Q1. The figure below shows magnesium burning in air.



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(a) Look at the figure above.

How can you tell that a chemical reaction is taking place?

.....

.....

(1)

(b) Name the product from the reaction of magnesium in the figure.

.....

(1)

(c) The magnesium needed heating before it would react.

What conclusion can you draw from this?

Tick **one** box.

The reaction is reversible ☐

The reaction has a high activation energy ☐

The reaction is exothermic ☐

Magnesium has a high melting point ☐

(1)

(d) A sample of the product from the reaction in the figure above was added to water and shaken.

Universal indicator was added.

The universal indicator turned blue.

What is the pH value of the solution?

Tick **one** box.

1 ☐

4 ☐

7 ☐

9 ☐

(1)

(e) Why are nanoparticles effective in very small quantities?

Tick **one** box.

They are elements ☐

They are highly reactive ☐

They have a low melting point ☐

They have a high surface area to volume ratio ☐

(1)

(f) Give **one** advantage of using nanoparticles in sun creams.

.....

.....

(1)

(g) Give **one** disadvantage of using nanoparticles in sun creams.

.....

.....

(1)

(h) A coarse particle has a diameter of 1×10^{-6} m.
A nanoparticle has a diameter of 1.6×10^{-9} m.

Calculate how many times bigger the diameter of the coarse particle is than the diameter of the nanoparticle.

.....

.....

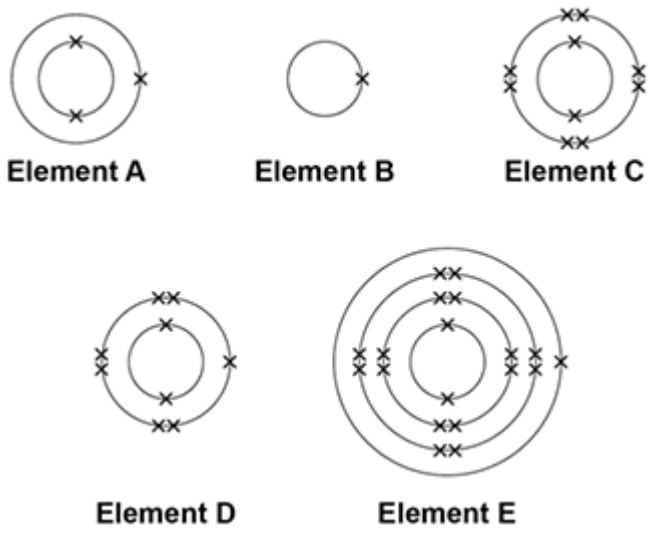
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(2)
(Total 9 marks)

Q2. The electronic structure of the atoms of five elements are shown in the figure below.

The letters are **not** the symbols of the elements.



Choose the element to answer the question. Each element can be used once, more than once or not at all.

Use the periodic table to help you.

(a) Which element is hydrogen?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(b) Which element is a halogen?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(c) Which element is a metal in the same group of the periodic table as element **A**?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(d) Which element exists as single atoms?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

(e) There are two isotopes of element **A**. Information about the two isotopes is shown in the table below.

Mass number of the isotope	6	7
Percentage abundance	92.5	7.5

Use the information in the table above above to calculate the relative atomic mass of element **A**.
Give your answer to 2 decimal places.

.....

.....

.....

.....

.....

.....

.....

Relative atomic mass = ...

(4)
(Total 8 marks)

Q3. This question is about mixtures and analysis.

(a) Which **two** substances are mixtures?

Tick **two** boxes.

Air	☐
Carbon dioxide	☐
Graphite	☐
Sodium Chloride	☐
Steel	☐

(2)

(b) Draw **one** line from each context to the correct meaning.

Context	**Meaning**
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons

Pure substance in everyday life	A substance that can be separated by filtration

A useful product made by mixing substances

(2)

(c) What is the test for chlorine gas?

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

Limewater turns milky ☐

(1)

(d) A student tested a metal chloride solution with sodium hydroxide solution.

A brown precipitate formed.

What was the metal ion in the metal chloride solution?

Tick **one** box.

