Write your name here

Surname	Other names

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

Centre Number | | | | | |

Candidate Number | | | | |

Combined Science

Paper 3: Chemistry 1

Higher Tier

Thursday 17 May 2018 – Morning
Time: 1 hour 10 minutes

Paper Reference
1SC0/1CH

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.
- A periodic table is printed on the back cover of this 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 ▶

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1/

P 5 9 1 7 7 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 (a) Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)

Squeaky pop test
Lit splint over test tube of suspected hydrogen and if squeaky pop then hydrogen present

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

It loses 2 electrons during oxidation

Ni => Ni + 2e

(b) A nickel sulfate solution is made by dissolving 23.5 g of nickel sulfate to make 250 cm^3 of solution.

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

(2)

23.5 / 250 = 0.094
0.094 * 1000 = 94 g/dm3

concentration = 94 g dm^{-3}

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(c) Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

$$\text{nickel carbonate} + \text{sulfuric acid} \rightarrow \text{nickel sulfate} + \text{carbon dioxide} + \text{water}$$

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

Filter the solution through filter paper into a conical flask
Fill an evaporation basin with the filtrate
Leave to evaporate over a few days
Dab with a paper towel to ensure dry

(Total for Question 1 = 9 marks)

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2 Most metals are extracted from ores found in the Earth's crust.

The method used to extract a metal from its ore is linked to the reactivity of the metal.

Part of the reactivity series is shown in Figure 1.

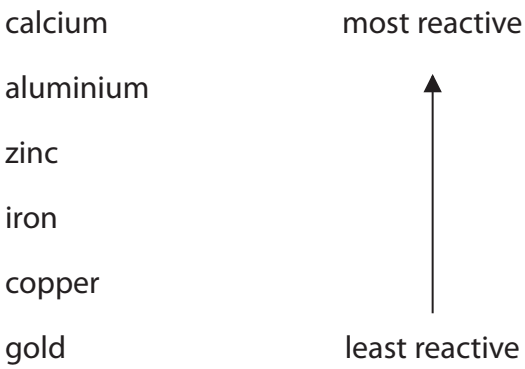

Figure 1

(a) Iron ore contains iron oxide.

Iron is extracted from iron oxide by heating the oxide with carbon.

$$\text{iron oxide} + \text{carbon} \rightarrow \text{iron} + \text{carbon dioxide}$$

(i) In this reaction

(1)

☒ **A** carbon is reduced

☒ **B** iron oxide is neutralised

☒ **C** iron oxide is reduced

☒ **D** iron is oxidised

(ii) The formula of the iron oxide is Fe_2O_3.

Calculate the maximum mass of iron that can be obtained from 240 tonnes of iron oxide, Fe_2O_3.

(relative atomic masses: O = 16, Fe = 56)

(3)

2*56 + 3*16 = 160
240/160 = 1.5
1.5*112 = 168

mass of iron = ... tonnes

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(b) Aluminium cannot be extracted by heating its oxide with carbon.
Aluminium has to be extracted from its oxide by electrolysis.

Explain why.

(2)

Aluminium is more reactive than carbon therefore cannot be reduced by carbon

(c) Predict the method that will have to be used to extract calcium from its ore.

(1)

electrolysis

(d) In recent years, researchers have been investigating alternative methods of extracting metals from soils.

Researchers have found that growing certain plants in appropriate areas can result in the phytoextraction of copper.

Describe how growing plants can result in the phytoextraction of copper.

(2)

(Total for Question 2 = 9 marks)

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3 (a) Which of the following substances will be a solid at 20 °C and will melt when placed in a beaker of hot water at 80 °C?

(1)

	melting point in °C	boiling point in °C
☒ **A**	122	249
☒ **B**	–7	59
☒ **C**	30	2403
☒ **D**	–32	27

(b) A student set up the apparatus shown in Figure 2 to obtain pure water from sea water by distillation.

