

0 1 . 4

Which element forms ions with different charges?

Tick one box.

J L M Q R

[1 mark]

0 1 . 5

Which element has three electron shells?

Tick one box.

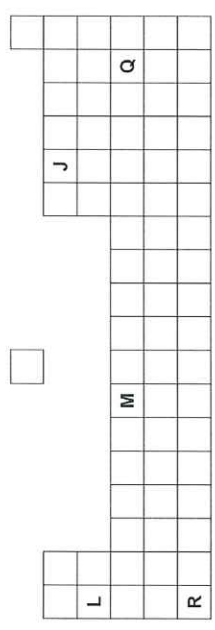
J L M Q R

[1 mark]

Question 1 continues on the next page

Figure 1 shows an outline of the modern periodic table.

Figure 1



J, L, M, Q and R represent elements in the Periodic Table.

0 1 . 1

Which element has four electrons in its outer shell?

Tick one box.

J L M Q R

[1 mark]

0 1 . 2

Which two elements in Figure 1 are in the same period?

_____ and _____

[1 mark]

0 1 . 3

Which element reacts with potassium to form an ionic compound?

Tick one box.

J L M Q R

[1 mark]

Turn over ►

0 1 6 Mendeleev's table became accepted by other scientists whereas Newlands' table was not.

Evaluate Newlands' and Mendeleev's tables.

You should include:

- a comparison of the tables
- reasons why Mendeleev's table was more acceptable.

Use Figure 2 and Figure 3 and your own knowledge.

[6 marks]

Turn over ►

In the 1860s scientists were trying to organise elements.

Figure 2 shows the table published by John Newlands in 1865.

The elements are arranged in order of their atomic weights.

Figure 2

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru
Pd	Ag	Cd	U	Sn	Sb	Te

Figure 3 shows the periodic table published by Dmitri Mendeleev in 1869.

Figure 3

H								
Li	Be	B	C	N	O	F		
Na	Mg	Al	Si	P	S	Cl		
K	Ca	Zn	?	Ti	V	As	Cr	Mn
Rb	Ag	Sr	Y	In	Zr	Nb	Sb	Mo
								Te
								I
								Ru
								Rh
								Pd

0 2

A student investigated the law of conservation of mass.

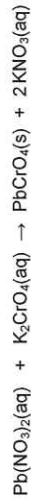
The law of conservation of mass states that the mass of the products is equal to the mass of the reactants.

This is the method used.

1. Pour lead nitrate solution into a beaker labelled **A**.
2. Pour potassium chromate solution into a beaker labelled **B**.
3. Measure the mass of both beakers and contents.
4. Pour the solution from beaker **B** into beaker **A**.
5. Measure the mass of both beakers and contents again.

When lead nitrate solution and potassium chromate solution are mixed, a reaction takes place.

This is the equation for the reaction:



0 2 . 1

What would the student see when the reaction takes place?

[1 mark]

0 2 . 2

Table 1 shows the student's results.

Table 1

	Mass in g
Beaker A and contents before mixing	128.71
Beaker B and contents before mixing	128.97
Beaker A and contents after mixing	154.10
Beaker B after mixing	103.58

Show that the law of conservation of mass is true.

Use the data from Table 1.

[2 marks]

0 2 . 3

What is the resolution of the balance used to obtain the results in Table 1?

[1 mark]

Tick one box.

0.01 g 0.1g 1g 100g

Question 2 continues on the next page

Turn over ►

0 2 . 4 Calculate the relative formula mass (M_r) of lead nitrate $Pb(NO_3)_2$ [2 marks]

Relative atomic masses (A_r): N = 14 O = 16 Pb = 207

Relative formula mass = _____

0 2 . 5 The formula of potassium chromate is K_2CrO_4

The charge on the potassium ion is +1

What is the formula of the chromate ion?

Tick one box.

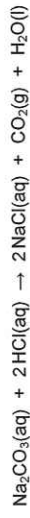
- CrO_4^+
 CrO_4^{2+}
 CrO_4^-
 CrO_4^{2-}

[1 mark]

0 2 . 6 Another student also tests the law of conservation of mass using the same method.

The student uses a different reaction.

This is the equation for the reaction.



Explain why this student's results would **not** appear to support the law of conservation of mass.

[3 marks]

Turn over for the next question

0 3 A student makes a hypothesis:

‘When different salt solutions are electrolysed with inert electrodes, the product at the negative electrode is always a metal’.

0 3 . 1 Describe how you would test this hypothesis in the laboratory.

