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

Thursday 14 May 2020

Morning (Time: 1 hour 10 minutes) | Paper Reference **1SC0/1CH**

Combined Science
Paper 2
Higher 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 ▶

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 apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

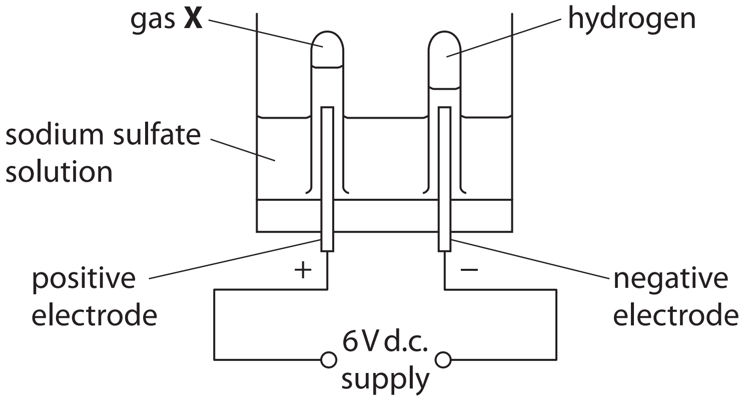

Figure 1

(a) Hydrogen is produced at the negative electrode during electrolysis.

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

(2)

apply lighted splint (1)
• gas burns / (squeaky) pop

(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

☐ **A** ammonia

☒ **B** oxygen

☐ **C** nitrogen

☐ **D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

electrical energy / electricity
• {decomposes / breaks down / splits} {electrolytes / (ionic)

(b) The sodium sulfate solution was made by dissolving 28.4 g of sodium sulfate in water to make 250 cm^3 of solution.

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

Give your answer to three significant figures.

(3)

final answer of 114 (g dm-3) with
or without working
OR
28.4 (1) (= 0.1136)
250
0.1136 x 1000 (1) (= 113.6)

concentration = ... g dm^{-3}

(c) The ions present in sodium sulfate are

sodium	Na^+
sulfate	SO_4^{2-}

Write the formula of sodium sulfate using this information.

(1)

Na2SO4

(Total for Question 1 = 9 marks)

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2 The word equation for the reaction between copper carbonate and dilute sulfuric acid is

copper carbonate + sulfuric acid → copper sulfate + carbon dioxide + water

(a) (i) Complete the balanced equation for this reaction.

(2)

$CuCO_3$ + H2SO4 → CuSO4 + CO_2 + H_2O

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

63.5 + 12 + 3x16
= 123.5

relative formula mass of $CuCO_3$ = ...

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

☒ **A** bubble the gas through limewater, limewater turns cloudy

☐ **B** put damp blue litmus paper in the gas, litmus paper turns red

☐ **C** put a lighted splint into the gas, the splint is extinguished

☐ **D** measure the pH of the gas, pH = 4

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(b) Figure 2 shows a conical flask containing dilute sulfuric acid.
Copper carbonate is added to the acid in the flask.
The copper carbonate is added one spatula measure at a time until the reaction has finished.

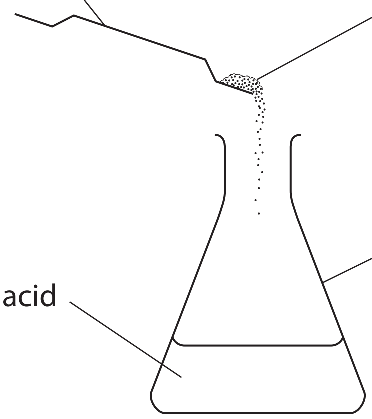

Figure 2

State **two** observations that would show the reaction has finished.

(2)

1 no more bubbles / fizzing (1)

2

(c) The electronic configuration of carbon is 2.4
The electronic configuration of oxygen is 2.6

Draw a dot and cross diagram for a molecule of carbon dioxide.

Show outer electrons only.

(2)

CO2 with one correct double bond (1)
• rest of structure correct

(Total for Question 2 = 9 marks)

3 (a) A sample of rock salt contains a mixture of sodium chloride and some insoluble substances.

The rock salt is added to water and the mixture stirred.

The mixture is then filtered to obtain a filtrate of sodium chloride solution.

