AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.4

Relative electrical charges of subatomic particles

Past-paper questions

Tier	**Foundation**
Question groups	**83**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

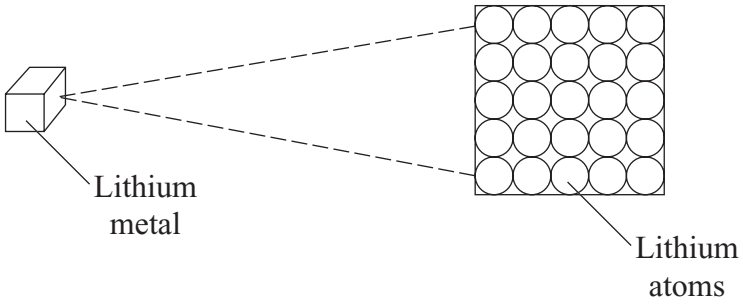
4.1.1.4 Relative electrical charges of subatomic particles

Question 01

January 2007 | CHY1F | Original Q1 | Legacy

1 Lithium metal is used in alkaline batteries.

(a) The diagram shows the atoms in lithium metal.



Why is lithium metal described as an element?

.....

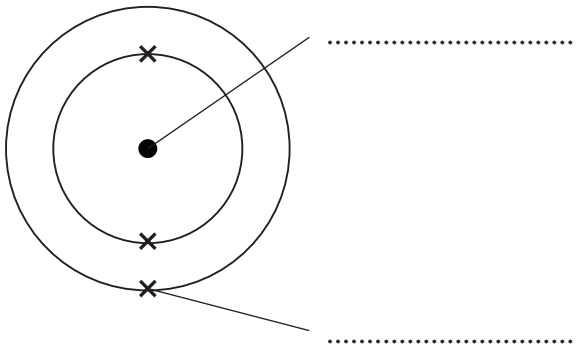
.....

(1 mark)

(b) The diagram below represents a lithium atom.

Choose words from the box to label parts of the atom.

bond	**electron**	**molecule**	**nucleus**



(2 marks)

3

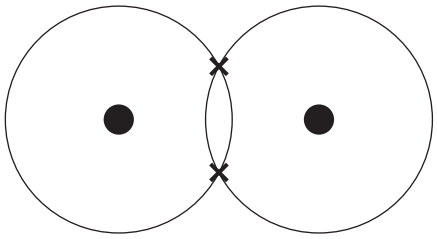
4.1.1.4 Relative electrical charges of subatomic particles

Question 02

June 2007 | CHY1A | Original Q3 | Legacy

QUESTION THREE

The diagram shows how two atoms of hydrogen are joined.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a bond

B an electron

C a molecule

D a nucleus

In the diagram, ● represents . . . **1** . . . and ✕ represents . . . **2** . . . .

The two atoms are held together by . . . **3** . . . to form . . . **4** . . . of hydrogen.

4.1.1.4 Relative electrical charges of subatomic particles

Question 03

January 2008 | CHY2F | Original Q3 | Legacy

3 Distress flares are used to attract attention in an emergency.



Flares often contain magnesium. Magnesium burns to form magnesium oxide.

(a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

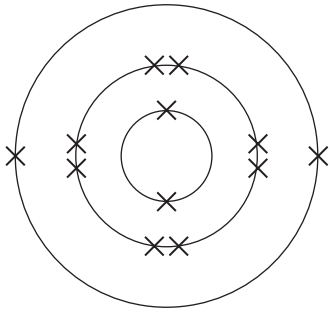
Complete the following sentence using the correct words from the box.

gives out heat	**stores heat**	**takes in heat**

An *exothermic* reaction is one which ..... .

(1 mark)

(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.



Magnesium atom

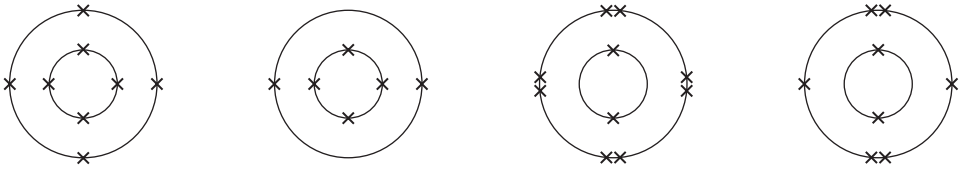
4.1.1.4 Relative electrical charges of subatomic particles

Question 03 · continued

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The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?

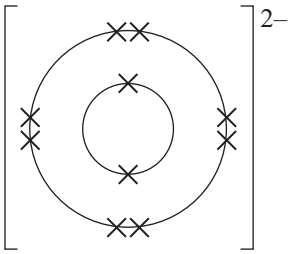


A **B** **C** **D**

Diagram .....

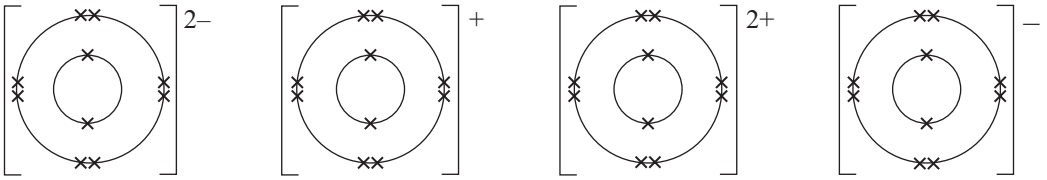
(1 mark)

(c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.



Oxide ion

Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?



J **K** **L** **M**

Diagram .....

(1 mark)

(d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

magnesium chloride **magnesium hydroxide** **magnesium sulfate**

(1 mark)

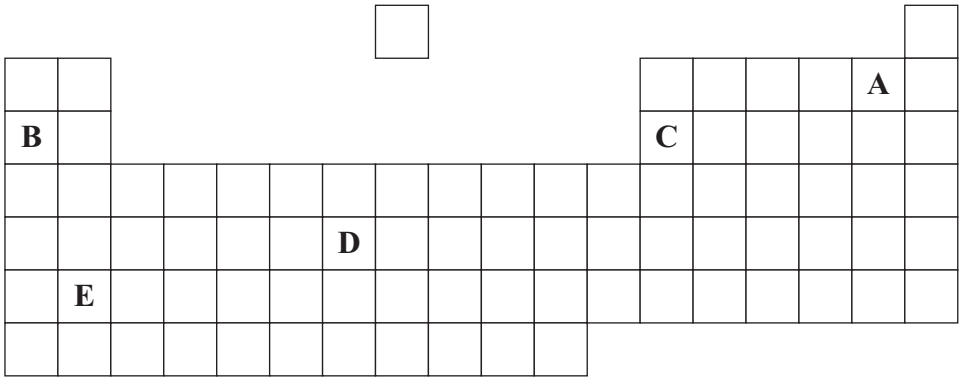
4

4.1.1.4 Relative electrical charges of subatomic particles

Question 04

1 (a) The periodic table on the Data Sheet may help you to answer this question.

Part of the periodic table is shown below.



Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A** to **E**, represents:

(i) sodium Letter .....

(1 mark)

(ii) a non-metal Letter .....

(1 mark)

(iii) a Group 2 element Letter .....

(1 mark)

(iv) a transition element? Letter .....

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 04 · continued

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(b) Complete these sentences by drawing a ring around the correct answer.

(i) Attempts to classify the elements into a periodic table were made

by [Arrhenius and Dalton / Brønsted and Lowry / Mendeleev and Newlands] .

(1 mark)

(ii) They arranged the elements in order of their [atomic weight / melting point / reactivity] .

(1 mark)

(iii) They put elements in the same Group if they had similar [boiling points / chemical reactions / electrical conductivities] .

(1 mark)

(iv) We now know that elements in the same Group have the same number of

[electrons / neutrons / protons] in their outer shell (energy level).

(1 mark)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 05

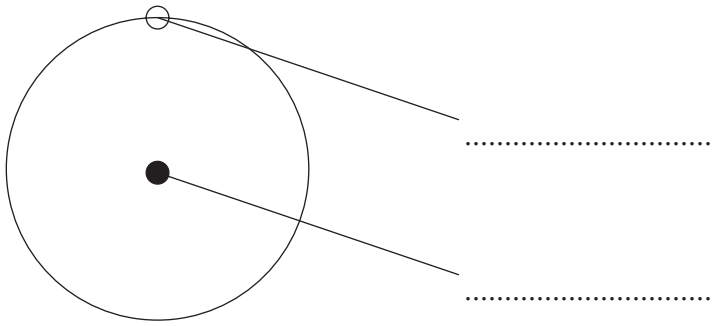
June 2008 | CHY1F | Original Q1 | Legacy

1 Hydrogen is an element.

1 (a) The diagram shows the parts of a hydrogen atom.

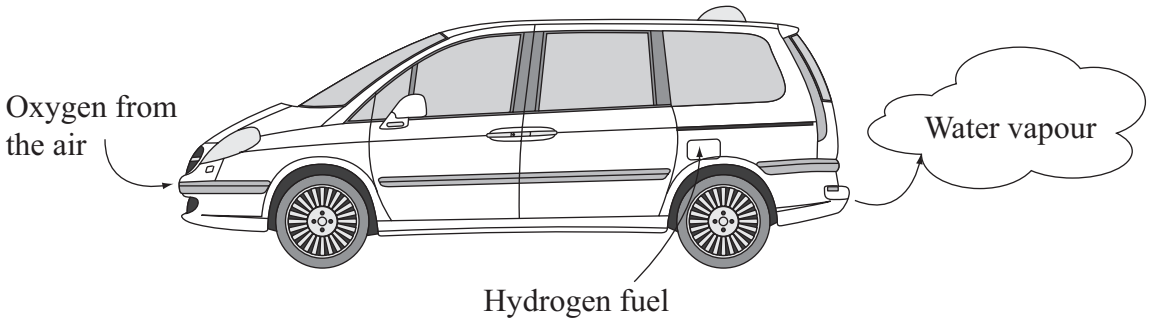
Use words from the box to label the diagram.

electron	**group**	**nucleus**	**symbol**



(2 marks)

1 (b) Hydrogen can be used as a *clean fuel* for cars.



1 (b) (i) When hydrogen burns in air, it reacts with another element.

Complete the word equation for this reaction.

hydrogen + ... → water

(1 mark)

1 (b) (ii) Suggest **one** reason why hydrogen is called a *clean fuel*.

.....

.....

(1 mark)

4

4.1.1.4 Relative electrical charges of subatomic particles

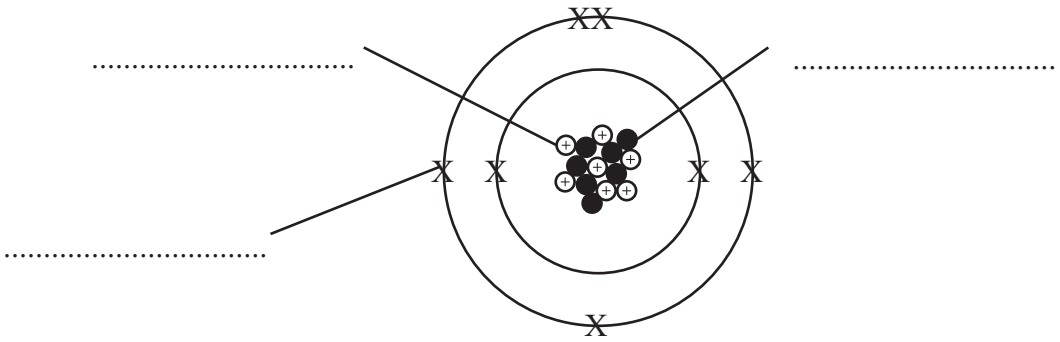
Question 06

June 2008 | CHY2F | Original Q5 | Legacy

5 (a) The diagram represents an atom of nitrogen.

5 (a) (i) Use words from the box to label the diagram.

electron	neutron	nucleus	proton



(2 marks)

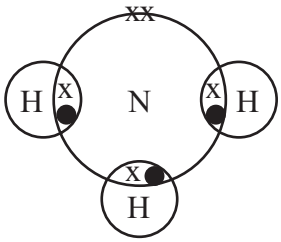
5 (a) (ii) Draw a ring around the mass number of this atom.

5 **7** **14** **21**

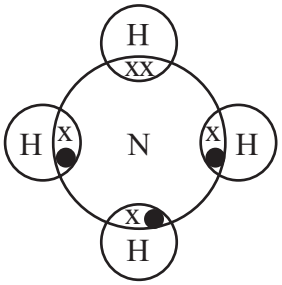
(1 mark)

5 (b) Nitrogen can react with hydrogen to make ammonia, NH_3.

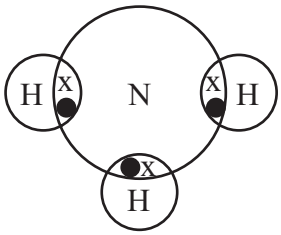
A



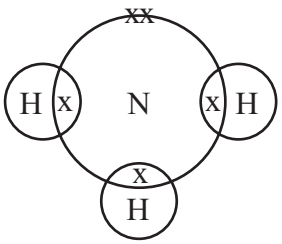
B



C



D



Which diagram, **A**, **B**, **C** or **D**, best represents an ammonia molecule?

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 06 · continued

for mark

5 (c) Ammonia is made using the Haber process. The word equation for this reaction is shown below.

nitrogen + hydrogen $\rightleftharpoons$ ammonia

5 (c) (i) Which **two** of the statements in the table do you know are true **only** by looking at the word equation?

Put a tick (✓) next to these **two** true statements.

Statement	(✓)
The reaction is very fast.	
Ammonia can break up to form nitrogen and hydrogen.	
Ammonia is made from nitrogen and hydrogen.	
The reaction that makes ammonia is endothermic.	

(2 marks)

5 (c) (ii) Draw a ring around the name of the raw material from which nitrogen is obtained.

air **methane** **oil** **water**

(1 mark)

5 (d) Some of the ammonia produced is neutralised by nitric acid to make a salt. This salt is used as a fertiliser.

Put a tick (✓) next to the name of the salt produced when ammonia is neutralised with nitric acid.

Name of salt	(✓)
ammonia nitrate	
ammonia nitride	
ammonium nitrate	
ammonium nitride	

(1 mark)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 07

June 2008 | CHY2F | Original Q7 | Legacy

7 Toothpastes often contain fluoride ions to help protect teeth from attack by bacteria.



Some toothpastes contain tin(II) fluoride.

This compound has the formula SnF_2.

7 (a) Calculate the relative formula mass (M_r) of SnF_2.
Relative atomic masses: F = 19; Sn = 119

.....

.....

.....

.....

Relative formula mass (M_r) = ...

(2 marks)

7 (b) Calculate the percentage by mass of fluorine in SnF_2.

.....

.....

.....

.....

Percentage by mass of fluorine = ... %

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 07 · continued

for mark

7 (c) A tube of toothpaste contains 1.2 g of SnF_2.

Calculate the mass of fluorine in this tube of toothpaste.

.....

.....

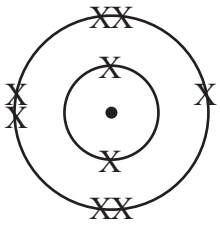
.....

.....

Mass of fluorine = ... g

(1 mark)

7 (d) The diagram represents the electron arrangement of a fluorine atom.



Explain how a fluorine atom can change into a fluoride ion, F^-.

.....

.....

.....

.....

(2 marks)

7

4.1.1.4 Relative electrical charges of subatomic particles

Question 08

November 2008 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about elements.

Match words, **A**, **B**, **C**, and **D**, with the numbers **1–4** in the sentences.

A a nucleus

B a compound

C a group

D an element

An atom consists of electrons orbiting . . . **1** . . . .

A substance that is made up of only one kind of atom is called . . . **2** . . . .

In the periodic table, a vertical column is called . . . **3** . . . .

When two or more elements combine together, they form . . . **4** . . . .

4.1.1.4 Relative electrical charges of subatomic particles

Question 09

March 2009 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about molecules of ammonia.

The formula for ammonia is NH_3

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A elements

B electrons

C atoms

D bonds

The formula tells us that one molecule of ammonia contains three . . . **1** . . . of hydrogen.

In ammonia, the particles of nitrogen and hydrogen are joined together by . . . **2** . . . which are formed by sharing . . . **3** . . . between the nitrogen and hydrogen.

Nitrogen and hydrogen are both . . . **4** . . . .

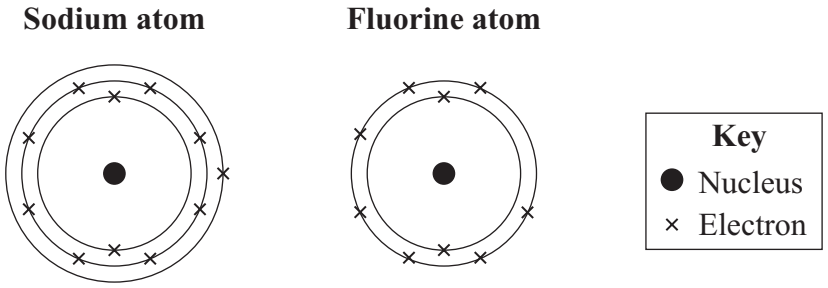
4.1.1.4 Relative electrical charges of subatomic particles

Question 10

June 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows a sodium atom and a fluorine atom.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a compound

B an electron

C a bond

D an element

Fluorine is made of only one sort of atom. This means that it is . . . **1** . . . .

When sodium and fluorine react, the fluorine atom takes . . . **2** . . . from the sodium atom.

The atoms are then held together by . . . **3** . . . .

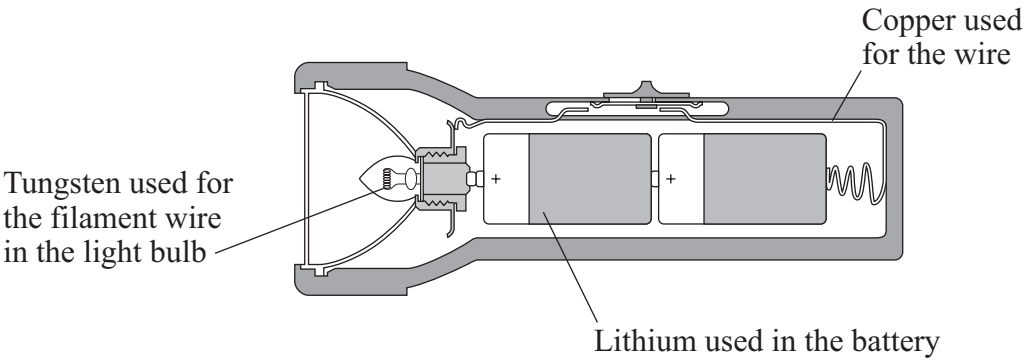
Sodium and fluorine combine together to form sodium fluoride, which is . . . **4** . . . .