You should:

- draw a labelled diagram of the apparatus
- give the independent variable
- describe what you would see at the negative electrode if the hypothesis is true. **[5 marks]**

Diagram

Independent variable _____

Observation _____

0 3 . 2

The student’s hypothesis is only partially correct.

Explain why the product at the negative electrode is not always a metal. **[2 marks]**

0 3 . 3

Predict the product at the **positive** electrode in the electrolysis of:

- sodium chloride solution
- copper sulfate solution.

[2 marks]

Sodium chloride solution _____

Copper sulfate solution _____

9

Turn over for the next question

Turn over ▶

0 4 This question is about atoms.

0 4 . 1 What does the number 19 represent in ${}^{19}_9\text{F}$?

[1 mark]

0 4 . 2 How many atoms are present in one mole of fluorine atoms?

Tick **one** box.

2.03×10^{26}

2.06×10^{23}

6.02×10^{23}

6.02×10^{26}

[1 mark]

0 4 . 3 The plum pudding model of the atom was replaced by the nuclear model.

The nuclear model was developed after the alpha particle scattering experiment.

Compare the plum pudding model with the nuclear model of the atom.

[4 marks]

0 4 . 4 An element has three isotopes.

Table 2 shows the mass numbers and percentage of each isotope.

Table 2

	Isotope 1	Isotope 2	Isotope 3
Mass number	24	25	26
Percentage (%)	78.6	10.1	11.3

Calculate the relative atomic mass (A_r) of the element.

Give your answer to 3 significant figures.

[2 marks]

Relative atomic mass = _____

Turn over for the next question

0 5 Some students investigated the energy changes occurring in the reaction between potassium hydrogencarbonate and hydrochloric acid.

The equation for the reaction is:



This is the method used.

1. Measure 50 cm³ hydrochloric acid into a glass beaker.
2. Measure the temperature of the hydrochloric acid.
3. Measure a given mass of potassium hydrogencarbonate.
4. Add the potassium hydrogencarbonate to the hydrochloric acid.
5. Stir until all the potassium hydrogencarbonate has reacted.
6. Record the lowest temperature reached.
7. Repeat three more times, using the same mass of potassium hydrogencarbonate.

Each student used a different mass of potassium hydrogencarbonate.

0 5 . 1 The method described will not give very accurate results.

Suggest **one** change to the apparatus that would improve the accuracy of the results.

Give a reason for your answer.

[2 marks]

0 5 . 2 The students controlled the volume of the hydrochloric acid.

Give **one** other control variable the students should use.

[1 mark]

Table 3 shows one student's results.

Table 3

	Trial 1	Trial 2	Trial 3	Trial 4
Initial temperature in °C	21.2	21.1	21.0	21.1
Final temperature in °C	15.6	15.4	15.6	16.6
Temperature decrease in °C	5.6	5.7	5.4	4.5

0 5 . 3 Calculate the mean temperature decrease for the results shown in Table 3.

Ignore any anomalous results.

Give your answer to 1 decimal place.

Give the uncertainty in your answer.

[3 marks]

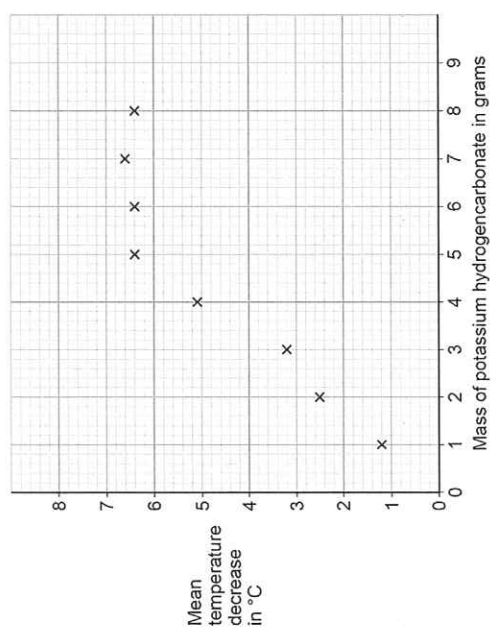
Mean = _____ °C ± _____ °C

Question 5 continues on the next page

Turn over ►

Figure 4 shows the students' results.

Figure 4



0 5 . 4 Draw two intersecting straight lines of best fit on Figure 4. [2 marks]

0 5 . 5 Explain why the graph has this shape. Use data from the graph. [3 marks]

0 5 . 6 Suggest a possible reason for the anomalous points. Do not include errors in measuring. [1 mark]

Turn over for the next question

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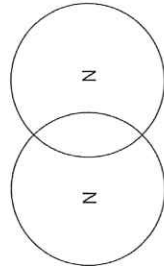
This question is about structure and bonding.

