Q1.

A student investigated the reactivity of metals with hydrochloric acid.

This is the method used.

1. Measure 50 cm^3 of hydrochloric acid into a polystyrene cup.
2. Measure the temperature of the hydrochloric acid.
3. Add one spatula of metal powder to the hydrochloric acid and stir.
4. Measure the highest temperature the mixture reaches.
5. Calculate the temperature increase for the reaction.
6. Repeat steps 1 to 5 three more times.
7. Repeat steps 1 to 6 with different metals.

The table below shows the student's results.

Metal	**Temperature increase in °C**				**Mean temperature increase in °C**
	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**	
Cobalt	6	7	5	9	7
Magnesium	54	50	37	55	**X**
Zinc	18	16	18	20	18

(a) Calculate the mean temperature increase **X** for magnesium in the table above.

Do **not** include the anomalous result in your calculation.

_____

_____

_____

_____

X = _____ °C

(2)

(b) Determine the order of reactivity for the metals cobalt, magnesium and zinc.

Use the table above.

Most reactive _____

_____

Least reactive _____

(1)

(c) The range of measurements either side of the mean shows the uncertainty in the mean temperature increase.

Complete the sentence.

Use the table above.

The mean temperature increase for zinc is 18 ± _____°C

(1)

(d) What type of variable is the volume of hydrochloric acid in this investigation?

Tick (✓) **one** box.

Control	☐
Dependent	☐
Independent	☐

(1)

(e) Suggest **one** way of improving **step 3** in the method to give results which are more repeatable.

_____

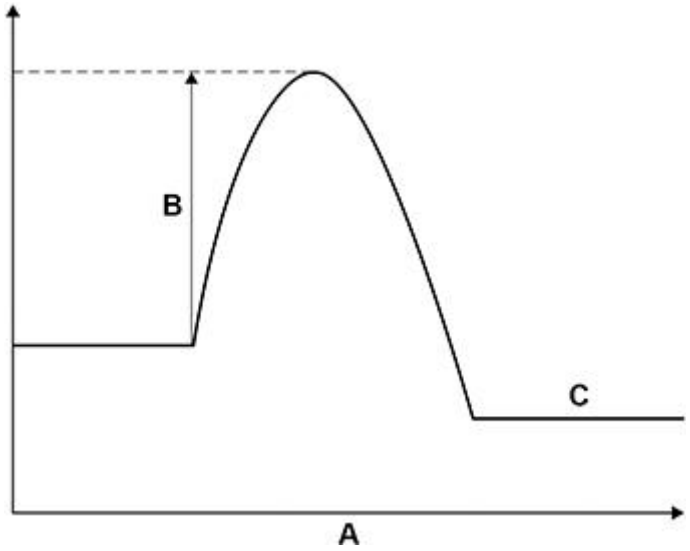
_____

_____

_____

(1)

(f) The figure below shows a reaction profile for the reaction of magnesium with hydrochloric acid.



What do labels **A**, **B** and **C** represent on the figure above?

Choose answers from the box.

activation energy	**energy**	**overall energy change**
products	**progress of reaction**	**reactants**

A _____

B _____

C _____

(3)

(Total 9 marks)

Q2.

This question is about the extraction of metals.

Element **R** is extracted from its oxide by reduction with hydrogen.

The equation for the reaction is:

$$3\ H_2 + \mathbf{R}O_3 \rightarrow \mathbf{R} + 3\ H_2O$$

(a) The sum of the relative formula masses (M_r) of the reactants ($3\ H_2 + \mathbf{R}O_3$) is 150

Calculate the relative atomic mass (A_r) of **R**.

Relative atomic masses (A_r): H = 1 O = 16

_____

_____

_____

_____

Relative atomic mass (A_r) of **R** = _____

(2)

(b) Identify element **R**.

You should use:

- your answer to part (a)
- the periodic table.

Identity of **R** = _____

(1)

(c) Carbon is used to extract tin (Sn) from tin oxide (SnO_2).

The equation for the reaction is:

$$SnO_2 + C \rightarrow Sn + CO_2$$

Calculate the percentage atom economy for extracting tin in this reaction.

Relative atomic masses (A_r): C = 12 O = 16 Sn = 119

_____

_____

_____

_____

_____

_____

Percentage atom economy = _____ %

(3)

(d) Tungsten (W) is a metal.

Tungsten is extracted from tungsten oxide (WO_3).

All other solid products from the extraction method must be separated from the tungsten.

The table below shows information about three possible methods to extract tungsten from tungsten oxide.

Method	Reactant	Relative cost of reactant	Products

1	Carbon	Low	Tungsten solid Carbon dioxide gas Tungsten carbide solid
2	Hydrogen	High	Tungsten solid Water vapour
3	Iron	Low	Tungsten solid Iron oxide solid

Evaluate the three possible methods for extracting tungsten from tungsten oxide.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q3.

This question is about cycloalkenes.

Cycloalkenes are ring-shaped hydrocarbon molecules containing a double carbon-carbon bond.

Cycloalkenes react in a similar way to alkenes.

(a) Describe a test for the double carbon-carbon bond in cycloalkene molecules.

Give the result of the test.

Test _____

_____

Result _____

_____

_____

(2)

(b) The table below shows the name and formula of three cycloalkenes.

Name	**Formula**
Cyclobutene	C_4H_6
Cyclopentene	C_5H_8
Cyclohexene	C_6H_{10}

Determine the general formula for cycloalkenes.