4.1.1.4 Relative electrical charges of subatomic particles

Question 11

June 2009 | CHY1F | Original Q1 | Legacy

1 The diagram shows a circuit that is used in a torch. Electrons flow through this circuit.

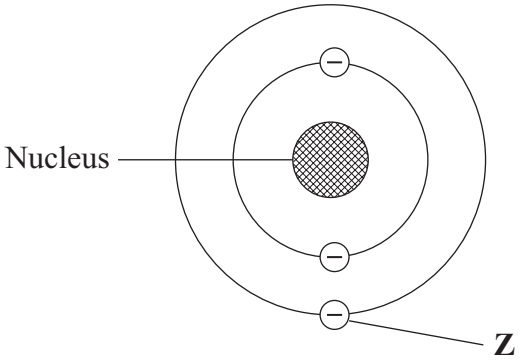


1 (a) Why is copper used for the wire?

.....

(1 mark)

1 (b) The diagram shows the structure of an atom of lithium.



Name the particle labelled **Z**.

.....

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 11 · continued

for mark

1 (c) The table shows some properties of the metals used in the electrical circuit.

Metal	Melting point in °C	Boiling point in °C	Reaction with oxygen
Copper	1083	2582	Reacts **slowly** to form a thin oxide layer on surface
Lithium	179	1317	Reacts **rapidly** to form oxide
Tungsten	3370	5930	Reacts **only** when very hot to form oxide

1 (c) (i) Use information from the table to suggest the order of reactivity for copper, lithium and tungsten.

most reactive .....

.....

least reactive .....

(2 marks)

1 (c) (ii) The filament wire glows because it gets very hot.

Use information from the table to suggest **one** reason why tungsten is used for the filament wire in the light bulb.

.....

.....

(1 mark)

1 (d) The gas used in the light bulb is argon.

Draw a ring around the correct word in the box to complete the sentence.

Argon is used in the light bulb because it is

dense.
solid.
unreactive.

(1 mark)

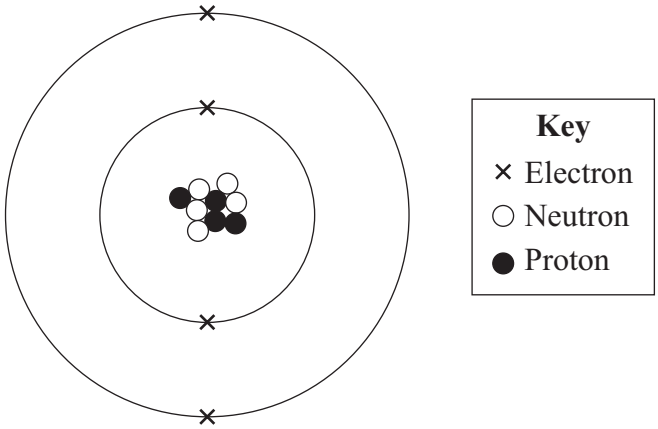
6

4.1.1.4 Relative electrical charges of subatomic particles

Question 12

June 2009 | CHY2F | Original Q1 | Legacy

1 The diagram represents an atom of beryllium.



Use a number from the box to complete each sentence.

4	7	9	12

1 (a) The atomic number (proton number) of this atom is ☐ .

(1 mark)

1 (b) The mass number of this atom is ☐ .

(1 mark)

2

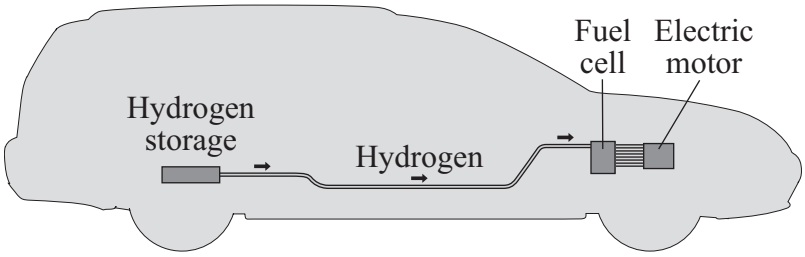
4.1.1.4 Relative electrical charges of subatomic particles

Question 13

June 2009 | CHY2F | Original Q6 | Legacy

6 Read the article and then answer the questions that follow.

Hydrogen fuel for cars?



Hydrogen is an excellent fuel. On combustion it reacts with oxygen from the air to release a large amount of energy. The only product of combustion is water which does not cause pollution. Hydrogen gas can be stored under pressure in a cylinder but a leak of the gas could cause an explosion.

It has been found that lithium nitride can absorb and then release large volumes of hydrogen. Hydrogen stored in lithium nitride will not explode.

The problem is that the rate at which hydrogen is absorbed and then released from normal sized particles of lithium nitride is slow.

Recently scientists have made 'nanosized' particles of lithium nitride. The 'nanosized' particles have the advantage that they absorb and release the hydrogen much faster when needed in the fuel cell.

4.1.1.4 Relative electrical charges of subatomic particles

Question 13 · continued

for mark

6 (a) Use information from the article to help you to answer these questions.

6 (a) (i) Give **two** reasons why hydrogen is an excellent fuel.

1 .....

.....

2 .....

.....

(2 marks)

6 (a) (ii) Hydrogen stored in lithium nitride is safer in an accident than a cylinder full of hydrogen gas.

State why.

.....

.....

(1 mark)

6 (a) (iii) What is the advantage of using 'nanosized' particles of lithium nitride instead of normal sized particles for storing hydrogen?

.....

.....

(1 mark)

Question 6 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

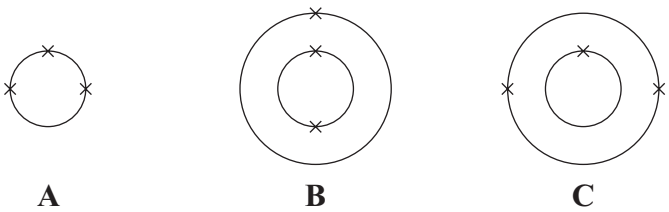
Question 13 · continued

for mark

6 (b) Lithium nitride is an ionic compound that contains lithium ions (Li^+) and nitride ions (N^{3-}).

6 (b) (i) The periodic table on the Data Sheet may help you to answer this question.

Which diagram, **A**, **B** or **C**, represents the electronic structure of a lithium atom?
Write your answer in the box.



A **B** **C**

Diagram ☐

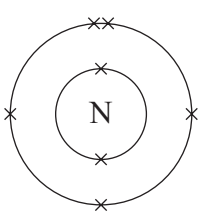
(1 mark)

6 (b) (ii) Tick (✓) the statement which describes how a lithium atom (Li) changes into a lithium ion (Li^+).

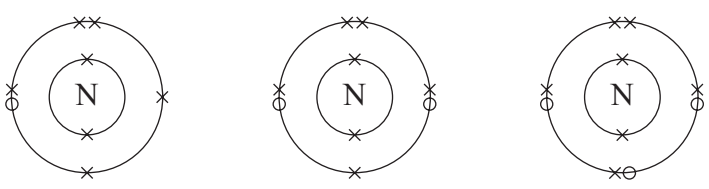
Statement	Tick (✓)
A lithium atom loses a neutron.	
A lithium atom loses an electron.	
A lithium atom loses a proton.	

(1 mark)

6 (b) (iii) The diagram shows the electronic structure of a nitrogen atom.



Which diagram, **A**, **B** or **C**, represents the electronic structure of a nitride ion (N^{3-})?
Write your answer in the box.



A **B** **C**

Diagram ☐

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 13 · continued

for mark

6 (c) The equation for the reaction of lithium nitride with hydrogen is:

$$Li_3N + 2H_2 \rightleftharpoons LiNH_2 + 2LiH$$

What does the $\rightleftharpoons$ symbol mean?

Draw a ring around your answer.

reversible reaction **endothermic reaction** **neutralisation**

(1 mark)

6 (d) Draw a ring around the correct answer in each box to complete the sentences.

6 (d) (i) 'Nanosized' particles of lithium nitride will be

much larger
a little larger
much smaller

than normal sized particles of lithium nitride. *(1 mark)*

6 (d) (ii) One of the reasons why 'nanosized' particles have different properties from normal sized particles is that they have a greater

density
mass
surface area

than normal sized particles of lithium nitride. *(1 mark)*

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 14

November 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The formula of hydrogen sulfide is H_2S.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A atoms

B electrons

C compounds

D elements

Hydrogen and sulfur are in the periodic table because they are . . . **1** . . . .

Hydrogen and sulfur are combined together in hydrogen sulfide, which is one of many known . . . **2** . . . .

The bonds in hydrogen sulfide are formed by shared pairs of . . . **3** . . . .

The formula of hydrogen sulfide contains a total of three . . . **4** . . . .

4.1.1.4 Relative electrical charges of subatomic particles

Question 15

4 Natural gas is mainly a hydrocarbon called methane.

4 (a) Use **one** word from the box to complete the sentence.

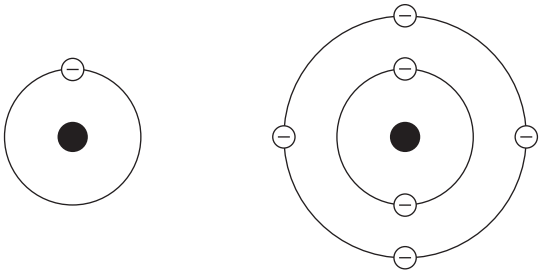
compounds	**elements**	**molecules**

Hydrocarbons contain hydrogen and carbon only.

Hydrogen and carbon are ..... .

(1 mark)

4 (b) The diagrams represent atoms of hydrogen and carbon.



Hydrogen Carbon

Draw a ring around the correct answer to complete the sentences.

4 (b) (i) The centre of each atom is called the

bond.
nucleus.
symbol.

(1 mark)

4 (b) (ii) The hydrogen atom has one electron and the carbon atom has

three
four
six

electrons.

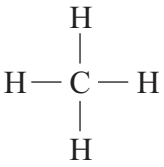
(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 15 · continued

for mark

4 (c) A molecule of methane can be represented as



Draw a ring around the correct answer to complete the sentences.

4 (c) (i) The formula of methane is

CH

CH_4

C_4H_4

(1 mark)

4 (c) (ii) The line between C—H is called a

bond.

molecule.

nucleus.

(1 mark)

4 (d) Methane burns to produce carbon dioxide (CO_2) and water (H_2O).

4 (d) (i) Draw a ring around the correct answer to complete the sentence.

When methane burns it reacts with

carbon.

nitrogen.

oxygen.

(1 mark)

4 (d) (ii) Hydrogen (H_2) can be used as a fuel.

Suggest why burning hydrogen would be less harmful to the environment than burning methane.

.....

.....

(1 mark)

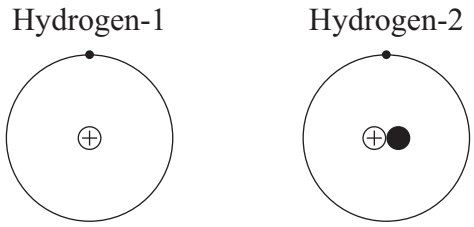
7

4.1.1.4 Relative electrical charges of subatomic particles

Question 16

3 Two isotopes of hydrogen are hydrogen-1 ($^{1}_{1}H$) and hydrogen-2 ($^{2}_{1}H$).

The diagrams represent atoms of hydrogen-1 and hydrogen-2.



3 (a) Use the correct words from the box to complete the sentences.

electrons	**neutrons**	**protons**

3 (a) (i) The positive particles , ⊕ , in the nucleus of atoms are called

..... .

(1 mark)

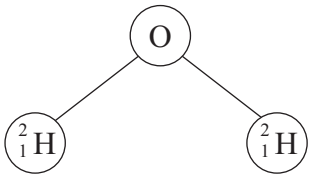
3 (a) (ii) The particles with no charge, ● , in the nucleus of atoms are called

..... .

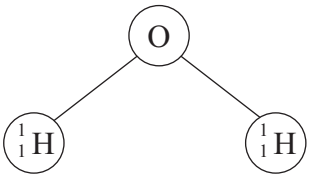
(1 mark)

3 (b) The diagrams show two different types of water molecule.

Molecule A



Molecule B



Draw a ring around the correct answer to complete the sentence.

Molecule **A** is

heavier than
lighter than
the same mass as

molecule **B**.

Explain your answer.

.....

.....

(2 marks)

4

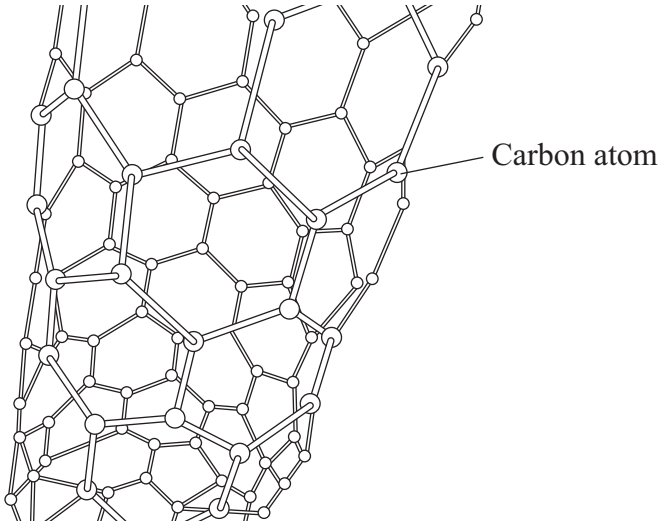
4.1.1.4 Relative electrical charges of subatomic particles

Question 17

4 Lightweight handlebars for bicycles are made from materials containing carbon nanotubes.

Carbon nanotubes are lightweight but very strong.

The diagram shows the structure of a carbon nanotube.



4 (a) What does the term 'nano' tell you about the diameter of carbon nanotubes?

Tick (✓) the correct answer in the table.

Answer	Tick (✓)
The diameter of the tube is very small.	
The diameter of the tube is large.	
The diameter of the tube is very large	

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 17 · continued

for mark

4 (b) Look at the diagram and then draw a ring around the correct word to complete each sentence.

4 (b) (i) Carbon nanotubes are similar to graphite because each carbon atom is joined to

two
three
four

other carbon atoms.

(1 mark)

4 (b) (ii) The carbon atoms are joined by

covalent
ionic
metallic

bonds.

(1 mark)

4 (b) (iii) Carbon nanotubes are very strong because the

atoms
bonds
electrons

are hard to break.

(1 mark)

4

4.1.1.4 Relative electrical charges of subatomic particles

Question 18

6 Hydrogen fluoride is used to make hydrofluoric acid.

6 (a) A company makes hydrogen fluoride by reacting solid calcium fluoride with sulfuric acid. The reaction takes place in a rotating kiln.

calcium fluoride + sulfuric acid → calcium sulfate + hydrogen fluoride

The company want this reaction to take place quickly.

6 (a) (i) Rotating the kiln makes the reaction take place faster.

Suggest why.

.....

.....

(1 mark)

6 (a) (ii) Draw a ring around the correct word in each box.

To make the reaction take place **faster**:

the temperature should be [higher / lower] so that the particles have [less / more] energy

the solid calcium fluoride should be [powder / lumps] to give a [small / big] surface area

the sulfuric acid solution should be [dilute / concentrated] to give [less / more] collisions between the particles each second.

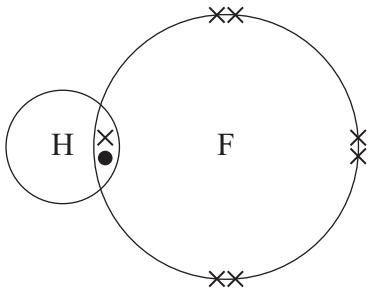
(3 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 18 · continued

for mark

6 (b) The diagram represents a molecule of hydrogen fluoride.



The hydrogen and fluorine atoms are joined by a covalent bond.

Use the correct word from the box to complete the sentence.

electrons	**neutrons**	**protons**

In a covalent bond the atoms share ..... .

(1 mark)

6 (c) Hydrogen fluoride is dissolved in water to make an acidic solution of hydrofluoric acid.

Draw a ring around the symbol of the ion that makes the solution acidic.

$\mathbf{H^+}$ $\mathbf{OH^-}$ $\mathbf{F^-}$

(1 mark)

6

4.1.1.4 Relative electrical charges of subatomic particles

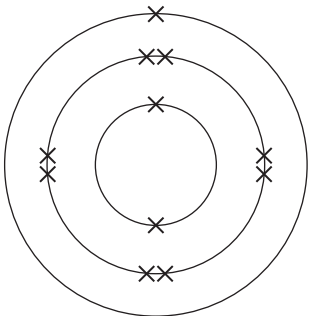
Question 19

7 Sodium chloride is a raw material.

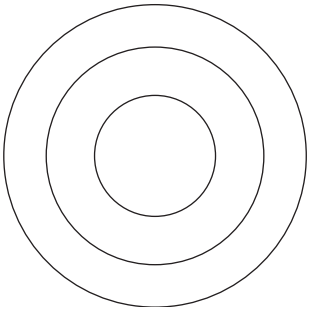
7 (a) The electronic structure of a sodium atom is shown below.

Complete the diagram for the electronic structure of a chlorine atom. A chlorine atom has 17 electrons.

Sodium atom



Chlorine atom



(1 mark)

7 (b) When sodium and chlorine react to form sodium chloride they form sodium ions (Na^+) and chloride ions (Cl^-).

How does a sodium atom change into a sodium ion?

.....

.....

.....

.....

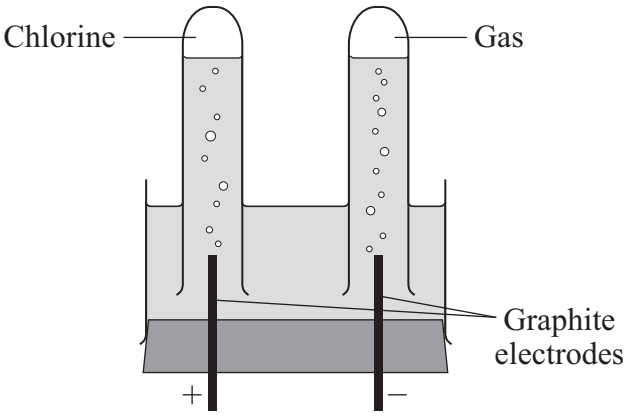
(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 19 · continued

for mark

7 (c) The diagram shows apparatus used in a school laboratory for the electrolysis of sodium chloride solution.



The solution contains sodium ions (Na^+), chloride ions (Cl^-), hydrogen ions (H^+) and hydroxide ions (OH^-).

7 (c) (i) Why do chloride ions move to the positive electrode?

.....