0 6 . 1

0 6 . 1 Complete the dot and cross diagram to show the covalent bonding in a nitrogen molecule, N_2

Show only the electrons in the outer shell.

[2 marks]



0 6 . 2

0 6 . 2 Explain why nitrogen is a gas at room temperature.
Answer in terms of nitrogen's structure.

[3 marks]

Question 6 continues on the next page

Turn over ▶

Graphite and fullerenes are forms of carbon.

0 6 . 3

Graphite is soft and is a good conductor of electricity.

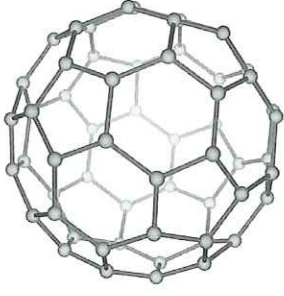
Explain why graphite has these properties.

Answer in terms of structure and bonding.

[4 marks]

0 6 . 4 **Figure 5** shows a model of a Buckminsterfullerene molecule.

Figure 5



A lubricant is a substance that allows materials to move over each other easily.

Suggest why Buckminsterfullerene is a good lubricant.

Use **Figure 5**. **[2 marks]**

Question 6 continues on the next page

Turn over ▶

0 6 . 6

Silver nanoparticles are sometimes used in socks to prevent foot odour. Suggest why it is cheaper to use nanoparticles of silver rather than coarse particles of silver. [2 marks]

Four horizontal lines for writing the answer.

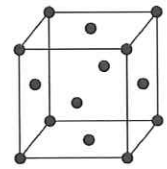
Turn over for the next question

16

Turn over ▶

Silver can form cubic nanocrystals. Figure 6 represents a silver nanocrystal.

Figure 6



0 6 . 5 A silver nanocrystal is a cube of side 20 nm. Calculate the surface area to volume ratio of the nanocrystal. [3 marks]

Five horizontal lines for writing the answer.

Surface area to volume ratio = _____

0 7 A scientist produces zinc iodide (ZnI_2).

This is the method used.

1. Weigh 0.500 g of iodine.
2. Dissolve the iodine in ethanol.
3. Add an excess of zinc.
4. Stir the mixture until there is no further change.
5. Filter off the excess zinc.
6. Evaporate off the ethanol.

0 7 . 1

Ethanol is flammable.

Suggest how the scientist could carry out **Step 6** safely.

[1 mark]

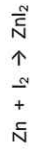
0 7 . 2

Explain why the scientist adds excess zinc rather than excess iodine.

[3 marks]

0 7 . 3 Calculate the minimum mass of zinc that needs to be added to 0.500 g of iodine so that the iodine fully reacts.

The equation for the reaction is:



Relative atomic masses (A_r): Zn = 65 I = 127

[3 marks]

Minimum mass of zinc = _____ g

Question 7 continues on the next page

Turn over ▶

A different scientist makes zinc iodide by the same method.

The scientist obtains 12.5 g of zinc iodide.

The percentage yield in this reaction is 92.0%.

0 7 . 4 What is the maximum theoretical mass of zinc iodide produced in this reaction? **[3 marks]**

Maximum theoretical mass = _____ g

0 7 . 5 Suggest **one** reason why the percentage yield in this reaction is **not** 100%. **[1 mark]**

0 7 . 6 The scientist makes a solution of zinc iodide with a concentration of 0.100 mol/dm³

Calculate the mass of zinc iodide (ZnI₂) required to make 250 cm³ of this solution.

Relative atomic masses (A_r): Zn = 65 I = 127 **[3 marks]**

Mass = _____ g

Turn over for the next question

0 8 Cells contain chemicals which react to produce electricity.

0 8 . 1 Why can a rechargeable cell be recharged?

[1 mark]

0 8 . 2 Give **two** factors that affect the voltage produced by a cell.

1

2

[2 marks]

0 8 . 3 Balance the half-equation for the reaction occurring at an electrode in one type of hydrogen fuel cell.



[1 mark]

0 8 . 4 Why is the fuel cell in Question 08.3 described as an alkaline fuel cell?

[1 mark]

0 8 . 5 Another type of fuel cell uses methanol instead of hydrogen.

Figure 7 represents the reaction in this fuel cell.

Figure 7

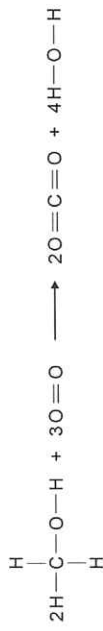


Table 4 shows the bond energies for the reaction.

Table 4

Bond energy in kJ/mol	C-H	C-O	O-H	O=O	C=O
	412	360	464	498	805

Calculate the overall energy change for the reaction.

