Paper Reference(s) **1SC0/1CH**

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

Combined Science
Paper 2: Chemistry 1
Higher Tier

Thursday 16 May 2019 – Morning

Time: 1 hour 10 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES
Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

Centre No.							
Candidate No.							
Surname							
Other names							
Signature							
Paper Reference	1	S	C	0	/	1	C	H

- Use BLACK ink or ball-point pen.
- 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.

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Periodic Table

INFORMATION FOR CANDIDATES
- 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.

(Instructions continue on next page)

- **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 provided.**

ADVICE TO CANDIDATES

- **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.**

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 ☒.

(Questions begin on next page)

1 In Figure 1, the letters A, E, G, J, X and Z show the positions of six elements in the periodic table.

These letters are not the symbols of the atoms of these elements.

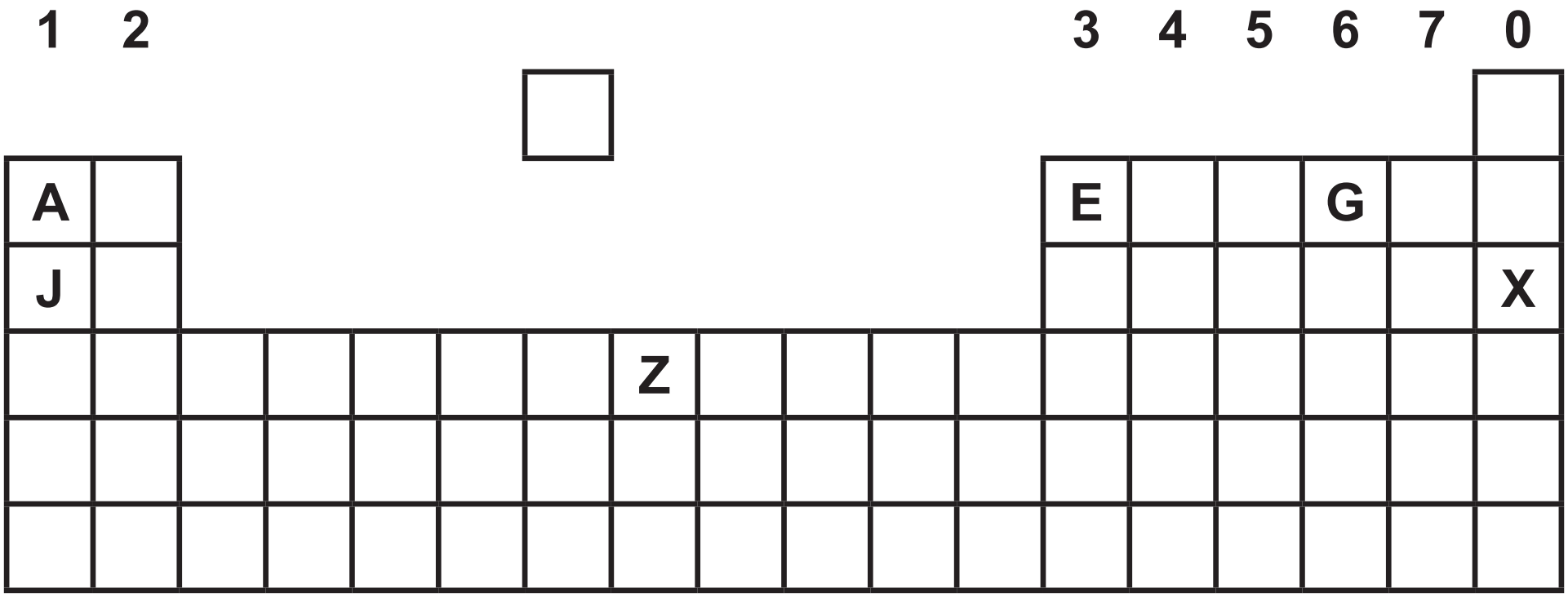

Figure 1

(Question continues on next page)

(a) Using the letters A, E, G, J, X and Z

(i) give the letters of the TWO elements that are non-metals (1 mark)

(ii) give the letters of TWO elements in period 2 (1 mark)

(iii) give the letter of an element that normally forms an ion with a charge of +1. (1 mark)

(Question continues on next page)

(b) Element E has an atomic number of 5. In a sample of E there are two isotopes. One isotope has a mass number of 10 and the other isotope has a mass number of 11.

