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

Sample Assessment Materials for first teaching September 2016	Paper Reference
Time: 1 hour 10 minutes	**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.

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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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 Mixtures of coloured substances can be separated by paper chromatography.

(a) Paper chromatography was used to separate a mixture of blue and red inks.
A spot of the mixture was placed on chromatography paper as shown in Figure 1.

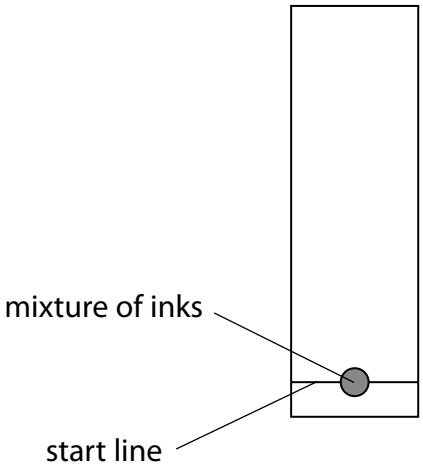

Figure 1

(i) Give a reason why the start line is drawn in pencil rather than in ink.

(1)

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(ii) The chromatography paper, with the spot of mixture on it, was placed in a beaker with the bottom of the paper in water.

On Figure 2, complete the diagram showing the position of the chromatography paper with the spot of mixture at the start of the experiment.

(1)

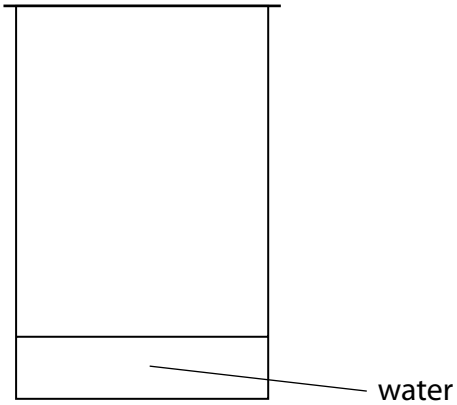

Figure 2

(iii) The chromatography was carried out and the result is shown in Figure 3.

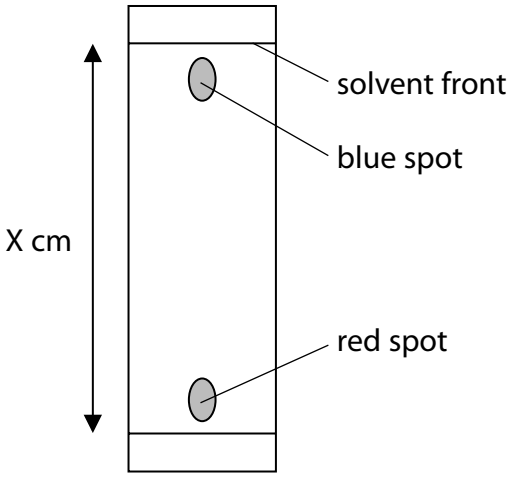

Figure 3

The blue spot had moved 14.5 cm and the solvent front had moved 15.3 cm

Calculate the R_f value of the substance in the blue spot, giving your answer to 2 significant figures.

$$R_f \text{ value} = \frac{\text{distance travelled by a dye}}{\text{distance travelled by solvent front}}$$

(2)

R_f value = ...

(b) **P**, **Q**, **R** and **S** are mixtures of food colourings.

They are investigated using paper chromatography.

Figure 4 shows the chromatogram at the end of the experiment.

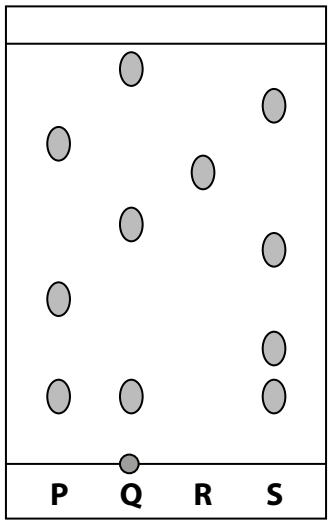

Figure 4

(i) Which mixture contains an insoluble food colouring?