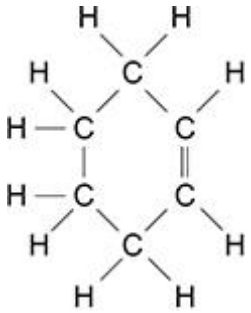
_____

General formula = _____

(1)

Figure 1 shows the displayed structural formula of cyclohexene, C_6H_{10}

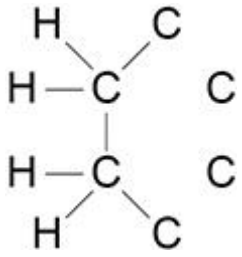
Figure 1



Chlorine reacts with cyclohexene to produce a compound with the formula $C_6H_{10}Cl_2$

(c) Complete **Figure 2** to show the displayed structural formula of $C_6H_{10}Cl_2$

Figure 2



(2)

(d) Calculate the percentage by mass of chlorine in a molecule of $C_6H_{10}Cl_2$

Relative atomic masses (A_r): H = 1 C = 12 Cl = 35.5

_____

_____

_____

_____

Percentage by mass = _____ %

(3)

(Total 8 marks)

Q4.

This question is about the elements in Group 7 of the periodic table.

Table 1 shows the melting points and boiling points of some of the elements.

Table 1

Element	**Melting point in °C**	**Boiling point in °C**
Fluorine	–220	–188
Chlorine	–101	–35
Bromine	–7	59

(a) What is the state of bromine at 100 °C?

Use **Table 1**.

Tick (✓) **one** box.

Gas ☐

Liquid ☐

Solid ☐

(1)

(b) What temperature does chlorine gas condense at to form a liquid?

Use **Table 1**.

Temperature = _____ °C

(1)

(c) Complete the sentences.

Going down Group 7 the melting points _____ .

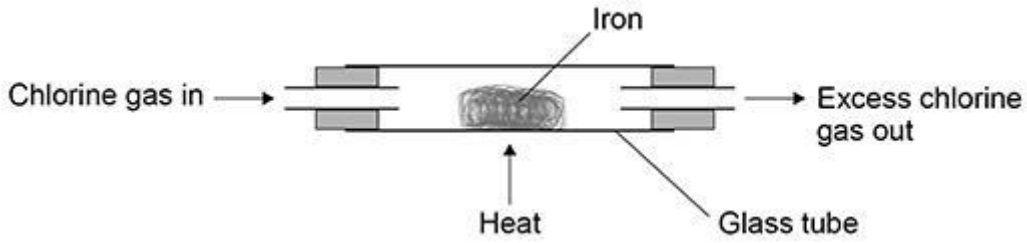
This is because the size of the molecules increases so the intermolecular forces

_____ .

(2)

A teacher investigated the reaction of iron with chlorine.

The diagram below shows the apparatus used.



(d) Why did the teacher do the investigation in a fume cupboard?

Tick (✓) **one** box.

Chlorine gas is coloured. ☐

Chlorine gas is flammable. ☐

Chlorine gas is toxic. ☐

(1)

(e) The word equation for the reaction is:

iron + chlorine → iron chloride

Iron chloride is a solid.

The teacher weighed the glass tube and contents:

- before the reaction
- after the reaction.

What happened to the mass of the glass tube and contents during the reaction?

Give **one** reason for your answer.

The mass of the glass tube and contents _____

Reason

_____

_

_____

(2)

The teacher repeated the investigation with bromine gas and with iodine gas.

Table 2 shows the results.

Table 2

Element	**Observation**
Chlorine	Iron burns vigorously with an orange glow
Bromine	Iron burns with an orange glow
Iodine	Iron slowly turns darker

(f) Fluorine is above chlorine in Group 7.

Predict what you would observe when fluorine gas reacts with iron.

Use **Table 2**.

_____

_____

(1)

(g) Balance the equation for the reaction between iron and bromine.

$$2Fe + \_\_\_\_\_\ Br_2 \rightarrow 2\ FeBr_3$$

(1)

(h) Calculate the relative formula mass (M_r) of $FeBr_3$

Relative atomic masses (A_r): Fe = 56 Br = 80

_____

_____

Relative formula mass (M_r) = _____

(2)

(Total 11 marks)

Q5.

This question is about silver iodide.

Silver iodide is produced in the reaction between silver nitrate solution and sodium iodide solution.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

(a) A student investigated the law of conservation of mass.

This is the method used.

1. Pour silver nitrate solution into a beaker labelled **A**.
2. Pour sodium iodide solution into a beaker labelled **B**.
3. Measure the masses of both beakers and their contents.
4. Pour the solution from beaker **B** into beaker **A**.
5. Measure the masses of both beakers and their contents again.

The table below shows the student's results.

	Mass before mixing in g	**Mass after mixing in g**
Beaker **A** and contents	78.26	108.22
Beaker **B** and contents	78.50	48.54

Explain how the results demonstrate the law of conservation of mass.

You should use data from table above in your answer.

_____

_____

_____

_____

(2)

(b) Suggest how the student could separate the insoluble silver iodide from the mixture at the end of the reaction.

_____

_____

(1)

The student purified the separated silver iodide.

This is the method used.

1. Rinse the silver iodide with distilled water.
2. Warm the silver iodide.

(c) Suggest **one** impurity that was removed by rinsing with water.

_____

_____

(1)

(d) Suggest why the student warmed the silver iodide.

