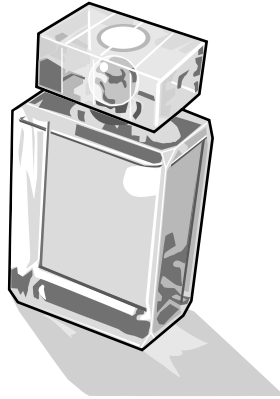


Answer **all** the questions.

SECTION A – Module C1

1 Stowmarket Synthetics make perfumes.



They make and test four new perfumes.

(a) Perfumes must be tested before they are **permitted** to be used.

Write about **two** reasons why.

.....

.....

.....

..... [2]

(b) Look at some of the properties of the four new perfumes.

| Perfume | Boiling point in °C | Solubility in water (0 = insoluble and 10 = very soluble) |
|---------|---------------------|---|
| G | 130 | 10 |
| I | 340 | 0 |
| J | 40 | 0 |
| K | 50 | 5 |

(i) Which perfume has the best set of properties?

.....

Write down **two** reasons for your choice of perfume.

.....

 [2]

(ii) Richard works for Stowmarket Synthetics.

He thinks there is not enough information in the table to decide which perfume should be manufactured.

He thinks the **cost** of making the perfume is important.

Write down one **other** piece of information that is important.

..... [1]

[Total: 5]

2 Coal is a fossil fuel. It is a non-renewable fuel.

(a) What is meant by a **non-renewable** fuel?

.....
 [1]

(b) Some power stations burn coal.

Coal often contains **sulfur** as an impurity.

The sulfur reacts with oxygen to make sulfur dioxide.

Write down the **word equation** for this reaction.

..... [1]

(c) Sulfur dioxide causes acid rain.

Write about **two** environmental problems caused by acid rain.

.....

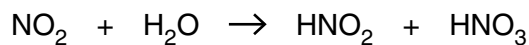
 [2]

(d) Nitrogen dioxide is also made in a power station.

To stop the nitrogen dioxide going into the atmosphere it is reacted with water.

Nitrogen dioxide reacts with water to make two acids.

Copy out and **balance** the **symbol equation** for this reaction.



..... [1]

(e) Karen burns some coal.

She wants to find out if any carbon dioxide is made.

Describe the chemical test she uses.

Name of chemical

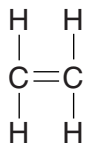
Effect of carbon dioxide on the chemical

..... [2]

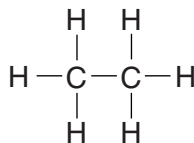
[Total: 7]

3 This question is about compounds containing carbon.

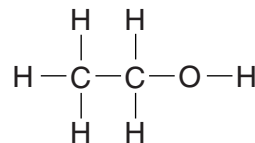
Look at the displayed formulas of some compounds.



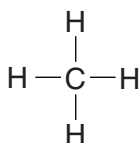
compound **A**



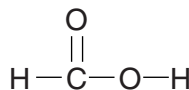
compound **B**



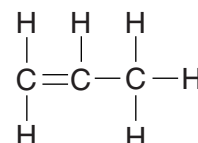
compound **C**



compound **D**



compound **E**



compound **F**

(a) Two compounds have molecules that contain only **five** atoms.

Which two?

..... and

[1]

(b) Two compounds decolourise bromine water.

Which two?

..... and

[1]

(c) Explain why compound **B** is a hydrocarbon but compound **C** is not a hydrocarbon.

.....

 [3]

[Total: 5]

(b) Anna finishes her sandwiches.

She throws the packaging into a dustbin.

Write about **two** ways the waste plastic from the dustbin is disposed of.

.....

.....

.....

