PMT Education

GCSE
CHEMISTRY

Higher Tier   Paper 2

Predicted Paper 2024

(based on AQA)

_____

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- the periodic table.

Instructions
- Use black ink or black ball-point pen.
- Pencils should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough workings in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Marker's Use	
Question	Mark
1	
2	
3	
4	
5	
7	
TOTAL	

0 1 A paint manufacturer wants to analyse the mixture of dyes in their green paint.

0 1 . 1 What is the name for a mixture which has been designed as a useful product?

Tick (✓) the correct box.

[1 mark]

Composite ☐

Polymer ☐

Medication ☐

Formulation ☐

0 1 . 2 One of the compounds used in the green paint is called "indigo blue". It has the chemical formula $C_{16}H_{10}N_2O_2$.

Calculate the relative formula mass of this compound.

[2 marks]
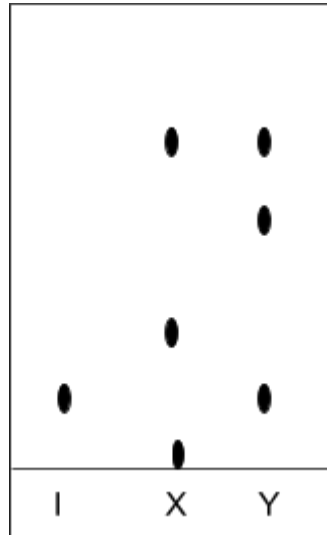
_____

_____

_____

0 1 . 3 The chemist sets up a paper chromatography experiment in order to check for impurities in the paint.

Describe how the chemist could use chromatography to calculate the Rf value of indigo blue.

[6 marks]

0 1 . 4 **Figure 1** shows the chromatogram with the chemist's results. **X**

and **Y** are unknown paint samples.

I is the chromatogram for indigo blue.

Figure 1

Which sample contains indigo blue?

[1 mark]

Tick (✓) the correct box.

I ☐

X ☐

Y ☐

0 1 . 5 The chromatogram shows that indigo blue contains no other elements or compounds.

We can call this a _____ substance.

[1 mark]

0 1 . 6 Indigo blue has the molecular formula $C_{16}H_{10}N_2O_2$.

Calculate the percentage by mass of oxygen in a molecule of $C_{16}H_{10}N_2O_2$.

[3 mark]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____%

14

Turn over to the next question

| 0 | 2 | A student is investigating the reaction between marble chips and hydrochloric acid. Marble chips are mostly calcium carbonate ($CaCO_3$).

| 0 | 2 |.| 1 | Give the balanced equation for the reaction between hydrochloric acid and calcium carbonate.

[2 marks]