Use Figure 7 and Table 4.

[3 marks]

Overall energy change = _____ kJ/mol

Turn over ►

Citric acid is a weak acid.

0 9

Explain what is meant by a weak acid.

0 9 . 1

[2 marks]

Question 9 continues on the next page

Turn over ▶

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A student titrated citric acid with sodium hydroxide solution.

This is the method used.

1. Pipette 25.0 cm³ of sodium hydroxide solution into a conical flask.
2. Add a few drops of thymol blue indicator to the sodium hydroxide solution.
Thymol blue is blue in alkali and yellow in acid.
3. Add citric acid solution from a burette until the end-point was reached.

0 9 . 2

1. Explain what would happen at the end-point of this titration.

Refer to the acid, the alkali and the indicator in your answer.

[3 marks]

0 9 . 3

2. Explain why a pipette is used to measure the sodium hydroxide solution but a burette is used to measure the citric acid solution.

[2 marks]

0 9 . 4 Table 5 shows the student's results.

Table 5

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of citric acid solution in cm ³	13.50	12.10	11.10	12.15	12.15

The equation for the reaction is:



The concentration of the sodium hydroxide was 0.102 mol/dm³

Concordant results are those within 0.10 cm³ of each other.

Calculate the concentration of the citric acid in mol/dm³

Use only the concordant results from Table 5 in your calculation.

You must show your working.

[5 marks]

Concentration = _____ mol/dm³

END OF QUESTIONS

12

Turn over ►

There are no questions printed on this page

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0 1 . 1 Burgundy Mixture is a formulation used to kill fungi on grapevines.

It is made by mixing two compounds, **A** and **B**.

The ratio by mass of **A** : **B** in the mixture is 1 : 8

0 1 . 1 Calculate the mass of **A** needed in a mixture containing 125 g of **B**. [2 marks]

Mass of **A** = _____ g

Scientists test a solution of compound **A**.

Table 1 shows their results.

Table 1

Test	Result
Add sodium hydroxide solution	Blue precipitate
Add dilute hydrochloric acid and barium chloride solution	White precipitate

0 1 . 2 Which two ions are in compound **A**?

Choose answers from the box.

[2 marks]

bromide	chloride	copper
iron(II)	iron(III)	sulfate

_____ ions and _____ ions

0 1 . 3 The scientists think that compound **B** is sodium carbonate.

Describe how the scientists can test a solution of **B** to see if sodium ions are present.

Give the result of the test if sodium ions are present. [2 marks]

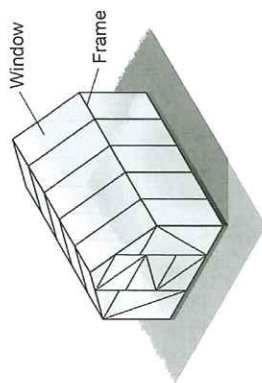
0 1 . 4 Describe how the scientists can test a solution of **B** to see if carbonate ions are present.

Give the result of the test if carbonate ions are present. [3 marks]

Turn over for the next question

0 2 1 Figure 1 shows a greenhouse.

Figure 1



A greenhouse frame can be made from wood or aluminium.
 Table 2 gives some information about wood and aluminium.

Table 2

	Wood	Aluminium
Raw material	Renewable	Non-renewable
Mass of greenhouse frame in kg	80	20
Useful lifetime in years	20	50
End of useful life	Can be chopped up and used as fuel	Can be recycled into new aluminium products

0 2 1 Evaluate the use of each material for making greenhouse frames.
 Use Table 2.

[4 marks]

0 2 2 Greenhouse frames are transported by lorry.
 The lorry used can carry a maximum load of 12 tonnes.

[2 marks]

Calculate the largest number of wooden greenhouse frames which could be transported by the lorry.
 Use Table 2.

1000 kg = 1 tonne

Number of wooden greenhouse frames = _____

Question 2 continues on the next page

Turn over ▶

0 2 . 3 It is more sustainable to make greenhouse frames from recycled aluminium than from aluminium from aluminium ore.

Give two reasons why.

[2 marks]

1 _____
2 _____

0 2 . 4 Greenhouse windows can be made from glass or from polymers.

Table 3 gives information about glass and a polymer.

Table 3

	Glass	Polymer
Density in g/cm ³	2.8	1.2
Cost in £ per m ²	20	28
Effect of sunlight	No effect	Discolours over time

Suggest one advantage of making greenhouse windows from the polymer rather than from glass.

Use Table 3.

[1 mark]

0 3 This question is about alkenes and crude oil.

0 3 . 1 Pentene is an alkene molecule containing five carbon atoms.