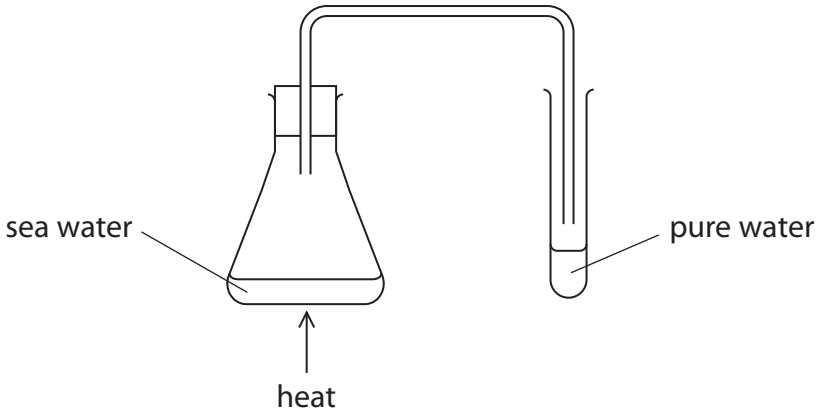

Figure 2

(i) Explain how the water in sea water separates to produce the pure water in this apparatus.

(2)

water evaporates to form steam which leaves the salt behind and then the steam condenses to form pure water

(ii) Explain how the apparatus could be improved to increase the amount of pure water collected from the same volume of sea water.

(2)

To increase the amount of pure water collected, use a Liebig condenser to cool the steam more efficiently, ensuring more condensation.

(c) A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 3.

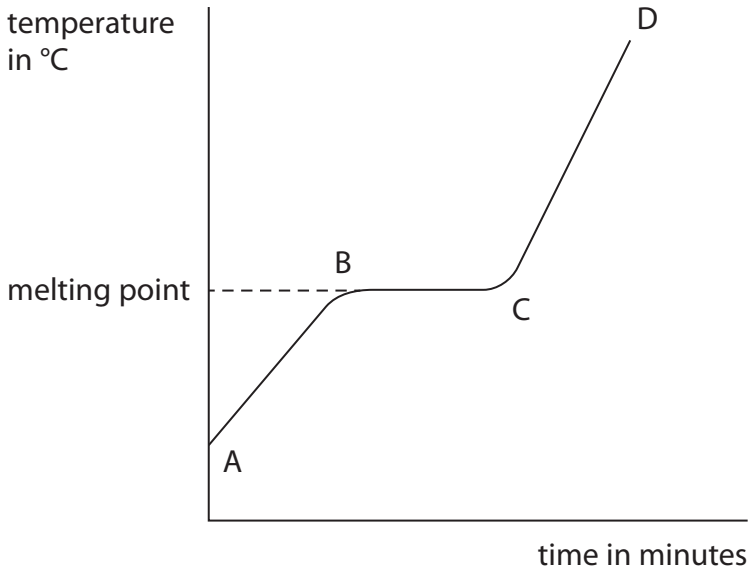

Figure 3

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

A-B: Temp rises as particles gain kinetic energy and vibrate more

B-C: Temp stays constant because energy breaks intermolecular bonds, changing the movement from fixed free moving (solid -> liquid), while particle movement increases

C-D: Temperature rises again as particles move faster in a less ordered arrangement

(Total for Question 3 = 9 marks)

4 (a) Molten zinc chloride is an electrolyte.

(i) Which row shows the products formed at the anode and at the cathode when molten zinc chloride is electrolysed?

(1)

		product at anode	product at cathode
☒	**A**	oxygen	zinc
☒	**B**	chlorine	hydrogen
☒	**C**	chlorine	zinc
☒	**D**	oxygen	hydrogen

(ii) Which of the following is the reason why molten zinc chloride is an electrolyte?

(1)

☒ **A** it contains molecules that can move

☒ **B** it has a giant structure

☒ **C** it contains delocalised electrons

☒ **D** it contains ions that can move

(b) Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

(2)

(ii) Before the electrolysis, the masses of the electrodes were determined. After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 4 shows these masses and the resulting changes in masses of the electrodes.

	mass of electrode before electrolysis in g	mass of electrode after electrolysis in g	change in mass of electrode in g
anode	11.27	10.42	−0.85
cathode	11.32	12.17	+0.85

Figure 4

Explain these results.

