Please check the examination details below before entering your candidate information

Candidate surname	Other names

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

Centre Number | Candidate Number

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 the question 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.
- Good luck with your examination.

Turn over ▶

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 If liquid water is cooled below 0 °C it turns into the solid, ice.

(a) (i) Give the name for the change of state from liquid to solid.

(1)

freezing / solidifying / solidification

(ii) Here are five statements about ice and water.

Place ticks in boxes by the **two** statements that are correct.

(2)

the molecules move faster in water than in ice	✓
the molecules are more randomly arranged in ice than in water	
the molecules start moving when water becomes ice	
the molecules are arranged regularly in ice but not in water	✓
the molecules have more energy in ice than in water	

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(b) Figure 1 shows a label from a bottle of drinking water.

Pure drinking water	
Mass of dissolved solids in mg per 1000 cm^3	
calcium ions	60
sodium ions	2
hydrogencarbonate ions	200
pH of water	
pH	7

Figure 1

(i) Explain why this drinking water should not be described as pure water. **(2)**

An explanation linking
• pure water contains {only water (molecules)/ only one substance} / impure water contains more than one substances (1)
• identification from label of impurity: dissolved solids/ calcium (ions) / sodium (ions) / hydrogencarbonate (ion) / ions

(ii) State the information from Figure 1 that shows that the drinking water is neutral. **(1)**

pH (=7)

(iii) Calculate the mass of calcium ions in 250 cm^3 of this drinking water. **(2)**

250/1000 (1) (=0.250) • 60 x 250/1000 (1) (=15)
OR
• 1000/250 (1) = 4 • 60/4 (1) (=15)

mass = 15 mg

(c) State how you know that calcium is a metal from its position in the periodic table. **(1)**

It is on left / in group 2 / column 2

(Total for Question 1 = 9 marks)

2 (a) When chromium reacts with oxygen, chromium oxide is formed.

(i) Write the word equation for this reaction.

(1)

chromium + oxygen ------> → chromium oxide

(ii) What type of reaction occurs when chromium reacts with oxygen?

(1)

☐ **A** condensation

☐ **B** evaporation

☐ **C** neutralisation

☒ **D** oxidation

(iii) Calculate the relative formula mass of chromium oxide, Cr_2O_3.

(relative atomic masses: O = 16, Cr = 52)

(2)

(52 x 2) + (16 x 3) (1)

= 152 (1)

relative formula mass = 152

(b) Three different metals are added to separate test tubes of acid.

The observations are shown in Figure 2.

metal	observation
silver	no change is seen
iron	very slow bubbling
magnesium	steady bubbling

Figure 2

(i) Place the metals in order of reactivity from most to least reactive.

(1)

most reactive magnesium

iron

least reactive silver

(ii) Hydrogen is given off when magnesium reacts with acid.
The hydrogen is tested by collecting the gas in a test tube and igniting it.

What is the safest way to ignite the gas?

(1)

- ☐ **A** add fuel to the test tube
- ☐ **B** heat the test tube with a Bunsen burner
- ☒ **C** put a lighted splint at the open end of the test tube
- ☐ **D** put the test tube in an oven

(iii) State the observation made in this test that shows that the gas is hydrogen.

(1)

(squeaky) pop / flame

(c) Iron is extracted by heating iron oxide with carbon.
Electrolysis of molten iron oxide is not used to extract iron.

(i) State why iron can be extracted by heating iron oxide with carbon.

(1)

iron is less reactive (than carbon) ORA

(ii) State why electrolysis is **not** used to extract iron.