(1 mark)

7 (c) (ii) Name the gas formed at the negative electrode.

.....

(1 mark)

Question 7 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

for mark

7 (d) Chlorine and chlorine compounds are used to bleach wood pulp that is used to make paper.

The article below is from a newspaper.

> Local people have been protesting outside a paper factory. They say:
> 'We want the company to stop using chlorine compounds. Chlorine compounds release poisons into the environment. The company should use safer compounds.'
>
> The company replied:
> 'Chlorine has been used safely for many years to treat drinking water. Only tiny amounts of chlorine are released, which cause no harm. Using other compounds will be more expensive and may put us out of business.'

7 (d) (i) Why are some local people worried about the use of chlorine compounds?

.....

.....

(1 mark)

7 (d) (ii) Why might other local people want the company to continue to use chlorine compounds?

.....

.....

(1 mark)

7 (d) (iii) It is decided to have an enquiry.
Why should this be done by independent scientists?

.....

.....

(1 mark)

8

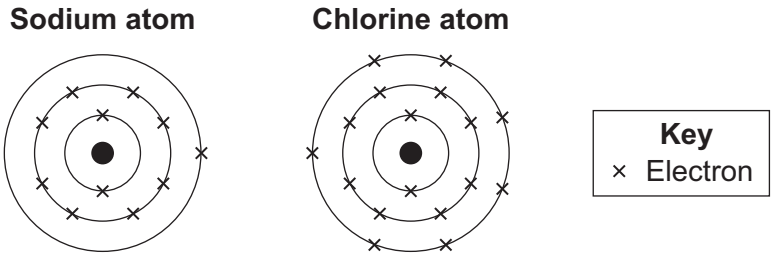
4.1.1.4 Relative electrical charges of subatomic particles

Question 20

June 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about a sodium atom and a chlorine atom.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A bonds

B electrons

C elements

D nuclei

In the diagrams, ● represents . . . **1** . . . .

Sodium and chlorine are . . . **2** . . . .

When sodium and chlorine react, the chlorine atoms take . . . **3** . . . from the sodium atoms.

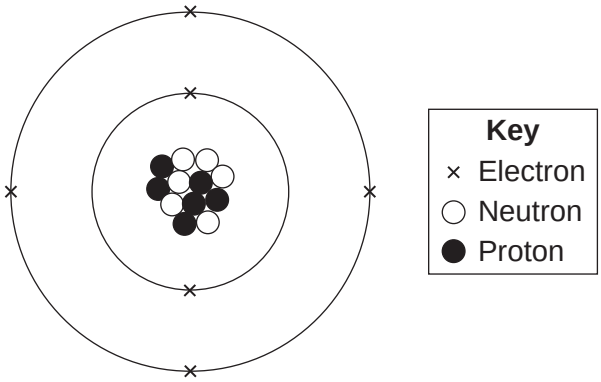
The sodium and chlorine atoms are then held together by . . . **4** . . . .

4.1.1.4 Relative electrical charges of subatomic particles

Question 21

June 2010 | CHY2F | Original Q2 | Legacy

2 The diagram represents a carbon atom.



2 (a) Use words from the box to answer the questions.

electron	**neutron**	**nucleus**	**proton**

2 (a) (i) What is the name of the central part of the atom?

.....

(1 mark)

2 (a) (ii) What is the name of the particle with no charge?

.....

(1 mark)

2 (a) (iii) What is the name of the particle with a negative charge?

.....

(1 mark)

2 (b) Use the diagram above to help you to answer these questions.

2 (b) (i) Draw a ring around the atomic (proton) number of this carbon atom.

6 **12** **18**

(1 mark)

2 (b) (ii) Draw a ring around the mass number of this carbon atom.

6 **12** **18**

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 21 · continued

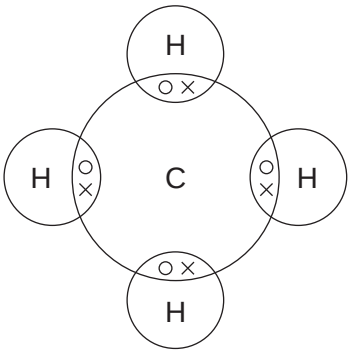
2 (c) A different carbon atom has 6 protons and 8 neutrons.

Draw a ring around the symbol that represents this atom.

$^{8}_{6}C$ $^{14}_{6}C$ $^{14}_{8}C$

(1 mark)

2 (d) The diagram shows the bonding in a methane molecule.



2 (d) (i) Draw a ring around the chemical formula of a methane molecule.

CH_4 **CH^4** **C_4H**

(1 mark)

2 (d) (ii) Draw a ring around the word that describes methane.

compound **element** **mixture**

(1 mark)

2 (d) (iii) Draw a ring around the type of bonding in a methane molecule.

covalent **ionic** **metallic**

(1 mark)

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 22

June 2010 | CHY2F | Original Q5 | Legacy

5 This question is about lead iodide and magnesium iodide.

5 (a) Lead iodide can be made by mixing a solution containing lead ions with a solution containing iodide ions.

Lead iodide is formed as a solid.

lead ions in solution + iodide ions in solution → lead iodide solid

5 (a) (i) Draw a ring around the name given to this type of reaction.

electrolysis **neutralisation** **precipitation**

(1 mark)

5 (a) (ii) Tick (✓) the method used to separate solid lead iodide from the solution.

Method	Tick (✓)
distillation	
evaporation	
filtration	

(1 mark)

5 (a) (iii) The table below gives information about the solubility of some compounds.

Soluble compounds	Insoluble compounds
all sodium and potassium salts	
all nitrates	
most chlorides, bromides and iodides	silver and lead chlorides, bromides and iodides

Use the table to help you to:

draw a ring around a soluble compound which contains lead ions

lead bromide **lead chloride** **lead nitrate**

draw a ring around a soluble compound which contains iodide ions.

lead iodide **silver iodide** **sodium iodide**

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 22 · continued

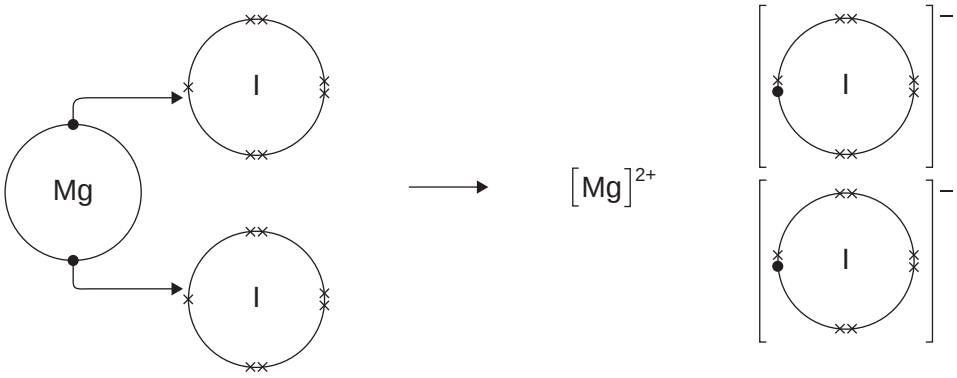
5 (b) Magnesium iodide can be made by reacting magnesium with iodine.

magnesium + iodine → magnesium iodide

The diagram shows how this takes place.

Only the outer electrons are shown.

The dots (•) and crosses (×) are used to represent electrons.



Use the diagram to help you to answer this question.

Describe, as fully as you can, what happens when magnesium reacts with iodine to make magnesium iodide.

To gain full marks you should use the words atom, electron and ion in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

8

4.1.1.4 Relative electrical charges of subatomic particles

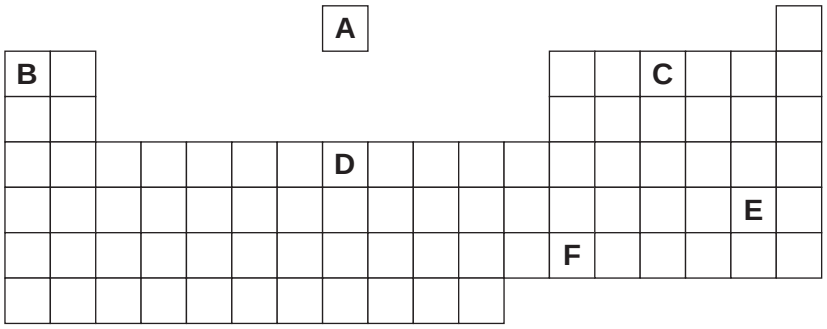
Question 23

June 2010 | CHY3F | Original Q3 | Legacy

3 (a) Use the periodic table on the Data Sheet to help you answer these questions.

Part of the periodic table is shown below.

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



Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

3 (a) (i) hydrogen Letter ☐

(1 mark)

3 (a) (ii) a Group 3 element Letter ☐

(1 mark)

3 (a) (iii) a halogen Letter ☐

(1 mark)

3 (a) (iv) the element with atomic (proton) number of 7 Letter ☐

(1 mark)

3 (a) (v) an element with one electron in its outer shell? Letter ☐

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 23 · continued

3 (b) The table shows the melting points of the Group 1 metals arranged in alphabetical order.

Group 1 metal		
Name	**Symbol**	**Melting point in °C**
Caesium	Cs	29
Francium	Fr	27
Lithium	Li	180
Potassium	K	64
Rubidium	Rb	39
Sodium	Na	98

3 (b) (i) Arrange these metals in order of increasing melting point. Three have been done for you.

Fr Cs Li

Lowest ⟶ Highest

(1 mark)

3 (b) (ii) Use the periodic table on the Data Sheet **and** your answer in part (b)(i) above to complete this sentence about how the melting points change.

Going down Group 1, the melting points ..... .

(1 mark)

3 (c) The transition metals are a block of elements between Groups 2 and 3 of the periodic table. Transition metals have different properties to Group 1 metals.

Put ticks (✓) next to the **three** correct statements about transition metals in the table below.

Statement	(✓)
They are harder than Group 1 metals	
They have lower densities than Group 1 metals	
They have higher melting points than Group 1 metals	
They are more reactive with water than Group 1 metals	
They often form coloured compounds but Group 1 compounds are usually white	

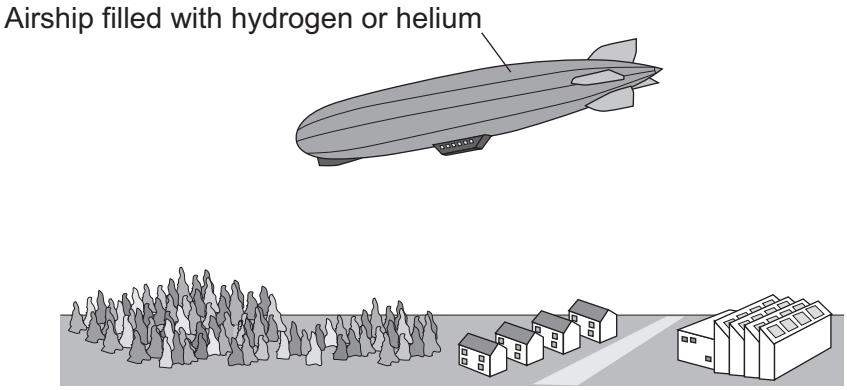
(3 marks)

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 24

1 Hydrogen and helium have both been used in airships.



1 (a) Tick (✓) the property which both hydrogen and helium have that makes an airship float in air.

Property	Tick (✓)
Colourless	
Less dense than air	
More dense than air	

(1 mark)

1 (b) (i) Hydrogen is no longer used in airships because it burns in oxygen.

The chemical equation for this reaction is shown.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Complete the word equation for this reaction.

hydrogen + oxygen → .....

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 24 · continued

1 (b) (ii) Helium is safer than hydrogen because it does **not** burn in oxygen.

Draw a ring around the correct answer to complete the sentence.

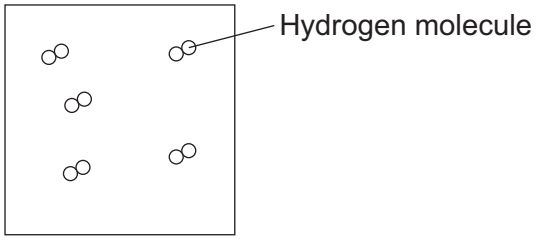
Helium is now used in airships because it is

- a fuel.
- already in the air.
- unreactive.

(1 mark)

1 (c) **Diagram 1** represents hydrogen molecules.

Diagram 1



Draw a ring around the correct answer to complete the sentence.

Each hydrogen molecule is made up of two hydrogen

- atoms.
- compounds.
- elements.

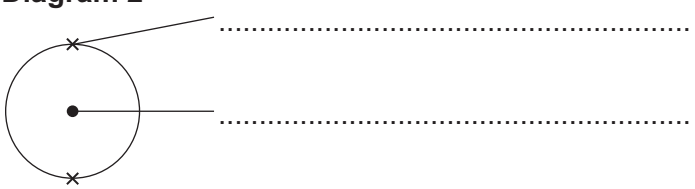
(1 mark)

1 (d) **Diagram 2** shows the parts of a helium atom.

Use words from the box to label **diagram 2**.

bond	**electron**	**nucleus**

Diagram 2



(2 marks)

6

4.1.1.4 Relative electrical charges of subatomic particles

Question 25

January 2011 | CHY2F | Original Q3 | Legacy

3 (a) A magnesium atom contains 12 protons (●),12 neutrons (o) and 12 electrons (×).

Which diagram, **A**, **B** or **C**, represents this magnesium atom?

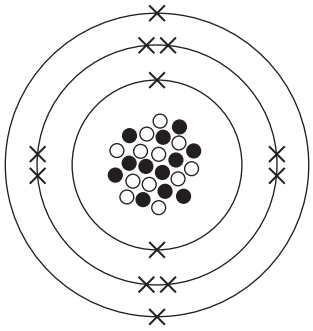


Diagram A

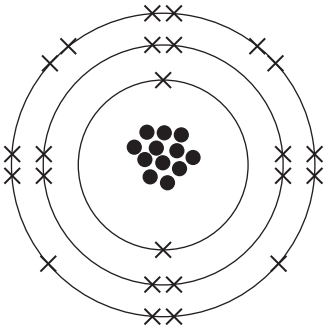


Diagram B

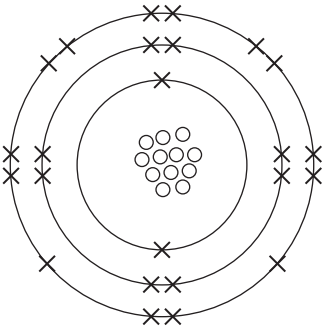
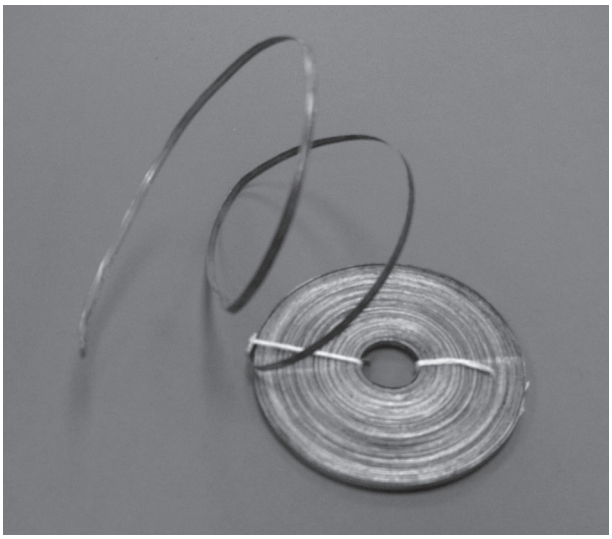


Diagram C

This magnesium atom is **Diagram** ☐ .

(1 mark)

3 (b) Magnesium metal is shaped to make magnesium ribbon.



Tick (✓) **two** reasons which explain why metals can be shaped.

Reason why	Tick (✓)
The atoms are all joined by covalent bonds.	
The atoms can slide over each other.	
The atoms are large.	
The atoms are in layers.	

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 25 · continued

3 (c) Magnesium sulfate is a salt of magnesium.

It can be prepared by the reaction of magnesium metal with an acid. The equation for the reaction of magnesium with this acid is:

$$\underset{\text{magnesium}}{Mg(s)} + \underset{\text{acid}}{H_2SO_4(aq)} \rightarrow \underset{\text{magnesium sulfate solution}}{MgSO_4(aq)} + \underset{\text{hydrogen}}{H_2(g)}$$

3 (c) (i) Draw a ring around the name of the acid used in this reaction.

hydrochloric **nitric** **sulfuric**

(1 mark)

3 (c) (ii) Use the equation to help you to answer this question.

Tick (✓) **two** things that happen when this reaction takes place.

	Tick (✓)
Bubbles are produced.	
The magnesium disappears.	
A solid is formed.	
Water is formed.	

(2 marks)

3 (c) (iii) Draw a ring around a method to get solid magnesium sulfate from magnesium sulfate solution.

crystallisation **electrolysis** **oxidation**

(1 mark)

7

4.1.1.4 Relative electrical charges of subatomic particles

Question 26

7 Calamine lotion is used to treat itching. The main ingredients are two metal oxides.



7 (a) One of the metal oxides has a relative formula mass (M_r) of 81.

The formula of this metal oxide is MO.
(M is **not** the correct symbol for the metal.)

The relative atomic mass (A_r) of oxygen is 16.

7 (a) (i) Calculate the relative atomic mass (A_r) of metal M.

.....

.....

.....

Relative atomic mass (A_r) = ...

(2 marks)

7 (a) (ii) Use your answer to part (a)(i) and the periodic table on the Data Sheet to name metal M.

The name of metal M is ..... .

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 26 · continued

7 (b) The other metal oxide is iron(III) oxide.

This contains iron(III) ions (Fe^{3+}) and oxide ions (O^{2-}).

7 (b) (i) Explain in terms of electrons how an iron atom (Fe) can change into an iron(III) ion (Fe^{3+}).

.....

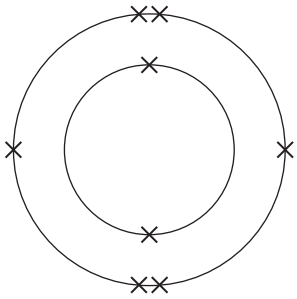
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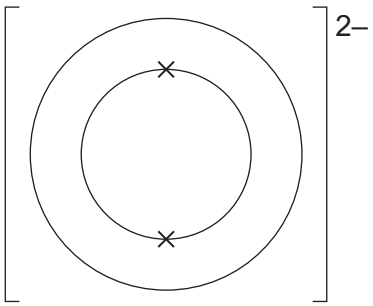
.....

(2 marks)

7 (b) (ii) The diagram below represents the electronic structure of an oxygen atom (O).



