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)

Time 1 hour 10 minutes

Paper reference **1SC0/1CF**

Combined Science

PAPER 2

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 ▶

P69481A

Q:1/1/

P 6 9 4 8 1 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 a metal spoon and two test tubes being heated in a water bath.

One test tube contains a piece of chocolate, the other some liquid egg white.

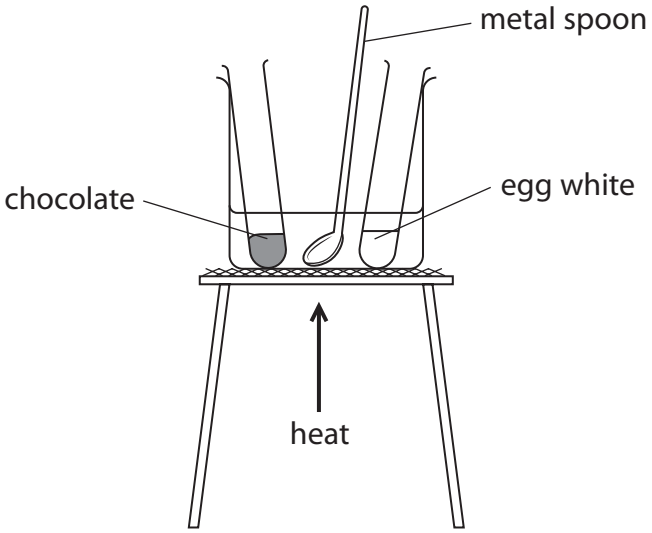

Figure 1

After heating, the spoon, the chocolate and the egg white are allowed to cool to room temperature.

Figure 2 shows the state of the three different substances before heating, when hot and after cooling.

substance	before heating	when hot	after cooling
metal spoon	solid	solid	solid
chocolate	solid	liquid	solid
egg white	liquid	solid	solid

Figure 2

(a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

in a solid (particles are):
• regularly arranged/ close(r) / in lattice / fixed (position) (1)

difference in movement of particles

in a solid (particles):
• vibrate / do not move (around) (1)

(b) What name is given to the process when the chocolate changes from a solid to a liquid?

(1)

- ☒ **A** condensing
- ☒ **B** evaporating
- ☒ **C** freezing
- ☒ **D** melting

(c) Give a reason why the metal spoon has not changed state during the experiment.

(1)

melting point (too) high / (temperature) below melting point / metals have high melting point / (water is) not hot enough

(d) Explain how we know the change to the egg white is a chemical change rather than a physical change.

(2)

An explanation linking:

• (when heated) changes to a solid (1)

• (when cooled) stays solid / doesn't change back / change is permanent / change is irreversible (1)

(Total for Question 1 = 6 marks)

2 Potable water is water that is suitable for drinking.

(a) River water can be treated to make it potable.
Chlorination, filtration and sedimentation are three of the processes involved in making the river water potable.

(i) Which row of the table shows these three processes in the order in which they are carried out?

(1)

		first	second	third
☒	**A**	chlorination	sedimentation	filtration
☒	**B**	chlorination	filtration	sedimentation
☒	**C**	sedimentation	filtration	chlorination
☒	**D**	sedimentation	chlorination	filtration

(ii) State the reason why chlorine is added during the water treatment.

(1)

to kill {bacteria / microorganisms / microbes / pathogens}

(iii) Describe how sedimentation is carried out.

(2)

A description including:

• (put waste) water in tank / left to (stand / settle) (1)

• {particles / dirt / impurities / sediment / solid} fall to bottom (1)

(iv) Figure 3 shows the results of an analysis of a sample of potable water.

ion	concentration in mg dm^{-3}
chloride	60.70
fluoride	0.24
nitrate	24.90
sulfate	71.40
copper	0.05
magnesium	9.10

Figure 3

Using this information, explain why this sample of potable water is not the same as pure water.

(2)

an explanation linking:

• (the water) contains {chloride / fluoride, nitrate / sulfate / copper / magnesium / ions / salts } (1)

• (therefore) more than just water (molecules) / it does not contain just water / which are impurities / pure substances contain only one substance / pure water does not contain ions
(1)

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(b) A student wanted to distil a sample of potable water.
Figure 4 shows apparatus the student used.