$CaCO_3$ + _____ → _____ + _____ + _____

| 0 | 2 |.| 2 | Draw a diagram to show the apparatus the student could use.
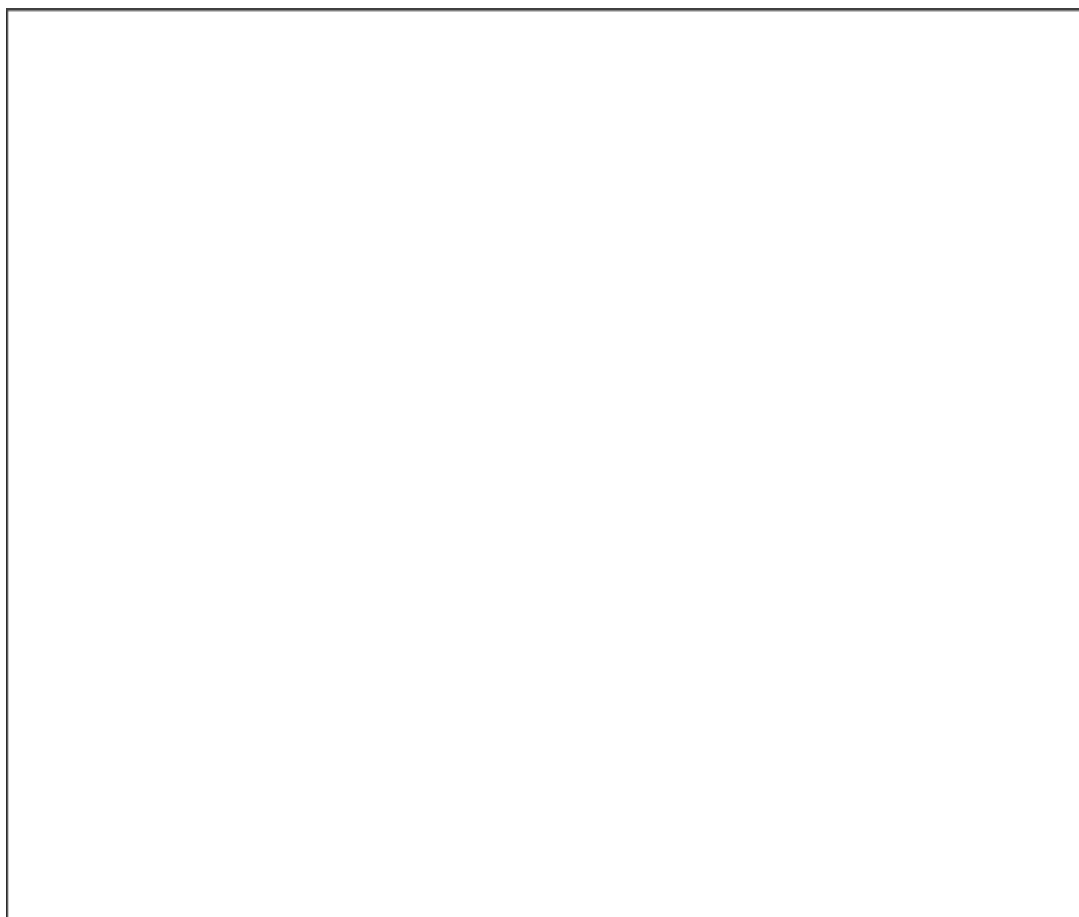
Label the gas syringe, delivery tube and conical flask

[3 marks]

The student is given 3 different sizes of marble chips.

0 2 . 3 Plan an investigation to find out how the rate of reaction changes when the surface area of marble chips changes.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Question 2 continues on the next page

Table 1 shows the student's results for the large marble chips are shown below.

Table 1

Time (s)	Volume of gas produced (dm³)
0	0.000
20	0.015
40	0.035
60	0.055
80	0.070
100	0.090
120	0.105
140	0.115
160	0.120
180	0.120

0 2 . 4 Plot the date from **Table 1** on **Figure 2**

Draw a line of best fit.

[4 marks]

Figure 2

Volume of gas in dm3

Time in s

0 2 . 5 Calculate the rate of reaction between 0 and 100 s. Give the units. Use

the equation;

mean rate of reaction $= \dfrac{\text{volume of gas formed}}{\text{time taken}}$

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 2 . 6 Sketch a line on **Figure 2** to show the results you would expect if the student used small marble chips.

Label this line X.

[2 marks]

Question 2 continues on the next page

0 2 . 7 Explain in terms of particles how and why the rate of reaction changes during the course of this experiment.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

23

0 3 A water company wants to test the amount of solids dissolved in their water.

0 3 . 1 Suggest a method of how they might do this.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

0 3 . 2 Describe a test to find out if the solids from the water contain sulfate ions.

Give the result of the test.

[2 marks]

_____

_____

_____

Question 3 continues on the next page

0 3 . 3 Describe a test to find out if the solids form the water contain carbonate ions.

Give the result of the test.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

The water company suspects there may be lithium in the solids from the water.

0 3 . 4 Describe how they could carry out a flame test to do this. Include the expected result.

[2 marks]

_____

_____

_____

12

0 4 **Table 2** gives some information about cups made from different materials. They all hold the same volume of liquid.

Table 2

	Paper cup	Ceramic cup	Stainless steel cup
Raw material	wood	Mined clay	Mined iron ore + carbon
Average number of times used	1	1000	5000
Number packaged in a 10dm³ box	5000	50	200
biodegradable?	yes	no	no
recyclable?	yes	no	yes

The energy of manufacture and transportation has been omitted from this table.

0 4 . 1 Evaluate the use of these materials for making cups. Include a life cycle assessment.

[6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Question 4 continues on the next page

There are different alloys of steel.

0 4 . 2 Match the alloy with the properties

[3 marks]

High carbon steel   strong but brittle

Low carbon steel   hard and resistant to corrosion

Stainless steels   softer and more easily shaped

There are many ways of preventing corrosion in metals.

0 4 . 3 Explain how magnesium fixed to a steel ship prevents rusting of the steel.