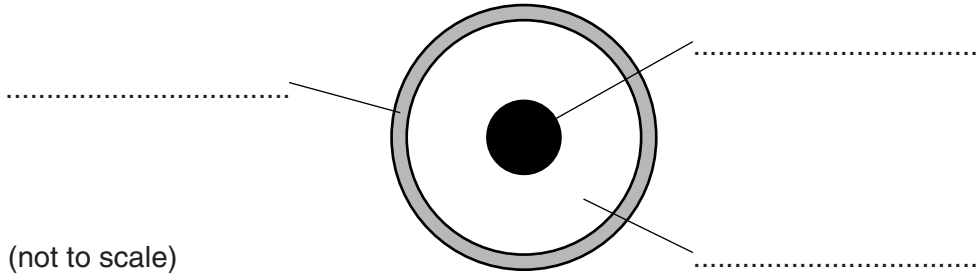
..... [2]

[Total: 8]

SECTION B – Module C2

5 This question is about the structure of the Earth.

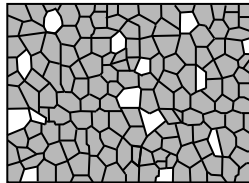
(a) Label the diagram of the Earth.



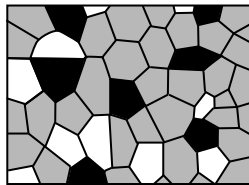
[2]

(b) Igneous rocks are made when molten rock cools.

Look at the diagrams of two different types of igneous rock, **A** and **B**.



rock A



rock B

One rock was made when molten rock cooled **slowly**.

Which rock?

Explain your answer.

.....
..... [1]

(c) Bornite is a mineral extracted from the Earth.

Bornite has the chemical formula Cu_5FeS_4 .

How many different **elements** are in Cu_5FeS_4 ?

..... [1]

[Total: 4]

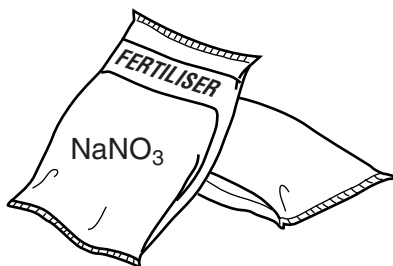
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Question 6 begins on page 10

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6 This question is about fertilisers.

(a) Fertilisers are chemicals that provide plants with **essential elements**.



Sodium nitrate, NaNO_3 , is a fertiliser.

Write down the **name** of the essential element for plant growth found in sodium nitrate.

..... [1]

(b) Ammonium sulfate is another fertiliser.

Ammonium sulfate is made by reacting an acid with an alkali.

Write down the name of the **acid** used to make ammonium sulfate.

..... [1]

(c) Fertilisers can be **beneficial** but may also cause **problems**.

Write about the benefits and problems of using fertilisers.

.....
.....
.....
..... [2]

7 Many different materials are needed to build a car.



(a) (i) Suggest a property of glass that makes it useful for making a car windscreen.

..... [1]

(ii) Some car bodies are now built from aluminium instead of steel.

One advantage of using aluminium is that it is less dense than steel.

Write down **one other advantage** of building car bodies from aluminium instead of steel.

..... [1]

(b) Look at the table.

It shows information about some of the materials used to build a car.

| Material | Density in g/cm ³ | Electrical conductivity | Flexibility |
|-----------|------------------------------|-------------------------|-------------|
| aluminium | 2.7 | very high | low |
| glass | 2.5 | very low | low |
| PVC | 1.4 | very low | high |
| steel | 7.8 | high | low |

Explain why PVC is used for covering the electrical wires in a car.

Use the information from the table.

.....

 [2]

[Total: 4]

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Question 8 begins on page 14

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8 Sodium chloride (salt) is an important raw material in the chemical industry.

(a) Sodium, Na, reacts with chlorine, Cl₂.

Sodium chloride, NaCl, is made.

Write a **balanced symbol** equation for this reaction.

..... [2]

(b) The electrolysis of concentrated sodium chloride solution (brine) makes:

- hydrogen
- chlorine
- sodium hydroxide.

(i) Write down one **use** of **chlorine**.