(1)

electrolysis is expensive/ more expensive method than heating with carbon/ heating with carbon is cheaper/ electrolysis needs a large amount of electricity

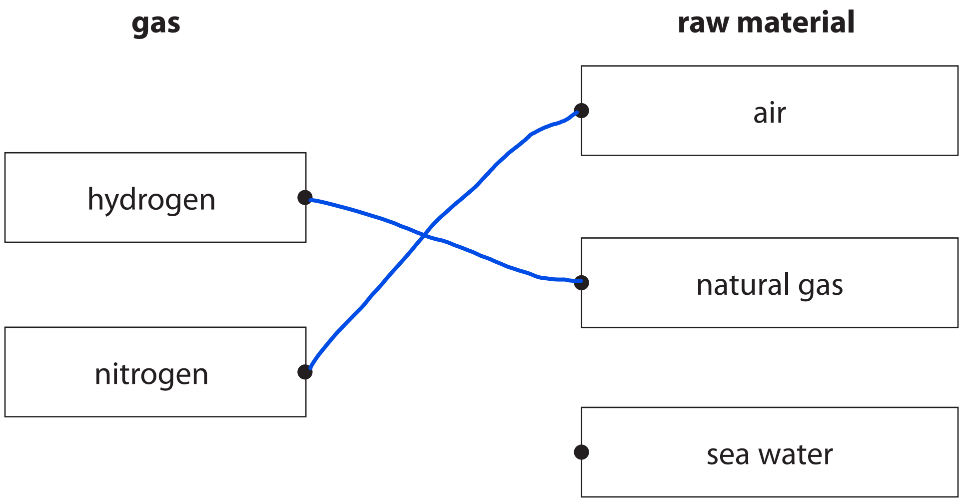
(Total for Question 2 = 9 marks)

3 Ammonia is made by reacting nitrogen with hydrogen.

(a) The nitrogen and hydrogen are obtained from raw materials.

Draw one straight line from each gas to the raw material it is obtained from.

(2)



(b) When nitrogen and hydrogen are reacted together, the reaction can reach a dynamic equilibrium.

Use words from the box to complete the sentences about dynamic equilibrium.

(2)

backward	different	equal	faster	reversible

In a dynamic equilibrium two reactions occur at the same time.

These are the forward reaction and the backward (1) reaction.

The rates of the two reactions are equal (1) .

(c) The reaction between nitrogen and hydrogen happens at a pressure of 200 atmospheres.

Another unit of pressure is Pascals, Pa (1 atmosphere = 101 325 Pa).

Calculate the value of 200 atmospheres in Pascals.

(2)

101325 x 200 (1)

= 20265000 (Pascals) (1)

pressure = ... Pa

(d) Figure 3 shows molecules of nitrogen, hydrogen and ammonia before the reaction and at equilibrium.

