 reject CH4 / H4C / CH^4 / Ch_4 / ch_4	**(1)** **AO3-1**

Question number	Answer	Additional guidance	Mark
1(b)	 one mark for each line	do not award mark if more than one line join a left hand box with those on the right	**(2)** **AO1-1**

Question number	Answer	Additional guidance	Mark
1(c)	 shared pair (1) rest of molecule correct (1)	allow all dots or all crosses or a mixture of both allow remaining electrons not shown as pairs MP2 depends on MP1	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
1(d)	protons – 15 (1) neutrons – 16 (1) electrons – 15 (1)	accept ONLY whole numbers if no marks scored then maximum 1 mark for number of electrons = number of protons OR p + n = 31	**(3)** **AO1-1**

Total for Question 1 = 8 marks

Question number	Answer	Mark
2(a)	24.16 – 22.52 = 1.64 (g)	**(1) AO2-2**

Question number	Answer	Additional guidance	Mark
2(b)(i)	**+** (1) 8.7 (1) (°C) sign (1) value (1)	Allow answer to be shown on the table mark independently	**(2) AO2-2**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation linking • salt with larger positive temperature rise in part (i) (1) • shows the {largest/highest} temperature rise (1)	allow ecf from Q02b(i) +8.7 °C in part(i) gives salt C in Q02b(ii) MP2 depends on MP1 allow gives out most heat / loses most energy /heats up the most / biggest temperature change ignore just quoting numbers ignore biggest exothermic change / because it's getting hotter reject B for both marking points	**(2) AO2-1**

Question number	Answer	Additional guidance	Mark
2(c)	An explanation linking • polystyrene is an insulator / poor conductor (of heat) (1) • reduces {heat/energy} {loss/transfer} (1)	 allow RA for glass allow polystyrene has a higher specific heat capacity than glass allow (polystyrene) {keeps heat in / doesn't absorb heat} allow holds {warmth/heat} better (than glass) ignore temperature stays in the cup ignore loss of heat through the top	**(2)** **AO3-3**

Total for Question 2 = 7 marks

Question number	Answer	Additional guidance	Mark
3(a)	bar on bar chart for carbon dioxide to 95 %	allow ±½ small square ignore width of bar	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
3(b)(i)	over the past 3 billion years the average surface temperature of the Earth has decreased.		**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	an explanation linking any **two** from • {the Earth / atmosphere / water vapour} cooled (1) • water vapour condensed / formed clouds (1) • {(liquid) water / rain} formed (1) • produced {oceans / seas / rivers / bodies of water} (1)	 allow surface temperature has decreased allow lakes	**(2)** **AO2-1**

Question number	Answer	Mark
3(c)(i)	photosynthesis	**(1)** **AO1-1**

Question number	Answer	Mark
3(c)(ii)	**B** put a glowing splint into the gas and it relights **A**, **C** and **D** are incorrect tests for oxygen	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
3(d)(i)	(416.56 – 371.17 =) 45.39 (1) = 45 (1) (to nearest whole number)	answer of 45 alone with or without working scores (2) 1 mark for correct rounding (has to use only the numbers 416.56 and 371.17 in any calculation)	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
3(d)(ii)	eg global warming / {ice caps/glaciers} melting / changing habitats / rising sea levels	allow {**enhanced/increased}** greenhouse effect / increased global temperatures / climate change / allow effects of climate change eg <u>more</u> extreme weather allow more photosynthesis ignore references to pollution / less oxygen in the air reject references to ozone layer / deforestation / acid rain	**(1)** **AO1-1**