Calcium ☐

Copper(II) ☐

Iron(II) ☐

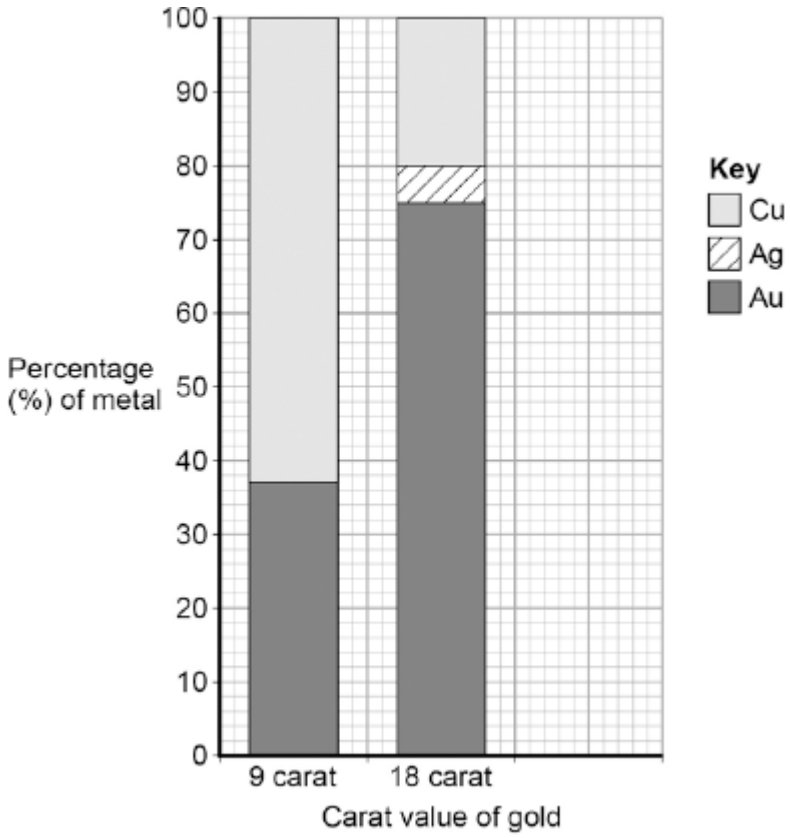
Iron(III) ☐

(1)

(Total 6 marks)

Q4. Gold is mixed with other metals to make jewellery.

The figure below shows the composition of different carat values of gold.



(a) What is the percentage of gold in 12 carat gold?

Tick **one** box.

12 % ☐ **30 %** ☐ **50 %** ☐ ☐

(1)

(b) Give the percentage of silver in 18 carat gold.

Use the figure above to answer this question.

Percentage = ... %

(1)

(c) Suggest **two** reasons why 9 carat gold is often used instead of pure gold to make jewellery.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)

Q5. This question is about hydrocarbons.

(a) The names and formulae of three hydrocarbons in the same homologous series are:

Ethane	C_2H_6
Propane	C_3H_8
Butane	C_4H_{10}

The next member in the series is pentane.

What is the formula of pentane?

.....

(1)

(b) Which homologous series contains ethane, propane and butane?

Tick **one** box.

Alcohols ☐

Alkanes ☐

Alkenes ☐

Carboxylic acids ☐

(1)

(c) Propane (C_3H_8) is used as a fuel.

Complete the equation for the complete combustion of propane.

C_3H_8 + $5O_2$ → 3 ..... + 4 .....

(2)

(d) Octane (C_8H_{18}) is a hydrocarbon found in petrol.

Explain why octane is a hydrocarbon.

.....

.....

(2)

(e) The table below gives information about the pollutants produced by cars using diesel or petrol as a fuel.

Fuel	**Relative amounts of pollutants**		
	Oxides of Nitrogen	**Particulate matter**	**Carbon dioxide**
Diesel	31	100	85
Petrol	23	0	100

Compare the pollutants from cars using diesel with those from cars using petrol.

.....

.....

.....

.....

.....

.....

(3)

(f) Pollutants cause environmental impacts.

Draw **one** line from each pollutant to the environmental impact caused by the pollutant.

Pollutant	**Environmental impact caused by the pollutant**

	Acid rain
Oxides of nitrogen	Flooding
	Global dimming
Particulate matter	Global warming
	Photosynthesis

(2)
(Total 11 marks)

Q6. This question is about carbon and gases in the air.

(a) Carbon atoms have protons, neutrons and electrons.

Complete the table by writing the relative mass of a neutron and an electron.

Name of particle	**Relative mass**
proton	1
neutron	
electron	

(2)

(b) What is the total number of protons and neutrons in an atom called?

Tick (✓) **one** box.

The atomic number ☐

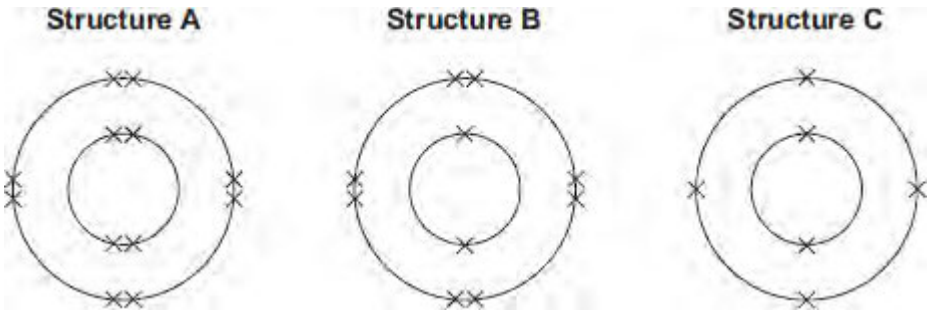
The mass number ☐

One mole of the atom ☐

(1)

(c) An atom of carbon has six electrons.

Which structure, **A, B** or **C**, represents the electronic structure of the carbon atom?



The carbon atom is structure ☐

(1)

(d) Carbon reacts with oxygen to produce carbon dioxide (CO_2).