(i) Explain, in terms of subatomic particles, what is meant by the term ISOTOPES. (2 marks)

(Question continues on next page)

(ii) All atoms of element E in this sample contain (1 mark)

☐ A 5 protons

☐ B 5 neutrons

☐ C 6 protons

☐ D 6 neutrons

(c) Element X has an atomic number of 18.

State the electronic configuration of an atom of element X. (1 mark)

(Question continues on next page)

(d) In an experiment, 3·5 g of element A reacted with 4·0 g of element G to form a compound.

Calculate the empirical formula of this compound.
(relative atomic masses: A = 7, G = 16)

You must show your working.
(3 marks)

(Continue your answer on next page)

empirical formula
of this compound = _____

(TOTAL FOR QUESTION 1 = 10 MARKS)

(Questions continue on next page)

2 (a) Water, acidified with sulfuric acid, is decomposed by electrolysis.
The water is decomposed to produce hydrogen and oxygen.

(i) A sample of hydrogen is mixed with air and ignited.

State what would happen.
(1 mark)

(Question continues on next page)

(ii) Throughout the experiment the volume of hydrogen and the volume of oxygen are measured at two-minute intervals.

The results are shown in Figure 2.

time in minutes	volume of hydrogen in cm^3	volume of oxygen in cm^3
0	0	0
2	4	2
4	8	4
6	12	6
8	16	8

Figure 2

(Question continues on next page)

Describe, using the data in Figure 2, what the results show about the volumes of hydrogen and of oxygen produced in this experiment. (2 marks)

(Question continues on next page)

(b) Molten lead bromide is electrolysed.

The products of this electrolysis are
(1 mark)

☐ A hydrogen and bromine

☐ B hydrogen and oxygen

☐ C lead and bromine

☐ D lead and oxygen

(Question continues on next page)

(c) Calcium nitrate and calcium carbonate are both ionic compounds.

Calcium nitrate mixed with water behaves as an electrolyte.
Calcium carbonate mixed with water does not behave as an electrolyte.

Explain, in terms of solubility and movement of ions, this difference in behaviour. (2 marks)

(Question continues on next page)

(d) When molten zinc chloride is electrolysed, zinc ions, Zn^{2+}, form zinc atoms.

Write the half equation for this reaction. (2 marks)

(TOTAL FOR QUESTION 2 = 8 MARKS)

(Questions continue on next page)

3 (a) One way to extract metals from land contaminated with metal compounds is phytoextraction.
When plants grow they absorb metal ions through their roots.
The plants are harvested, dried and burned forming an ash.
The ash contains metal compounds.

Plants were grown in a piece of ground contaminated with nickel compounds.

(i) 1 kg of the ash from these plants contained 142·0 g of nickel compounds.

Calculate the percentage by mass of nickel compounds in the ash.
(3 marks)

(Continue your answer on next page)

percentage by mass = _____

(Question continues on next page)

(ii) Nickel is extracted from nickel compounds.

State an advantage of extracting nickel by phytoextraction rather than from its ore. (1 mark)

(Question continues on next page)

(b) Some nickel ores contain nickel sulfide.

(i) In the first stage of extracting nickel from nickel sulfide, the nickel sulfide, NiS, is heated in air to form nickel oxide, NiO, and sulfur dioxide.

Write the balanced equation for this reaction. (2 marks)

(Question continues on next page)

(ii) In the final stage of the extraction process, a nickel compound is electrolysed to produce pure nickel.

An advantage of producing a metal by electrolysis is that
(1 mark)

☐ A electrolysis uses a large amount of electricity

☐ B the metal produced by electrolysis is very pure

☐ C electrolysis is a very cheap method of extraction

☐ D electrolysis is the only method of extracting unreactive metals

(Question continues on next page)

(c) In a different method of obtaining nickel, the process produces a mixture of the liquids nickel tetracarbonyl and iron pentacarbonyl.

The boiling point of nickel tetracarbonyl is 43 °C.
The boiling point of iron pentacarbonyl is 103 °C.
These two liquids mix together completely.

Describe the process used to separate these two liquids. (3 marks)

(Continue your answer on next page)

(TOTAL FOR QUESTION 3 = 10 MARKS)

(Questions continue on next page)

4 (a) Hydrated copper sulfate, $CuSO_4.5H_2O$, is a blue solid. Anhydrous copper sulfate, $CuSO_4$, is a white solid.