(i) Draw a labelled diagram of the apparatus used to filter the mixture and collect the sodium chloride solution.

(2)

diagram: funnel with separate filter paper and (conical) flask

labels: (filter) funnel and filter

(ii) Describe how a sample of pure, dry sodium chloride crystals can be obtained from the filtrate.

(3)

heat solution (to concentrate)
then either
• leave solution {in warm place / to crystallise}
• scrape crystals (from container) /

(b) Inks contain coloured dyes.
Samples of four inks, **W**, **X**, **Y** and **Z**, were separated using paper chromatography.
Figure 3 shows the chromatogram obtained.

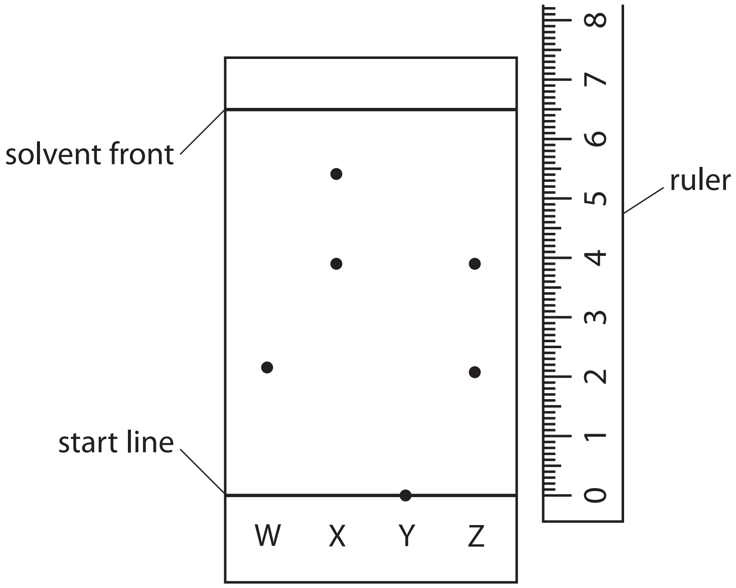

Figure 3

(i) In the experiment, the solvent front moved 6.5 cm.
Calculate the R_f value of the dye that is present in both inks **X** and **Z**.

(1)

0.6

R_f = ...

(ii) State what could be changed in the experiment to make the R_f value more accurate.

(1)

longer paper/ different {medium/ paper}

(iii) In this experiment, ink sample **Y** did not move from the start line.
Explain a change to the experiment that would be needed to separate the dyes in ink sample **Y**.

(2)

use a different solvent
so that the ink will dissolve

(Total for Question 3 = 9 marks)

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4 Titanium and iron are examples of transition metals.

(a) Figure 4 shows the percentage abundance of each isotope in a sample of titanium.