Complete the diagram below to show the electronic structure of an oxide ion (O^{2-}).



(1 mark)

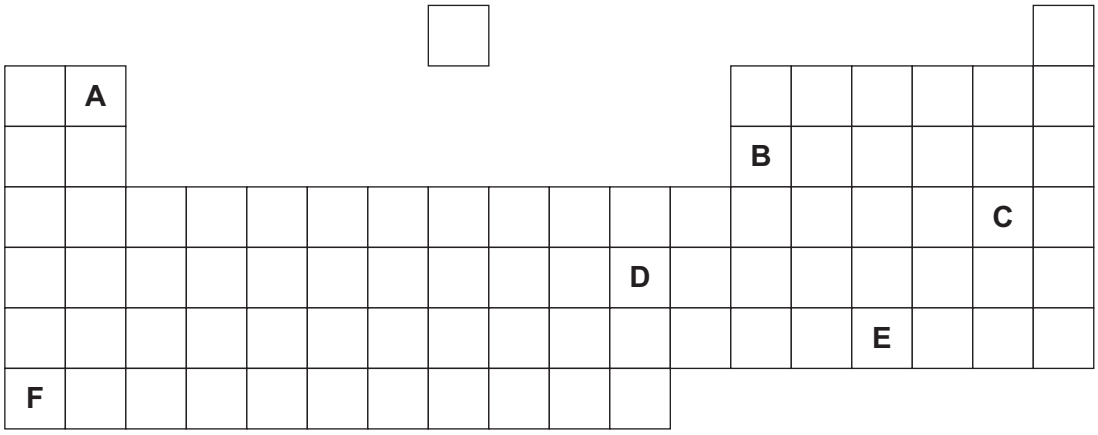
6

4.1.1.4 Relative electrical charges of subatomic particles

Question 27

1 The periodic table on the Data Sheet may help you to answer these questions.

1 (a) Part of the periodic table is shown below.



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

Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

1 (a) (i) aluminium ☐ *(1 mark)*

1 (a) (ii) a Group 5 element ☐ *(1 mark)*

1 (a) (iii) an alkali metal ☐ *(1 mark)*

1 (a) (iv) the element with atomic (proton) number of 47 ☐ *(1 mark)*

1 (a) (v) an element with seven electrons in its outer shell? ☐ *(1 mark)*

4.1.1.4 Relative electrical charges of subatomic particles

Question 27 · continued

1 (b) The table shows the boiling points of the Group 7 elements.

The elements are arranged **in alphabetical order**.

Group 7 element		
Name	**Symbol**	**Boiling point in °C**
Astatine	At	337
Bromine		58
Chlorine	Cl	–34
Fluorine	F	–188
Iodine	I	184

1 (b) (i) The symbol for bromine is missing from the table.

What is the symbol for bromine? Symbol = ...

(1 mark)

1 (b) (ii) Arrange these elements in order of **decreasing** boiling point. The first one and the last one have been done for you.

At .... F

Highest boiling point ⟶ Lowest boiling point

(1 mark)

1 (c) The table shows some statements about Group 7 elements.

Tick (✓) the **two** correct statements.

	Tick (✓)
They are halogens.	
They are metals.	
They become less reactive down Group 7.	
They are compounds.	

(2 marks)

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 28

June 2011 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

A mixture of iron oxide and aluminium reacts when heated.

This is the balanced equation for the reaction:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Symbols	
Fe	Iron
O	Oxygen
Al	Aluminium

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A electrons

B bonds

C products

D elements

Iron oxide and aluminium are the reactants. Aluminium oxide and iron are the . . . **1** . . . .

Aluminium atoms and oxygen atoms combine by transferring . . . **2** . . . .

The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

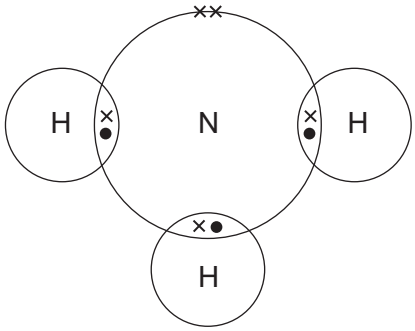
The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

4.1.1.4 Relative electrical charges of subatomic particles

Question 29

June 2011 | CHY2F | Original Q1 | Legacy

1 The diagram shows how the atoms are bonded in ammonia.



1 (a) Draw a ring around the correct answer.

1 (a) (i) The formula of an ammonia molecule is

NH^3 **N_3H** **NH_3**

(1 mark)

1 (a) (ii) The particles represented by the dots (•) and crosses (×) in the diagram are

electrons **neutrons** **protons**

(1 mark)

1 (a) (iii) The bonds between the nitrogen and hydrogen atoms in ammonia are

covalent **ionic** **metallic**

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 29 · continued June 2011 | CHY2F | Original Q1 | Legacy

1 (b) Ammonia is made by reacting nitrogen with hydrogen in the Haber process.
The equation for this reaction is shown below.

nitrogen + hydrogen $\rightleftharpoons$ ammonia

1 (b) (i) Use words from the box to complete the sentences.

air	limestone	iron ore	natural gas

Nitrogen is obtained from ..... .

Hydrogen is obtained from ..... .

(2 marks)

1 (b) (ii) Draw a ring around the correct answer to complete the sentence.

The symbol $\rightleftharpoons$ means that the reaction is

exothermic.
endothermic.
reversible.

(1 mark)

1 (b) (iii) A catalyst is used in the Haber process.

Draw a ring around the name of this catalyst.

iron **magnesium** **sodium**

(1 mark)

1 (c) Ammonium nitrate is a fertiliser that can be made by reacting ammonia with an acid.

Draw a ring around the name of the acid used in this reaction.

hydrochloric acid **nitric acid** **sulfuric acid**

(1 mark)

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 29 · continued

1 (d) Humberstone was a town in the desert of Northern Chile in South America. It was built for the people who worked in the nearby sodium nitrate mines.

The sodium nitrate was used as a fertiliser.

The sodium nitrate was exported by ship to countries all around the world.

Today the mines have closed and nobody lives in Humberstone.



One of the reasons for the mines closing was the invention of the Haber process.

Haber process factories can be built anywhere in the world.

1 (d) (i) How did the invention of the Haber process affect the people of Humberstone?

.....

.....

(1 mark)

1 (d) (ii) Suggest **two** advantages of making ammonium nitrate in the UK rather than importing sodium nitrate from Chile.

1 .....

.....

2 .....

.....

(2 marks)

11

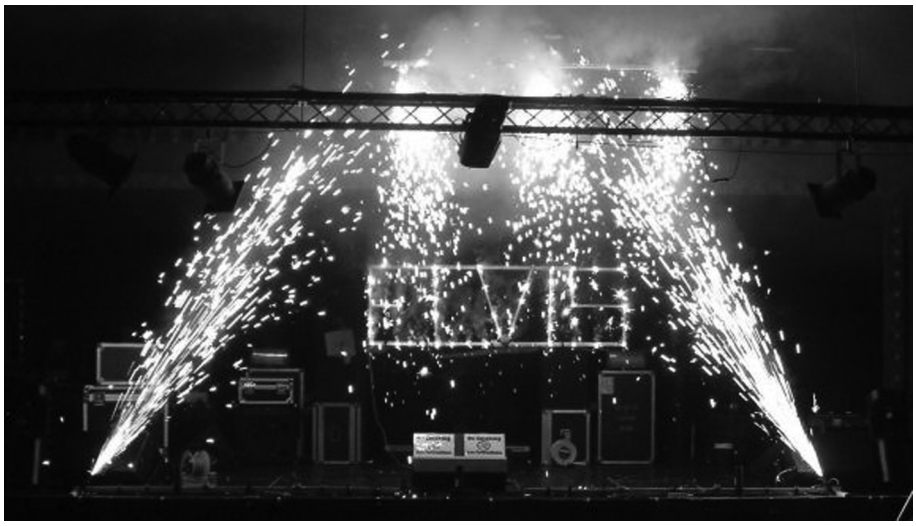
4.1.1.4 Relative electrical charges of subatomic particles

Question 30

June 2011 | CHY2F | Original Q5 | Legacy

5 Read the information in the box.

Flash powder is used to produce special effects at pop concerts.



Flash powder contains aluminium. The powder burns with a bright white flame and gives out lots of heat and light. It also produces white smoke.

The flash powder is placed on stage in a special container. At the bottom of the container there is a thin piece of wire. When the flash is needed, electricity is passed through the wire. The wire gets hot and starts the aluminium burning.

5 (a) When aluminium burns the reaction is exothermic.

Give **one** piece of information from the box which shows that the reaction is exothermic.

.....

(1 mark)

5 (b) The hot wire provides energy to start the aluminium burning.

Draw a ring around the name given to the energy needed to start a chemical reaction.

activation energy **potential energy** **solar energy**

(1 mark)

5 (c) When aluminium burns it reacts with oxygen to make aluminium oxide.

Complete the word equation for this reaction.

aluminium + ... → .....

(1 mark)

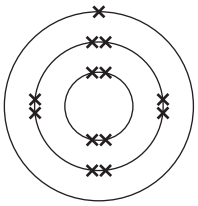
4.1.1.4 Relative electrical charges of subatomic particles

Question 30 · continued June 2011 | CHY2F | Original Q5 | Legacy

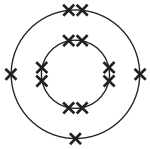
5 (d) An aluminium atom has 13 electrons.

Which diagram, **A, B** or **C**, represents the electronic structure of an aluminium atom?

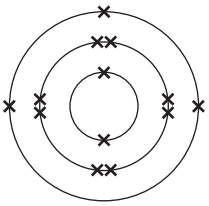
A



B



C



The electronic structure of an aluminium atom is diagram ☐

(1 mark)

5 (e) The white smoke produced is aluminium oxide.

Aluminium oxide contains aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

Draw a ring around the correct word in each box to complete each sentence.

5 (e) (i) Electrons have [a negative / no / a positive] charge.

(1 mark)

5 (e) (ii) When an aluminium atom (Al) turns into an aluminium ion (Al^{3+})

it [gains / loses / shares] three electrons.

(1 mark)

5 (e) (iii) When an oxygen atom (O) turns into an oxide ion (O^{2-})

it [gains / loses / shares] [one / two / three] electrons.

(2 marks)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 31

June 2011 | CHY3F | Original Q1 | Legacy

1 Use the periodic table on the Data Sheet to help you to answer these questions.

1 (a) The following is a list of symbols of some elements.

Sb	**Se**	**Si**	**Sn**	**Sr**

Choose your answers **only** from the symbols shown in the box above.

Which symbol represents

1 (a) (i) a Group 5 element ☐

(1 mark)

1 (a) (ii) the element in the same group as oxygen (O) ☐

(1 mark)

1 (a) (iii) the element with atomic (proton) number of 50 ☐

(1 mark)

1 (a) (iv) silicon? ☐

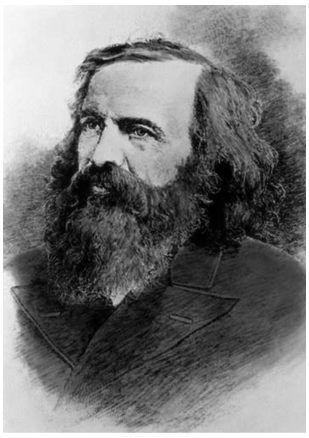
(1 mark)

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 31 · continued

1 (b)



Mendeleev suggested his version of the periodic table in 1869.

Part of Mendeleev's table is shown below.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K Cu	Ca Zn	# #	Ti #	V As	Cr Se	Mn Br

4.1.1.4 Relative electrical charges of subatomic particles

Question 31 · continued

There are differences between Mendeleev's table and the periodic table on the Data Sheet.

Draw a ring around the correct answer to complete the sentences.

1 (b) (i) Mendeleev left gaps (shown by #) in his table.

Mendeleev left gaps for [compounds / elements / mixtures] that had not been discovered.

(1 mark)

1 (b) (ii) Mendeleev put copper (Cu) in the same box as [bromine (Br). / chromium (Cr). / potassium (K).]

(1 mark)

1 (b) (iii) Mendeleev did **not** have a Group [0. / 3. / 5.]

(1 mark)

7

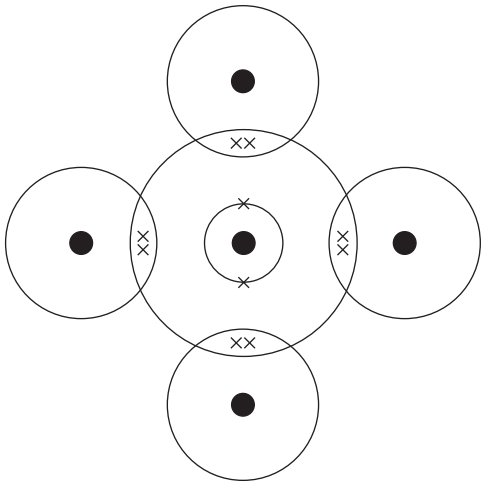
4.1.1.4 Relative electrical charges of subatomic particles

Question 32

November 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows how a carbon atom can be joined to four atoms of hydrogen to form methane.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a bond

B an electron

C a molecule

D a nucleus

In the diagram, each ● represents . . . **1** . . . and each × represents . . . **2** . . . .

The carbon atom is joined to each hydrogen atom by . . . **3** . . . .

This forms . . . **4** . . . of methane.

4.1.1.4 Relative electrical charges of subatomic particles

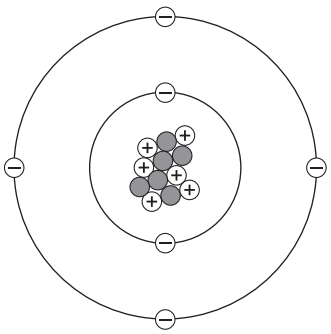
Question 33

January 2012 | CH1FP | Original Q1 | Legacy

1 The picture shows a diamond ring.



1 (a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	–1

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 33 · continued

1 (b) Use the Chemistry Data Sheet to help you to answer these questions.

1 (b) (i) Draw a ring around the correct answer to complete the sentence.

Gold and carbon are

compounds.
elements.
mixtures.

(1 mark)

1 (b) (ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a ..... .

(1 mark)

1 (c) Draw a ring around the correct answer to complete each sentence.

Pure gold is not used to make the ring because pure gold is too

hard.
reactive.
soft.

The gold ring is made by mixing pure gold with other metals to form

a compound.
an atom.
an alloy.

(2 marks)

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 33 · continued

1 (d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
	61
How many electrons are there in a copper atom?	75
How many neutrons are in an atom of silver with a mass number of 108?	79

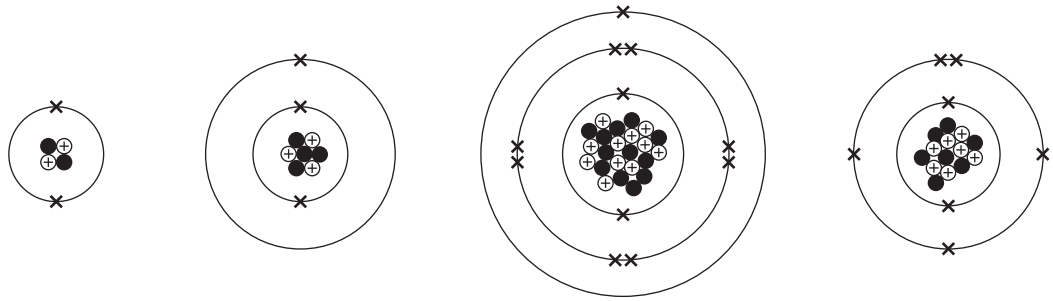
(3 marks)

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 34

1 The diagrams show the sub-atomic particles in four different atoms.



Atom A **Atom B** **Atom C** **Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The centre of each atom is called the

energy level.
molecule.
nucleus.

(1 mark)

1 (a) (ii) The centre of each atom contains neutrons and

bonds.
electrons.
protons.

(1 mark)

1 (b) Complete the sentence.

There is no overall electrical charge on each atom because the

number of ..... is equal to the number of ..... .

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 34 · continued

1 (c) What is the name of the element represented by atom **D**? .....
(1 mark)

1 (d) Which **two** of the atoms, **A**, **B**, **C** and **D**, are in the same group of the periodic table?

Give a reason for your answer.

Atom ☐ and atom ☐

Reason .....

.....
(2 marks)

6

Turn over for the next question

4.1.1.4 Relative electrical charges of subatomic particles

Question 35

June 2012 | CH2FP | Original Q1 | Legacy

1 (a) The symbol equation for the decomposition of hydrogen peroxide is:

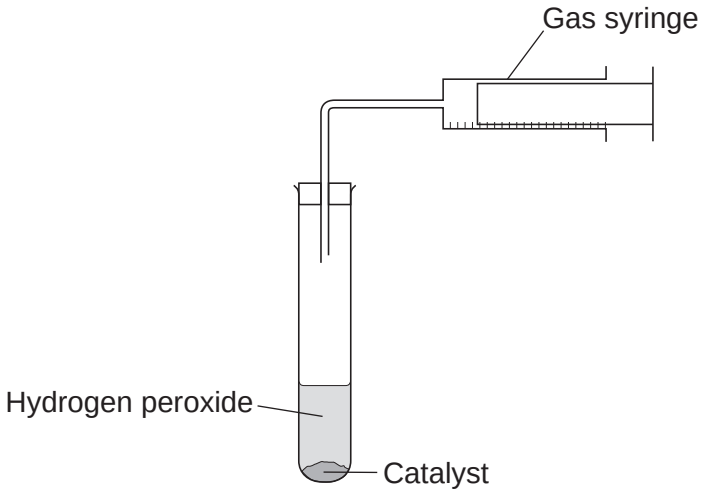
$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Complete the word equation for the decomposition of hydrogen peroxide.

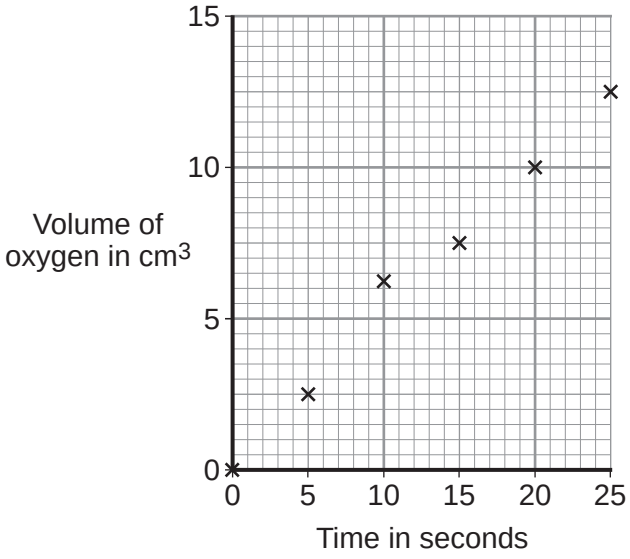
Hydrogen peroxide → ..... + ...