_____

_____

(1)

(e) Calculate the percentage atom economy for the production of silver iodide in this reaction.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

Give your answer to 3 significant figures.

Relative formula masses:

(M_r): $AgNO_3 = 170$ NaI = 150 AgI = 235 $NaNO_3 = 85$

_____

_____

_____

_____

_____

_____

_____

_____

Percentage atom economy (3 significant figures) = _____ %

(4)

(f) Give **one** reason why reactions with a high atom economy are used in industry.

_____

_____

(1)

(Total 10 marks)

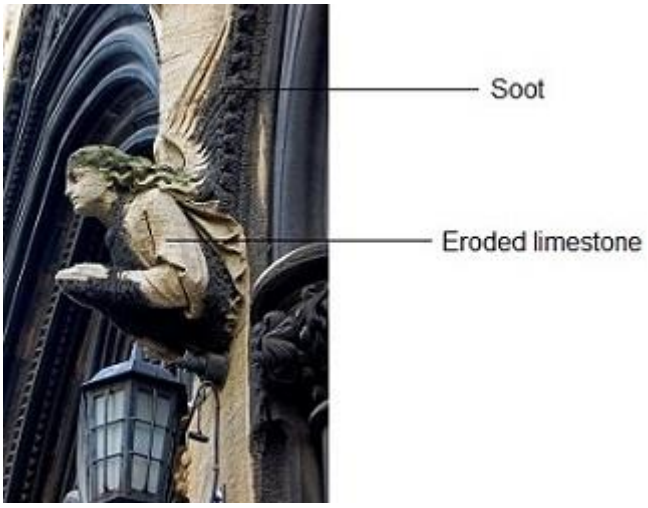
Q6.

This question is about atmospheric pollution.

The image below shows a limestone carving which has been damaged by atmospheric pollution.

The carving has been:

- blackened by soot
- eroded where the limestone has reacted with atmospheric pollutants.



(a) What reacted with the limestone to cause the erosion?

Tick (✓) **one** box.

Acid rain	☐
Ammonia	☐
Carbon monoxide	☐
Oxygen	☐

(1)

(b) Soot is produced by the incomplete combustion of diesel oil.

Complete the sentences.

Choose answers from the box.

ammonia	**carbon**	**methane**
nitrogen	**oxygen**	

Incomplete combustion happens when there is not enough _____.

Incomplete combustion produces particles of _____.

(2)

(c) Complete the sentence.

Particles of soot in the atmosphere cause global _____.

(1)

(d) Carbon monoxide is produced by the incomplete combustion of methane.

Balance the equation for the reaction.

$$2\ CH_4 + 3\ O_2 \rightarrow \_\_\_\_\ CO + 4\ H_2O$$

(1)

(e) Car engines work at high temperatures.

Complete the sentences.

Choose answers from the box.

air	**methane**	**oxides of nitrogen**
oxygen	**petrol**	**sulfur dioxide**

In car engines, nitrogen is present.

The nitrogen in car engines comes from _____.

At high temperatures, the nitrogen reacts with _____.

This reaction produces _____.

(3)

(Total 8 marks)

Q7.

A student investigated the reaction between lumps of calcium carbonate and dilute hydrochloric acid.

This is the method used.

1. Pour 100 cm^3 of dilute hydrochloric acid into a conical flask.

2. Place the conical flask on a balance.

3. Add 2 g of calcium carbonate lumps to the conical flask.

4. Wait until the calcium carbonate stops reacting.

5. Record the decrease in mass of the conical flask and contents.

6. Repeat steps 1 to 5 three more times.

The equation for the reaction is:

$$CaCO_3(\mathbf{X}) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

(a) What is the state symbol **X** in the equation?

Tick (✓) **one** box.

aq ☐ g ☐ l ☐ s ☐

(1)

The following table shows the student's results.

	Result 1	**Result 2**	**Result 3**	**Result 4**
Decrease in mass of the conical flask and contents in g	0.84	0.79	0.86	0.47

(b) Why does the mass of the conical flask and contents decrease during the reaction?

Tick (✓) **one** box.

A gas escapes. ☐

A new solution is made. ☐

The dilute hydrochloric acid is used up. ☐

The calcium carbonate lumps decrease in size. ☐

(1)

(c) What is the range of the four results in the table above?

From _____ g to _____ g

(1)

(d) Calculate the mean decrease in mass of the conical flask and contents.

Do **not** include the anomalous result.

Use the above.