Total for Question 3 = 9 marks

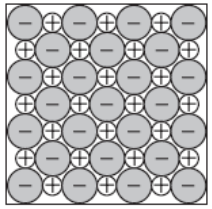
Question number	Answer	Mark
4(a)	**B** halogens **A**, **C** and **D** are names for other groups in the periodic table	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
4(b)(i)	Left side: sodium + chlorine (1) Right side: sodium chloride (1)	reactants in either order reject chlor**ide** on left hand side reject sodium chlor**ine** on right hand side reject if other substances on right side use of formulae to produce a correctly balanced equation: $2Na + Cl_2 \rightarrow 2NaCl$ (2)	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	A description to include • (two or more) atoms joined together (1) • by a {covalent bond / shared pair of electrons} (1)	 allow made up of more than one atom / group of atoms ignore 'compound atoms' MP2 depends on MP1 allow {(chemically) bonded / chemically joined} together reject references to ionic bonding for MP2 if no other mark scored, allow 'particles joined by a {covalent bond / shared pair of electrons} (1)	**(2)** **AO1-1**

Question number	Answer	Additional guidance	Mark
4(b)(iii)	An explanation linking • electrons (1) • (electrons) {can move / are delocalised / can pass through / can flow} (1)	 reject ions MP2 depends on MP1 allow charged particles can move / are delocalised (1) ignore 'free' alone allow free-moving electrons / delocalised electrons / free flowing electrons (2)	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(b)(iv)	NaCl / Na^+Cl^-	allow ClNa ignore upper case A, upper case L, lower case n ignore numbers in front of formula reject $Na^+ + Cl^-$ as final answer / Na^-Cl^+	**(1)** **AO3-1**

Question number	Answer	Mark
4(b)(v)	**D**  is the only correct answer **A**, **B** and **C** represent different structure types	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(b)(vi)	ammeter / (light) bulb / lamp	allow buzzer / multimeter allow correct symbol (on diagram) ignore voltmeter / data logger (alone) ignore 'add arrows'	**(2)** **AO3-3**

Question number	Answer	Additional guidance	Mark
4(c)(i)	$H_2 + Cl_2 \rightarrow 2\,HCl$	allow multiples	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(c)(ii)	{dissolve in / add} water	allow {make aqueous / dissolve into a solution} allow bubble through water / mix with water ignore dilute / make it a liquid reject other substances	**(1)** **AO1-1**

Total for Question 4 = 12 marks

Question number	Answer	Additional guidance	Mark
5(a)	6 or 7 points plotted correctly (2) or 4 or 5 points plotted correctly (1) best fit curve starting at (0,0) (1)	allow +/- half a square. for MP3, curve must be a single smooth curved line going through most or all of THEIR plotted points (ecf allowed), or if the points are not visible, through most or all of the correct values. reject curves going above or below 100cm^3 by more than half a square. reject straight line / dot to dot straight lines bar charts – max 2 marks for plotting points if time value is clear	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
5(b)(i)	13	answer may be given in table	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation linking	Note: a comparison of the rate of marble chips with that of marble powder is ignored ignore anything about rate increasing at the beginning / starts fast	**(3)** **AO3-2**
	• rate of reaction decreases / reaction is slow**er** (1)	allow (rate of) reaction slows down ignore references to volumes of gas produced ignore reaction stops	
	• as {reactants /acid/ marble chips} are used up (1)	allow {concentration/amount} of acid decreases / marble chips getting smaller allow {marble chips <u>have</u> / acid <u>has</u>} react**ed** allow less {reactants/ marble chips/ acid} available ignore limiting factor/ reaction is ending	
	• so less frequent collisions (1)	allow fewer (successful) collisions ignore less particles have less energy	

Question number	Answer	Additional guidance	Mark
5(c)	graph to show • initial line steeper and to the left (1) • line levelling off at 100 cm^3 before 5 minutes (1)	there must be a line from part (a) to award these marks. if lines are not labelled, make a reasonable assumption about which is C. mark independently. line should start from start of original line all levelling off within half a square of original line	**(2)** **AO3-2**

Question number	Answer	Mark
5(d)	**C** use a more concentrated acid is the only correct answer **A**, **B** and **D** will have no effect on the speed of reaction	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
5(e)	stopwatch / clock	allow timer / time app on phone	**(1)** **AO1-2**