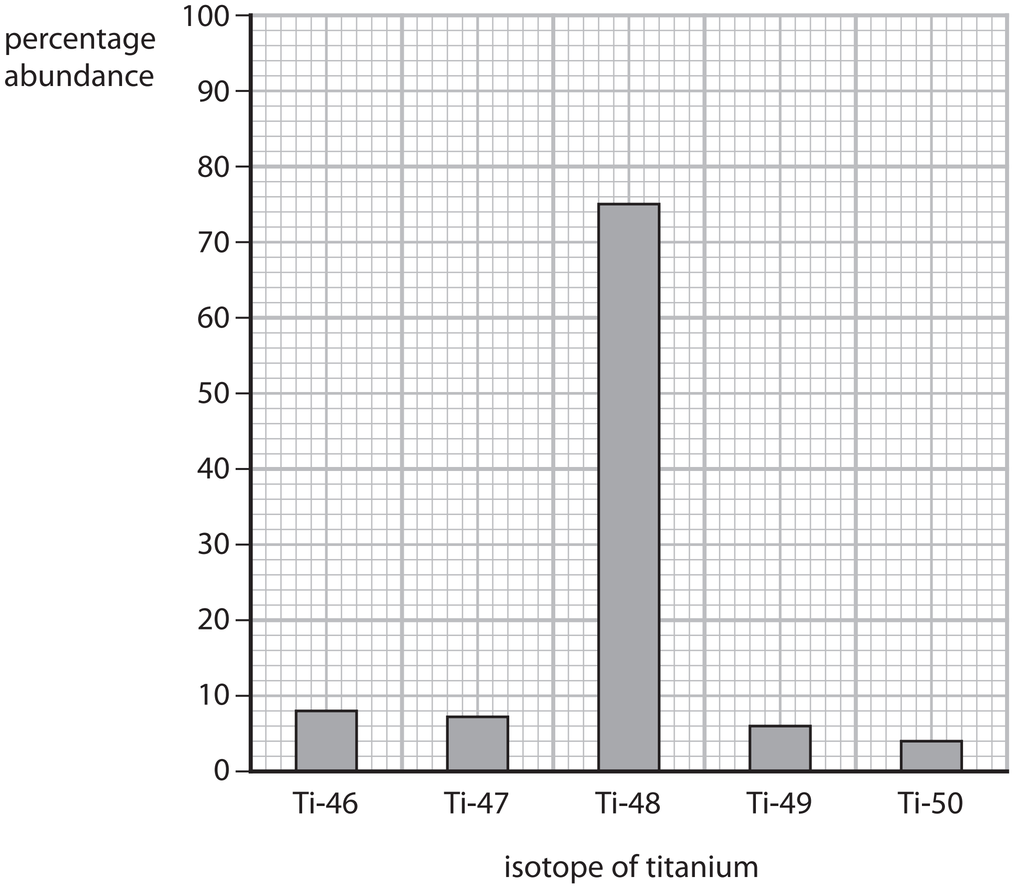

Figure 4

Calculate the relative atomic mass of titanium in this sample.

(3)

final answer of 47.91 / 47.9 with or without working

All percentages given as:

Ti–46 = 8
Ti–47 = 7
Ti–48 = 75
Ti–49 = 6
Ti–50 = 4 (1)

46 x 8 = (368)
47 x 7 = (329)
48 x 75 = (3600)
49 x 6 = (294)
50 x 4 = (200)
(= 4791) (1)

$\frac{4791}{100} = 47.91$

relative atomic mass = ...

(b) Iron, when heated in air, reacts with oxygen to form iron oxide.

(i) This reaction is an example of

(1)

☐ **A** crystallisation

☐ **B** distillation

☐ **C** neutralisation

☒ **D** oxidation

(ii) The equipment shown in Figure 5 can be used to find the mass of oxygen that combines with iron.

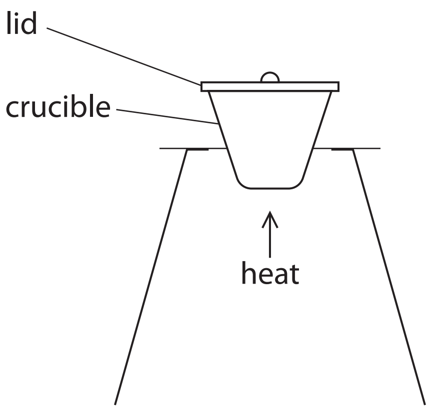

Figure 5

Describe how the equipment shown in Figure 5 could be used to find the mass of oxygen that combines with 0.500 g of iron wool in a crucible and lid of known mass.

(3)

lift lid from time to time/ leave small gap between crucible and lid
• find mass (of crucible, lid and product)

(c) 2.24 g of iron combines with 0.96 g of oxygen to form an oxide of iron.

Determine the formula of this oxide of iron and use it to complete the balanced equation.

(relative atomic masses: Fe = 56.0, O = 16.0)

You must show your working.

(4)

2.24 = 0.04 and 0.96 = 0.06 (1)
56.0 16.0
1 : 1.5 / 2 : 3

balanced equation for the reaction is

4 Fe + 3 $O_2 \rightarrow$ Fe2O3

(Total for Question 4 = 11 marks)

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Turn over

5 (a) Calcium has an atomic number of 20.
A calcium atom has a mass number of 40.

(i) Which row of the table shows the number of protons and number of neutrons in this atom of calcium?

(1)

		number of protons	number of neutrons
☒	**A**	20	20
☐	**B**	40	20
☐	**C**	20	60
☐	**D**	60	20

(ii) Figure 6 shows the arrangement of electrons in an atom of calcium.