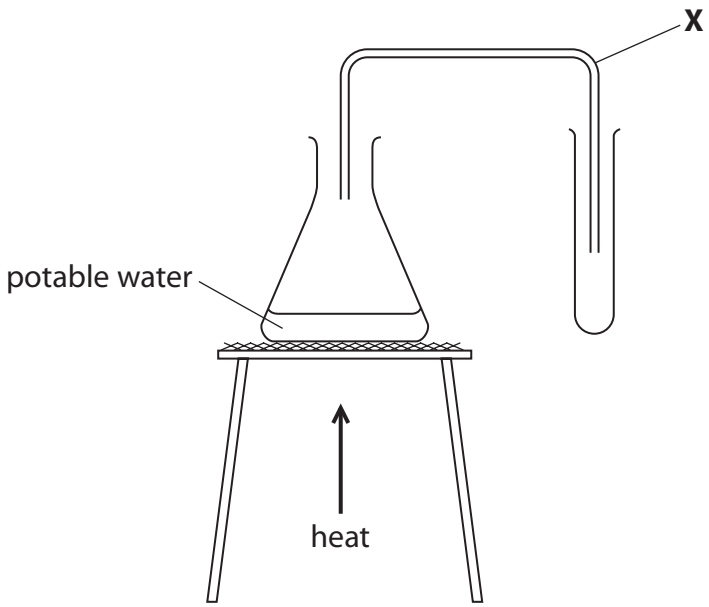

Figure 4

(i) Name the piece of equipment labelled **X** in Figure 4.

(1)

(delivery) tube

(ii) The student made an error when setting up the equipment in Figure 4.
This error meant no water could be collected in the test tube.

Explain what the student needs to do so water can be collected.

(2)

an explanation linking:

• add bung / cork (to top of flask) (1)

• (so) {water / vapour / gas / steam} cannot escape (from top of flask) / will go into {(delivery) tube/ X} (1)

(Total for Question 2 = 9 marks)

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3 (a) An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

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

(3)

number of electrons = 13

number of neutrons = 14

number of protons = 13

(b) Aluminium reacts with bromine to form aluminium bromide.
A sample of aluminium bromide contains 1.35 g of aluminium atoms and 12.00 g of bromine atoms.

Calculate the empirical formula of this sample of aluminium bromide.

(relative atomic masses: Al = 27.0, Br = 80.0)

(3)

$\frac{1.35}{27}$ and $\frac{12.00}{80}$ (1)

ratios derived from two fractions into simplest whole number ratio

(0.05 0.15)
1 3 (1)

whole number ratio to formula

AlBr3

empirical formula = ...

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(c) Gallium is in the same group in the periodic table as aluminium and in the same period in the periodic table as bromine.

(i) State in which group and period of the periodic table gallium can be found.

You may want to refer to the periodic table.

(2)

group = 3

period = 4

(ii) Gallium had not been discovered when Mendeleev created his first periodic table.

Figure 5 shows some properties of gallium that Mendeleev predicted and some of the actual properties of gallium.

property	predicted property	actual property
relative atomic mass	about 68	70
density in g / cm^3	about 6.0	5.9
melting point	lower than 40 °C	29.8 °C
density of oxide in g / cm^3	about 5.5	5.9

Figure 5

Describe how Mendeleev predicted these properties of gallium.

(2)

A description including:

• compared to the elements in same {group / period} (1)

• (and used the) {trend/pattern} going {down the group / across a period} (1)

(Total for Question 3 = 10 marks)

4 (a) 3.14 g of solid copper sulfate was dissolved in water and made up to 250 cm^3 of solution.

$$\text{concentration (g dm}^{-3}) = \frac{\text{mass of solid (g)}}{\text{volume of solution (dm}^3)}$$

Calculate the concentration of this copper sulfate solution in g dm^{-3}.

(2)

$\frac{3.14}{250}$ (1) (= 0.01256)

0.01256 x 1000 (1) (= 12.56)

concentration = 12.56 g dm^{-3}

(b) Sodium hydroxide solution was added to a solution of copper sulfate.
A precipitate of copper hydroxide and a solution of sodium sulfate were formed.

(i) State what would be **seen** in the reaction.

(1)

solid (forms) / (goes) cloudy / {solution/ liquid/ mixture} will go colourless

(ii) Complete the balanced equation for the reaction by adding a number in front of NaOH.

(1)

2 $NaOH + CuSO_4 \rightarrow Cu(OH)_2 + Na_2SO_4$

(iii) Describe how to obtain a pure, dry sample of the precipitate of copper hydroxide from the reaction mixture.