_____

_____

_____

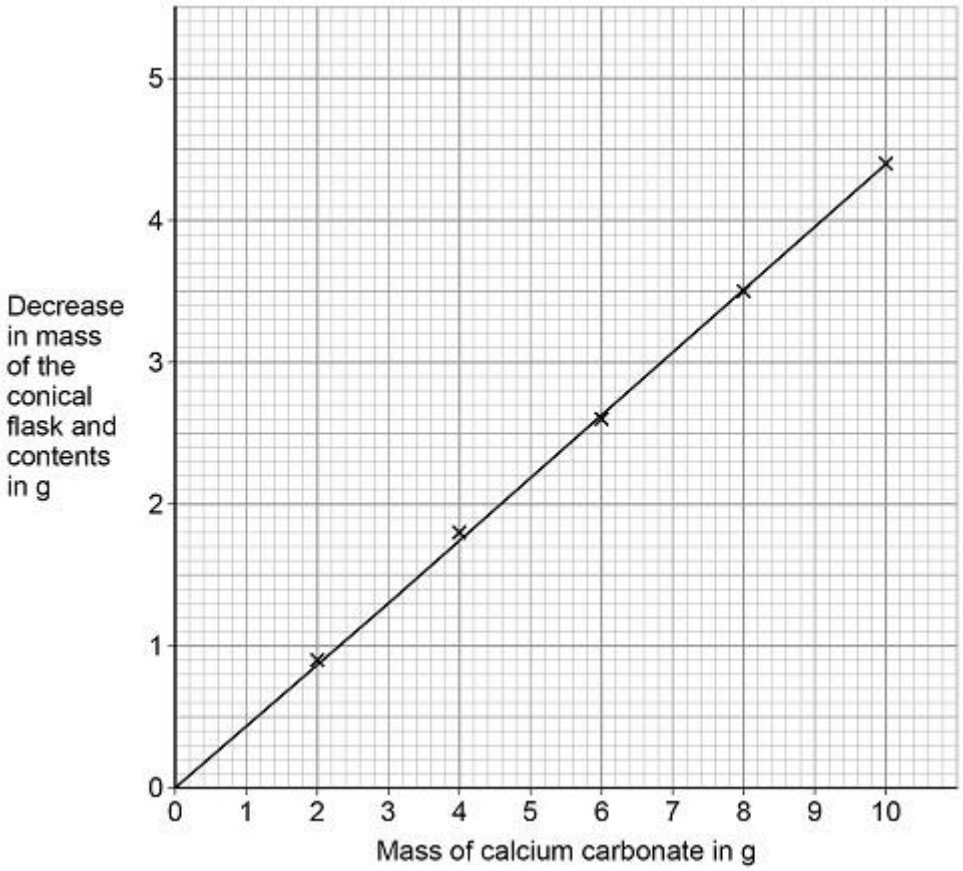
Mean decrease in mass = _____ g

(2)

A teacher demonstrated the investigation.

The teacher used different masses of calcium carbonate.

The following graph shows the teacher's results.



(e) What type of variable is the mass of calcium carbonate?

(1)

Tick (✓) **one** box.

Control ☐

Dependent ☐

Independent ☐

(1)

Use the graph to answer parts (f) and (g)

(f) Complete the sentence.

As the mass of calcium carbonate used increases, the decrease in mass of the conical flask and contents _____.

(1)

(g) What is the decrease in mass of the conical flask and contents when a 3 g sample of calcium carbonate is used?

Decrease in mass = _____ g

(1)

(Total 8 marks)

Q8.

This question is about the extraction of metals.

(a) Tungsten is a metal.

The symbol of tungsten is W

Tungsten is produced from tungsten oxide by reaction with hydrogen.

The equation for the reaction is:

$$WO_3 + 3\,H_2 \rightarrow W + 3\,H_2O$$

Calculate the percentage atom economy when tungsten is produced in this reaction.

Use the equation:

$$\text{percentage atom economy} = \frac{184}{(M_r\ WO_3) + (3 \times M_r\ H_2)} \times 100$$

Relative formula masses (M_r): $WO_3 = 232$ $H_2 = 2$

_____

_____

_____

_____

Percentage atom economy = _____%

(2)

Aluminium is extracted from aluminium oxide.

(b) 38% of a rock sample is aluminium oxide.

Calculate the mass of aluminium oxide in 40 kg of the rock sample.

_____

_____

_____

_____

Mass of aluminium oxide = _____ kg

(2)

(c) The formula of aluminium oxide is Al_2O_3

Calculate the relative formula mass (M_r) of aluminium oxide.

Relative atomic masses (A_r): O = 16 Al = 27

_____

_____

_____

_____

Relative formula mass (M_r) = _____

(2)

(d) 60.0 kg of aluminium oxide produces a maximum of 31.8 kg of aluminium.

In an extraction process only 28.4 kg of aluminium is produced from 60.0 kg of aluminium oxide.

Calculate the percentage yield.

Give your answer to 3 significant figures.

Use the equation:

$$\text{percentage yield} = \frac{\text{mass of product actually made}}{\text{maximum theoretical mass of product}} \times 100$$

_____

_____

_____

_____

_____

_____

_____

Percentage yield = _____%

(3)

(e) Extracting metals by electrolysis is a very expensive process.

Explain why aluminium is extracted using electrolysis and not by reduction with carbon.

_____

_____

_____

_____

(2)

(Total 11 marks)

Q9.

The halogens are elements in Group 7.

(a) Bromine is in Group 7.

Give the number of electrons in the outer shell of a bromine atom.

_____

(1)

(b) Bromine reacts with hydrogen. The gas hydrogen bromide is produced.

What is the structure of hydrogen bromide?

Tick **one** box.

Giant covalent ☐

Ionic lattice ☐

Metallic structure ☐

Small molecule ☐

(1)

(c) What is the formula for fluorine gas?

Tick **one** box.

F ☐

F_2 ☐

F^2 ☐

2F ☐

(1)

A student mixes solutions of halogens with solutions of their salts.

The table below shows the student's observations.

	Potassium chloride (colourless)	**Potassium bromide (colourless)**	**Potassium iodide (colourless)**
Chlorine (colourless)		Solution turns orange	Solution turns brown
Bromine (orange)	No change		Solution turns brown
Iodine (brown)	No change	No change	

(d) Explain how the reactivity of the halogens changes going down Group 7.

Use the results in the table above.