..... [1]

(ii) Describe the chemical test for chlorine and write down what you would see.

.....
.....
..... [2]

(c) Trevor needs to store these four chemicals.



Trevor investigates different metals, **A**, **B**, **C** and **D**.

Look at the results of his investigation.

| | Rate of corrosion of metal by chemical (1 = very slow, 3 = fast) | | | |
|------------------|---|---------|---------|---------|
| | Metal A | Metal B | Metal C | Metal D |
| chlorine gas | 1 | 2 | 3 | 3 |
| hydrogen gas | 1 | 1 | 1 | 1 |
| sodium chloride | 3 | 1 | 1 | 2 |
| sodium hydroxide | 1 | 3 | 1 | 2 |

Trevor concludes that he **cannot** use the same metal to make the container for each chemical.

Do you think that Trevor has made the correct conclusion?

Explain your answer using the evidence in the table.

.....

.....

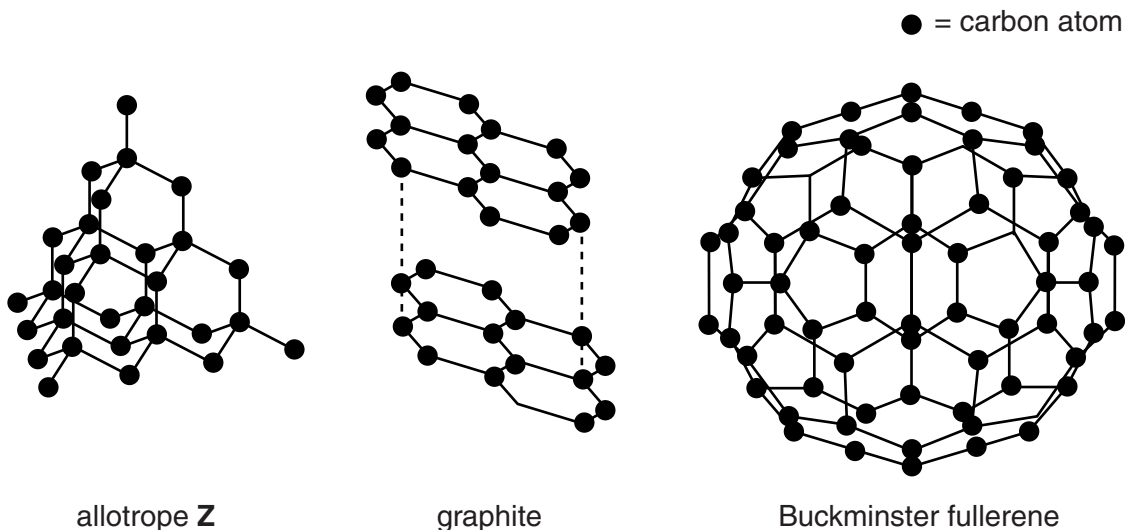
..... [2]

[Total: 7]

SECTION C – Module C3

9 This question is about carbon.

Look at the structures of the three allotropes of carbon.



(a) What is the name of allotrope **Z**?

..... [1]

(b) One property of graphite is that it is slippery.

Write about two **other** properties of graphite.

.....

 [2]

(c) Fullerenes can be used in new drug delivery systems for patients who are ill in hospitals.

Explain why fullerenes can be used.

.....
 [1]

[Total: 4]

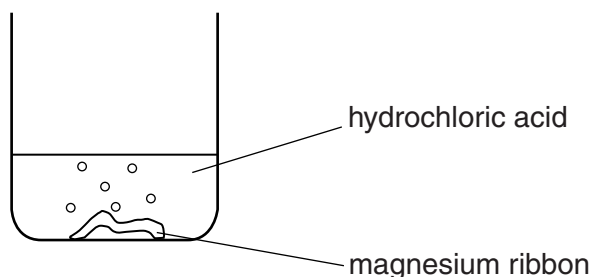
17
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Question 10 begins on page 18

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10 Rachel investigates the reaction between magnesium and hydrochloric acid.

