

Paper Reference(s) 1CH0/1F
Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Chemistry
Paper 1
Foundation Tier

Total Marks

Thursday 14 May 2020 – Morning

Time: 1 hour 45 minutes plus your additional time allowance

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Periodic Table, Diagram Booklet

INSTRUCTIONS

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 100.

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.

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) When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution? (1 mark)

☐ A crystallising

☐ B diluting

☐ C dissolving

☐ D melting

- (b) Sodium reacts with hydrochloric acid to form sodium chloride and hydrogen.

- (i) Write the word equation for this reaction.
(2 marks)

_____ →

(continued on the next page)

1 continued.

- (ii) Look at Figure 1 for Question 1(b)(ii) in the Diagram Booklet. The hazard symbol shown is used on containers of sodium.**

**What is the meaning of this hazard symbol?
(1 mark)**

- ☐ **A corrosive**
- ☐ **B flammable**
- ☐ **C oxidising**
- ☐ **D toxic**

- (iii) Hydrogen has one electron in its electron shell.**

Look at Figure 2 for Question 1(b)(iii) in the Diagram Booklet. It shows the incomplete dot and cross diagram of a hydrogen molecule.

Complete Figure 2 to show the electrons in the covalent bond between the two atoms of hydrogen. (1 mark)

(continued on the next page)

1 continued.

(c) The pH of a sodium chloride solution was measured.

(i) State what could be used to measure the pH of a solution. (1 mark)

(ii) Sodium chloride solution is neutral.

Give the pH of this solution. (1 mark)

(TOTAL FOR QUESTION 1 = 7 MARKS)

2 Chlorine has an atomic number of 17.

(a) Look at Figure 3 for Question 2 in the Diagram Booklet. It shows the arrangement of electrons in an atom of chlorine.

(i) What is the electronic configuration of this atom? (1 mark)

☐ **A 10.7**

☐ **B 17**

☐ **C 2.8.7**

☐ **D 7.8.2**

(ii) Explain, using Figure 3, why chlorine belongs to group 7 of the periodic table. (2 marks)

2 continued.

- (b) The nucleus of an atom is made up of protons and neutrons.**

Atoms of chlorine contain 17 protons.

Look at Figure 4 for Question 2(b) in the Diagram Booklet. It shows some information about a proton, a neutron and an electron.

- (i) Explain, using the information in Figure 3 and Figure 4, why atoms of chlorine have no overall charge. (2 marks)**

(continued on the next page)

2 continued.

(ii) Atoms of chlorine-37 have a mass number of 37.

Calculate the number of neutrons in atoms of chlorine-37. (1 mark)

number of neutrons = _____

(iii) There are two isotopes of chlorine, chlorine-35 and chlorine-37.

**Explain the meaning of the term ISOTOPES.
(2 marks)**

(TOTAL FOR QUESTION 2 = 8 MARKS)

Turn over

3 In industry, ammonia is manufactured by reacting nitrogen with hydrogen.

(a) (i) Give the name of the industrial process used to manufacture ammonia. (1 mark)

(ii) Write the word equation for this reaction, including the correct symbol to show that the reaction is reversible. (3 marks)

(continued on the next page)

3 continued.

(b) The formula of ammonia is NH_3 .

State what the formula of ammonia shows about the number of nitrogen atoms and the number of hydrogen atoms combined in a molecule of ammonia. (1 mark)

(c) Most of the ammonia manufactured in industry is used to produce fertilisers.

(i) A fertiliser is made by reacting ammonia with nitric acid.

What is the name of this fertiliser? (1 mark)

- ☐ **A ammonia nitrate**
- ☐ **B ammonia nitric**
- ☐ **C ammonium nitrate**
- ☐ **D ammonium nitric**

(continued on the next page)

Turn over

3 continued.

- (ii) Explain the importance of fertilisers in farming.
(2 marks)**

(TOTAL FOR QUESTION 3 = 8 MARKS)

- 4 (a) In the 19th century, Mendeleev arranged the elements known at the time to form his periodic table. Mendeleev's periodic table is different from the modern periodic table.

State ONE difference between Mendeleev's periodic table and the modern periodic table. (1 mark)

- (b) Aluminium oxide reacts with hydrochloric acid to form a salt and water.

(i) State the name of the salt formed. (1 mark)

(ii) In this reaction aluminium oxide is a base.

State the type of reaction that takes place when an acid reacts with a base. (1 mark)

(continued on the next page)

Turn over

4 continued.

- (c) Gallium, Ga, is in the same group of the modern periodic table as aluminium.

The formula of aluminium oxide is Al_2O_3 .

- (i) Predict the formula of gallium oxide. (1 mark)
-

- (ii) Gallium oxide has a very high melting point. Gallium oxide does not conduct electricity when solid but does conduct electricity when molten.

What type of substance is gallium oxide?
(1 mark)

- ☐ A giant covalent
- ☐ B ionic
- ☐ C metallic
- ☐ D simple molecular

(continued on the next page)

4 continued.