Heat energy is needed to convert hydrated copper sulfate to anhydrous copper sulfate. This is a reversible reaction.

$$CuSO_4.5H_2O \rightleftharpoons CuSO_4 + 5H_2O$$

Devise an experiment to show that this is a reversible reaction. (4 marks)

(Continue your answer on next page)

(Question continues on next page)

(b) Hydrogen reacts with iodine to form hydrogen iodide.
Iodine gas is purple and
hydrogen iodide gas is colourless.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Hydrogen and iodine are placed in a sealed container.
The container is left until equilibrium is reached.

The conditions are changed favouring the forward reaction.

Explain what you would SEE.
(2 marks)

(Continue your answer on next page)

(Question continues on next page)

(c) Calculate the number of atoms combined in one mole of copper iodide, CuI_2. (2 marks)

(Avogadro constant = $6{\cdot}02 \times 10^{23}$)

number of atoms = _____

(TOTAL FOR QUESTION 4 = 8 MARKS)

(Questions continue on next page)

5 Pieces of zinc react with copper sulfate solution.
Zinc sulfate solution is colourless.

$$Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$$

(a) Describe what you would SEE when an excess of zinc is added to copper sulfate solution and the mixture left until the reaction is complete. (2 marks)

(Question continues on next page)

(b) This reaction is described as a redox reaction.

Explain, in terms of electrons, which particles have been oxidised and which particles have been reduced in this reaction. (4 marks)

(Question continues on next page)

(c) The copper sulfate solution used has a concentration of $15{\cdot}95\,g\,dm^{-3}$.

Calculate the number of moles of copper sulfate, $CuSO_4$, in $50{\cdot}00\,cm^3$ of this solution. (3 marks)
(relative atomic masses: O = 16, S = 32, Cu = 63.5)

(Continue your answer on next page)

number of moles
of copper sulfate = _____ mol

(Question continues on next page)

(d) In another experiment, 0·043 mol of copper sulfate, $CuSO_4$, is used.

Calculate, to one decimal place, the minimum mass of zinc that must be added to react with all the copper sulfate. (2 marks)
(relative atomic mass: Zn = 65)

mass = _____ g

(TOTAL FOR QUESTION 5 = 11 MARKS)

(Questions continue on next page)

6 (a) X and Y are solutions of two different acids.
The concentration of acid in each solution, in mol dm^{-3}, is the same.
Solution X has a pH of 3·40 and solution Y has a pH of 4·40.

(i) State what could be used to measure these pH values of 3·40 and 4·40. (1 mark)

(Question continues on next page)

(ii) What is the concentration of hydrogen ions in solution X compared with that in solution Y? (1 mark)

☐ A ten times lower

☐ B lower by a factor of 3·30 / 4·40

☐ C higher by a factor of 4·40 / 3·30

☐ D ten times higher

(Question continues on next page)

(b) An experiment is planned to record the change in pH as a powdered base is added to 50 cm^3 dilute hydrochloric acid.

The method suggested is

step 1 add dilute hydrochloric acid up to the 50 cm^3 mark on a beaker

step 2 add one spatula of the base and stir

step 3 measure the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

(Question continues on next page)

(i) State how you could change the method so that the amounts of dilute hydrochloric acid and of the base can be measured more accurately. (2 marks)

dilute hydrochloric acid _____

_____

_____

base _____

_____

_____

(Question continues on next page)

(ii) During the experiment the pH changes from 2 to 10.
If phenolphthalein indicator is added at the beginning of the experiment, a colour change occurs as the base is added.

State the colour change that occurs. (1 mark)

colour at start

_____

colour at end

_____

(Question continues on next page)

(iii) Explain, in terms of the particles present, why the pH increases during the experiment. (2 marks)

(Question continues on next page)

*(c) Some properties of four solids, A, B, C and D, are shown in Figure 3.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

(Question continues on next page)

	A	B	C	D
colour of solid	black	silver	white	green
observation when solid is added to water	black solid remains	a few bubbles appear on surface of solid	solid dissolves and forms colourless solution	green solid remains
pH of mixture of solid added to water	7	8	13	7
observation when solid is added to dilute sulfuric acid	on warming, solid disappears to form blue solution	effervescence solid disappears to form colourless solution	solid disappears to form colourless solution	effervescence solid disappears to form blue solution

Figure 3

(Question continues on next page)

Identify the solids A, B, C and D, explaining how the information in Figure 3 supports the identification of each solid. (6 marks)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(TOTAL FOR QUESTION 6 = 13 MARKS)

TOTAL FOR PAPER = 60 MARKS

END