(3)

- filter (1)
- (residue is) rinsed / washed / has distilled water added (1)
- leave in warm place / put in oven (1)

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(c) Figure 6 shows the equipment used to electrolyse a sample of sodium sulfate solution.

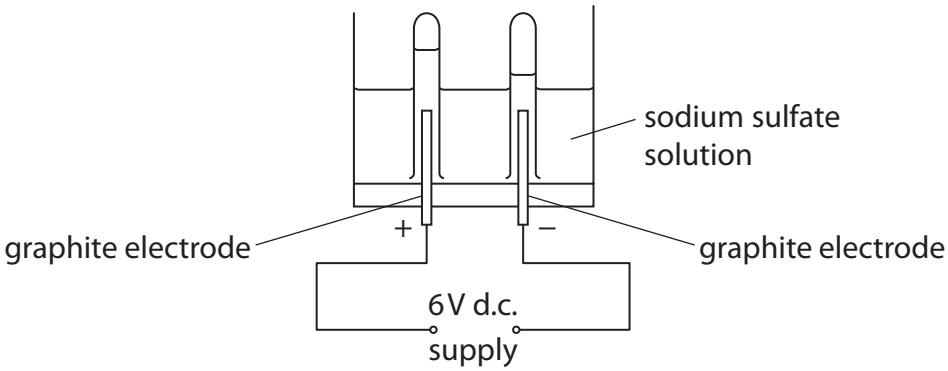

Figure 6

Graphite electrodes are used in the electrolysis of sodium sulfate solution. Graphite is used because it is inert and conducts electricity.

(i) Figure 7 shows the ions in the sodium sulfate solution.

Draw a circle around each of the ions in Figure 7 that are attracted to the negative graphite electrode during the electrolysis.

(1)

Figure 7

(ii) State why it is important that the electrodes are inert.

(1)

so that they do not react (with the electrolyte/sodium sulfate solution / products formed)

(iii) Explain, in terms of its structure, how graphite conducts electricity.

(2)

An explanation linking:
- electrons (1)
- move (through graphite) / are {delocalised / free / sea of electrons} (1)

(Total for Question 4 = 11 marks)

5 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

(a) The equation for the reaction is

$$Ba(OH)_2(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$$

Which row of the table shows the correct state of each of the substances in the equation for the reaction?

(1)

		barium hydroxide	hydrochloric acid	barium chloride	water
☒	**A**	solid	aqueous	aqueous	liquid
☒	**B**	solid	liquid	solid	aqueous
☒	**C**	aqueous	aqueous	solid	liquid
☒	**D**	aqueous	liquid	aqueous	aqueous

(b) A student wanted to investigate how the pH of the mixture changes as barium hydroxide is added to dilute hydrochloric acid.

They followed this method.

step 1 measure out 50.0 cm^3 of dilute hydrochloric acid into a beaker using a measuring cylinder

step 2 use a glass rod to place a drop of the acid onto a piece of universal indicator paper and record the pH

step 3 add 0.2 g of barium hydroxide to the acid in the beaker and stir

step 4 use the glass rod to place a drop of the mixture onto a new piece of universal indicator paper and record the pH again

step 5 repeat steps 3–4 until there is no further change in the pH.

(i) Name a piece of equipment which could be used to measure out 50.0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.

(1)

burette / (volumetric/graduated) pipette

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(ii) Describe how the pH of the mixture is determined when a drop of it is placed on the universal indicator paper.

(2)

A description to include

• (observe / look at) colour produced on (universal indicator) paper (1)

• compare to pH {chart / scale} (1)

(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment.

(2)

An explanation linking

• litmus paper only shows if the solution is {acidic / alkaline} (1)

• does not show how acidic or alkaline the solution is (1)

(iv) Figure 8 shows the student's results.

mass of barium hydroxide in g	pH of mixture
0.0	1
0.2	1
0.4	1
0.6	1
0.8	2
1.0	7
1.2	12
1.4	13
1.6	13