(1)

☒ **A** mixture **P**

☒ **B** mixture **Q**

☒ **C** mixture **R**

☒ **D** mixture **S**

(ii) Give a change that could be made to the experiment to obtain an R_f value for the insoluble colouring.

(1)

.....

.....

(iii) Explain, by referring to Figure 4, which mixture is separated into the greatest number of soluble food colourings by this chromatography experiment.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

2 Ionic compounds contain ions.

(a) The numbers of electrons, neutrons and protons in four particles, **W**, **X**, **Y** and **Z**, are shown in Figure 5.

particle	electrons	neutrons	protons
W	9	10	9
X	10	14	12
Y	16	16	16
Z	18	18	16

Figure 5

Explain which particle, **W**, **X**, **Y** or **Z**, is a negative ion.

(2)

.....

.....

.....

.....

(b) Calcium nitrate contains calcium ions and nitrate ions.

Calculate the relative formula mass of calcium nitrate, $Ca(NO_3)_2$.
(relative atomic masses: Ca = 40, N = 14, O = 16)

(2)

relative formula mass = ...

(c) The electronic configurations of a lithium atom and of a fluorine atom are shown in Figure 6.

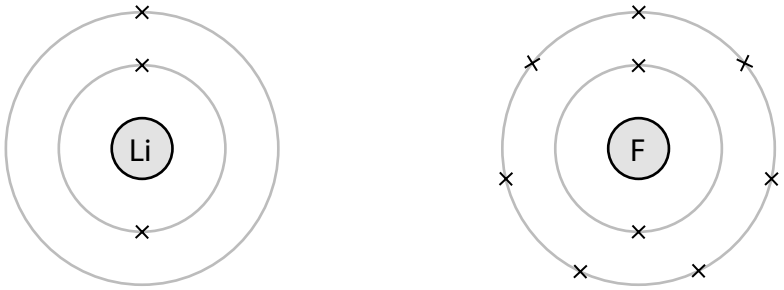

Figure 6

Lithium fluoride, LiF, is an ionic compound.

It contains lithium cations and fluoride anions.

Complete Figure 7 to show the electronic configurations and charges of the ions in lithium fluoride.

(4)

charge on ion ..... charge on ion .....

Figure 7

(Total for Question 2 = 8 marks)

3 A student carried out an experiment to see how reactive different metals are when they are placed in dilute hydrochloric acid.

A sample of each metal was placed in a separate test tube of acid.

(a) When zinc reacts with dilute hydrochloric acid, a gas is given off and zinc chloride is formed.

(i) Which gas is given off?

(1)

☒ **A** carbon dioxide

☒ **B** chlorine

☒ **C** hydrogen

☒ **D** oxygen

(ii) What is the formula of zinc chloride?

(1)

☒ **A** ZnCl

☒ **B** Zn_2Cl

☒ **C** $ZnCl_2$

☒ **D** Zn_2Cl_2

(b) In the experiment, the student used the same amount of each metal in a finely powdered form.

State **two** factors, concerning the hydrochloric acid, which should also be controlled to produce valid results.

(2)

1 .....

.....

2 .....

.....

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(c) Part of the reactivity series is shown in Figure 8.

most reactive	magnesium
	aluminium
	iron
least reactive	silver

Figure 8

Iron is extracted from its ore by heating with carbon.
Aluminium is extracted from its ore using a different method.

(i) Give the name of the method used to extract aluminium.

(1)

.....

(ii) Explain why aluminium is extracted by a different method rather than heating the ore with carbon.

(2)

.....

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.....

(d) The extraction of iron involves the reduction of iron oxide, Fe_2O_3, by carbon monoxide, CO. During this reaction, the iron oxide is reduced to iron, Fe, and the carbon monoxide is oxidised to carbon dioxide.