_____

_____

_____

_____

_____

_____

(3)

A company uses chlorine to produce titanium chloride from titanium dioxide.

(e) What is the relative formula mass (M_r) of titanium dioxide, TiO_2?

Relative atomic masses (A_r): O = 16 Ti = 48

Tick **one** box.

64 ☐

80 ☐

128 ☐

768 ☐

(1)

(f) The company calculates that 500 g of titanium dioxide should produce 1.2 kg of titanium chloride.

However, the company finds that 500 g of titanium dioxide only produces 900 g of titanium chloride.

Calculate the percentage yield.

_____

_____

_____

_____

Percentage yield = _____ %

(2)

(Total 9 marks)

Q10.

A student investigated the mass of copper oxide produced by heating copper carbonate.

This is the method used.

1. Weigh an empty test tube.
2. Weigh 2.00 g of copper carbonate into the test tube.
3. Heat the copper carbonate until there appears to be no further change.
4. Re-weigh the test tube and copper oxide produced.
5. Subtract the mass of the empty tube to find the mass of copper oxide.
6. Repeat steps 1−5 twice.
7. Repeat steps 1−6 with different masses of copper carbonate.

The table below shows the student's results.

Mass of copper carbonate in g	**Mass of copper oxide in g**			
	Trial 1	**Trial 2**	**Trial 3**	**Mean**
2.00	1.29	1.27	1.31	1.29
4.00	2.89	2.57	2.59	2.58
6.00	3.85	3.90	3.87	3.87
8.00	5.12	5.15	5.09	**X**
10.00	6.42	6.45	6.45	6.44

The equation for the reaction is:

$$CuCO_3(s) \longrightarrow CuO(s) + CO_2(g)$$

(a) Complete the sentence.

The state symbol shows carbon dioxide is a _____ .

(1)

(b) Why do the contents of the test tube lose mass in the investigation?

_____

_____

(1)

(c) Calculate the mean mass **X** in the table above.

_____

_____

X = _____ g

(1)

(d) One of the results in the table above is anomalous.

Which result is anomalous?

Mass of copper carbonate _____ g Trial _____

(1)

(e) Suggest how the investigation could be improved to make sure the reaction is complete.

_____

_____

_____

_____

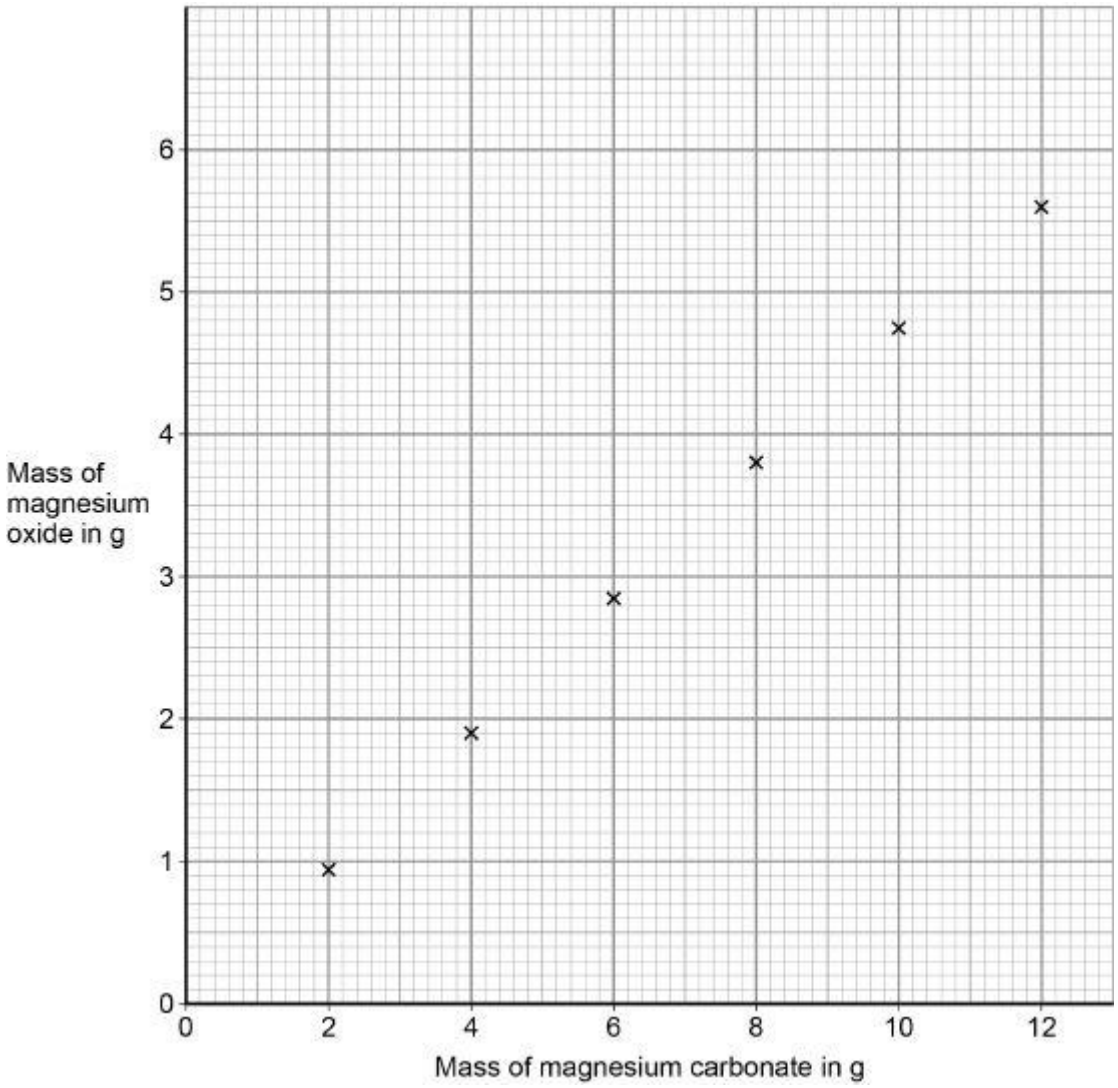
(2)

Another student repeated the investigation using magnesium carbonate instead of copper carbonate.