Complete the formula for pentene.

[1 mark]



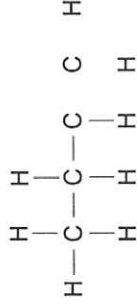
0 3 . 2 Butene is an alkene molecule containing four carbon atoms.

Figure 2 shows all of the atoms and some of the bonds in the displayed formula for butene.

Complete the displayed formula by adding the remaining bonds.

[1 mark]

Figure 2



Question 3 continues on the next page

Turn over ►

Pentene and butene are produced from crude oil.

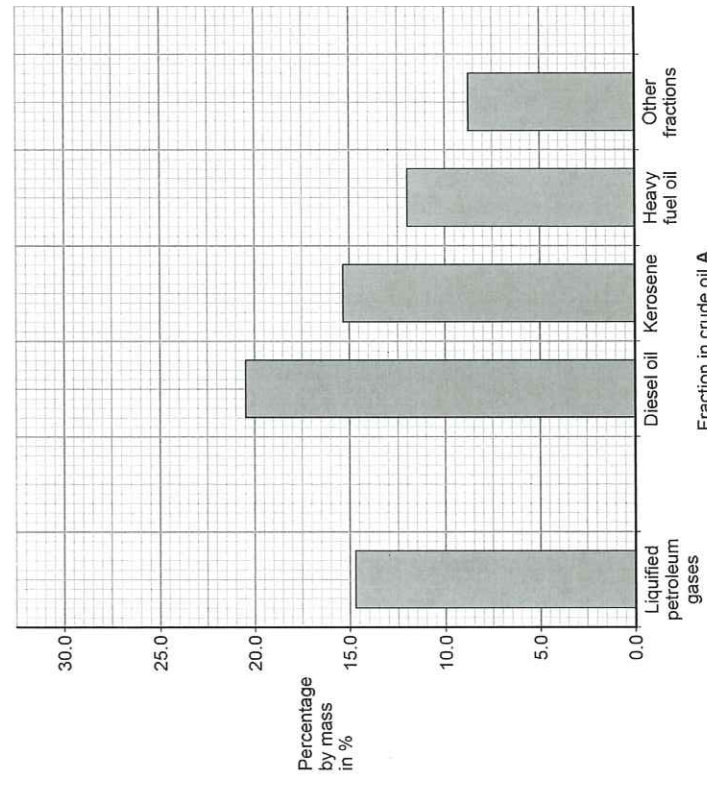
Table 4 shows the percentages of different fractions in two samples of crude oil.

Table 4

Fraction	Percentages by mass in %	
	Crude oil A	Crude oil B
Liquefied petroleum gases	14.7	7.1
Petrol	28.6	11.1
Diesel oil	20.5	17.2
Kerosene	15.4	38.5
Heavy fuel oil	12.0	16.0
Other fractions	8.8	10.1

Figure 3 shows the percentages of different fractions in crude oil A.

Figure 3



0 3 . 3 Plot the data for petrol in Table 4 on Figure 3.

[1 mark]

Question 3 continues on the next page

Turn over ▶

0 3 . 4 What mass of crude oil A is needed to obtain 12 tonnes of heavy fuel oil? [1 mark]

Use Table 4.

Tick one box.

- 10 tonnes
- 100 tonnes
- 1000 tonnes
- 10 000 tonnes

0 3 . 5 Liquefied petroleum gases, petrol and diesel oil are used as car fuels. Calculate the total mass of car fuel that can be produced from 2000 kg of crude oil B. Use Table 4. [3 marks]

Mass of car fuel = _____ kg

0 3 . 6 Crude oil B is a better source of hydrocarbons for cracking than crude oil A. Suggest why. Use Table 4. [1 mark]

0 3 . 7 Alkenes are obtained from crude oil using fractional distillation followed by cracking. Explain how alkenes are produced using fractional distillation followed by cracking. [6 marks]

Turn over for the next question

Turn over ▶

0 4 When sodium thiosulfate solution reacts with dilute hydrochloric acid, the solution becomes cloudy.

The equation for the reaction is:

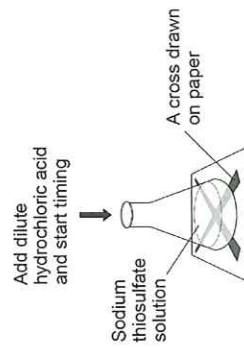


0 4 . 1 Why does the solution become cloudy? [2 marks]

Some students used this reaction to investigate the effect of concentration on rate of reaction.

Figure 4 shows the apparatus used.

Figure 4



This is the method used.

