

Paper Reference(s) 4CH1/2CR
Pearson Edexcel International GCSE (9–1)

Chemistry
UNIT: 4CH1
PAPER: 2CR

Total Marks

Tuesday 13 June 2023 – Morning

Time: 1 hour 15 minutes

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

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.

Show all the steps in any calculations and state the units.

Turn over

INFORMATION

The total mark for this paper is 70.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

There may be spare copies of some diagrams.

A periodic table is provided as a separate insert.

ADVICE

Read each question carefully before you start to answer it.

Write your answers neatly and in good English.

Try to answer every question.

Check your answers if you have time at the end.

Answer ALL questions.

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) The table lists three subatomic particles.**

**Complete the table by giving the missing information.
(2 marks)**

Subatomic particle	Relative mass	Relative charge
proton		+1
neutron		
electron	0.0005	

(continued on the next page)

Turn over

1 continued.

(b) Look at the diagram for Question 1(b) in the Diagram Booklet. It shows the position of some elements in the Periodic Table.

Use the Periodic Table provided as a separate insert to help you answer this question.

**(i) How are elements arranged in the Periodic Table?
(1 mark)**

- ☐ **A increasing atomic number**
- ☐ **B increasing melting point**
- ☐ **C increasing reactivity**
- ☐ **D increasing relative atomic mass**

(continued on the next page)

Turn over

1(b) continued.

**(ii) Which statement is correct about the position of phosphorus, P, in the Periodic Table?
(1 mark)**

☐ **A Group 2 and Period 5**

☐ **B Group 3 and Period 5**

☐ **C Group 5 and Period 2**

☐ **D Group 5 and Period 3**

**(iii) Explain which of the four elements in the diagram is least reactive.
(2 marks)**

Answer lines continue on the next page.

Turn over

1(b) continued.

(Total for Question 1 = 6 marks)

2 Look at the table for Question 2(a) in the Diagram Booklet. It shows some information about the halogens, fluorine, chlorine, bromine and iodine.

**(a) Complete the table by giving the missing information.
(2 marks)**

**(b) Describe a test to show that a colourless liquid is an alkene.
(2 marks)**

(continued on the next page)

Turn over

2 continued.

(c) A student is given an aqueous solution of chlorine and an aqueous solution of sodium iodide.

The student mixes the two solutions.

**Explain the colour change that occurs.
(3 marks)**

Answer space continues on the next page.

Turn over

2(c) continued.

(Total for Question 2 = 7 marks)

- 3 (a) Look at the list for Question 3(a) in the Diagram Booklet. It gives the names of some metals.**

Use words from the list to answer these questions.

- (i) Identify the metal that burns with a bright white flame.
(1 mark)**

(continued on the next page)

3(a) continued.

**(ii) Explain which metal is most likely to be found in the Earth as an uncombined element.
(2 marks)**

(continued on the next page)

3 continued.

(b) Steel is an alloy of iron and carbon.

Look at the diagram for Question 3(b) in the Diagram Booklet. It shows how the particles are arranged in steel.

**(i) State what is meant by the term ALLOY.
(1 mark)**

(continued on the next page)

3(b) continued.

**(ii) Explain why an alloy is less malleable than a pure metal.
(2 marks)**

(Total for Question 3 = 6 marks)

Turn over

4 (a) Look at the diagram for Question 4(a) in the Diagram Booklet. It shows a fractionating column used to separate crude oil into fractions.

**(i) Give one use for refinery gases and one use for bitumen.
(2 marks)**

refinery gases

bitumen

(continued on the next page)

Turn over

4(a) continued.

**(ii) Give a reason why refinery gases rise to the top of the column.
(1 mark)**

**(iii) State what must happen to the crude oil before it is pumped into the column.
(1 mark)**

(continued on the next page)

Turn over

4 continued.

(b) There is a low demand for some of the hydrocarbons obtained from crude oil.

Catalytic cracking can be used to convert low-demand hydrocarbons into more useful products.

**(i) Give the conditions needed for cracking.
(2 marks)**

(continued on the next page)

Turn over

4(b) continued.

(ii) The cracking of tetradecane is shown in the equation.



**Explain why there is a high demand for both of the products.
(3 marks)**

Answer space continues on the next page.

Turn over

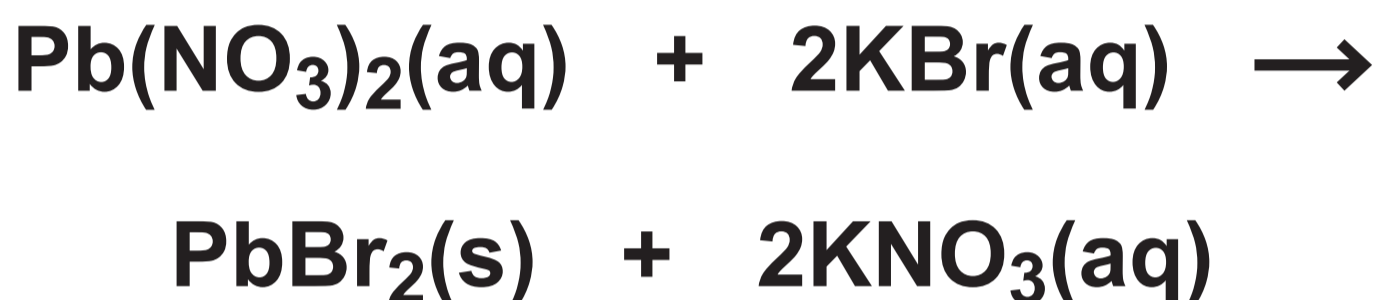
4(b)(ii) continued.