The word equation for the reaction is:

magnesium carbonate ⟶ magnesium oxide + carbon dioxide

The graph below shows the results of the investigation.



(f) Draw a line of best fit on the graph above.

(1)

(g) Determine the mass of magnesium oxide produced by 8.4 g of magnesium carbonate.

Use the graph above.

Mass = _____ g

(1)

(h) Calculate the mass of magnesium oxide produced when 168 g of magnesium carbonate is heated.

Use your answer to part **(g)**

_____

_____

_____

_____

Mass of magnesium oxide produced = _____ g

(2)

(Total 10 marks)

Q11.

Older cars are tested each year to measure the amount of pollutants contained in exhaust fumes.

The table below shows the maximum allowed percentages of exhaust pollutants for petrol cars.

Age of car in years	Maximum allowed percentage (%) of exhaust pollutant	
	Carbon monoxide	Unburned hydrocarbons
16−24	0.30	0.02
3−16	0.20	0.02

(a) Explain how carbon monoxide is produced when petrol is burned in car engines.

_____

_____

_____

_____

(2)

(b) Suggest **two** reasons why the maximum allowed percentage of carbon monoxide has been decreased for newer cars.

1.

_____

_____

2.

_____

_____

(2)

(c) Give **one** reason for having a maximum allowed percentage of unburned hydrocarbons in exhaust fumes.

_____

_____

(1)

Oxides of nitrogen are also pollutants contained in exhaust fumes.

(d) Describe how oxides of nitrogen are produced when petrol is burned in car engines.

_____

_____

_____

_____

(2)

Catalytic converters are fitted to car exhausts to reduce the amount of pollutants released into the atmosphere.

(e) Nitrogen dioxide is an oxide of nitrogen.

Nitrogen dioxide reacts to produce nitrogen and oxygen in catalytic converters.

Complete the equation for this reaction.

The equation should be balanced.

$$\_\_\_\ NO_2\ (g) \longrightarrow \_\_\_\_\_ + \_\_\_\ O_2\ (g)$$

(2)

(f) Give **two** effects of atmospheric pollution which are reduced by using catalytic converters.

1.

_____

_____

2.

_____

_____

(2)

(g) The catalyst in catalytic converters is a mixture of three elements.

Where in the periodic table are these elements most likely to be found?

Tick **one** box.

Alkali metals ☐

Halogens ☐

Noble gases ☐

Transition metals ☐

(1)

(Total 12 marks)

Q12.

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:

$$Pb(NO_3)_2(aq) + K_2CrO_4(aq) \longrightarrow PbCrO_4(s) + 2KNO_3(aq)$$

(a) What would the student see when the reaction takes place?

_____

_____

(1)

(b) The table shows the student's results.

	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 the table above.

_____

_____

_____

_____

(2)

(c) What is the resolution of the balance used to obtain the results in the table?

Tick (✓) **one** box.

0.01 g ☐ 0.1 g ☐ 1 g ☐ 100 g ☐

(1)

(d) Calculate the relative formula mass (M_r) of lead nitrate $Pb(NO_3)_2$

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

_____

_____

_____

_____

Relative formula mass = _____

(2)

(e) 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)

(f) 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.

$$Na_2CO_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

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

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q13.

This question is about hydrocarbons.

The table gives information about four hydrocarbons.

The hydrocarbons are four successive members of a homologous series.

Hydrocarbon	Formula	Boiling point in °C
A	C_4H_{10}	0
B		36
C	C_6H_{14}	69
D	C_7H_{16}	98

(a) What is the formula of hydrocarbon **B**?

Tick (✓) **one** box.

C_4H_{12} ☐

C_5H_{12} ☐

C_5H_{12} ☐

C_6H_{12} ☐

(1)

(b) What is the simplest ratio of carbon : hydrogen atoms in a molecule of hydrocarbon **A**?

Ratio = 2 : _____

(1)

(c) Which hydrocarbon is a gas at room temperature (25 °C)?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(d) Which hydrocarbon is most flammable?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(e) Which **two** substances are produced when a hydrocarbon **completely** combusts in air?

Tick (✓) **two** boxes.

Carbon ☐

Carbon dioxide ☐

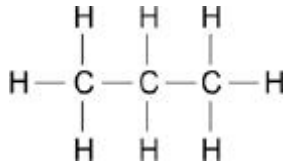
Hydrogen ☐

Sulfur dioxide ☐

Water ☐

(2)

The diagram shows the displayed structure of a hydrocarbon molecule.



(f) What is the name of the hydrocarbon in the diagram above?

Tick (✓) **one** box.

