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

Chemistry

PAPER 1
Foundation Tier

Total Marks

Time: 1 hour 45 minutes

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

Surname					
Other names					
Centre Number					
Candidate Number					

X69484A

Pearson

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Diagram Booklet, Periodic Table

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – 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.

A periodic table is provided as a separate insert.

There may be spare copies of some diagrams.

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) This question is about NPK fertilisers.

N, P and K are the symbols of three elements that are essential for plant growth.

N is the symbol for nitrogen.

Name the other two elements, P and K, that are essential for plant growth.

You may want to refer to the periodic table.
(2 marks)

P _____

K _____

(continued on the next page)

1 continued.

(b) Many fertilisers are produced using ammonia.

Ammonia is produced on an industrial scale from the reaction of nitrogen with hydrogen.

The equation for the reaction is

nitrogen + hydrogen $\rightleftharpoons$ ammonia

(i) State the name of this industrial process.
(1 mark)

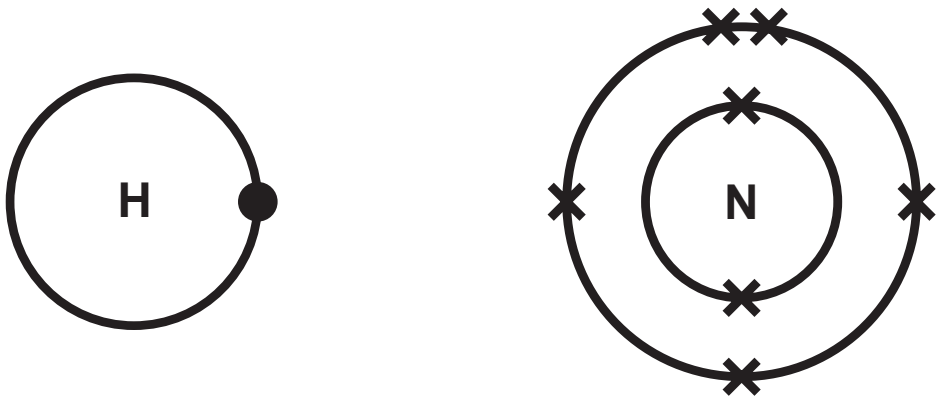
(ii) State the meaning of the $\rightleftharpoons$ symbol in the equation.
(1 mark)

(continued on the next page)

1 continued.

(iii) Figure 2 shows the electronic configurations for an atom of nitrogen and an atom of hydrogen.

FIGURE 2



Look at the diagrams for Question 1(b)(iii) in the Diagram Booklet. Which dot and cross diagram for ammonia, NH_3, is correct?
(1 mark)

☐ A Diagram A

☐ B Diagram B

☐ C Diagram C

☐ D Diagram D

(continued on the next page)

1 continued.

(c) Ammonia reacts with nitric acid to produce ammonium nitrate.

Look at the diagram for Question 1(c) in the Diagram Booklet. Write the word equation for this reaction.
(2 marks)

(Total for Question 1 = 7 marks)

2 A metal spoon and two test tubes are heated in a water bath.

One test tube contains a piece of chocolate, the other some liquid egg white.

After heating, the spoon, the chocolate and the egg white are allowed to cool to room temperature.

Look at Figure 4 for Question 2 in the Diagram Booklet. It shows the state of the three different substances before heating, when hot and after cooling.

(a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid. (2 marks)

difference in arrangement of particles

_____

_____

_____

_____

_____

(continued on the next page)

2 continued.

difference in movement of particles

_____

_____

_____

_____

_____

(b) What name is given to the process when the chocolate changes from a solid to a liquid? (1 mark)

☐ A condensing

☐ B evaporating

☐ C freezing

☐ D melting

(continued on the next page)

2 continued.

(c) Give a reason why the metal spoon has not changed state during the experiment.
(1 mark)

(d) Explain how we know the change to the egg white is a chemical change rather than a physical change.
(2 marks)

(Total for Question 2 = 6 marks)

3 Potable water is water that is suitable for drinking.

(a) River water can be treated to make it potable.

Chlorination, filtration and sedimentation are three of the processes involved in making the river water potable.