She adds a piece of magnesium ribbon to hydrochloric acid in a beaker.



Rachel measures the time it takes for all the magnesium ribbon to react.

This is the reaction time.

She does four different experiments.

Look at Rachel's prediction.



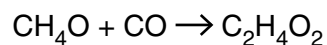
Look at Rachel's results.

| Experiment number | Mass of magnesium used in g | Volume of acid used in cm ³ | Concentration of acid in mol/dm ³ | Reaction time in seconds |
|-------------------|-----------------------------|--|--|--------------------------|
| 1 | 0.05 | 25 | 1.0 | 30 |
| 2 | 0.10 | 25 | 1.0 | 30 |
| 3 | 0.05 | 50 | 1.0 | 30 |
| 4 | 0.05 | 50 | 2.0 | 15 |

11 Ethanoic acid, $C_2H_4O_2$, can be made by several different processes.

Three of these are process **R**, process **S** and process **T**.

(a) In process **R**, methanol reacts with carbon monoxide.



(i) Process **R** has 100% atom economy.

What does 100% atom economy mean?

.....

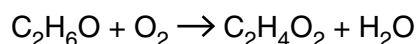
 [1]

(ii) A factory uses 16 tonnes of methanol to make 30 tonnes of ethanoic acid.

What mass of carbon monoxide is needed?

.....
 mass of carbon monoxide = tonnes [1]

(b) In process **S**, ethanol is oxidised using oxygen.



Mike knows that 46 tonnes of ethanol should make 60 tonnes of ethanoic acid.

A factory uses 4.6 tonnes of ethanol.

Predict the mass of ethanoic acid that should be made.

.....

 predicted mass of ethanoic acid = tonnes [1]

(c) Process **R** is a continuous process and process **S** is a batch process.

Explain the difference between a continuous process and a batch process.

.....

 [2]

(d) In process T, hydrocarbons are oxidised to make ethanoic acid.

Mike predicts that 5.2 tonnes of ethanoic acid should be made.

The factory actually makes 2.4 tonnes of ethanoic acid.

Calculate the percentage yield of ethanoic acid.

Write your answer to **two** significant figures.

.....

.....

.....

percentage yield = % [2]

[Total: 7]

12 Paraffin is a liquid fuel obtained from crude oil.

Heat energy is released when paraffin burns.

(a) What is the name of a reaction that releases heat energy?

Put a **ring** around the correct answer.

catalysis

endothermic

evaporation

exothermic

filtration

[1]

(b) Jenna investigates the amount of energy released when paraffin is burnt.

She does five experiments.

She uses the same mass of water in each experiment.

She uses a different mass of paraffin for each experiment.

Look at her results.

| Mass of paraffin burnt in grams | Temperature increase of water in °C |
|---------------------------------|-------------------------------------|
| 1.0 | 12 |
| 2.0 | 24 |
| 3.0 | 36 |
| 4.0 | 48 |
| 5.0 | 60 |