(Total for Question 4 = 9 marks)

- 5 This question is about the insoluble salt, lead(II) bromide.**

Lead(II) bromide can be made by a precipitation reaction.

This is the equation for the reaction.



- (a) Describe how solutions of lead nitrate and potassium bromide can be used to make a pure, dry sample of lead(II) bromide.
(4 marks)**

Answer space continues on the next page.

Turn over

5(a) continued.

[illegible]

(continued on the next page)

Turn over

5 continued.

**(b) A solution containing
0.150 mol of lead(II) nitrate
is reacted with an excess of
potassium bromide solution.**

**A mass of 49.6 g of pure, dry
lead(II) bromide is produced.**

**Show, by calculation, that the
percentage yield of lead(II) bromide
is 90.1%.**

(2 marks)

[for PbBr_2 , $M_r = 367$]

Answer space continues on the next page.

Turn over

5(b) continued.

[for PbBr_2 , $M_r = 367$]

5 continued.

(c) A student investigates the change in electrical conductivity as dilute lead(II) nitrate solution is added to dilute potassium bromide solution.

This is the student's method.

STEP 1 add 50 cm³ of potassium bromide solution to a beaker

STEP 2 measure the electrical conductivity of the solution

STEP 3 add 10 cm³ of lead(II) nitrate solution to the beaker

STEP 4 stir the mixture

STEP 5 measure the electrical conductivity of the mixture

Repeat steps 3, 4 and 5 until a total of 50 cm³ of lead(II) nitrate solution has been added.

(continued on the next page)

Turn over

5(c) continued.

The table shows the student's results.

Total volume of lead(II) nitrate solution added in cm³	Electrical conductivity in arbitrary units
0	10·00
10	9·80
20	9·77
30	9·40
40	9·20
50	9·00

(i) Look at the grid for Question 5(c) in the Diagram Booklet. Plot the student's results on the grid.

(1 mark)

(ii) Draw a line of best fit, ignoring the anomalous result.

(1 mark)

(continued on the next page)

Turn over

5(c) continued.

**(iii) Explain the shape of the graph.
(2 marks)**

**(iv) Suggest a mistake the student
could have made to cause the
anomalous result.
(1 mark)**

(continued on the next page)

Turn over

5(c) continued.

(v) Further 10 cm^3 volumes of lead(II) nitrate are added to the beaker so the lead(II) nitrate is in excess.

**Predict what will happen to the conductivity of the mixture when the lead(II) nitrate is in excess.
(1 mark)**

(continued on the next page)

5 continued.

(d) Look at the diagram for Question 5(d) in the Diagram Booklet. It shows the electrolysis of molten lead(II) bromide, PbBr_2

This is the ionic half-equation for the formation of bromine at electrode A.



**Give a reason why this half-equation shows oxidation.
(1 mark)**

(Total for Question 5 = 13 marks)

- 6 (a) Describe the forces of attraction in metallic bonding.
(2 marks)**

(continued on the next page)

6 continued.

(b) When a small piece of potassium is added to water, bubbles of hydrogen gas are observed.

**(i) Give the test for hydrogen gas.
(1 mark)**

(continued on the next page)

6(b) continued.

**(ii) Give two other observations that
would be made.
(2 marks)**

1 _____

2 _____

(continued on the next page)

Turn over

6 continued.

(c) Explain why lithium is less reactive than potassium.

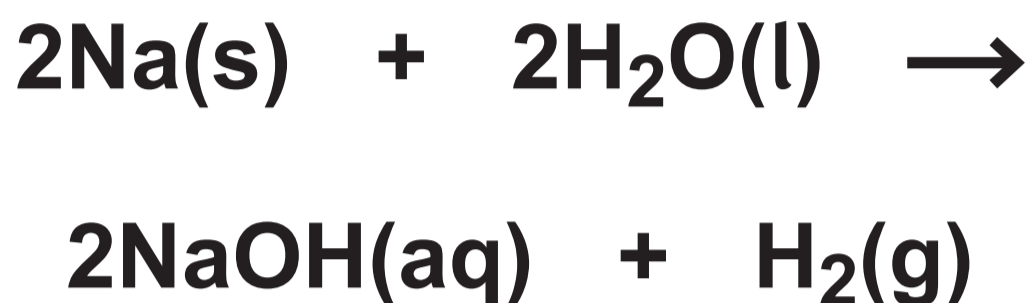
**Refer to atomic structure in your answer.
(3 marks)**

(continued on the next page)

Turn over

6 continued.

(d) This is the equation for the reaction between sodium and water.