(i) Which row of the table shows these three processes in the order in which they are carried out?
(1 mark)

	first	second	third
☐ A	chlorination	sedimentation	filtration
☐ B	chlorination	filtration	sedimentation
☐ C	sedimentation	filtration	chlorination
☐ D	sedimentation	chlorination	filtration

(continued on the next page)

3 continued.

(ii) State the reason why chlorine is added during the water treatment.
(1 mark)

(iii) Describe how sedimentation is carried out.
(2 marks)

(continued on the next page)

3 continued.

(iv) Look at Figure 5 for Question 3(a)(iv) in the Diagram Booklet. It shows the results of an analysis of a sample of potable water.

Using this information, explain why this sample of potable water is not the same as pure water.
(2 marks)

(continued on the next page)

3 continued.

(b) A student wanted to distil a sample of potable water.

Look at Figure 6 for Question 3(b) in the Diagram Booklet. It shows apparatus the student used.

(i) Name the piece of equipment labelled **X** in Figure 6.
(1 mark)

_____

_____

(continued on the next page)

3 continued.

(ii) The student made an error when setting up the equipment in Figure 6. This error meant no water could be collected in the test tube.

Explain what the student needs to do so water can be collected.
(2 marks)

(Total for Question 3 = 9 marks)

4 A student wanted to find the volume of dilute hydrochloric acid that would react with 25·0 cm^3 of lithium hydroxide solution.

Look at Figure 7 for Question 4 in the Diagram Booklet. They used the equipment in Figure 7 to carry out a rough titration and then a further two accurate titrations.

(a) Suggest why the student carried out a rough titration before the two accurate titrations. (1 mark)

(continued on the next page)

4 continued.

(b) Figure 8 shows the results of the rough titration.

FIGURE 8

final reading on burette in cm^3	30·10
initial reading on burette in cm^3	2·50

What was the volume of acid added in the rough titration?
(1 mark)

☐ A 2·50 cm^3

☐ B 27·60 cm^3

☐ C 30·10 cm^3

☐ D 32·60 cm^3

(continued on the next page)

4 continued.

(c) Describe how the rough titration should be carried out once the dilute hydrochloric acid, lithium hydroxide solution and indicator are placed in the apparatus in Figure 7.
(4 marks)

(continued on the next page)

4 continued.

(d) Which is the name of an indicator that is suitable to use in this titration?
(1 mark)

☐ A limewater

☐ B litmus paper

☐ C methyl orange

☐ D universal indicator

(continued on the next page)

4 continued.

(e) During the titration the dilute hydrochloric acid, HCl, is reacting with the lithium hydroxide solution, LiOH.

Explain what type of reaction is taking place in the titration.
(3 marks)

(Total for Question 4 = 10 marks)

5 (a) An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

State the number of electrons, neutrons and protons in this atom.
(3 marks)

number of electrons = _____

number of neutrons = _____

number of protons = _____

(b) Aluminium reacts with bromine to form aluminium bromide.

A sample of aluminium bromide contains 1·35 g of aluminium atoms and 12·00 g of bromine atoms.

Calculate the empirical formula of this sample of aluminium bromide.
(3 marks)

(relative atomic masses: Al = 27.0, Br = 80.0)

_____

_____

(continued on the next page)

5 continued.

_____

_____

_____

_____

_____

_____

_____

empirical formula = _____

(continued on the next page)

5 continued.

(c) Gallium is in the same group in the periodic table as aluminium and in the same period in the periodic table as bromine.

(i) State in which group and period of the periodic table gallium can be found.

You may want to refer to the periodic table. (2 marks)

group = _____

period = _____

(continued on the next page)

5 continued.

(ii) Gallium had not been discovered when Mendeleev created his first periodic table.

Look at Figure 9 for Question 5(c)(ii) in the Diagram Booklet. It shows some properties of gallium that Mendeleev predicted and some of the actual properties of gallium.

Describe how Mendeleev predicted these properties of gallium.
(2 marks)

(Total for Question 5 = 10 marks)

6 (a) 3·14 g of solid copper sulfate was dissolved in water and made up to 250 cm^3 of solution.

$$\text{concentration } (g\,dm^{-3}) = \frac{\text{mass of solid (g)}}{\text{volume of solution } (dm^3)}$$

Calculate the concentration of this copper sulfate solution in g dm^{-3}.
(2 marks)

_____

_____

_____

_____

_____

concentration = _____ g dm^{-3}

(continued on the next page)

6 continued.