(d) Look at Figure 5 for Question 4(d) in the Diagram Booklet. It shows the changes of state for gallium and the arrangement of particles in liquid gallium.

(i) Complete the boxes for solid gallium and gaseous gallium by drawing the arrangement of the particles in each of these physical states. (2 marks)

(ii) Give the name of the change of state labelled Y in Figure 5. (1 mark)

(continued on the next page)

4 continued.

(e) Gallium metal is a conductor of electricity.

Explain how metals conduct electricity. (2 marks)

(TOTAL FOR QUESTION 4 = 10 MARKS)

5 Transition metals have many uses.

- (a) Look at Figure 6 for Question 5(a) in the Diagram Booklet. The pie chart shows the uses of one transition metal.**

Calculate the percentage of this transition metal used in construction. (1 mark)

**percentage of this transition
metal used in construction = _____**

- (b) Look at Figure 7 for Question 5(b) in the Diagram Booklet. It shows five statements about iron.**

Put ticks (✓) in the boxes in Figure 7 to show which statements are true and which statements are false.

The first one has been done for you. (3 marks)

(continued on the next page)

5 continued.

(c) Most iron produced is converted into alloys of iron.

(i) State why alloys have more uses than pure metals. (1 mark)

(continued on the next page)

5 continued.

- (ii) An alloy of iron contains 0.40 % of molybdenum.**

Calculate the mass of molybdenum contained in a 30 g sample of this alloy of iron. (2 marks)

mass of molybdenum = _____ g

(continued on the next page)

5 continued.

- (d) Many transition metals are used to make the reactants in chemical cells.**

Look at Figure 8 for Question 5(d) in the Diagram Booklet. It shows a graph of the voltage produced by a chemical cell as it is used in a torch for many hours.

**Suggest an explanation for the shape of the graph.
(2 marks)**

(TOTAL FOR QUESTION 5 = 9 MARKS)

- 6 Some metals are found in the Earth's crust as uncombined elements.**

Reactive metals are found in ores.

In ores, metals are combined with other elements.

- (a) Which of these metals is found as the uncombined element in the Earth's crust? (1 mark)**

☐ **A aluminium**

☐ **B gold**

☐ **C potassium**

☐ **D zinc**

(continued on the next page)

6 continued.

(b) Give TWO advantages of recycling metals rather than extracting metals from their ores. (2 marks)

1 _____

2 _____

(continued on the next page)

6 continued.

- (c) An ore of iron is mostly iron oxide, Fe_2O_3 .
Iron can be extracted from this iron oxide by heating it with carbon.

Balance this equation for the reaction that takes place. (1 mark)



(continued on the next page)

6 continued.

- (d) Most copper ores are described as low grade.
This means that the percentage of copper in the
ore is very small.**

**5000 kg of one copper ore was found to contain
42.5 kg of copper.**

**Calculate the percentage of copper in this ore.
(2 marks)**

percentage of copper in ore = _____

(continued on the next page)

6 continued.

- (e) In one stage of the extraction of lead from its ore, lead oxide is heated strongly with carbon.

The equation for the reaction is



Explain, using this equation, which substance has been oxidised in this reaction. (2 marks)

(continued on the next page)

6 continued.

- (f) A titanium ore was analysed and found to contain 12 g of titanium atoms combined with 8.0 g of oxygen atoms.**

Calculate the empirical formula of this titanium compound.

(relative atomic masses: Ti = 48, O = 16)

You must show your working. (3 marks)

empirical formula = _____

(TOTAL FOR QUESTION 6 = 11 MARKS)

Turn over

7 (a) Iron rusts when it is left in certain conditions.

- (i) Look at Figure 9 for Question 7(a)(i) in the Diagram Booklet. It shows the apparatus used to investigate the rusting of some iron nails.**

Explain why the iron nail in tube A would rust but the iron nails in tubes B and C would not rust. (3 marks)

(continued on the next page)

Turn over

7 continued.

(ii) Magnesium is more reactive than iron.

Look at Figure 10 for Question 7(a)(ii) in the Diagram Booklet. It shows an iron nail with a strip of magnesium wrapped around it, placed in some water.

The tube was left for a few days.

**State what would happen to this iron nail.
(1 mark)**

(iii) When iron rusts, a brown solid forms on the surface of the iron.

**What happens to the iron as the rust forms?
(1 mark)**

- ☐ **A the iron is hydrated**
- ☐ **B the iron is neutralised**
- ☐ **C the iron is oxidised**
- ☐ **D the iron is reduced**

7 continued.

- (b) Give ONE reason why metals are electroplated.
(1 mark)**

- *(c) The pure metals aluminium, copper and gold and the alloys brass and magnalium are used to make many useful articles.**

The way in which these metals and alloys are used is related to their properties, such as their density, electrical conductivity, resistance to corrosion and strength.

State some uses of aluminium, copper, gold, brass and magnalium and explain how each use is related to their properties. (6 marks)

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7 continued.