(4)

(c) When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

(Total for Question 4 = 10 marks)

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5 Covalent substances can be simple molecular covalent or giant covalent.

(a) (i) Ammonia is a simple molecular, covalent substance.

Which is the most likely set of properties for ammonia?

(1)

	melting point in °C	boiling point in °C	ability to conduct electricity in liquid state
☒ **A**	1713	2950	does not conduct
☒ **B**	–78	–33	does not conduct
☒ **C**	–39	357	conducts
☒ **D**	801	1413	conducts

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

(b) Oxygen, O_2, is also a simple molecular, covalent substance.

Draw a dot and cross diagram for the molecule of oxygen.

(2)

*(c) Figure 5 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).

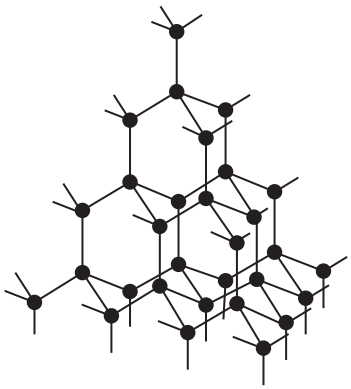	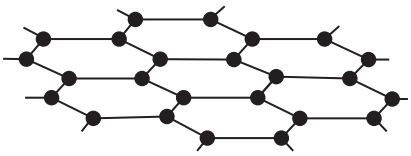	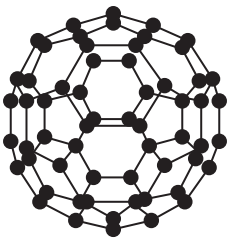
diamond	graphene	a fullerene, C_{60}

Figure 5

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

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(Total for Question 5 = 11 marks)

6 (a) A student placed a piece of metal **P** in a test tube containing excess dilute sulfuric acid.
The student repeated this with three other metals, **Q**, **R** and **S**.
All the pieces of all four metals were the same size.

(i) The student recorded the observations until each metal had reacted with the acid for two minutes.
The observations are shown in Figure 6.

metal	observations
P	bubbles produced very slowly some metal remained
Q	bubbles produced quickly no metal remained
R	bubbles produced slowly no metal remained
S	bubbles produced very quickly no metal remained

Figure 6

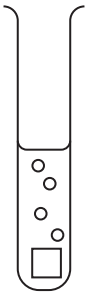
Use this information to put the four metals in order of reactivity from the least reactive to the most reactive.

(2)

least reactive | | | | | **most reactive**

(ii) Complete the diagram below to show how the student could add to the apparatus to measure the volume of gas produced in the two minutes.

(2)



(b) When iron reacts with copper sulfate solution, solid copper is formed.

Two possible equations for this reaction are

A $CuSO_4 + Fe \rightarrow Cu + FeSO_4$
B $3CuSO_4 + 2Fe \rightarrow 3Cu + Fe_2(SO_4)_3$

It was found that 10.00 g of iron powder reacted with excess copper sulfate solution to produce 11.34 g of copper.

Carry out a calculation to decide which equation, **A** or **B**, represents the reaction taking place.
(relative atomic masses: Fe = 56.0, Cu = 63.5)

(2)

.....

.....

.....

.....

(c) Acid solutions contain hydrogen ions.

Aluminium reacts with dilute hydrochloric acid to form a solution containing aluminium ions, Al^{3+}.

Complete the balanced ionic equation for this reaction.

(2)

..... + ... H^+ → ..... Al^{3+} + ...

(d) The hydrogen ion concentration in a solution is decreased by a factor of 10.

State how the pH of this solution changes.

(1)

.....

(e) Calculate the mass, in g, of a hydrogen atom, using the data below.
(relative atomic mass: H = 1.00;
Avogadro constant = 6.02×10^{23})

(3)

.....

.....

.....

.....

.....

.....

mass of hydrogen atom = ...g

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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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.