(b) Sodium hydroxide solution was added to a solution of copper sulfate.

A precipitate of copper hydroxide and a solution of sodium sulfate were formed.

(i) State what would be SEEN in the reaction. (1 mark)

_____

_____

(ii) Complete the balanced equation for the reaction by adding a number in front of NaOH. (1 mark)

$$\_\_\_\_\_NaOH + CuSO_4 \longrightarrow Cu(OH)_2 + Na_2SO_4$$

(continued on the next page)

6 continued.

(iii) Describe how to obtain a pure, dry sample of the precipitate of copper hydroxide from the reaction mixture.
(3 marks)

(continued on the next page)

6 continued.

(c) Look at Figure 10 for Question 6(c) in the Diagram Booklet. It shows the equipment used to electrolyse a sample of sodium sulfate solution.

Graphite electrodes are used in the electrolysis of sodium sulfate solution.
Graphite is used because it is inert and conducts electricity.

(i) Look at Figure 11 for Question 6(c)(i) in the Diagram Booklet. It shows the ions in the sodium sulfate solution.

Draw a circle around each of the ions in Figure 11 that are attracted to the negative graphite electrode during the electrolysis.
(1 mark)

(ii) State why it is important that the electrodes are inert.
(1 mark)

(continued on the next page)

6 continued.

(iii) Explain, in terms of its structure, how graphite conducts electricity.
(2 marks)

(Total for Question 6 = 11 marks)

7 (a) When iron wool reacts with oxygen from the air, the iron corrodes and iron oxide is formed.

What happens to the iron in this reaction? (1 mark)

☐ A it is decomposed

☐ B it is neutralised

☐ C it is oxidised

☐ D it is reduced

(continued on the next page)

7 continued.

(b) Look at Figure 12 for Question 7(b) in the Diagram Booklet. A piece of damp iron wool was placed in a measuring cylinder with 50 cm^3 of air, as shown in Figure 12.

Look at Figure 13 for Question 7(b) in the Diagram Booklet. It shows the apparatus one week later.

(i) Complete the table of results.
(1 mark)

volume of gas in Figure 12 in cm^3	50
volume of gas in Figure 13 in cm^3	_____

(continued on the next page)

7 continued.

(ii) Use these results to calculate the percentage decrease in the volume of gas in the measuring cylinder after one week.
(3 marks)

_____

_____

_____

_____

_____

percentage decrease
in volume of gas = _____

(continued on the next page)

7 continued.

(iii) Not all of the oxygen in the air in the measuring cylinder has reacted with the iron.

Give a reason why.
(1 mark)

_____

_____

_____

(continued on the next page)

7 continued.

*(c) Pure metals can be made more useful by converting them into alloys or by electroplating them.

Explain what alloying and electroplating are and how they can make metals more useful.
(6 marks)

(continued on the next page)

7 continued.

(continued on the next page)

7 continued.

(continued on the next page)

7 continued.

(continued on the next page)

7 continued.

(continued on the next page)

7 continued.

(Total for Question 7 = 12 marks)

8 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

(a) The equation for the reaction is

$$Ba(OH)_2(s) + 2HCl(aq) \longrightarrow BaCl_2(aq) + 2H_2O(l)$$

Which row of the table shows the correct state of each of the substances in the equation for the reaction?
(1 mark)

	barium hydroxide	hydrochloric acid	barium chloride	water
☐ A	solid	aqueous	aqueous	liquid
☐ B	solid	liquid	solid	aqueous
☐ C	aqueous	aqueous	solid	liquid
☐ D	aqueous	liquid	aqueous	aqueous

(continued on the next page)

8 continued.

(b) A student wanted to investigate how the pH of the mixture changes as barium hydroxide is added to dilute hydrochloric acid.

They followed this method.

STEP 1 measure out 50·0 cm^3 of dilute hydrochloric acid into a beaker using a measuring cylinder

STEP 2 use a glass rod to place a drop of the acid onto a piece of universal indicator paper and record the pH

STEP 3 add 0·2 g of barium hydroxide to the acid in the beaker and stir

STEP 4 use the glass rod to place a drop of the mixture onto a new piece of universal indicator paper and record the pH again

STEP 5 repeat steps 3–4 until there is no further change in the pH.