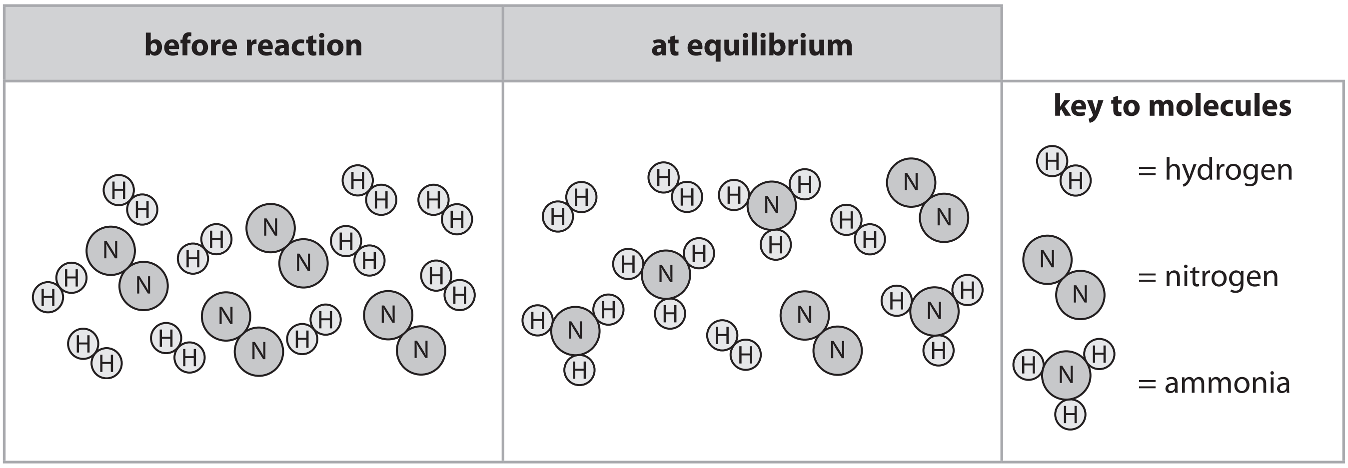


Figure 3

(i) Complete the table showing

- the number of hydrogen molecules before reaction
- the number of hydrogen molecules at equilibrium
- the change in the number of hydrogen molecules.

(1)

	number of molecules before reaction	**number of molecules at equilibrium**	**change in number of molecules**
nitrogen	4	2	−2
hydrogen	10	4	-6
ammonia	0	4	+4

(ii) Complete the equation for this reaction.

(2)

N2 + 3 H2 $\rightleftharpoons$ 2 NH_3

(Total for Question 3 = 9 marks)

4 (a) Hydrochloric acid reacts with solid **B**.
Solid **B** is an alkali.

A student carries out an experiment to see how the pH changes when different masses of solid **B** are added to dilute hydrochloric acid.

The student uses the following method.

step 1 use a measuring cylinder to measure out 100 cm^3 of dilute hydrochloric acid

step 2 pour the acid into a beaker

step 3 measure the pH with a pH probe

step 4 add half a spatula of solid **B** and stir

step 5 repeat steps 3 and 4 until the pH stops changing.

(i) Give a safety precaution that should be taken during the experiment.

(1)

wear safety goggles/ gloves

(ii) Give an improvement to step 4 that would produce more accurate results.

(1)

Measure mass of solid/ use a specified mass of solid

(iii) What is the most likely change in pH during the experiment?

(1)

☐ **A** from 1 to 7

☒ **B** from 1 to 12

☐ **C** from 7 to 12

☐ **D** from 12 to 1

(iv) If some methyl orange indicator is added to the acid in step 2, the mixture changes colour during the experiment.

State the colour change.

(2)

colour at start in acid red/pink (1) colour at end yellow (1)

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(b) Concentrated hydrochloric acid can be broken down using electricity.
The apparatus that can be used is shown in Figure 4.

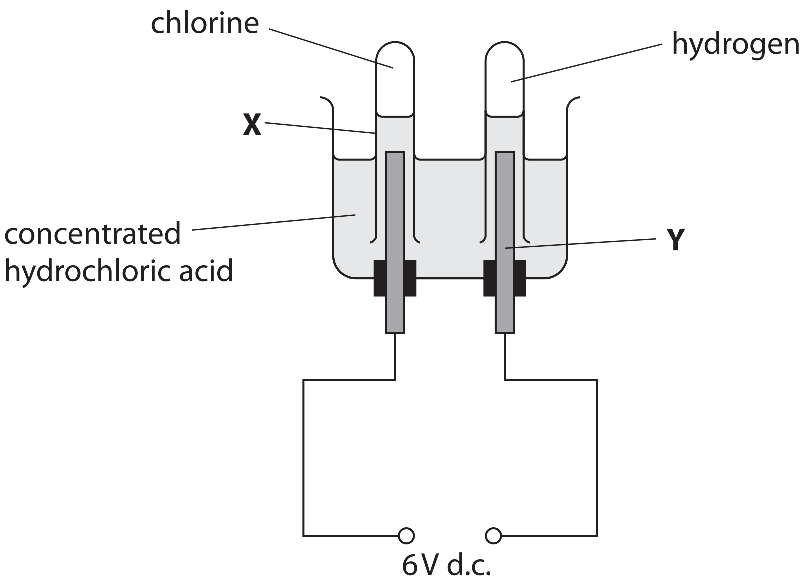

Figure 4

(i) Give the name of the piece of apparatus labelled **X**.