Total for Question 5 = 11 marks

Question number	Answer	Additional guidance	Mark
6(a)	An explanation linking • 1 <u>electron</u> (1) • in outer shell(s) (1)	 allow 1 is the last number of the electronic configuration (1) ignore electronic configurations written out reject incorrect number of electrons MP2 depends on MP1 for outer allow {highest energy / last} for shell allow ring, energy level, orbital allow: 1 outer electron (2) 1 valence electron (2) have to lose 1 electron to get full outer shell (2) same number of electrons in outer shell (1) forms a +1 ion by losing one electron (1)	**(2)** **AO1-1**

Question number	Answer	Mark
6(b)	**C** soft enough to be cut by a knife / low melting point is the only correct answer **A** and **D** are incorrect because alkali metals do not have a high density **B** is incorrect because alkali metal compounds are not blue in colour	**(1)** **AO1-1**

Question number	Answer	Additional Guidance	Mark
6(c)	$2\ K(s) + Br_2(g) \rightarrow 2\ KBr(s)$ balancing (1) state symbol s (1)	allow multiples ignore 'two' ignore 'solid'	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
6(d)	An explanation linking • (atom**s**) {of same element / with same number of protons} / all contain 19 protons / same atomic number (1) • different number of neutrons / different mass <u>number</u> / have 20, 21, 22 neutrons (1)	reject compound / molecule / ion / element**<u>s</u>** once allow same protons ignore electrons reject different protons allow different / extra / more / fewer neutrons ignore different mass / relative atomic mass reject different electrons	**(2)** **AO1-1**

Question number	Indicative content	Mark
6(e)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. • lithium, sodium, potassium float on water • metals move around on the water • bubbles form / fizz / effervescence • hydrogen / gas produced • metal hydroxide solution formed • metal + water $\rightarrow$ metal hydroxide + hydrogen • purple solution formed if universal indicator present in the water • lithium slowly disappears • sodium forms a ball / melts • sodium disappears quickly • potassium burns with a lilac flame • potassium disappears very quickly • rubidium much more reactive (than potassium) • rubidium burns with coloured flame • caesium explosive / more reactive than rubidium	**(6)** **AO1-1**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question.
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question.
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question.

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance Correctly describes the trend in reactivity of group 1 metals down the group. Gives at least 1 observation for reaction of one alkali metal and water. Identifies at least 1 product formed when alkali metals react with water. Writes at least one correct word equation	Possible candidate response potassium is more reactive than sodium (1) the metals get more reactive down the group (1) water with universal indicator turns purple when lithium is added (1) when potassium is added to water it moves on the surface with a lilac flame (2) when lithium is added to water, bubbles of hydrogen are formed (2) sodium makes sodium hydroxide (1) sodium + water → sodium hydroxide + hydrogen (2)
Level 2	3–4	Additional Guidance Compares reactions of at least 2 alkali metals including at least 1 observation. Compares at least 2 alkali metals including identifying at least 1 product of reaction with water. Gives at least 1 observation about reaction of alkali metals and makes prediction for Rb / Cs.	Possible candidate response lithium and sodium both float on the water (3) lithium is the least reactive because it moves less than the others, with fewer bubbles (4) lithium is less reactive than sodium because it produces fewer bubbles of hydrogen (4) sodium makes sodium hydroxide, potassium makes potassium hydroxide (3) potassium burns with a flame, caesium would explode (3) rubidium would give off more bubbles than potassium, and would move faster in the water (4)
Level 3	5–6	Additional Guidance Compares reactions of at least 3 alkali metals including at least 2 observations for at least one metal AND identifies at least one product of reaction with water. Compares at least 3 alkali metals, including predictions for Cs / Rb AND identifies at least one product of reaction with water.	Possible candidate response potassium is more reactive than sodium, which is more reactive than lithium. When added to water they move around the surface and then disappear, with lithium moving the slowest. The metals react to form metal hydroxides and hydrogen (6) sodium + water → sodium hydroxide + hydrogen potassium + water → potassium hydroxide + hydrogen rubidium + water → rubidium hydroxide + hydrogen (5)

Total for Question 6 = 13 marks