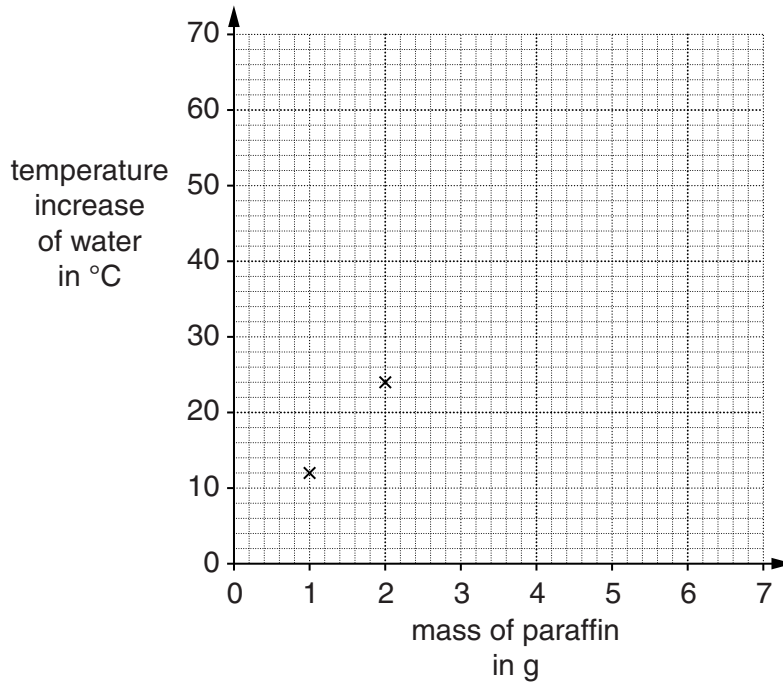
(i) Jenna uses a spirit burner with paraffin in the investigation.

Draw a fully **labelled** diagram of the apparatus she must use to collect these results.

[3]

(ii) Plot Jenna's results on the graph below. Two points have been done for you.

Use the graph to predict what mass of paraffin would give a temperature rise of 30 °C.



mass of paraffin = g

[2]

[Total: 6]

END OF QUESTION PAPER



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The Periodic Table of the Elements

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | |
|--|-----------------------------------|------------------------------------|-------------------------------------|--|--------------------------------------|---|---------------------------------------|--------------------------------------|---|---|--|---|--------------------------------------|-----------------------------------|
| | 7 Li lithium 3 | 9 Be beryllium 4 | 11 Na sodium 11 | 12 C carbon 6 | 13 Al aluminium 13 | 14 N nitrogen 7 | 15 O oxygen 8 | 16 F fluorine 9 | 18 Ar argon 18 | | | | | |
| | 19 K potassium 19 | 20 Ca calcium 20 | 23 Sc scandium 21 | 24 Ti titanium 22 | 25 V vanadium 23 | 26 Cr chromium 24 | 27 Mn manganese 25 | 28 Fe iron 26 | 29 Co cobalt 27 | 30 Ni nickel 28 | 31 Cu copper 29 | 32 Zn zinc 30 | 35.5 Cl chlorine 17 | 36 Kr krypton 36 |
| | 37 Rb rubidium 37 | 38 Sr strontium 38 | 39 Y yttrium 39 | 40 Zr zirconium 40 | 41 Nb niobium 41 | 42 Mo molybdenum 42 | 43 Tc technetium [98] | 44 Ru ruthenium 44 | 45 Rh rhodium 45 | 46 Pd palladium 46 | 47 Ag silver 47 | 48 Cd cadmium 48 | 53 I iodine 53 | 54 Xe xenon 54 |
| | 55 Cs caesium 55 | 56 Ba barium 56 | 57 La* lanthanum 57 | 72 Hf hafnium 72 | 73 Ta tantalum 73 | 74 W tungsten 74 | 75 Re rhenium 75 | 76 Os osmium 76 | 77 Ir iridium 77 | 78 Pt platinum 78 | 79 Au gold 79 | 80 Hg mercury 80 | 85 At astatine [210] | 86 Rn radon [222] |
| | 87 Fr francium 87 | 88 Ra radium 88 | 89 Ac* actinium 89 | 104 Rf rutherfordium [261] | 105 Db dubnium [262] | 106 Sg seaborgium [266] | 107 Bh bohrium [264] | 108 Hs hassium [277] | 109 Mt meitnerium [268] | 110 Ds darmstadtium [271] | 111 Rg roentgenium [272] | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | |

| | |
|---|---------------------------|
| 1 | H hydrogen 1 |
|---|---------------------------|

| |
|------------------------|
| relative atomic mass |
| atomic symbol |
| name |
| atomic (proton) number |

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.