(1)

test tube/ boiling tube

(ii) The rod labelled **Y** in Figure 4 is made of graphite.

What is the name of this piece of apparatus?

(1)

☒ **A** electrode

☐ **B** electrolysis

☐ **C** electrolyte

☐ **D** electron

(iii) Give **one** reason why graphite is a suitable material to make **Y**.

(1)

it conducts (electricity)/ is inert

(iv) Complete the balanced equation for the reaction that occurs.

(1)

2 HCl $\rightarrow$ H_2 + Cl_2

(Total for Question 4 = 9 marks)

5 The scientist John Dalton lived over 200 years ago.

(a) John Dalton suggested an early model of atoms.

When Dalton first described atoms he said that

- all elements are made of atoms
- atoms are not formed of any smaller particles
- all atoms of the same element are identical.

Give two differences between Dalton's model of atoms and today's model of atoms.

(2)

1 Any two from (in modern model)

• atoms are formed of sub-atomic particles (1)

2

• atoms have a nucleus (1)

•

(b) Dalton also investigated different gases.

One of the gases that Dalton investigated was ethene.

The structure of one molecule of ethene is shown in Figure 5.

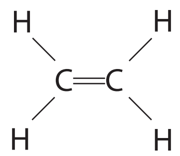

Figure 5

Give the molecular formula and the empirical formula of ethene.

(2)

molecular formula C_2H_4 (1)

empirical formula CH_2 (1)

(c) Another gas that Dalton investigated was chlorine.

Chlorine gas reacts with water.
The two products are a solution of hydrogen chloride and the substance HClO.

(i) Complete the balanced equation for this reaction, including the three missing state symbols.

(3)

Cl2 ((g)) + H2O ((l)) ⇌ HCl ((aq)) + HClO (aq)

(ii) Hydrogen chloride solution is acidic.

The formulae of four ions are shown in Figure 6.

H^+	H^-	Cl^+	Cl^-

Figure 6

Give the formula of the ion in Figure 6 that causes the hydrogen chloride solution to be acidic.

(1)

formula H+

(iii) An acid reacts with an alkali.

Give the name of this type of reaction.

(1)

neutralisation

(iv) Describe what you would **see** when some copper carbonate powder is added to a beaker of dilute sulfuric acid.

(2)

A description including any two from: \

• powder disappears (1)

• effervescence/ bubbles/ fizzing (1)
• blue solution forms (1)

(Total for Question 5 = 11 marks)

6 (a) A sample of potable water contains impurities.

Why is this sample of water potable even though it contains impurities?

(1)

- ☐ **A** the impurities have no smell
- ☐ **B** the impurities are colourless
- ☒ **C** the impurities are harmless
- ☐ **D** the impurities are soluble

(b) Waste water can be used to produce drinking water.
The processes used include sedimentation, filtration and chlorination.

(i) What is sedimentation?

(1)

- ☐ **A** the waste water is heated so the impurities evaporate
- ☐ **B** the waste water has an acid added to remove impurities
- ☒ **C** the impurities in the waste water settle to the bottom of their container
- ☐ **D** the impurities in the waste water are bleached

(ii) State why the waste water is filtered.

(1)

to remove {insoluble substances / solids}

(iii) State the reason for chlorination.

(1)

to kill {bacteria / microorganisms}

(c) Some salts can be added to waste water to remove impurities.
In an experiment, different masses of salt **A** were added to 1000 cm^3 samples of waste water.
The experiment was repeated with salt **B**.
The percentages of impurities removed from the waste water are shown in Figure 7.