1. Measure 25 cm³ sodium thiosulfate solution into a conical flask.
2. Stand the conical flask on a cross drawn on paper.
3. Add 10 cm³ of dilute hydrochloric acid.
4. Time how long it takes the cross to become no longer visible.
5. Repeat steps 1–4 with sodium thiosulfate solutions of different concentrations.

0 4 . 2

The students used a measuring cylinder to measure 25 cm³ of sodium thiosulfate solution.

Suggest a more accurate way of measuring 25 cm³ of sodium thiosulfate solution. [1 mark]

0 4 . 3

Name one control variable the students should use in this investigation. [1 mark]

Question 4 continues on the next page

Turn over ►

Table 5 shows the students' results.

Table 5

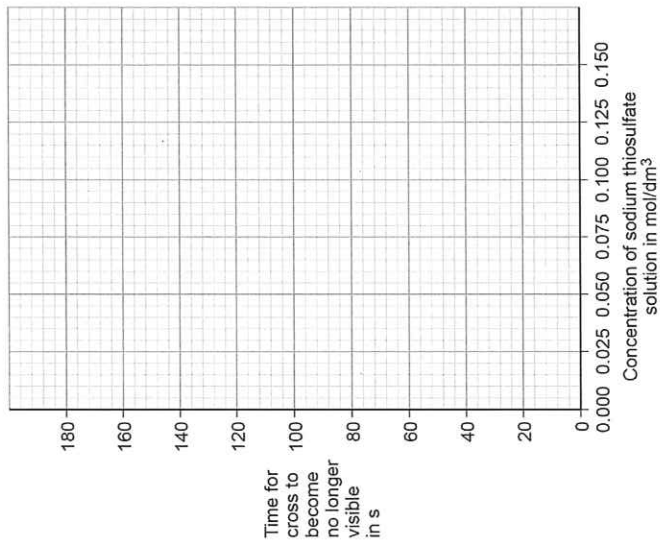
Concentration of sodium thiosulfate solution in mol/dm ³	Time for cross to become no longer visible in s
0.020	170
0.040	90
0.060	82
0.080	42
0.100	34
0.120	30
0.140	28

0 4 . 4 Plot the data from Table 5 on Figure 5.

Draw a line of best fit.

[3 marks]

Figure 5



Question 4 continues on the next page

Turn over ▶

The students repeated the investigation two more times. They obtained similar results each time.

0 4 . 5 What word describes an investigation by the same students which gives similar results each time? **[1 mark]**

0 4 . 6 Describe how the students can use their results to improve the accuracy of the investigation. **[2 marks]**

0 4 . 7 The students analysed their results to give a conclusion and an explanation for their investigation.

Conclusion: 'The higher the concentration, the lower the rate of reaction.'

Explanation: 'At higher concentrations, the particles have more energy, so they are moving faster. Therefore the collisions are more energetic.'

The students are **not** correct.

Give a **correct** conclusion **and** explanation for the results of the investigation. **[3 marks]**

Conclusion _____

Explanation _____

0 4 . 8 A solution containing 0.18 g of sodium thiosulfate reacts with dilute hydrochloric acid in 2 minutes.

Calculate the mean rate of reaction in g/s.

Give your answer in standard form. **[3 marks]**

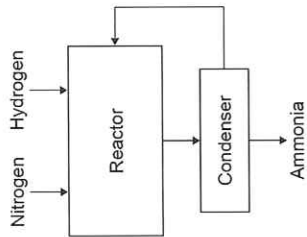
Mean rate of reaction = _____ g/s

16

Turn over ►

Nitrogen and hydrogen react to produce ammonia in the Haber process.
Figure 6 shows the Haber process.

Figure 6



A gaseous mixture of ammonia, hydrogen and nitrogen leaves the reactor.
Table 6 shows the boiling points of the gases.

Table 6

Gas	Boiling point in °C
Ammonia	-33
Nitrogen	-196
Hydrogen	-253

Suggest how ammonia is separated from the other gases.

0 5 . 1 [2 marks]

What happens to the unreacted hydrogen and nitrogen?

0 5 . 2 [1 mark]

The equation for the reaction is:



The forward reaction is exothermic.

Calculate the volume of ammonia produced from the complete reaction of 825 dm³ of hydrogen.

0 5 . 3 [2 marks]

Volume of ammonia = _____ dm³

Question 5 continues on the next page

Turn over ▶

0 5 . 4 The Haber process uses a temperature of 450 °C and a pressure of 200 atmospheres.

Why are these conditions used?

Tick **two** boxes.