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(TOTAL FOR QUESTION 7 = 12 MARKS)

8 Look at Figure 11 for Question 8 in the Diagram Booklet. It shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

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

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

(continued on the next page)

8 continued.

(ii) What is the name of gas **X** that forms at the positive electrode? (1 mark)

- ☐ A ammonia
- ☐ B oxygen
- ☐ C nitrogen
- ☐ D sulfur dioxide

(iii) State what is meant by the term **ELECTROLYSIS**. (2 marks)

(continued on the next page)

Turn over

8 continued.

- (b) The sodium sulfate solution was made by dissolving 28.4 g of sodium sulfate in water to make 250 cm³ of solution.

Calculate the concentration of this solution in g dm⁻³.

Give your answer to three significant figures.
(3 marks)

concentration = _____ g dm⁻³

(continued on the next page)

8 continued.

(c) The ions present in sodium sulfate are

sodium	Na^+
sulfate	SO_4^{2-}

Write the formula of sodium sulfate using this information. (1 mark)

(d) (i) In Figure 11, the gases given off at the electrodes are collected in test-tubes. However, the actual volume of gases cannot be measured using these test-tubes.

Suggest what apparatus could be used in place of the test-tubes in Figure 11 to measure the volume of gases given off. (1 mark)

(ii) State what could be added into the circuit to show a current is flowing during electrolysis. (1 mark)

(TOTAL FOR QUESTION 8 = 11 MARKS)

Turn over

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



- (a) (i) Complete the balanced equation for this reaction. (2 marks)



- (ii) Calculate the relative formula mass of copper carbonate, CuCO_3 . (2 marks)
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

relative formula mass of $\text{CuCO}_3 = \underline{\hspace{2cm}}$

(continued on the next page)

9 continued.

(iii) What is the chemical test to show that a gas is carbon dioxide? (1 mark)

- ☐ **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, splint is extinguished**
- ☐ **D measure the pH of the gas, pH = 4**

(continued on the next page)

9 continued.

(b) Look at Figure 12 for Question 9(b) in the Diagram Booklet. It 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.

(i) State TWO observations that would show the reaction has finished. (2 marks)

1 _____

2 _____

(continued on the next page)

9 continued.

- *(ii) Describe how you would obtain a solution of copper sulfate from the mixture and how you would obtain pure, dry copper sulfate crystals from this solution.**

Your description should include the apparatus you would use.

**You may wish to use diagrams in your answer.
(6 marks)**

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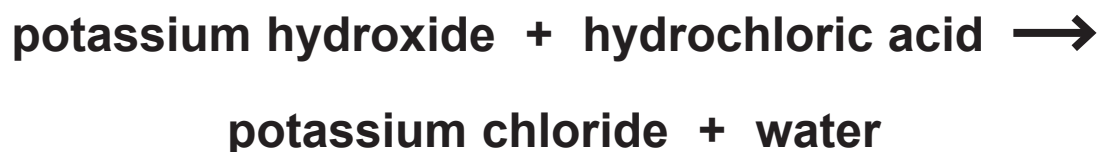
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9 continued.

(TOTAL FOR QUESTION 9 = 13 MARKS)

- 10 Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.**



- (a) A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.**

There were five steps in the titration.

Look at the steps for Question 10 in the Diagram Booklet. They are not in the correct order.

- (i) Write the steps in the correct order.**

Some of the steps have been completed for you. (1 mark)

FIRST STEP

LAST STEP

K				M
---	--	--	--	---

(continued on the next page)

10 continued.

- (ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm³ of potassium hydroxide solution.
(1 mark)**

(continued on the next page)

10 continued.

- (b) A student was then asked to produce a pure sample of solid potassium chloride.**

After finding the volume of acid reacted in step M, the student added this volume of acid to a fresh 25.0 cm^3 sample of the potassium hydroxide solution. This mixture was then evaporated.

- (i) Explain why this new mixture was evaporated rather than the original mixture from the titration, to produce a pure sample of solid potassium chloride. (2 marks)**

(continued on the next page)

Turn over

10 continued.

- (ii) After evaporation, the mass of the potassium chloride was determined.

The theoretical yield of the experiment was 0.70 g.
The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.
(2 marks)

percentage yield = _____

(continued on the next page)

10 continued.

(iii) Suggest a reason why the actual yield was greater than the theoretical yield. (1 mark)

(continued on the next page)

10 continued.

- (iv) The equation for the reaction between potassium hydroxide solution and dilute hydrochloric acid is



Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.

(relative formula masses: $\text{KOH} = 56.0$, $\text{HCl} = 36.5$, $\text{KCl} = 74.5$, $\text{H}_2\text{O} = 18.0$)

Give your answer to one decimal place.
(4 marks)

(continued on the next page)

Turn over

10 continued.

atom economy = _____%

(TOTAL FOR QUESTION 10 = 11 MARKS)

TOTAL FOR PAPER = 100 MARKS
END