Butane ☐

Ethane ☐

Methane ☐

Propane ☐

(1)

(g) Calculate the relative formula mass (M_r) of the hydrocarbon in the diagram above.

Relative atomic masses (A_r): H = 1 C = 12

_____

_____

Relative formula mass (M_r) = _____

(2)

(Total 9 marks)

Q14.

Metals are extracted from ores in the Earth's crust.

(a) Why is copper used in the manufacture of computers?

Tick (✓) **one** box.

Because it has a high density. ☐

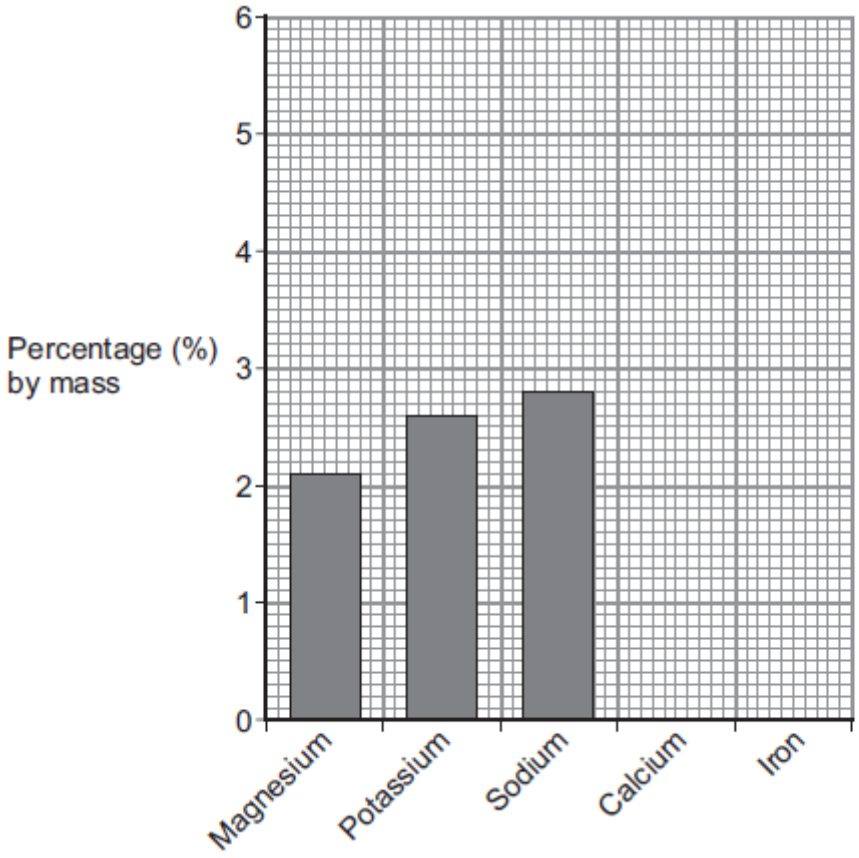
Because it does not react with water. ☐

Because it is a good conductor of electricity. ☐

(1)

(b) **Figure 1** shows the percentage (%) by mass of some metals in the Earth's crust.

Figure 1



(i) What is the percentage by mass of magnesium in the Earth's crust?

_____ %

(1)

(ii) On **Figure 1** draw the bars for:

- calcium at 3.6% by mass
- iron at 5.0% by mass.

(2)

(c) An ore of zinc contains zinc carbonate.

The equation for the reaction when zinc carbonate is heated is:

$$\underset{\text{zinc carbonate}}{ZnCO_3} \longrightarrow \underset{\text{zinc oxide}}{ZnO} + \underset{\text{carbon dioxide}}{CO_2}$$

(i) What is the name of this type of reaction?

Tick (✓) **one** box.

corrosion ☐

decomposition ☐

electrolysis ☐

(1)

(ii) Which substance in the equation is a gas at room temperature (20 °C)?

Tick (✓) **one** box.

zinc carbonate ☐

zinc oxide ☐

carbon dioxide ☐

(1)

(iii) Complete the table below to show the number of atoms of carbon and oxygen in the formula of zinc carbonate.

Element	**Number of atoms in the formula $ZnCO_3$**
zinc, Zn	1
carbon, C	
oxygen, O	

(2)

(iv) When 125 g zinc carbonate is heated, 81 g zinc oxide is produced.

Calculate the mass of carbon dioxide produced.

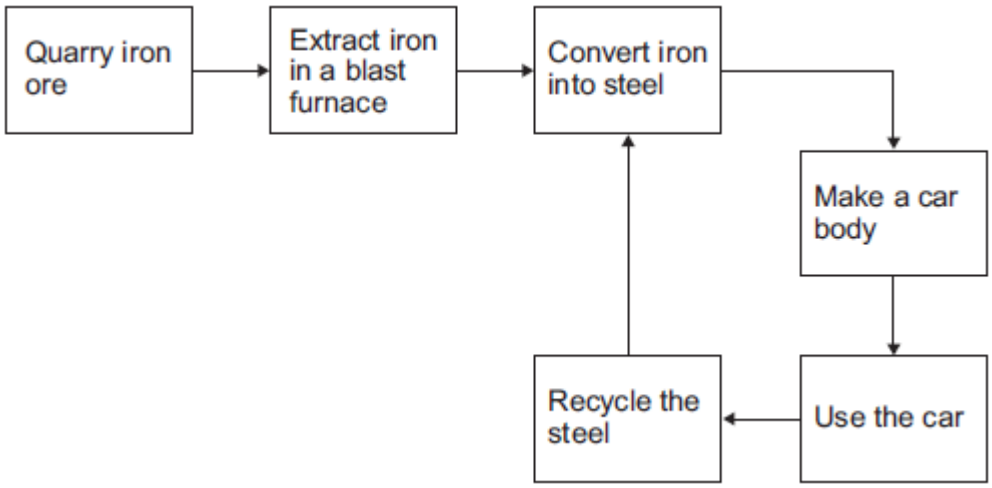
_____

Mass of carbon dioxide = _____g

(1)

(d) **Figure 2** shows a simple life cycle of a car body.