(1 mark)

1 (b) A student did an experiment to see how quickly hydrogen peroxide decomposes. The student used the apparatus shown below to measure the volume of oxygen.



1 (b) (i) Draw a straight line of best fit to complete the graph.



(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 35 · continued

1 (b) (ii) Draw a circle around the anomalous point on the graph.

(1 mark)

1 (b) (iii) What is the volume of oxygen given off after 15 seconds? ..... cm^3

(1 mark)

1 (b) (iv) How did the volume of oxygen change between 0 and 25 seconds?

.....

(1 mark)

1 (c) The student wanted to make the reaction faster.

Draw a ring around the correct answer to complete each sentence.

1 (c) (i) To make the reaction faster, the temperature should be

higher.

lower.

the same.

(1 mark)

1 (c) (ii) To make the reaction faster, the hydrogen peroxide should be

more dilute.

more concentrated.

the same.

(1 mark)

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 35 · continued

1 (d) The diagram represents the bonding in oxygen.

O=O

Draw a ring around the correct answer to complete each sentence.

1 (d) (i) When two oxygen atoms bond, the atoms [share / transfer / delocalise] electrons.

(1 mark)

1 (d) (ii) The oxygen atoms are joined by [ionic / metallic / covalent] bonds.

(1 mark)

1 (d) (iii) Oxygen is made of [simple molecules. / a giant lattice. / macromolecules.]

(1 mark)

1 (e) When hydrogen peroxide decomposes water is produced.
Which **two** statements in the table explain why water is a liquid at room temperature?

Tick (✓) the **two** statements.

Statement	Tick (✓)
Water has a boiling point of 100 °C.	
Water is made of ions.	
Water has a melting point lower than room temperature.	
Water has a giant covalent structure.	

(2 marks)

12

4.1.1.4 Relative electrical charges of subatomic particles

Question 36

June 2012 | CH2FP | Original Q2 | Legacy

2 Gold and gold ions are used as catalysts.

2 (a) An atom of gold is represented as:

$$^{197}_{79}Au$$

Complete the sentences.

The atomic number of gold is ..... .

The number of electrons in an atom of gold is ..... .

(2 marks)

2 (b) Scientists have found that gold nanoparticles are very good catalysts.

Draw a ring around the correct answer to complete the sentence.

A gold nanoparticle contains a few | hundred / thousand / million | atoms.

(1 mark)

2 (c) The formation of a gold ion (Au^{3+}) from a gold atom (Au) is shown in the symbol equation.

$$Au \rightarrow Au^{3+} + 3e^-$$

2 (c) (i) Complete the sentence.

The particles lost when a gold atom becomes a gold ion

are called ..... .

(1 mark)

2 (c) (ii) Draw a ring around the correct answer to complete the sentence.

The number of these particles lost when a gold atom becomes a gold ion is | one. / two. / three. |

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 36 · continued

2 (d) Gold ions are used as a catalyst in the reaction to make chloroethene.

How does a catalyst help a reaction?

.....

(1 mark)

2 (e) Chloroethene can react to make a thermosoftening polymer.

2 (e) (i) Draw a ring around the correct answer to complete the sentence.

When heated, a thermosoftening polymer will

dissolve.

melt.

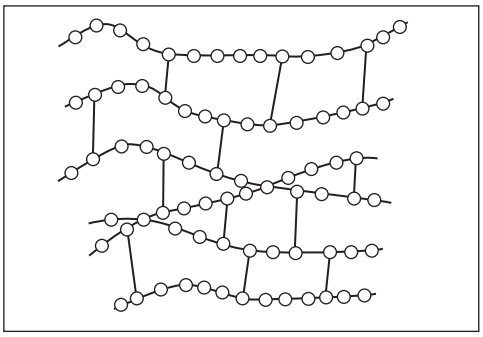
solidify.

(1 mark)

2 (e) (ii) Polymer **B** is a different type of polymer.

The diagram shows the structure of polymer **B**.

Polymer B



How can you tell from the diagram that polymer **B** is **not** thermosoftening?

.....

.....

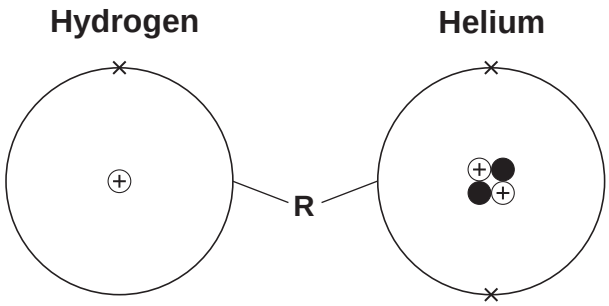
(1 mark)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 37

1 The Sun is mainly hydrogen and helium.
The diagrams show an atom of hydrogen and an atom of helium.



1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The centre of each atom is called the

molecule.
nucleus.
shell.

(1 mark)

1 (a) (ii) The circle (labelled **R**) around the centre of each atom is called

a bond.
an electrical charge.
an energy level (shell).

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 37 · continued

1 (b) Use the diagrams on page 2 to help you to answer these questions.

Draw **one** line from each question to its correct answer.

Question	Answer
How many protons are there in the hydrogen atom?	1
How many electrons are there in the helium atom?	2
What is the mass number of the helium atom?	3
	4

(3 marks)

1 (c) The Sun is 73% hydrogen and 25% helium. The rest is other elements.

What is the percentage of other elements in the Sun? ..... %

(1 mark)

1 (d) One of the other elements in the Sun is neon.
Neon is in the same group of the periodic table as helium.

Use the Chemistry Data Sheet to help you to answer these questions.

1 (d) (i) How many protons are there in a neon atom?

.....

(1 mark)

1 (d) (ii) Which group of the periodic table are helium and neon in?

.....

(1 mark)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 38

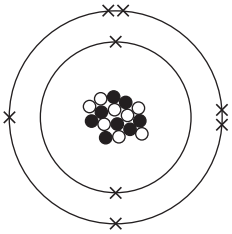
1 This question is about atoms and molecules.

1 (a) Complete the table to show the relative masses of the particles in atoms.

Name of particle	Relative mass
Proton	.....
Neutron	1
Electron	.....

(2 marks)

1 (b) The diagram shows an oxygen atom.



Key
- ● Proton
- ○ Neutron
- × Electron

Use the correct number to complete each sentence.

8	**16**	**18**	**24**

The atomic (proton) number of the oxygen atom shown above is ..... .

The mass number of the oxygen atom shown above is ..... .

(2 marks)

1 (c) (i) Draw a ring around the correct answer to complete the sentence.

Oxygen atoms with different numbers of neutrons are called

isotopes.

molecules.

polymers.

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 38 · continued

1 (c) (ii) An oxygen atom with a different number of neutrons has 10 neutrons.

Draw a ring around the symbol which represents this atom.

$^{16}_{8}O$ $^{18}_{10}O$ $^{18}_{8}O$

(1 mark)

1 (d) A water molecule contains hydrogen and oxygen atoms.

1 (d) (i) Use the correct answer to complete the sentence.

a compound	an element	a mixture

Water is ..... .

(1 mark)

1 (d) (ii) Draw a ring around the correct structure of a water molecule.

H — O — H **O — H — H** **O — H — O**

(1 mark)

1 (d) (iii) Draw a ring around the type of bonding in a water molecule.

covalent **ionic** **metallic**

(1 mark)

1 (d) (iv) Draw a ring around the correct answer to complete the sentence.

The bonds in a water molecule are formed by [gaining / losing / sharing] electrons.

(1 mark)

10

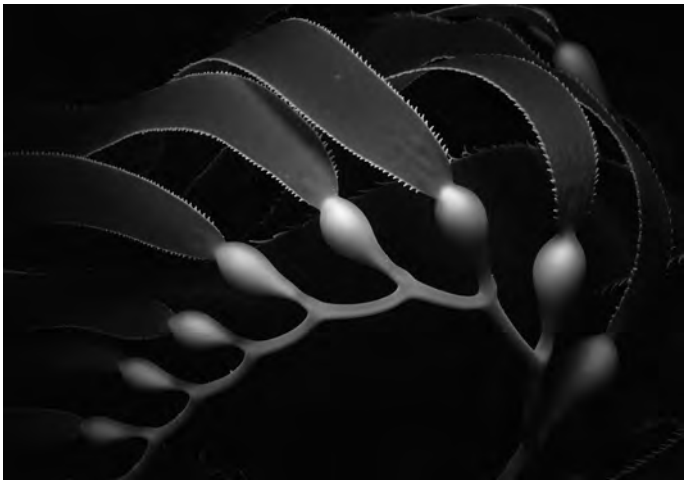
4.1.1.4 Relative electrical charges of subatomic particles

Question 39

January 2013 | CH2FP | Original Q3 | Legacy

3 Kelp is a seaweed.

Kelp can be burned to give out energy.



3 (a) Draw a ring around the correct answer to complete the sentence.

Reactions which give out energy are

endothermic.

exothermic.

reversible.

(1 mark)

3 (b) Which **two** of the following questions **cannot** be answered by scientific experiments alone?

Tick (✓) **two** boxes.

Question	Tick (✓)
How much carbon dioxide is produced when 100 g of kelp is burned?	
Does kelp give out more heat energy than coal when burned?	
Should people use kelp instead of oil as an energy source?	
Will kelp be more popular than coal in the next 10 years?	

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 39 · continued

3 (c) Potassium iodide can be produced from kelp.

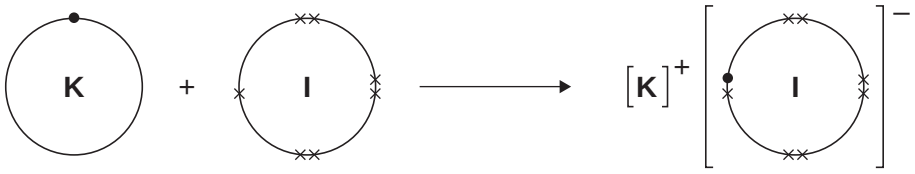
3 (c) (i) Potassium can be reacted with iodine to produce potassium iodide.

potassium + iodine → potassium iodide

The diagram shows how this happens.

Only the outer electrons are shown.

The dots (●) and crosses (×) are used to represent electrons.



Use the diagram to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with iodine to produce potassium iodide.

To get full marks you should use the words atom, electron and ion in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

Question 3 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 39 · continued

3 (c) (ii) Potassium iodide reacts with lead nitrate.

$$2\,KI(aq) + Pb(NO_3)_2(aq) \rightarrow 2\,KNO_3(aq) + PbI_2(s)$$

Why is this reaction a precipitation?

.....

.....

(1 mark)

3 (c) (iii) How can the precipitate be removed from the reaction mixture?

.....

.....

(1 mark)

9

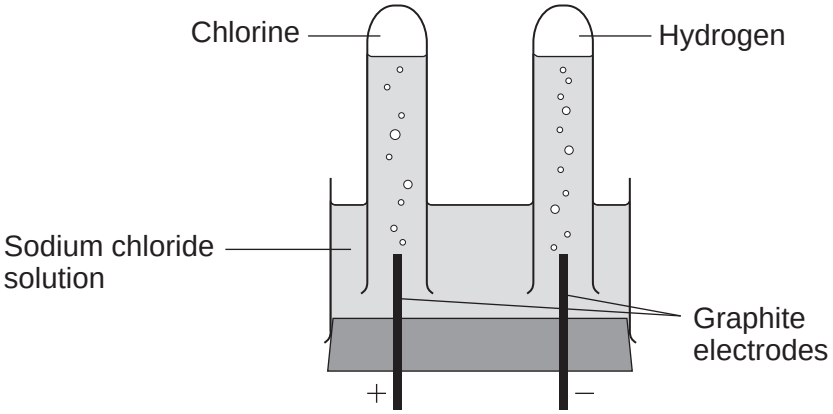
4.1.1.4 Relative electrical charges of subatomic particles

Question 40

January 2013 | CH2FP | Original Q8 | Legacy

8 The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.



8 (a) One of the products of the electrolysis of sodium chloride solution is hydrogen.

8 (a) (i) Why do hydrogen ions move to the negative electrode?

.....

.....

(1 mark)

8 (a) (ii) How does a hydrogen ion change into a hydrogen atom?

.....

.....

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

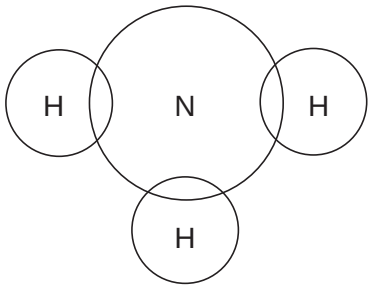
Question 40 · continued

8 (b) Hydrogen is used to make ammonia (NH_3).

Complete the diagram to show the bonding in ammonia.

Use dots (●) and crosses (x) to show electrons.

Show only outer shell electrons.



(2 marks)

8 (c) The table shows the ions in sodium chloride solution.

Positive ions	Negative ions
hydrogen	chloride
sodium	hydroxide

In industry, some of the waste from the electrolysis of sodium chloride solution is alkaline and has to be neutralised.

8 (c) (i) Which ion makes the waste alkaline?

.....

(1 mark)

8 (c) (ii) This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

.....

(1 mark)

Question 8 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 40 · continued

8 (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

	Mercury cell	**Membrane cell**
Cost of construction	Expensive	Relatively cheap
Additional substances used	Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste.	Membrane, which is made of a polymer. The membrane must be replaced every 3 years.
Amount of electricity used for each tonne of chlorine produced in kWh	3400	2950
Quality of chlorine produced	Pure	Needs to be liquefied and distilled to make it pure.
Quality of sodium hydroxide solution produced	50% concentration. Steam is used to concentrate the sodium hydroxide solution produced.	30% concentration. Steam is used to concentrate the sodium hydroxide solution produced.

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

.....

.....

.....

.....

.....

.....

.....

.....

4.1.1.4 Relative electrical charges of subatomic particles

Question 41

June 2013 | CH1FP | Original Q1 | Legacy

1 Magnesium burns in oxygen.



1 (a) Use the Chemistry Data Sheet to help you to answer this question.

The word equation for magnesium burning is:

magnesium + oxygen ⟶ magnesium oxide

Draw **one** line from each substance to its correct description.

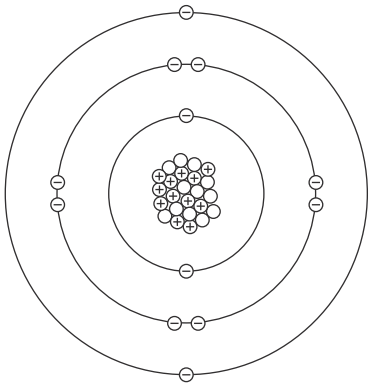
Substance	Description
magnesium	compound
magnesium oxide	metal
oxygen	mixture
	non-metal

(3 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 41 · continued

1 (b) The diagram represents a magnesium atom.



Complete the table to show the name of each particle and the charge of each particle in the magnesium atom.

Name of particle	Charge
proton	+1
neutron	.....
.....	–1

(2 marks)

1 (c) Use the Chemistry Data Sheet to help you to answer these questions.

Draw a ring around the correct answer to complete each sentence.

1 (c) (i) In a magnesium atom, the protons and neutrons are in the

core.
nucleus.
shell.

(1 mark)

1 (c) (ii) The number of protons in a magnesium atom is the

atomic number.
mass number.
group number.

(1 mark)

1 (c) (iii) The sum of the protons and neutrons in a magnesium atom is the

atomic number.
mass number.
group number.

(1 mark)

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 42

June 2013 | CH2FP | Original Q1 | Legacy

1 This question is about lithium and sodium.

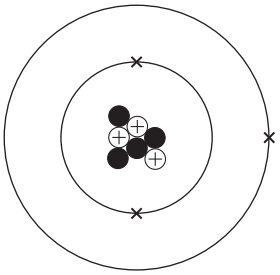
1 (a) Use the Chemistry Data Sheet to help you to answer this question.

In which group of the periodic table are lithium and sodium? Group ☐

(1 mark)

1 (b) A lithium atom can be represented as $^{7}_{3}Li$

The diagram represents the lithium atom.



1 (b) (i) Some particles in the nucleus have a positive charge.

What is the name of these particles? .....

(1 mark)

1 (b) (ii) Some particles in the nucleus have no charge.

What is the name of these particles? .....

(1 mark)

1 (b) (iii) Use the correct answer from the box to complete the sentence.

3	4	7

The mass number of this atom of lithium is ☐

(1 mark)

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

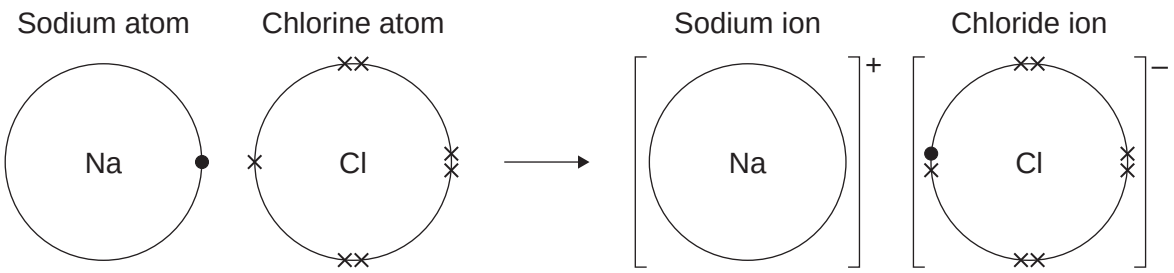
Question 42 · continued

1 (c) Sodium reacts with chlorine to produce sodium chloride.

sodium + chlorine ⟶ sodium chloride

The diagram shows how the reaction happens.

Only the outer electrons are shown.



Draw a ring around the correct answer to complete each sentence.

1 (c) (i) A sodium atom changes into a sodium ion by [gaining / losing / sharing] an electron.

(1 mark)

1 (c) (ii) A sodium ion has [a negative / no / a positive] charge.

(1 mark)

1 (c) (iii) The ions in sodium chloride are held together by strong [covalent / electrostatic / magnetic] forces.

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 42 · continued June 2013 | CH2FP | Original Q1 | Legacy

1 (d) Sodium chloride is an ionic compound.

Tick (✓) **two** properties of ionic compounds.

Property	Tick (✓)
Do **not** dissolve in water	
High melting points	
Low boiling points	
Strong bonds	

(2 marks)

1 (e) (i) The formula of sodium chloride is NaCl

Calculate the relative formula mass of sodium chloride.