[2 marks]

_____

_____

_____

_____

0 4 . 4 Explain how paint stops a steel bicycle from rusting.

[2 marks]

_____

_____

_____

_____

13

0 5 Crude oil is a mixture of hydrocarbons of differing sizes.

0 5 . 1 Explain how crude oil is separated into different fractions.

[4 marks]

_____

_____

_____

_____

0 5 . 2 Give the equation for the complete combustion of pentane, C_5H_{12}.

[2 marks]

_____ + _____ → _____ + _____
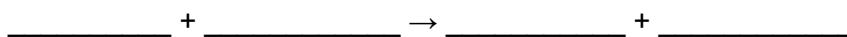
Large hydrocarbons can be cracked into smaller hydrocarbons.

0 5 . 3 Give the conditions required for this process.

[2 marks]

_____

_____

_____

$C_{20}H_{42}$ can be cracked. One of the products is Ethene.

0 5 . 4 Complete the equation below.

[1 marks]

_____ → C_2H_4 + _____
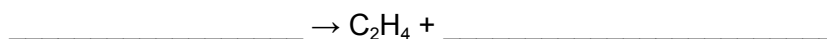
Question 5 continues on the next page

Ethene is an alkene.

0 5 . 5 Give the test for alkenes.

Include any observations.

[2 marks]

_____

_____

_____

Alkenes are used to make polymers.

Figure 3 shows a short section of a polymer.

Figure 3
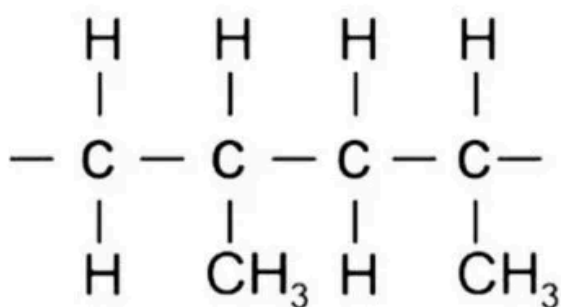
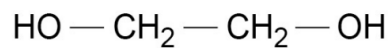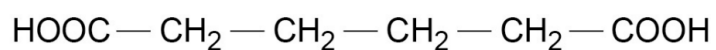0 5 . 6 Draw the structure of the monomer.

[2 marks]

C   C

Condensation polymers are made from two different monomers.

Below is an example of two monomers used to make a condensation polymer.

Monomer A

$HO - CH_2 - CH_2 - OH$

Monomer B

$HOOC - CH_2 - CH_2 - CH_2 - CH_2 - COOH$

0 5 . 7 Give the names of the functional group on monomers A and B.

[2 marks]

A _____

B _____

Some polymers are naturally occurring. Proteins are an example of naturally occurring polymers.

0 5 . 8 Name the monomer in a protein.

[1 marks]

Tick (✓) the correct box.

Starch ☐

Glucose ☐

Fat ☐

Amino acid ☐

16

Turn over to the next question

0 6   **Table 3** shows the percentage of gases in the Earth's atmosphere today is different compared with the Earth's early atmosphere.

0 6 . 1 Complete the table with the correct gases.

[3 marks]

Table 3

Gas	Estimated percentage in the Early atmosphere of Earth	Current percentage in Earth's atmosphere
	1.8	78.09
	0.2	20.95
	96.0	0.04
Other gases	2	0.92

0 6 . 2 Describe the role that algae and plants had in changing the composition of the atmosphere of the Earth to what it is today.

Include a word equation in your answer.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 6 . 3 Burning fossil fuels releases carbon dioxide into the atmosphere.

Give two other pollutants released when fossil fuels are burned and describe the problems they cause.
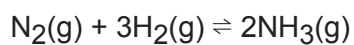
[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

0 6 . 4 Give the test for oxygen gas. Include the result

[2 marks]

_____

_____

_____

13

Turn over to the next question

0 7 The Haber process is used to make ammonia. The reaction is outlined below.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

0 7 . 1 Explain what happens when the temperature is increased from 350°C to 450 °C in this process. Refer to reaction rate and position of equilibrium.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

0 7 . 2 Explain what happens when the pressure is increased from 150 atm to 200 atm in this process. Refer to reaction rate and position of equilibrium.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

| 0 | 7 |.| 3 | Explain why a catalyst is added to this reaction. Refer to reaction rate and position of equilibrium.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

9

END OF QUESTIONS