(i) How many different elements are in one molecule of carbon dioxide?

.....

(1)

(ii) What is the total number of atoms in one molecule of carbon dioxide?

.....

(1)

(e) Sometimes carbon reacts with oxygen to produce carbon monoxide (CO).

(i) Calculate the relative formula mass (M_r) of carbon monoxide.

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

.....

.....

M_r of carbon monoxide = ...

(1)

(ii) Calculate the percentage by mass of carbon in carbon monoxide.

.....

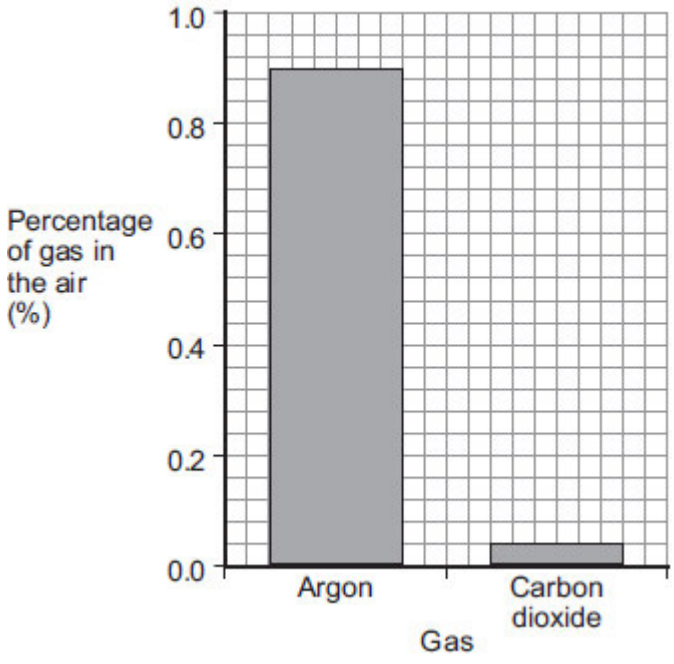
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Percentage by mass of carbon in carbon monoxide = ...%

(1)

(f) Carbon dioxide is one of the gases in the air.

(i) The graph shows the percentage of argon and the percentage of carbon dioxide in the air.



What is the percentage of argon in the air?

Percentage of argon = ... %

(1)

(ii) An instrumental method is used to measure the amount of carbon dioxide in the air.

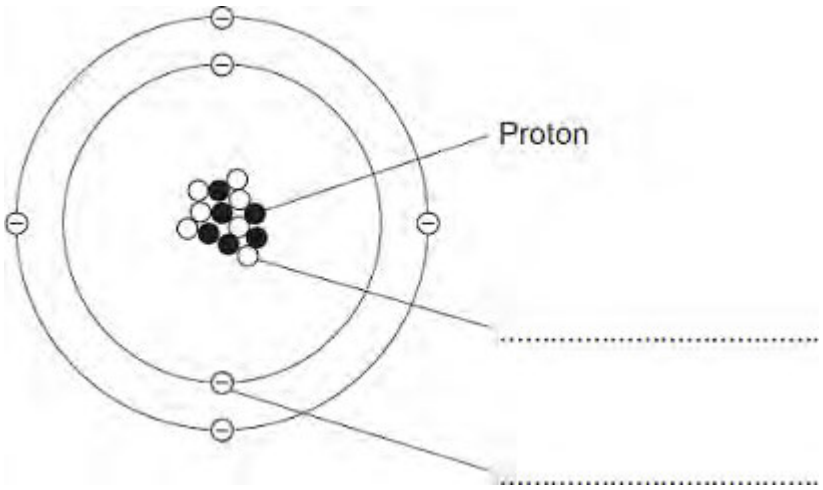
Give **one** reason for using an instrumental method.

.....

.....

(1)
(Total 10 marks)

Q7. The diagram shows a carbon atom.



(a) (i) A proton is labelled.

Use the correct answer from the box to label each of the other sub-atomic particles.

electron	**ion**	**molecule**	**neutron**

(2)

(ii) The atom of carbon is represented as:

$$^{13}_{6}C$$

What is the mass number of this carbon atom?

Draw a ring around the correct answer.

6 **13** **19**

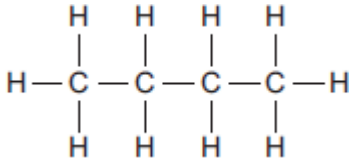
(1)

(iii) Complete the sentence.

Atoms of carbon have no overall electrical charge because the number of protons is the same as the number of ..... .

(1)

(b) Butane is represented as:



(i) Use the correct answer from the box to complete each sentence.

bond	**compound**	**helium**	**hydrogen**	**mixture**	**oxygen**

Butane is a ..... .

Butane contains atoms of carbon and ..... .

Each line between the atoms in butane represents a chemical

..... .

(3)

(ii) Which is the correct formula for butane?

Tick (✔) **one** box.

C_4H_4 ☐

C_4H_8 ☐

C_4H_{10} ☐

(1)
(Total 8 marks)