Relative atomic masses: Na = 23; Cl = 35.5

.....

.....

Relative formula mass = ...

(1 mark)

1 (e) (ii) Draw a ring around the correct answer to complete the sentence.

The relative formula mass of a substance, in grams, is one ion / isotope / mole of the substance.

(1 mark)

1 (f) Nanoparticles of sodium chloride (salt) are used to flavour crisps.

What are nanoparticles?

.....

.....

(1 mark)

12

4.1.1.4 Relative electrical charges of subatomic particles

Question 43

June 2013 | CH2FP | Original Q3 | Legacy

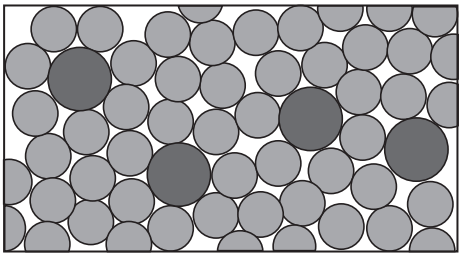
3 Oil rigs are used to drill for crude oil.



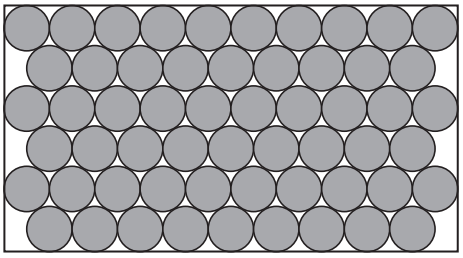
3 (a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.

Alloy



Pure iron



Use the diagrams to explain why the alloy is harder than pure iron.

.....

.....

.....

.....

(2 marks)

3 (b) Drill heads contain diamonds.

Tick (✓) **two** reasons why diamonds are hard.

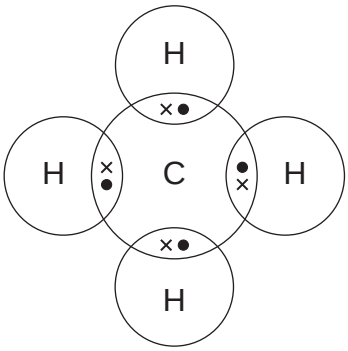
Reason	Tick (✓)
Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2 marks)

4.1.1.4 Relative electrical charges of subatomic particles

Question 43 · continued

3 (c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



3 (c) (i) Draw a ring around the correct answer to complete the sentence.

Methane is

a compound.

an element.

a mixture.

(1 mark)

3 (c) (ii) Draw a ring around the correct answer to complete the sentence.

The formula of methane is

C_4H_4

C_4H

CH_4

(1 mark)

3 (c) (iii) Name the type of bond between the carbon and hydrogen atoms in methane.

.....

(1 mark)

3 (d) Explain why methane is a gas at 20 °C.

.....

.....

.....

.....

(2 marks)

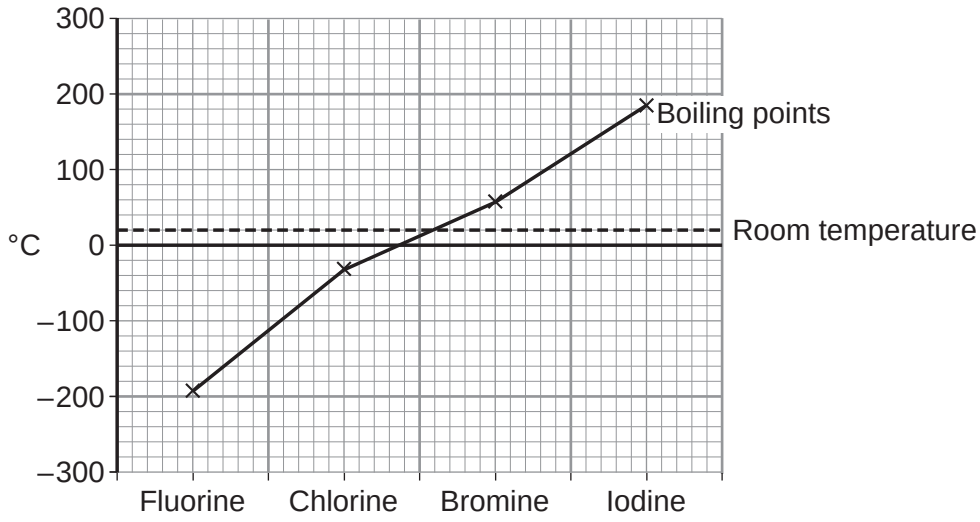
9

4.1.1.4 Relative electrical charges of subatomic particles

Question 44

June 2013 | CH3FP | Original Q5 | Legacy

5 The graph shows the boiling points of the halogens.



5 (a) Use the graph to help you answer these questions.

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

gas	liquid	solid

At room temperature chlorine is a ..... .

(1 mark)

5 (a) (ii) Describe the trend in boiling point from fluorine to iodine.

.....

.....

(1 mark)

5 (b) Chlorine reacts with metals to produce metal chlorides.

5 (b) (i) When a chlorine atom forms a chloride ion it gains one electron.

What is the charge on a chloride ion?

.....

(1 mark)

5 (b) (ii) Write a word equation for the reaction between sodium and chlorine.

.....

(1 mark)

4.1.1.4 Relative electrical charges of subatomic particles

Question 44 · continued

5 (c) In the UK water companies add chlorine to tap water.

Why is chlorine added to tap water?

.....

(1 mark)

5 (d) Water companies add fluoride to tap water in some parts of the UK.
Fluoride is added to improve dental health.

Suggest **one** reason why some people are against adding fluoride to tap water.

.....

.....

.....

(1 mark)

6

Turn over for the next question

4.1.1.4 Relative electrical charges of subatomic particles

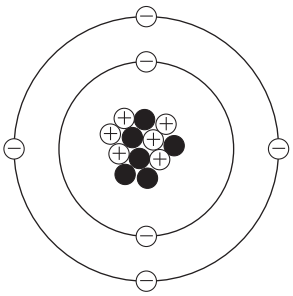
Question 45

June 2014 | CH1FP | Original Q1 | Legacy

1 Fossil fuels contain carbon.

1 (a) **Figure 1** represents a carbon atom.

Figure 1



Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The name of the particle with a positive charge is

an electron.
a neutron.
a proton.

[1 mark]

1 (a) (ii) The centre of the atom is called the

energy level.
molecule.
nucleus.

[1 mark]

1 (a) (iii) Use the Chemistry Data Sheet to help you to answer this question.

Use the correct number from the box to complete each sentence.

[2 marks]

4	6	8	10	12

The mass number of this carbon atom is ☐

In the periodic table, carbon is in Group ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 45 · continued

1 (b) Coal is a fossil fuel.

A piece of coal contains:

- 80% carbon
- 9% oxygen
- 1% sulfur
- 5% hydrogen.

The rest of the coal is other elements.

1 (b) (i) What is the percentage of other elements in this piece of coal?

[1 mark]

..... %

1 (b) (ii) Coal burns in air to produce carbon dioxide, sulfur dioxide and water.

Draw **one** line from each product to the type of pollution caused by each product.

[3 marks]

Product	Type of pollution
Carbon dioxide	Acid rain
Sulfur dioxide	Global dimming
Water	Global warming
	No pollution

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 46

June 2014 | CH2FP | Original Q4 | Legacy

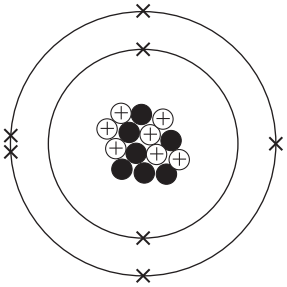
4 Fertilisers contain elements that plants need.

AQAGROW
Plant Fertiliser

Contains:
- Nitrogen
- Phosphorus
- Potassium

4 (a) **Figure 5** represents a nitrogen atom.

Figure 5



Complete each sentence.

4 (a) (i) The mass number of this nitrogen atom is ..... .

[1 mark]

4 (a) (ii) Atoms of nitrogen with different numbers of neutrons are called ..... .

[1 mark]

4 (a) (iii) Compared with a proton, the mass of an electron is ..... .

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

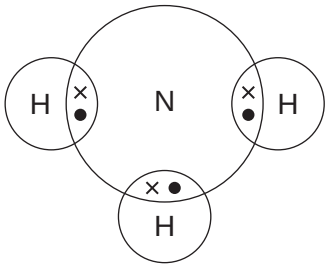
Question 46 · continued

4 (b) Fertilisers can be made from ammonia.

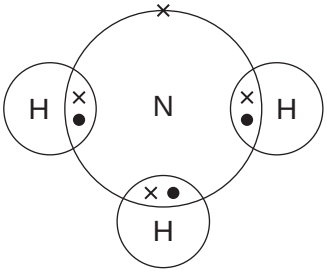
4 (b) (i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?

[1 mark]

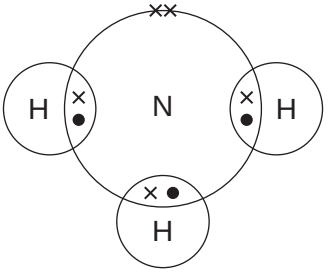
A



B



C



The electronic structure of an ammonia molecule is shown in diagram ☐

4 (b) (ii) What is the correct formula of ammonia?

Draw a ring around the correct answer.

[1 mark]

N_3H NH_3 NH^3

Question 4 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 46 · continued

4 (c) A student made ammonium nitrate by reacting ammonia solution with an acid.

4 (c) (i) Name the acid used to make ammonium nitrate.

[1 mark]

.....

4 (c) (ii) Complete the sentence.

[1 mark]

The student added a few drops of ....., which changed colour when the ammonia solution had neutralised the acid.

4 (c) (iii) The student added charcoal and filtered the mixture.

This produced a colourless solution of ammonium nitrate.

How is solid ammonium nitrate obtained from the solution?

[1 mark]

.....

4 (c) (iv) A farmer put ammonium nitrate fertiliser onto a field of grass.

Suggest what would happen to the grass.

[1 mark]

.....

.....

4.1.1.4 Relative electrical charges of subatomic particles

Question 46 · continued

4 (d) Some fertilisers contain potassium chloride.

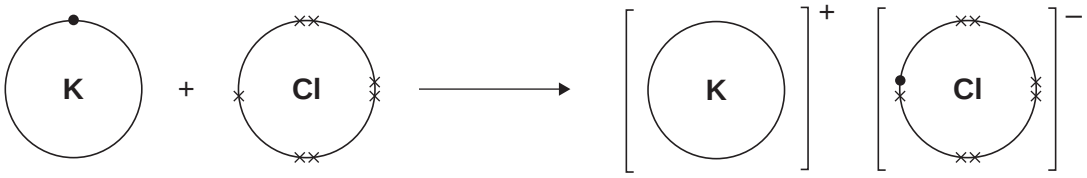
Potassium reacts with chlorine to produce potassium chloride.

Figure 6 shows how this happens.

The dots (•) and crosses (x) represent electrons.

Only the outer shell is shown.

Figure 6



Use **Figure 6** to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with chlorine to produce potassium chloride.

[4 marks]

.....

.....

.....

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.....

.....

.....

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.....

.....

13

4.1.1.4 Relative electrical charges of subatomic particles

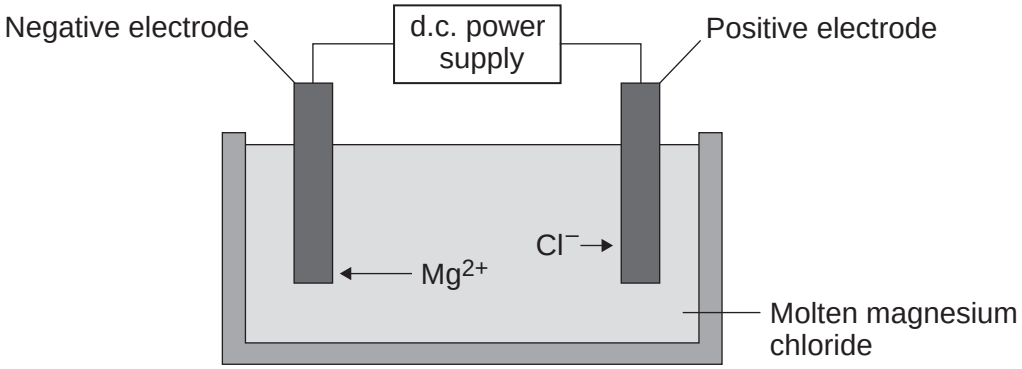
Question 47

June 2014 | CH2FP | Original Q5 | Legacy

5 Some students investigated reactions to produce magnesium.

5 (a) The students used electrolysis to produce magnesium from magnesium chloride, as shown in **Figure 7**.

Figure 7



5 (a) (i) Magnesium chloride contains magnesium ions and chloride ions.

Why does solid magnesium chloride **not** conduct electricity?

[1 mark]

.....

.....

5 (a) (ii) One of the products of the electrolysis of molten magnesium chloride is magnesium.

Name the other product.

[1 mark]

.....

5 (a) (iii) Why do magnesium ions (Mg^{2+}) move to the negative electrode?

[1 mark]

.....

.....

4.1.1.4 Relative electrical charges of subatomic particles

Question 47 · continued

5 (a) (iv) At the negative electrode, the magnesium ions (Mg^{2+}) gain electrons to become magnesium atoms.

How many electrons does each magnesium ion gain?

[1 mark]

.....

5 (b) The students did the experiment four times and weighed the magnesium produced.

Table 1 shows their results.

Table 1

Experiment	Mass of magnesium produced in grams
1	1.13
2	0.63
3	1.11
4	1.09

5 (b) (i) There is an anomalous result.

Suggest **one** possible reason for the anomalous result.

[1 mark]

.....

.....

5 (b) (ii) Calculate the mean mass of magnesium produced, taking account of the anomalous result.

[2 marks]

.....

.....

.....

Mean mass = ... g

4.1.1.4 Relative electrical charges of subatomic particles

Question 47 · continued

5 (c) The formula of magnesium chloride is $MgCl_2$

The relative formula mass of magnesium chloride is 95.

The relative atomic mass of magnesium is 24.

5 (c) (i) Use the equation to calculate the percentage mass of magnesium in magnesium chloride.

$$\text{Percentage mass of magnesium} = \frac{\text{mass of magnesium}}{\text{mass of magnesium chloride}} \times 100\%$$

[2 marks]

.....

.....

.....

Percentage mass of magnesium in magnesium chloride = ... %

5 (c) (ii) Draw a ring around the relative mass of chlorine in $MgCl_2$

[1 mark]

71 **95** **119**

4.1.1.4 Relative electrical charges of subatomic particles

Question 47 · continued

5 (d) Magnesium is also produced from the reaction of magnesium oxide with silicon.

5 (d) (i) The equation for the reaction is:

$$2\ MgO(s) + Si(s) \rightleftharpoons SiO_2(s) + 2\ Mg(s)$$

What is the meaning of this symbol $\rightleftharpoons$?

Draw a ring around the correct answer.

[1 mark]

neutralisation reaction **precipitation reaction** **reversible reaction**

5 (d) (ii) The forward reaction is endothermic.

Draw a ring around the correct answer to complete the sentence.

[1 mark]

In an endothermic reaction the temperature of the surroundings

decreases.

increases.

stays the same.

12

4.1.1.4 Relative electrical charges of subatomic particles

Question 48

June 2014 | CH3FP | Original Q1 | Legacy

1 This question is about the periodic table of elements.

Use the Chemistry Data Sheet to help you to answer these questions.

In 1869 Dmitri Mendeleev produced an early version of the periodic table.

1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) Mendeleev first arranged the elements in order of their

atomic weight.

date of discovery.

electron number.

[1 mark]

1 (a) (ii) Mendeleev then placed elements with similar properties in columns called

groups.

periods.

shells.

[1 mark]

1 (a) (iii) When the next element did not fit the pattern,

Mendeleev

ignored the element.

left a gap.

put the element at the end of the row.

[1 mark]

1 (a) (iv) Mendeleev was not able to include the noble gases (Group 0) in his periodic table

because the noble gases

are not elements.

are not reactive.

had not been discovered by 1869.

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

Question 48 · continued

1 (b) Use the correct word from the box to complete each sentence.

[2 marks]

electrons	**molecules**	**neutrons**	**protons**

In the modern periodic table elements are arranged in order of the number of ..... in their nucleus. Elements in the same group have the same number of ..... in their highest energy level (outer shell).

1 (c) Sodium (Na) is in Group 1 of the periodic table.

Nickel (Ni) is a transition element.

Tick (✓) **two** correct statements about sodium and nickel.

[2 marks]

Statement	Tick (✓)
Sodium and nickel are both metals.	
Sodium has a higher melting point than nickel.	
Sodium is more reactive than nickel.	
Sodium is harder than nickel.	

1 (d) Chlorine, bromine and iodine are in Group 7 of the periodic table.

Chlorine is more reactive than bromine.

1 (d) (i) Complete the word equation for the reaction between chlorine and sodium bromide.

[1 mark]

chlorine + sodium bromide ⟶ ..... + sodium chloride

1 (d) (ii) Why does iodine **not** react with sodium bromide solution?

[1 mark]

.....

.....

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 49

June 2015 | CH1FP | Original Q1 | Legacy

1 This question is about metals.

1 (a) Which unreactive metal is found in the Earth as the metal itself?

[1 mark]

Tick (✓) **one** box.

aluminium ☐

gold ☐

magnesium ☐

1 (b) Complete the sentence.

[1 mark]

Aluminium is an element because aluminium is made of

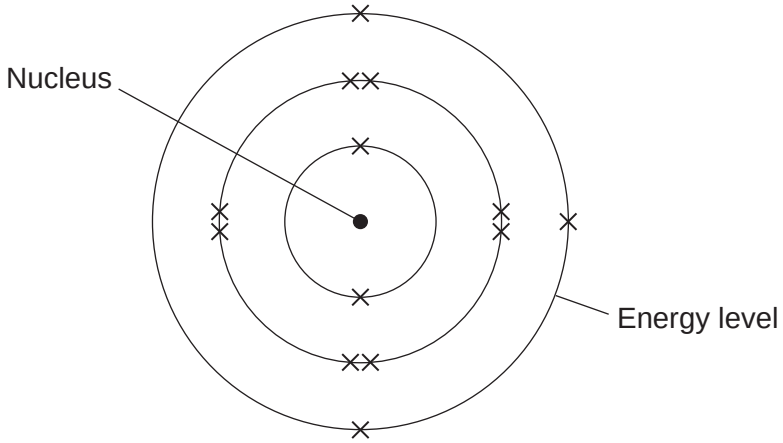
only one type of ..... .

4.1.1.4 Relative electrical charges of subatomic particles

Question 49 · continued

1 (c) **Figure 1** shows the electronic structure of an aluminium atom.