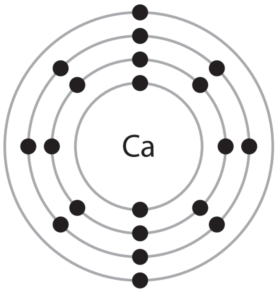

Figure 6

Explain, using the information in Figure 6, in which period of the periodic table calcium can be found.

(2)

period 4
• four shells of electrons

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(b) Calcium and potassium react with water in similar ways.

(i) One similarity in the reactions is that hydrogen gas is produced.

State **one** other similarity in the products of the reactions of calcium and potassium with water.

(1)

Both form hydroxide

(ii) Potassium is higher in the reactivity series than calcium and reacts more vigorously with water than calcium reacts with water.

State why potassium is higher in the reactivity series and reacts more vigorously with water than calcium.

(1)

potassium {forms cations / loses (outer) electron} more easily ORA *(c) Calcium chloride can be prepared by the reaction of calcium with chlorine gas.

Figure 7 shows some properties of calcium, chlorine and calcium chloride.

substance	relative melting point	ability to conduct electricity	
		when solid	when molten
calcium	high	good	good
chlorine	low	poor	poor
calcium chloride	high	poor	good

Figure 7

Explain, in terms of bonding and structure, why the properties of the product, calcium chloride, are different from the properties of the reactants, calcium and chlorine.

(6)

STRUCTURE
• calcium chloride is an ionic compound with lattice of positive and negative ions
• calcium is a metal and so has a metallic structure of delocalised electrons and {calcium/Ca2+ ions}
• chlorine is a simple molecular covalent compound
MELTING POINT
• there are strong electrostatic forces of attraction/ionic bonds between the ions in calcium chloride
• a large amount of heat energy is required to break the electrostatic forces (so calcium chloride has a high melting point)
• strong electrostatic forces between ions and delocalised electrons in calcium
• a large amount of heat energy is required to break the electrostatic forces (so calcium has a high melting point)
• chlorine has weak forces of attraction between its molecules and these weak forces only take a small amount of energy to break down (so chlorine has a low melting point)
CONDUCTIVITY WHEN SOLID
• ions are fixed in a lattice and so cannot move (therefore calcium chloride cannot conduct a current)
• delocalised electrons in metallic structure can move to carry a current (so calcium can conduct a current)
• there are no delocalised electrons/ions/charged particles/overall charges in chlorine molecules and (so chlorine cannot conduct a current)
CONDUCTIVITY WHEN MOLTEN
• however, when molten ions are free to move (and therefore molten calcium chloride can conduct a current)
• delocalised electrons in metallic structure can move to carry a current (so calcium can conduct a current)
• there are no delocalised electrons/ions/charged particles/overall charges in chlorine molecules and (so chlorine cannot conduct a current)

(Total for Question 5 = 11 marks)

Turn over

6 (a) Dilute hydrochloric acid is a strong acid.

(i) Explain why dilute hydrochloric acid is described as a strong acid.

(2)

fully dissociates
• to form {H+/hydrogen} ions

(ii) $1\,cm^3$ of hydrochloric acid of pH 2 is made up to a volume of $10\,cm^3$ with distilled water.

State the pH of the new solution.

(1)

pH = 3

(b) Magnesium oxide reacts with dilute hydrochloric acid to produce magnesium chloride solution and water.

$$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$$

Write the ionic equation for this reaction.

(3)

MgO + 2H+ → Mg2++ H2O

(c) In an experiment magnesium hydroxide powder is added in 0.1 g portions to $25\,cm^3$ of dilute hydrochloric acid until the magnesium hydroxide is just in excess.

Universal indicator paper can be used to test the pH of the solution after each addition of magnesium hydroxide.

(i) Give the name of an alternative piece of equipment that can be used to measure pH.

(1)

PH meter

(ii) State and explain how the pH changes as the magnesium hydroxide is added to the dilute hydrochloric acid.

(4)

increases pH
• until pH above 7
and an explanation linking
REACTION
• {magnesium hydroxide / base / alkali / OH- ions} {reacts with / neutralises} {the acid / the H+ ions}
IONS REMAINING
• so the hydrogen ions concentration is reduced / all hydrogen ions reacted / there is an excess of hydroxide ions

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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The Periodic Table of the Elements

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
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

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