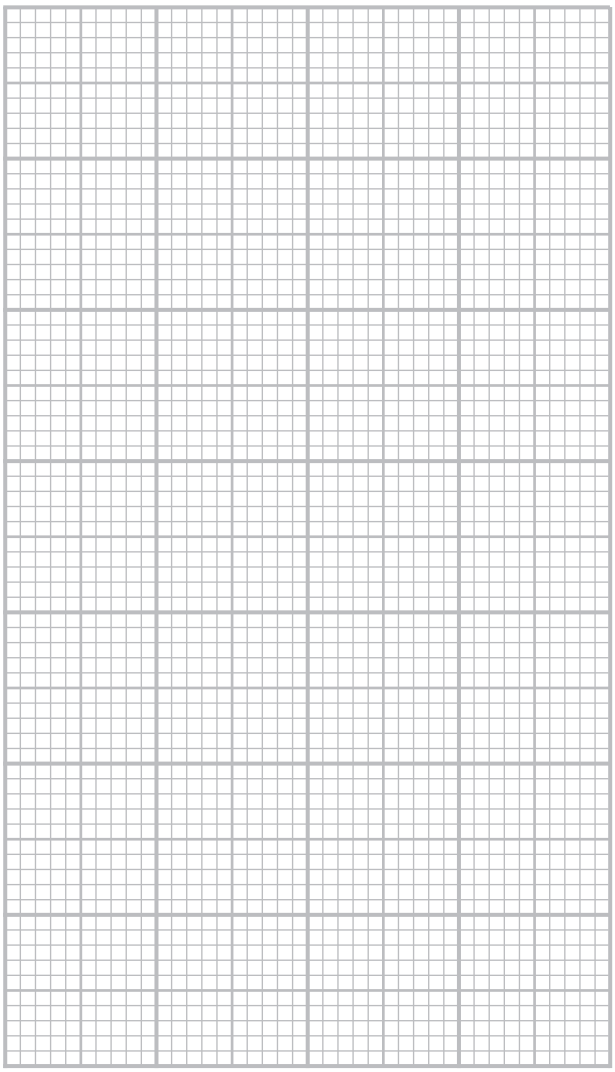
Figure 8

On the grid opposite:

- Add suitable scales to the vertical and horizontal axes.
- Plot a graph of the pH of the mixture against the mass of barium hydroxide.

(3)

pH of
the mixture



mass of barium hydroxide in g

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(c) Figure 9 shows a hazard symbol placed on a container of barium hydroxide.

Figure 9

(i) What is the meaning of the hazard symbol in Figure 9?

(1)

- ☒ **A** flammable
- ☒ **B** health hazard
- ☒ **C** oxidising
- ☒ **D** toxic

(ii) Barium hydroxide is also corrosive.

Give **one** precaution that the student should take when using barium hydroxide.

(1)

(safety) goggles / gloves

(Total for Question 5 = 11 marks)

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6 Magnesium carbonate has the formula $MgCO_3$.

(a) Magnesium carbonate contains Mg^{2+} and CO_3^{2-} ions.

(i) The atomic number of magnesium is 12.

What is the electronic configuration of the Mg^{2+} ion?

(1)

☒ **A** 2

☒ **B** 2.8

☒ **C** 2.8.2

☒ **D** 2.8.4

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can.

(3)

An explanation linking

• ions (in magnesium carbonate) {cannot move / in a fixed position / held in a lattice / held together by strong electrostatic forces} (1)

• magnesium contains {delocalised/free} electrons (1)

• electrons (in magnesium) can {flow / move} / are mobile (1)

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

MP1 – relative formula mass MgCO3

24.0 + 12.0 + 3x16.0 (1) (= 84.0)

MP2 – division

24(.0) / 84(.0) (= 0.28571429)

MP3 – conversion to percentage

(0.28571429) x 100

(= 28.57 / 28.6 / 29) (1)

percentage by mass of magnesium = ...

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.

(6)

magnesium carbonate

• bubbles / fizzing / effervescence

• magnesium carbonate gets smaller / disappears (allow 'dissolves')

• metal carbonate + acid ----> metal salt + carbon dioxide + water

• magnesium carbonate + sulfuric acid -----> magnesium sulfate + carbon dioxide + water

• therefore, gas is carbon dioxide

• test using limewater

• limewater will turn cloudy

magnesium

• bubbles / fizzing / effervescence

• metal gets smaller / disappears (allow 'dissolves')

• gas is hydrogen

• metal + acid ---> salt + hydrogen

• test gas with a lit splint

• (lit splint) burns with a squeaky pop

• magnesium + sulfuric acid ----> magnesium sulfate + hydrogen

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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.