- A higher pressure is maintained using less energy
- A higher temperature would increase the equilibrium yield
- A lower pressure would decrease the equilibrium yield
- A lower temperature would make the reaction too slow
- There are more product molecules than reactant molecules

[2 marks]

Most of the ammonia produced is used to make fertilisers.

Table 7 shows information about compounds used as fertilisers.

Table 7

Compound	Formula	Cost in £/tonne
A	NH_4NO_3	220
B	$(\text{NH}_4)_2\text{HPO}_4$	350
C	KCl	235

0 5 . 5 Which element in compound A improves agricultural productivity?

[1 mark]

0 5 . 6 Which **two** compounds can be mixed to make a fertiliser containing **three** elements that improve agricultural productivity?

Give a reason why you have chosen these compounds.

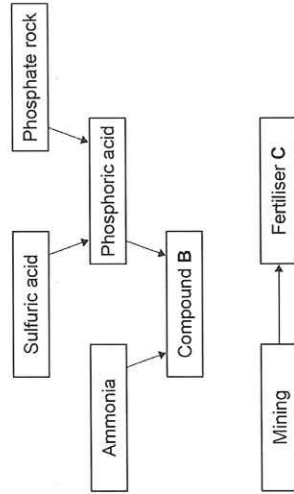
[2 marks]

Compounds _____ and _____

Reason _____

0 5 . 7 Figure 7 shows a flow chart for the production of compounds B and C.

Figure 7



Suggest **two** possible reasons for the difference in cost between compounds B and C. [2 marks]

1 _____

2 _____

Turn over ►

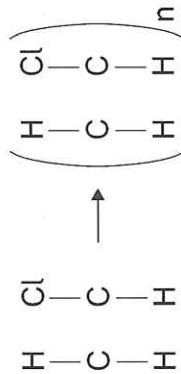
This question is about polymers.

0 6 . 1 Name the monomer used to form poly(chloroethene). [1 mark]

0 6 . 2 Figure 8 shows the equation for the formation of poly(chloroethene).

Complete Figure 8. [3 marks]

Figure 8



0 6 . 3 Poly(chloroethene) is the only product.

What type of polymer is poly(chloroethene)? [1 mark]

Ethanediol reacts with butanedioic acid to produce a polyester and a small molecule.

0 6 . 4 Figure 9 shows the structural formula of ethanediol.

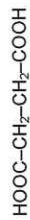
Figure 9



Name the functional group present in ethanediol. [1 mark]

0 6 . 5 Figure 10 shows the structural formula of butanedioic acid.

Figure 10



Which formula represents the carboxylic acid functional group? [1 mark]

Tick one box.

- $-\text{CH}_2-$
 $-\text{CH}_2-\text{CH}_2-$
 $-\text{CH}_2-\text{COOH}$
 $-\text{COOH}$

Question 6 continues on the next page

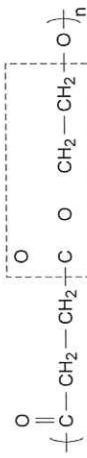
Turn over ►

0 6 . 6 Figure 11 shows part of the structure of the polyester.

Complete the box in Figure 11.

[2 marks]

Figure 11



0 6 . 7 Name the small molecule produced when ethanediol reacts with butanedioic acid. **[1 mark]**

Starch, proteins and DNA are naturally occurring polymers.

0 6 . 8

Name the monomers from which starch and proteins are produced.

[2 marks]

Starch _____

Proteins _____

0 6 . 9

Describe the structure of DNA.

[2 marks]

14

Turn over for the next question

Turn over ►

0 7 Cobalt forms coloured compounds.

A pink cobalt compound reacts with hydrochloric acid.

The reaction can be represented as:



The forward reaction is endothermic.

When both cobalt compounds are present in a solution at equilibrium, the equilibrium mixture is purple.

0 7 . 1 What is meant by equilibrium?

[2 marks]

0 7 . 2 The equilibrium mixture is cooled.

Explain what happens to the concentration of the pink cobalt compound.

[3 marks]

0 7 . 3 More hydrochloric acid is added.

Explain what happens to the colour of the equilibrium mixture.

[3 marks]

0 7 . 4 Why does cobalt form different coloured compounds?

[1 mark]

0 7 . 5 An oxide of cobalt has the formula Co_2O_3 .

Which cobalt ion is present in this oxide?

[1 mark]

Tick **one** box.

Co^+	
Co^{2+}	
Co^{3+}	
Co^{4+}	

Question 7 continues on the next page

Turn over ►

0 7 . 6 Cobalt compounds can act as catalysts.

Which **two** statements about cobalt compounds are correct?

Tick **two** boxes.