Figure 1



1 (c) (i) Use the correct words from the box to complete the sentence.

[2 marks]

electrons	**ions**	**protons**	**neutrons**	**shells**

The nucleus of an aluminium atom contains ..... and ..... .

1 (c) (ii) Complete the sentence.

[1 mark]

In the periodic table, aluminium is in Group ..... .

Question 1 continues on the next page

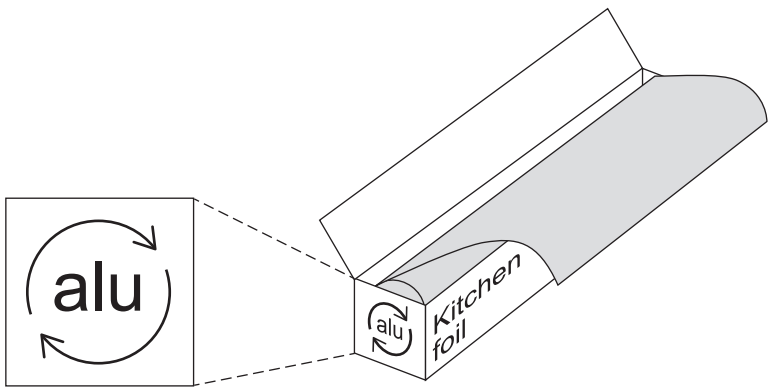
4.1.1.4 Relative electrical charges of subatomic particles

Question 49 · continued

1 (d) Aluminium is used for kitchen foil.

Figure 2 shows a symbol on a box of kitchen foil.

Figure 2



The symbol means that aluminium can be recycled. It does not show the correct chemical symbol for aluminium.

1 (d) (i) What is the correct chemical symbol for aluminium? ..... .

[1 mark]

1 (d) (ii) Give **two** reasons why aluminium should be recycled.

[2 marks]

.....

.....

.....

.....

1 (e) Aluminium has a low density, conducts electricity and is resistant to corrosion.

Which **one** of these properties makes aluminium suitable to use as kitchen foil? Give a reason for your answer.

[2 marks]

.....

.....

.....

.....

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 50

June 2015 | CH2FP | Original Q1 | Legacy

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

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

Complete **Table 1** by writing the relative mass of a neutron and an electron.

[2 marks]

Table 1

Name of particle	Relative mass
proton	1
neutron	
electron	

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

[1 mark]

Tick (✓) **one** box.

The atomic number ☐

The mass number ☐

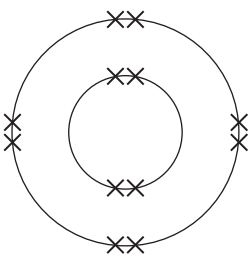
One mole of the atom ☐

1 (c) An atom of carbon has six electrons.

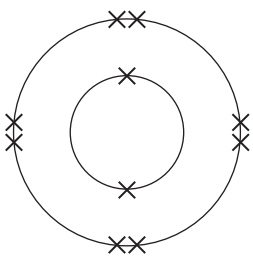
Which structure, **A**, **B** or **C**, represents the electronic structure of the carbon atom?

[1 mark]

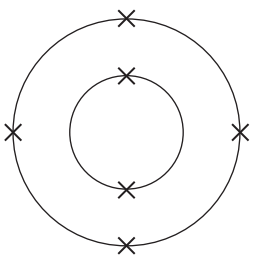
Structure A



Structure B



Structure C



The carbon atom is structure ☐.

4.1.1.4 Relative electrical charges of subatomic particles

Question 50 · continued

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

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

[1 mark]

.....

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

[1 mark]

.....

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

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

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

[1 mark]

.....

.....

M_r of carbon monoxide = ...

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

[1 mark]

.....

.....

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

Question 1 continues on the next page

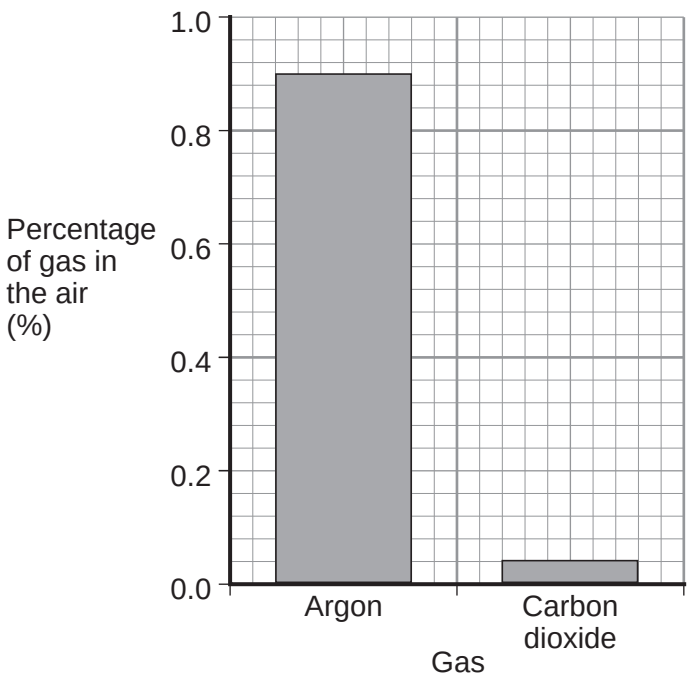
4.1.1.4 Relative electrical charges of subatomic particles

Question 50 · continued

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

1 (f) (i) **Figure 1** shows the percentage of argon and the percentage of carbon dioxide in the air.

Figure 1



What is the percentage of argon in the air?

[1 mark]

Percentage of argon = ... %

1 (f) (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 mark]

.....

.....

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 51

June 2015 | CH2FP | Original Q2 | Legacy

2 This question is about salts.

2 (a) Salt (sodium chloride) is added to many types of food.

Sodium chloride is produced by reacting sodium with chlorine.

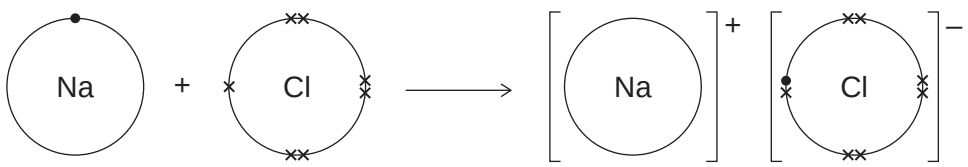
sodium + chlorine ⟶ sodium chloride

Figure 2 shows what happens to atoms of sodium and chlorine in this reaction.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.

Figure 2



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

[3 marks]

.....

.....

.....

.....

.....

.....

Question 2 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 51 · continued

2 (b) Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

2 (b) (i) Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

[1 mark]

Tick (✓) **one** box.

Have no overall electric charge ☐

Have high boiling points ☐

Have giant covalent structures ☐

2 (b) (ii) Which one of the following questions cannot be answered by science alone?

[2 marks]

Tick (✓) **one** box.

How much sodium chloride is in food? ☐

What harm does a lack of iodine do? ☐

Should iodine be added to salt in food? ☐

Give **one** reason why this question cannot be answered by science alone.

.....

.....

2 (c) A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

2 (c) (i) Name the acid used.

[1 mark]

.....

4.1.1.4 Relative electrical charges of subatomic particles

Question 51 · continued

2 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

an acid	an alkali	a salt

Ammonia solution (ammonium hydroxide) is ..... .

2 (c) (iii) The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

[1 mark]

The solution added is an ..... .

2 (d) Farmers buy solid ammonium nitrate in poly(ethene) sacks.

2 (d) (i) How is solid ammonium nitrate made from a solution of ammonium nitrate?

[1 mark]

Tick (✓) **one** box.

Crystallisation ☐

Decomposition ☐

Electrolysis ☐

2 (d) (ii) Why do farmers use ammonium nitrate on their fields?

[1 mark]

.....

.....

2 (d) (iii) The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

[1 mark]

.....

.....

12

4.1.1.4 Relative electrical charges of subatomic particles

Question 52

June 2015 | CH2FP | Original Q4 | Legacy

4 This question is about electrolysis.

4 (a) Metal spoons can be coated with silver.
This is called electroplating.

Suggest **one** reason why spoons are electroplated.

[1 mark]

.....

.....

4 (b) When sodium chloride solution is electrolysed the products are hydrogen and chlorine.

4 (b) (i) What is made from chlorine?

[1 mark]

Tick (✓) **one** box.

Bleach ☐

Fertiliser ☐

Soap ☐

4 (b) (ii) Sodium chloride solution contains two types of positive ions, hydrogen ions (H^+) and sodium ions (Na^+).

Why is hydrogen produced at the negative electrode and **not** sodium?

[1 mark]

Tick (✓) **one** box.

Hydrogen is a gas. ☐

Hydrogen is less reactive than sodium. ☐

Hydrogen ions move faster than sodium ions. ☐

4.1.1.4 Relative electrical charges of subatomic particles

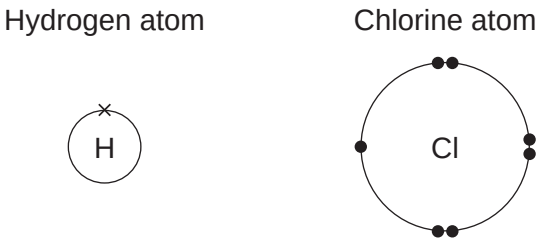
Question 52 · continued

June 2015 | CH2FP | Original Q4 | Legacy

4 (b) (iii) Hydrogen and chlorine can be used to produce hydrogen chloride.

The diagrams in **Figure 4** show how the outer electrons are arranged in an atom of hydrogen and an atom of chlorine.

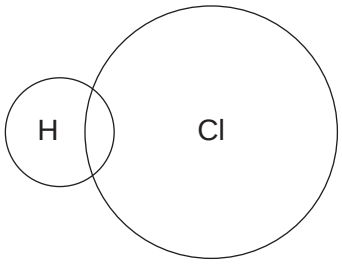
Figure 4



Complete **Figure 5** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

[1 mark]

Figure 5



4 (b) (iv) What is the type of bond in a molecule of hydrogen chloride?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

Question 4 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 52 · continued

4 (b) (v) Why is hydrogen chloride a gas at room temperature (20 °C)?

[2 marks]

Tick (✓) **two** boxes.

Hydrogen chloride has a low boiling point. ☐

Hydrogen chloride has a high melting point. ☐

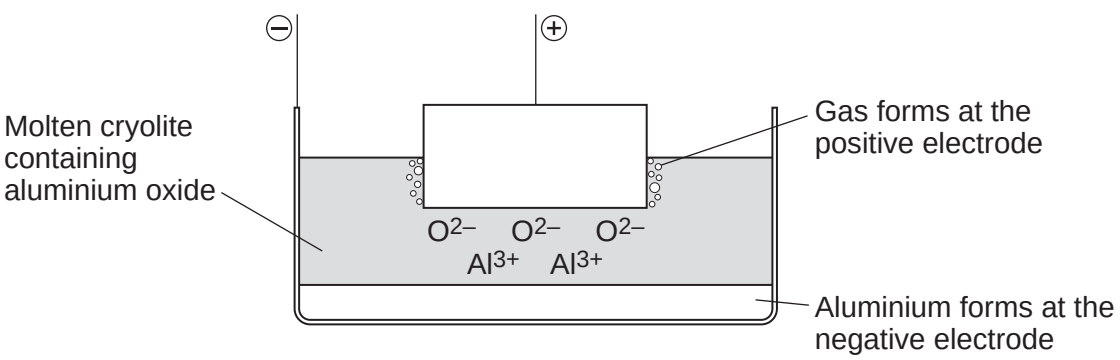
Hydrogen chloride is made of simple molecules. ☐

Hydrogen chloride does not conduct electricity. ☐

Hydrogen chloride has a giant structure. ☐

4 (c) Aluminium is produced by electrolysis of a molten mixture of aluminium oxide and cryolite.
This is shown in **Figure 6**.

Figure 6



4 (c) (i) Name a gas produced at the positive electrode.

[1 mark]

.....

4.1.1.4 Relative electrical charges of subatomic particles

Question 52 · continued

4 (c) (ii) Aluminium ions move to the negative electrode.

Explain why.

[2 marks]

.....

.....

.....

.....

4 (c) (iii) At the negative electrode, the aluminium ions gain electrons to produce aluminium.

What is this type of reaction called?

[1 mark]

Tick (✓) **one** box.

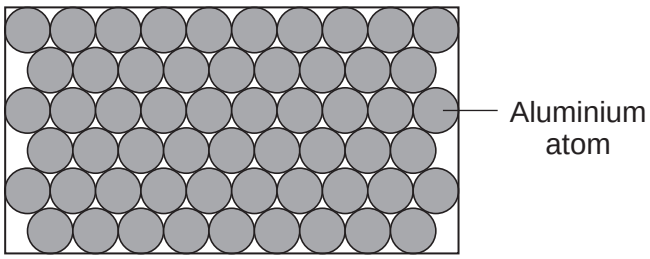
Combustion ☐

Oxidation ☐

Reduction ☐

4 (c) (iv) Aluminium has layers of atoms, as shown in **Figure 7**.

Figure 7



Complete the sentence.

[1 mark]

Metals can be bent and shaped because the layers of atoms can ..... .

Question 4 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

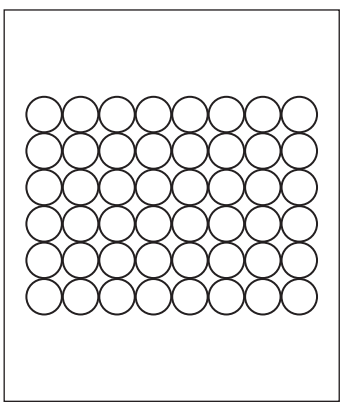
Question 52 · continued

4 (d) Electrodes used in the production of aluminium are made from graphite.

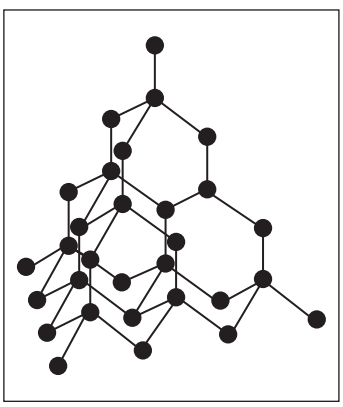
4 (d) (i) Which diagram, **A**, **B** or **C**, shows the structure of graphite?

[1 mark]

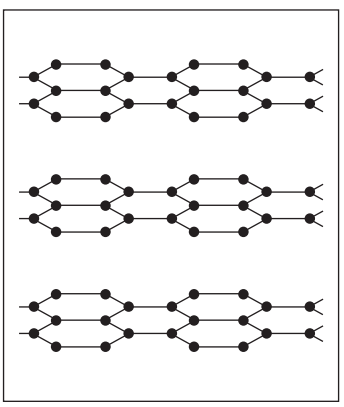
A



B



C



The structure of graphite is shown in diagram ☐.

4 (d) (ii) The temperature for the electrolysis is 950 °C.

Use the correct answer from the box to complete the sentence.

[1 mark]

cross links	**a giant ionic lattice**	**strong covalent bonds**

The graphite does not melt at 950 °C because

graphite has ..... .

14

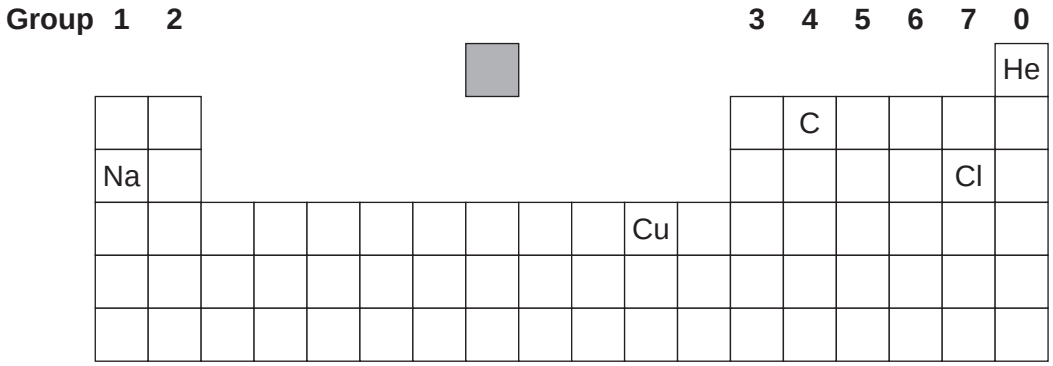
4.1.1.4 Relative electrical charges of subatomic particles

Question 53

June 2015 | CH3FP | Original Q2 | Legacy

2 **Figure 2** shows the chemical symbols of five elements in the periodic table.

Figure 2



2 (a) Choose the correct chemical symbol from **Figure 2** to complete each sentence.

2 (a) (i) The element that is an alkali metal is ..... .

[1 mark]

2 (a) (ii) The element that is a transition metal is ..... .

[1 mark]

2 (a) (iii) The element in Group 4 is ..... .

[1 mark]

2 (a) (iv) The element with a full outer energy level (shell) of electrons is ..... .

[1 mark]

2 (b) Which other element goes in the shaded box in **Figure 2**? .....

[1 mark]

5

4.1.1.4 Relative electrical charges of subatomic particles

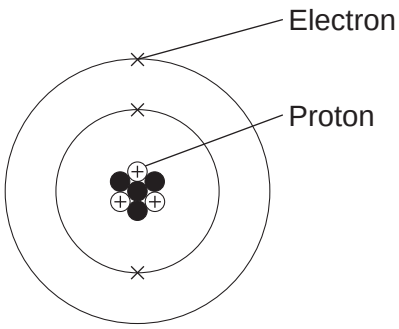
Question 54

June 2016 | CH1FP | Original Q1 | Legacy

1 There are eight elements in the second row (lithium to neon) of the periodic table.

1 (a) **Figure 1** shows a lithium atom.

Figure 1



1 (a) (i) What is the mass number of the lithium atom in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

3 ☐

4 ☐

7 ☐

1 (a) (ii) What is the charge of an electron?

[1 mark]

Tick (✓) **one** box.

–1 ☐

0 ☐

+1 ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 54 · continued

1 (a) (iii) Protons are in the nucleus.

Which other sub-atomic particles are in the nucleus?

[1 mark]

Tick (✓) **one** box.

ions ☐

molecules ☐

neutrons ☐

1 (b) What is **always** different for atoms of different elements?