(continued on the next page)

8 continued.

(i) Name a piece of equipment which could be used to measure out 50·0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.
(1 mark)

(ii) Describe how the pH of the mixture is determined when a drop of it is placed on the universal indicator paper.
(2 marks)

(continued on the next page)

8 continued.

(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment. (2 marks)

(continued on the next page)

8 continued.

(iv) Figure 14 shows the student's results.

FIGURE 14

mass of barium hydroxide in g	pH of mixture
0·0	1
0·2	1
0·4	1
0·6	1
0·8	2
1·0	7
1·2	12
1·4	13
1·6	13

Look at the grid for Question 8(b)(iv) in the Diagram Booklet. On the grid:

- Add suitable scales to the vertical and horizontal axes.
- Plot a graph of the pH of the mixture against the mass of barium hydroxide.

(3 marks)

(continued on the next page)

8 continued.

(c) Look at Figure 15 for Question 8(c) in the Diagram Booklet. It shows a hazard symbol placed on a container of barium hydroxide.

(i) What is the meaning of the hazard symbol in Figure 15?
(1 mark)

☐ A flammable

☐ B health hazard

☐ C oxidising

☐ D toxic

(continued on the next page)

8 continued.

(ii) Barium hydroxide is also corrosive.

Give ONE precaution that the student should take when using barium hydroxide.
(1 mark)

(Total for Question 8 = 11 marks)

9 Magnesium carbonate has the formula $MgCO_3$.

(a) Magnesium carbonate contains Mg^{2+} and CO_3^{2-} ions.

(i) The atomic number of magnesium is 12.

What is the electronic configuration of the Mg^{2+} ion?
(1 mark)

☐ **A 2**

☐ **B 2.8**

☐ **C 2.8.2**

☐ **D 2.8.4**

(continued on the next page)

9 continued.

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can. (3 marks)

(continued on the next page)

9 continued.

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.
(3 marks)

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

_____

_____

_____

_____

_____

_____

percentage by mass of magnesium = _____

(continued on the next page)

9 continued.

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.
(6 marks)

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(Total for Question 9 = 13 marks)

10 Sucrose is a carbohydrate.

When a solution of sucrose is fermented using yeast, ethanol is formed.

$$\text{sucrose} + \text{water} \longrightarrow \text{ethanol} + \text{carbon dioxide}$$

(a) In one experiment, 100·00 g of sucrose was dissolved in water.

Yeast was added and the mixture allowed to ferment until no more bubbles of carbon dioxide were seen to be formed.

The ethanol was obtained from the mixture and its mass determined.

Look at Figure 16 for Question 10(a) in the Diagram Booklet. The results are shown in Figure 16.

The percentage yield is calculated using

$$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

(continued on the next page)

10 continued.

(i) State the meanings of the terms ACTUAL YIELD and THEORETICAL YIELD. (2 marks)

actual yield

theoretical yield

(continued on the next page)

10 continued.

(ii) Use the information in Figure 16 to calculate the percentage yield of ethanol in this experiment.
(2 marks)

_____

_____

_____

_____

_____

_____

percentage yield = _____

(continued on the next page)

10 continued.

(iii) State TWO reasons why the actual yield of a reaction is usually less than the theoretical yield.
(2 marks)

1 _____

_____

_____

2 _____

_____

_____

(continued on the next page)

10 continued.

(b) The balanced equation for the fermentation of sucrose is

$$C_{12}H_{22}O_{11} + H_2O \longrightarrow 4C_2H_5OH + 4CO_2$$

(i) Calculate the atom economy of this reaction to produce ethanol.
(3 marks)

Give your answer to two significant figures.

(relative formula masses: $C_{12}H_{22}O_{11}$ = 342, H_2O = 18, C_2H_5OH = 46, CO_2 = 44)

atom economy = _____%

(continued on the next page)

10 continued.

(ii) Explain the effect on the atom economy of this reaction if the carbon dioxide produced was used to make fizzy drinks.
(2 marks)

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS
END OF PAPER