[2 marks]

- They allow reactions to reach equilibrium more quickly.
- They are reactants in reactions catalysed by cobalt compounds.
- They are used up when acting as catalysts.
- They increase the equilibrium yield of reactions.
- They provide a different reaction pathway.

0 7 . 7 The reaction of hydrogen with carbon monoxide is catalysed by cobalt metal.

Balance the equation for the reaction.

[1 mark]



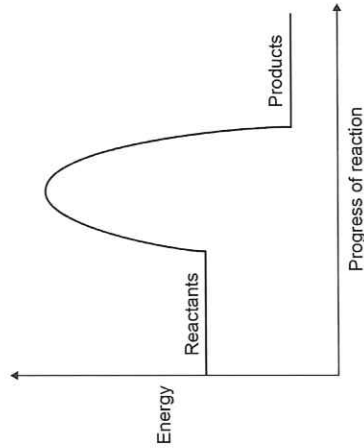
0 7 . 8 C_6H_{14} is an alkane.

What is the formula of an alkane containing 18 hydrogen atoms?

[1 mark]

0 7 . 9 Figure 12 shows a reaction profile diagram for a reaction **without** a catalyst.

Figure 12



On Figure 12:

- draw the reaction profile diagram for a catalysed reaction
- draw and label an arrow to show the activation energy for the reaction **without** a catalyst.

[2 marks]

16

Turn over for the next question

Turn over ►

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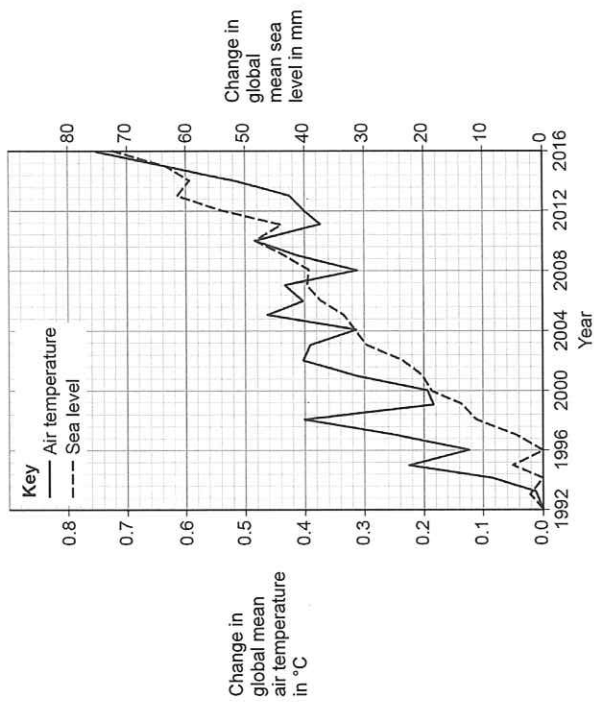
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This question is about climate change.

0 8

Figure 13 shows the changes in the global mean air temperature and global mean sea level from 1992 to 2016.

Figure 13



0 8 . 1 Calculate the mean yearly increase in sea level between 1992 and 2016.

Use Figure 13.

[2 marks]

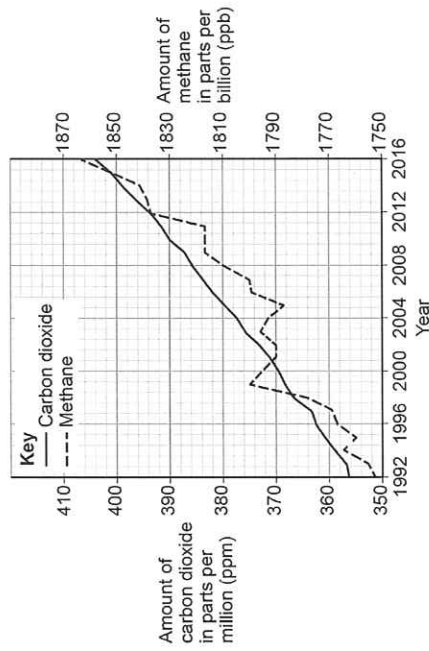
Mean yearly increase in sea level = _____ mm/year

Turn over ▶

Most scientists think carbon dioxide and methane are a cause of global climate change.

Figure 14 shows the amounts of these gases in the atmosphere from 1992 to 2016.

Figure 14



Describe the changes in Figure 13 and in Figure 14.

Explain how these changes have taken place.

[6 marks]

0 8 . 2

The data was collected by a single scientific group.

Give two reasons why more evidence is needed to support any conclusions made by this scientific group.

[2 marks]

0 8 . 3

1 _____

2 _____

10

END OF QUESTIONS

Turn over ▶

There are no questions printed on this page

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