A mass of 0.750 g of sodium is reacted with an excess of water.

Calculate the volume of hydrogen gas produced, in cm³, at room temperature.

[molar volume of hydrogen at rtp = 24 000 cm³]

[for Na, $A_r = 23$]

**Give your answer to three significant figures.
(4 marks)**

Answer space continues on the next page.

Turn over

6(d) continued.

[molar volume of hydrogen at rtp =
24 000 cm³]

[for Na, $A_r = 23$]

volume of hydrogen =

_____ cm³

(continued on the next page)

Turn over

6 continued.

(e) This is the equation for the reaction between sodium hydroxide and sulfuric acid.



A volume of 25.0 cm^3 of sodium hydroxide solution is completely neutralised by 16.3 cm^3 of 0.0500 mol/dm^3 sulfuric acid.

**Calculate the concentration of the sodium hydroxide solution in mol/dm^3 .
(3 marks)**

Answer space continues on the next page.

6(e) continued.

concentration =

_____ mol/dm³

(Total for Question 6 = 15 marks)

Turn over

- 7 Methanol is made by the reaction between hydrogen and carbon monoxide.**

This is the equation for the reaction.



A mixture of hydrogen and carbon monoxide is left until dynamic equilibrium is reached.

- (a) (i) Give two characteristics of a reaction at dynamic equilibrium. (2 marks)**

Answer space continues on the next page.

1 _____

7(a)(i) continued.

2 _____

(continued on the next page)

7(a) continued.

**(ii) Give a reason why adding a catalyst does NOT affect the yield of methanol.
(1 mark)**

(continued on the next page)

7(a) continued.

(iii) The temperature of the reaction mixture is decreased at constant pressure.

**Explain the effect of this change on the yield of methanol.
(2 marks)**

(continued on the next page)

Turn over

7(a) continued.

(iv) The pressure of the reaction mixture is increased at constant temperature.

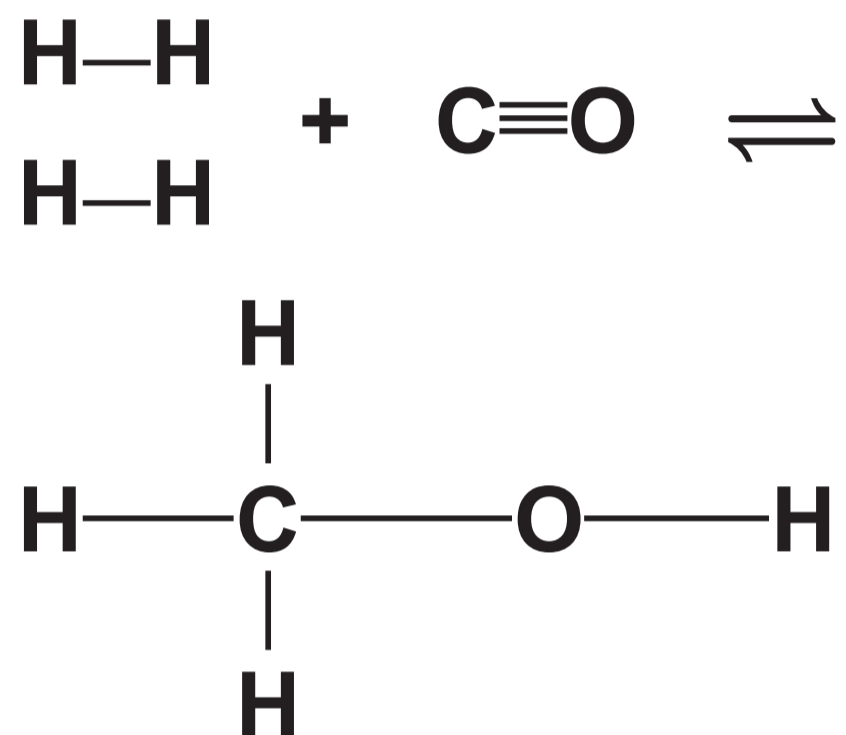
**Explain the effect of this change on the yield of methanol.
(2 marks)**

(continued on the next page)

Turn over

7 continued.

(b) This equation shows the displayed formulae for the reactants and product.



Look at the table for Question 7(b) in the Diagram Booklet. It gives the bond energies for the bonds in the reactants and product.

**(i) Show that the molar enthalpy change, ΔH , for the reaction is -119 kJ/mol .
(3 marks)**

Answer space continues on the next page.

Turn over

7(b) continued.

**(ii) Explain why this reaction
is exothermic.
(2 marks)**

(continued on the next page)

Turn over

7 continued.

(c) Look at the diagram for Question 7(c) in the Diagram Booklet. It shows the displayed formula of an ester that is made from methanol and a carboxylic acid.

**(i) Draw a circle around the functional group of the ester.
(1 mark)**

(continued on the next page)

7(c) continued.

- (ii) Give the displayed formula of the carboxylic acid used to make this ester.
(1 mark)**

(Total for Question 7 = 14 marks)

**TOTAL FOR PAPER = 70 MARKS
END OF PAPER**