Write the balanced equation for the reaction.

(2)

.....

(Total for Question 3 = 9 marks)

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4 Electrodes are placed in three different solutions, **J**, **K** and **L**.

A 6 V direct current source is connected to the electrodes.

Any products formed at the electrodes are identified.

The results are given in Figure 9.

solution	solution conducts electricity	product at cathode	product at anode
J	yes	copper	chlorine
K	yes	hydrogen	oxygen
L	no	none	none

Figure 9

(a) Explain which solutions are electrolytes.

(2)

.....

.....

.....

.....

(b) Which material is most suitable to make the electrodes for the electrolysis of a dilute acid?

(1)

☒ **A** zinc

☒ **B** sulfur

☒ **C** iron

☒ **D** graphite

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(c) When a solution of sodium sulfate, Na_2SO_4, is electrolysed, the products formed at the electrodes are hydrogen and oxygen.

Explain the formation of the products at the electrodes.

(4)

(d) Copper is purified by the electrolysis of copper sulfate solution using an impure copper anode and a pure copper cathode.

Write the half-equation for the formation of a copper atom from a copper ion.

(2)

(Total for Question 4 = 9 marks)

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5 Figure 10 shows a model of how particles are arranged in a solid.

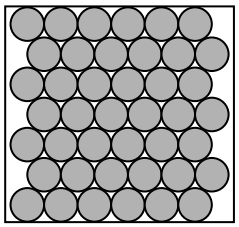

Figure 10

(a) (i) State **two** ways in which this model fails to accurately represent a crystal of sodium chloride.

(2)

1 .....

.....

2 .....

.....

(ii) Magnesium oxide has a melting point of 2852 °C.

Explain why magnesium oxide has such a high melting point.

(3)

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(b) (i) Carbon dioxide can be formed by the reaction of calcium carbonate, $CaCO_3$, with dilute hydrochloric acid.

Write the balanced equation for this reaction.

(3)

(ii) The thermal decomposition of copper carbonate forms copper oxide and carbon dioxide.

$$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$$

15.0 g of pure copper carbonate is decomposed completely.

Calculate the mass of solid produced.

(relative atomic masses: C = 12.0; O = 16.0; Cu = 63.5)

Give your answer to two significant figures.

(2)

mass of solid = ... g

(c) Magnesium reacts with water in the form of steam as shown in the equation.

$$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$$

2.4 g of magnesium reacts with sufficient steam for a complete reaction to form 5.8 g of magnesium hydroxide and 0.2 g of hydrogen.

Show, by calculation, that the law of conservation of mass applies to this reaction.

(relative atomic masses: H = 1.0, O = 16, Mg = 24)

(3)

(Total for Question 5 = 13 marks)

6 Some acids such as hydrochloric acid are described as strong acids.
Some acids such as ethanoic acid are described as weak acids.

(a) (i) Explain the difference between a strong acid and a weak acid.

(2)

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.....

(ii) Give a reason why adding hydroxide ions to an acid solution leads to an increase in pH.

(1)

.....

.....

(b) The salt zinc nitrate can be made by reacting zinc oxide, ZnO, with dilute nitric acid, HNO_3.

Write the balanced equation for this reaction.

(2)

.....

(c) 50 cm^3 of potassium hydroxide solution of concentration 40 g dm^{-3} is needed for an experiment.

Calculate the mass of potassium hydroxide that must be dissolved in water to make 50 cm^3 of solution of this concentration.

(2)

mass of potassium hydroxide = ... g

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*(d) Salts of metals can be made by reacting one of the metal's compounds with the appropriate acid.

Plan an experiment to prepare pure, dry crystals of magnesium sulfate, $MgSO_4$, by reacting a suitable magnesium compound with a suitable acid.

You may use equations if you wish.

(6)

(Total for Question 6 = 13 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
[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						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** 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.