Figure 2



(i) What is **one** reason why iron from the blast furnace is converted into steel?

Tick (✓) **one** box.

To make the iron pure. ☐

To make the iron more brittle. ☐

To make alloys for specific uses. ☐

(1)

(ii) Apart from cost, give **three different** reasons why steel should be recycled.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 13 marks)

Q15.

Metals are extracted from ores in the Earth's crust.

Some ores contain metal carbonates and some ores contain metal oxides.

(a) (i) Name the type of reaction that happens when a metal carbonate is heated.

_____

(1)

(ii) Which solid product is formed when copper carbonate is heated?

Tick (✓) **one** box.

copper ☐

copper nitrate ☐

copper oxide ☐

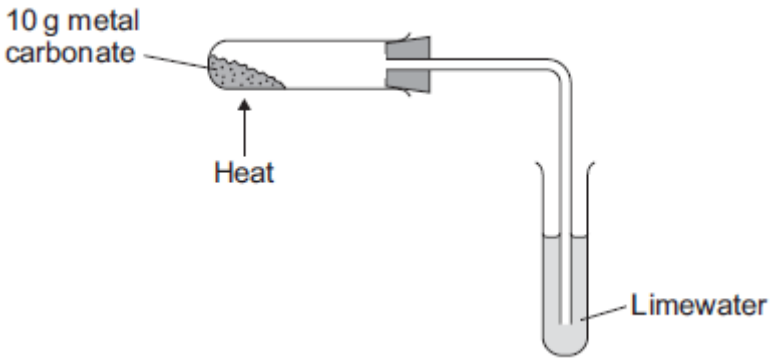
copper sulfide ☐

(1)

(b) A student investigated heating four metal carbonates.

Figure 1 shows the apparatus used.

Figure 1



The student heated each metal carbonate for five minutes.

The table below shows the results.

Metal carbonate	Mass of metal carbonate at	Mass of solid after heating for 5 minutes	Observations

	start in g	in g	
Copper carbonate	10.0	6.9	Limewater turns cloudy
Magnesium carbonate	10.0	9.1	Limewater turns cloudy
Potassium carbonate	10.0	10.0	Limewater does not turn cloudy
Zinc carbonate	10.0	8.3	Limewater turns cloudy

(i) Explain the results for potassium carbonate.

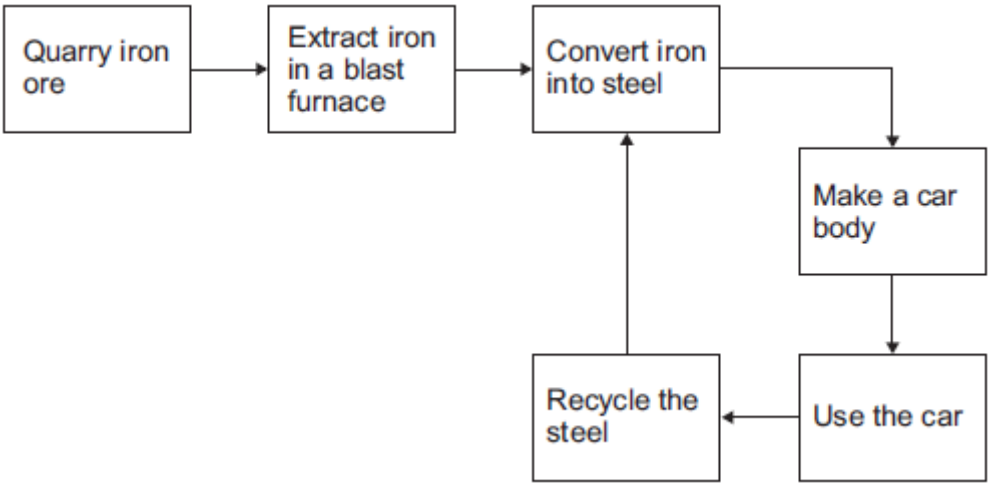
(3)

(ii) Suggest how the reactivity series can be used to predict which metal carbonate reacts most easily when heated.

(2)

(c) **Figure 2** shows a simple life cycle of a car body.

Figure 2



(i) Complete the sentence.

Iron ores must contain enough iron to _____

_____

(1)

(ii) Some iron ores contain iron oxide (Fe_2O_3).

Complete and balance the equation for a reaction to produce iron from iron oxide.

_____ Fe_2O_3 + _____ C $\longrightarrow$ _____ + _____ CO_2

(2)

(iii) Give **two** reasons why iron produced in a blast furnace is converted into steel.

_____

_____

_____

_____

(2)

(iv) When a car reaches the end of its useful life, the car body can be:

- recycled
- reused
- sent to landfill.

Give **three** reasons why a steel car body should be recycled and **not**

reused or sent to landfill.

_____

_____

_____

_____

_____

_____

(3)

(Total 15 marks)