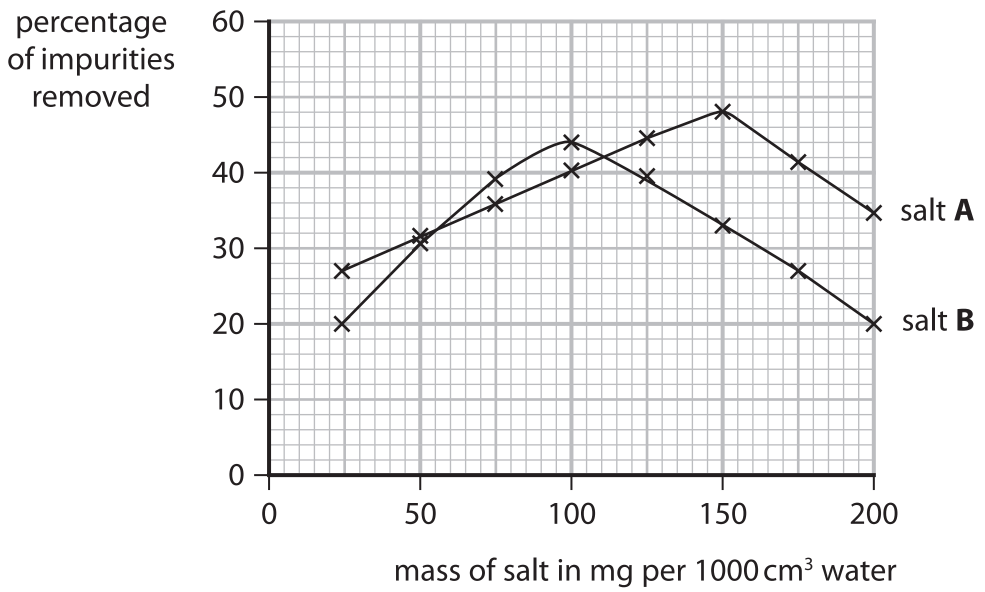

Figure 7

It was concluded that the best way to purify 1000 cm^3 of the waste water is to add 100 mg of salt **B**.

Use the information about salt **A** and salt **B** in Figure 7 to evaluate this conclusion.

(3)

best amount of A is 150 (mg) (1)
• 150 mg A removes more than 100 (mg) B (1)
• so it is better to use salt A than salt B (1)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA *(d) A sample of water was contaminated with a dissolved solid.

Devise a plan to separate pure water from this mixture, including a test to show that the water obtained is neutral.

You may use some or all of the apparatus shown in Figure 8 and any other laboratory apparatus.

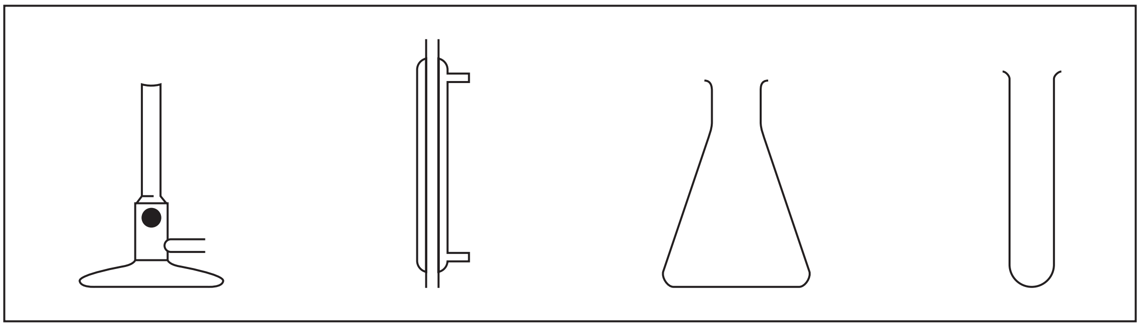

Figure 8

(6)

SEPARATION
- distillation
- solution in flask
- heat
- water evaporates
- water vapour into condenser
- cooling water jacket
- water vapour condensed back to liquid
- water collected in beaker
- solid remains in flask
- boiling point = 100 °C

TEST

- take distilled water in a test tube
- add a few drops of neutral litmus/Universal Indicator
- correct neutral colour

OR
- pH probe
- pH = 7

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

The periodic table of the elements

Key

Key
relative atomic mass **atomic symbol** name atomic (proton) number

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

**** 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.