[1 mark]

Tick (✓) **one** box.

number of neutrons ☐

number of protons ☐

number of shells ☐

Question 1 continues on the next page

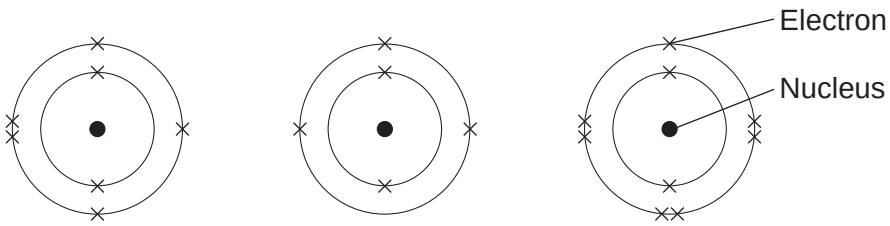
4.1.1.4 Relative electrical charges of subatomic particles

Question 54 · continued

1 (c) **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

Figure 2



Atom X **Atom Y** **Atom Z**

Which atom is from an element in Group 3 of the periodic table?

[1 mark]

Tick (✓) **one** box.

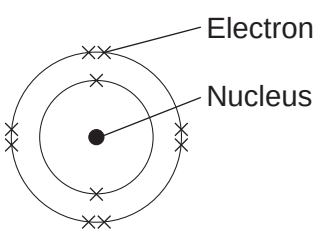
Atom X ☐

Atom Y ☐

Atom Z ☐

1 (d) **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.

Figure 3



1 (d) (i) Give the chemical symbol of this element.

[1 mark]

_____

1 (d) (ii) Why is this element unreactive?

[1 mark]

_____

_____

7

4.1.1.4 Relative electrical charges of subatomic particles

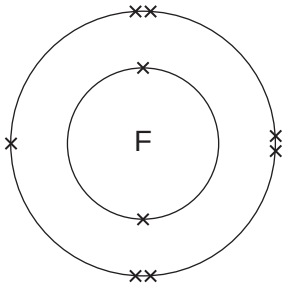
Question 55

June 2016 | CH2FP | Original Q1 | Legacy

1 This question is about fluorine.

1 (a) **Figure 1** shows the arrangement of electrons in a fluorine atom.

Figure 1



1 (a) (i) In which group of the periodic table is fluorine?

[1 mark]

Group _____

1 (a) (ii) Complete **Table 1** to show the particles in an atom and their relative masses.

[2 marks]

Table 1

Name of particle	Relative mass
Proton	
Neutron	1
	Very small

1 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	**alloys**	**isotopes**

Atoms of fluorine with different numbers of neutrons are called _____ .

4.1.1.4 Relative electrical charges of subatomic particles

Question 55 · continued

1 (b) Sodium reacts with fluorine to produce sodium fluoride.

1 (b) (i) Complete the word equation for this reaction.

[1 mark]

sodium + _____ ⟶ _____

1 (b) (ii) Complete the sentence.

[1 mark]

Substances in which atoms of two or more different elements are chemically combined are called _____ .

1 (b) (iii) The relative formula mass (M_r) of sodium fluoride is 42.

Use the correct answer from the box to complete the sentence.

[1 mark]

ion	mole	molecule

The relative formula mass (M_r), in grams, of sodium fluoride is one _____ of the substance.

Question 1 continues on the next page

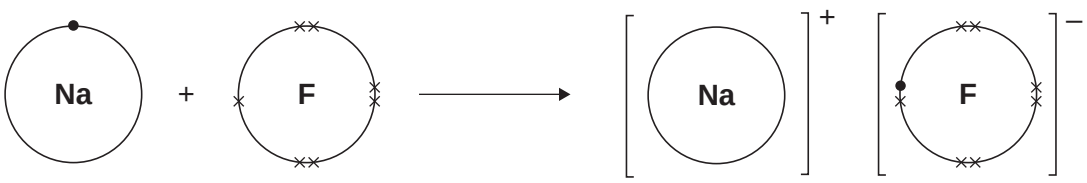
4.1.1.4 Relative electrical charges of subatomic particles

Question 55 · continued

1 (b) (iv) **Figure 2** shows what happens to the electrons in the outer shells when a sodium atom reacts with a fluorine atom.

The dots (•) and crosses (×) represent electrons.

Figure 2



Use **Figure 2** to help you answer this question.

Describe, as fully as you can, what happens when sodium reacts with fluorine to produce sodium fluoride.

[4 marks]

4.1.1.4 Relative electrical charges of subatomic particles

Question 55 · continued

1 (b) (v) Sodium fluoride is an ionic substance.

What are **two** properties of ionic substances?

[2 marks]

Tick (✓) **two** boxes.

- Dissolve in water ☐
- Gas at room temperature ☐
- High melting point ☐
- Low boiling point ☐

13

Turn over for the next question

4.1.1.4 Relative electrical charges of subatomic particles

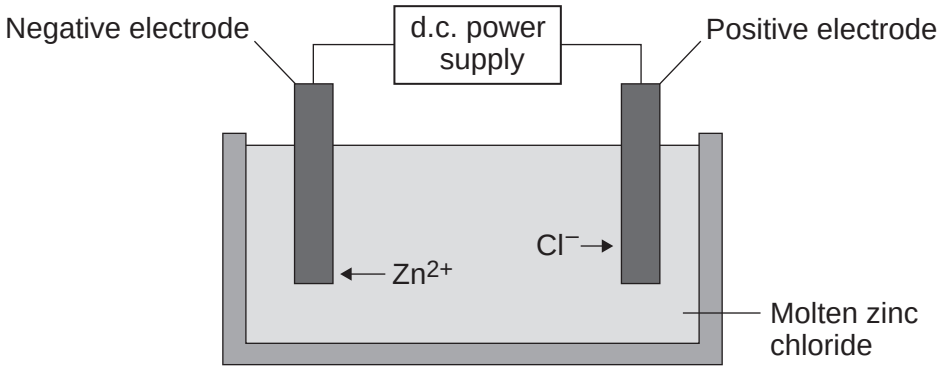
Question 56

June 2016 | CH2FP | Original Q3 | Legacy

3 This question is about zinc.

Figure 7 shows the electrolysis of molten zinc chloride.

Figure 7



3 (a) Zinc chloride is an ionic substance.
Complete the sentence.

[1 mark]

When zinc chloride is molten, it will conduct _____ .

3 (b) Zinc ions move towards the negative electrode where they gain electrons to produce zinc.

3 (b) (i) Name the product formed at the positive electrode.

[1 mark]

_____

3 (b) (ii) Explain why zinc ions move towards the negative electrode.

[2 marks]

_____

_____

_____

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 56 · continued

3 (b) (iii) What type of reaction occurs when the zinc ions gain electrons?

[1 mark]

Tick (✓) **one** box.

Neutralisation ☐

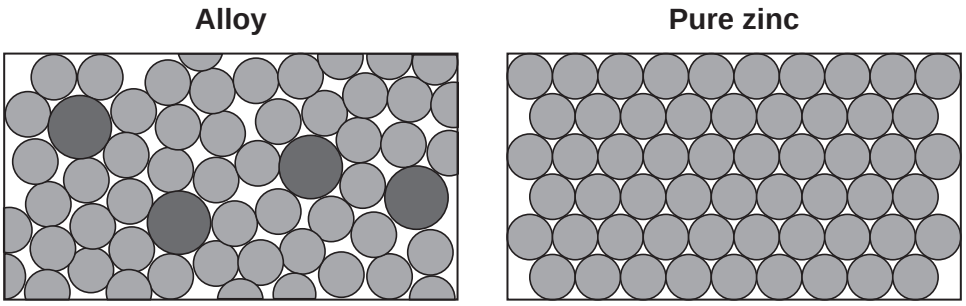
Oxidation ☐

Reduction ☐

3 (c) Zinc is mixed with copper to make an alloy.

3 (c) (i) **Figure 8** shows the particles in the alloy and in pure zinc.

Figure 8



Use **Figure 8** to explain why the alloy is harder than pure zinc.

[2 marks]

3 (c) (ii) Alloys can be bent. Some alloys return to their original shape when heated.

What name is used for these alloys?

[1 mark]

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 57

June 2016 | CH3FP | Original Q1 | Legacy

1 This question is about elements and the periodic table.

1 (a) Use the correct answers from the box to complete the sentences.

[3 marks]

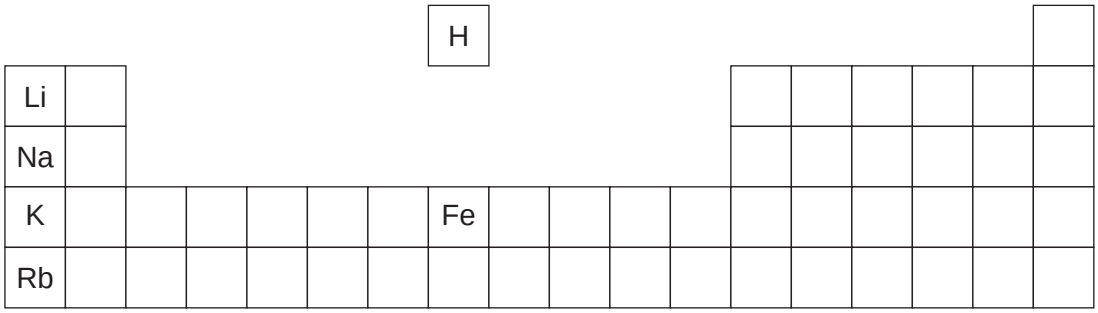
atoms	**atomic weights**	**electrons**	**proton numbers**

Newlands' and Mendeleev's periodic tables show the elements in order of their _____ .

Following the discovery of protons and _____, the modern periodic table shows the elements in order of their _____ .

1 (b) **Figure 1** shows the position of six elements in the modern periodic table.

Figure 1



1 (b) (i) Which **one** of these six elements has the lowest boiling point?

[1 mark]

_____

1 (b) (ii) Complete the sentence.

[1 mark]

In the periodic table, rubidium (Rb) is in Group _____ .

4.1.1.4 Relative electrical charges of subatomic particles

Question 57 · continued

1 (b) (iii) Which of these three elements is the most reactive?

[1 mark]

Tick (✓) **one** box.

Lithium (Li) ☐

Sodium (Na) ☐

Potassium (K) ☐

1 (b) (iv) Which **two** statements are correct?

[2 marks]

Tick (✓) **two** boxes.

Iron has a higher density than potassium. ☐

Iron is softer than potassium. ☐

Iron reacts vigorously with water. ☐

Iron forms ions that have different charges. ☐

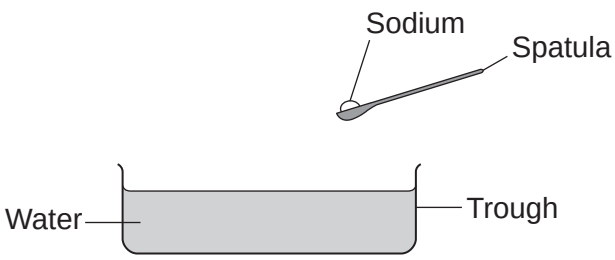
Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 57 · continued

1 (c) **Figure 2** shows sodium being put into water.

Figure 2



Describe **three** observations that can be seen when sodium is put into water.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

11

4.1.1.4 Relative electrical charges of subatomic particles

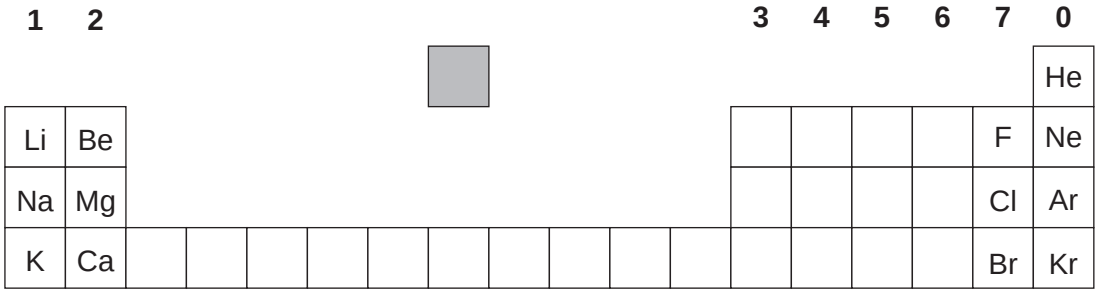
Question 58

June 2017 | CH1FP | Original Q2 | Legacy

2 Use the Chemistry Data Sheet to help you answer this question.

Figure 2 shows part of the periodic table.

Figure 2



2 (a) Give the name of the element that should be in the shaded box.

[1 mark]

_____

2 (b) How many different elements are there in the complete periodic table?

[1 mark]

Tick (✓) **one** box.

About 36 ☐

About 100 ☐

About 500 ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 58 · continued

2 (c) What are **two** reasons why lithium, sodium and potassium are in the same group of the periodic table?

[2 marks]

Tick (✓) **two** boxes.

- Low melting points ☐
- Same number of electrons in the outer shell ☐
- Similar atomic (proton) numbers ☐
- Similar chemical reactions ☐
- Two electrons in the innermost shell ☐

2 (d) Complete each sentence.

[2 marks]

The elements in Group 0 are called _____ gases.

The elements in the central block are known as _____ metals.

2 (e) Use the correct word from the box to complete each sentence.

[2 marks]

alloys	ions	molecules	polymers	protons

Atoms of fluorine gain electrons to form fluoride _____ .

Atoms of fluorine share electrons to form fluorine _____ .

8

4.1.1.4 Relative electrical charges of subatomic particles

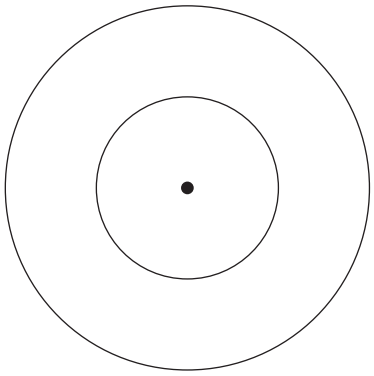
Question 59

June 2017 | CH1FP | Original Q6 | Legacy

6 This question is about compounds of carbon.

6 (a) **Figure 7** shows an atom with two energy levels (shells).

Figure 7



6 (a) (i) A carbon atom has six electrons.

Complete **Figure 7** to show the electronic structure of a carbon atom.

Use **x** to represent an electron.

[1 mark]

6 (a) (ii) Complete the following description about the central part of this carbon atom.

[3 marks]

The central part is made up of six neutrons that have no electrical charge and _____

_____

_____

_____

_____

6 (b) Crude oil is a mixture of compounds. These compounds are mainly hydrocarbons.

What does the term hydrocarbon mean?

[1 mark]

_____

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 59 · continued

6 (c) Alkanes and alkenes are hydrocarbons.

Table 2 shows the boiling points of some alkanes and alkenes.

Table 2

Alkanes

Name	Formula	Boiling point in °C
Ethane	C_2H_6	−88
Propane	C_3H_8	−42
Butane	C_4H_{10}	0
Pentane	C_5H_{12}	+36
Hexane	C_6H_{14}	+69

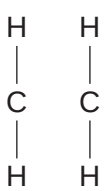
Alkenes

Name	Formula	Boiling point in °C
Ethene	C_2H_4	−104
Propene	C_3H_6	−48
Butene	C_4H_8	−6
Pentene	C_5H_{10}	+30
Hexene	C_6H_{12}	+64

6 (c) (i) Complete the displayed structure of ethane and the displayed structure of ethene.

[2 marks]

Ethane



Ethene



6 (c) (ii) Describe the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule.

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

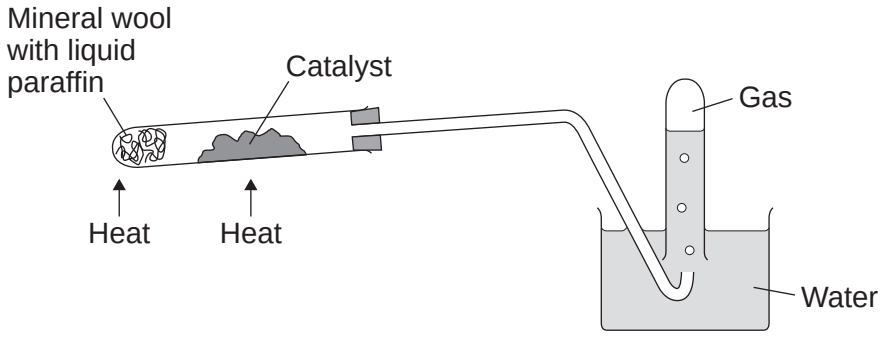
Question 59 · continued

6 (c) (iii) Use the information in **Table 2** to compare the boiling points of alkanes with the boiling points of alkenes.

[2 marks]

6 (d) A student used the apparatus in **Figure 8** to investigate what happens when liquid paraffin is heated to a high temperature.

Figure 8



Liquid paraffin contains alkanes.

Describe what happens to the alkane molecules in this investigation.

[3 marks]

13

4.1.1.4 Relative electrical charges of subatomic particles

Question 60

June 2017 | CH2FP | Original Q3 | Legacy

3 This question is about oxygen and substances containing oxygen.

3 (a) Oxygen is a gas at room temperature.

3 (a) (i) What type of bonding holds the atoms together in oxygen?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

3 (a) (ii) Which **two** statements about oxygen are true?

[2 marks]

Tick (✓) **two** boxes.

Oxygen consists of a giant lattice. ☐

Oxygen consists of small molecules. ☐

Oxygen conducts electricity. ☐

Oxygen is an alloy. ☐

Oxygen has a low boiling point. ☐

Question 3 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 60 · continued

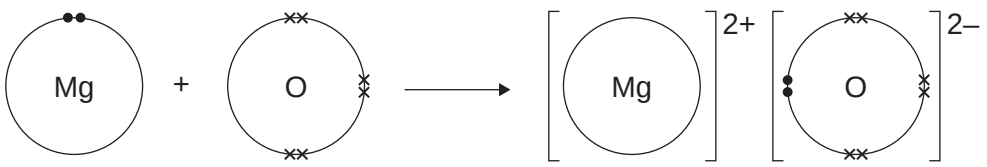
3 (b) Magnesium oxide is produced when magnesium reacts with oxygen.

3 (b) (i) **Figure 6** shows what happens to the electrons in the outer shells when a magnesium atom reacts with an oxygen atom.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.

Figure 6



Describe, in terms of electrons, what happens when a magnesium atom reacts with an oxygen atom to produce magnesium oxide.

[4 marks]

4.1.1.4 Relative electrical charges of subatomic particles

Question 60 · continued

3 (b) (ii) Nanoparticles of magnesium oxide can be made.

Which **two** statements about nanoparticles are true?

[2 marks]

Tick (✓) **two** boxes.

- Nanoparticles are very small atoms. ☐
- Nanoparticles can return to their original shape after being deformed. ☐
- Nanoparticles contain a few hundred atoms. ☐
- Nanoparticles contain millions of molecules. ☐
- Nanoparticles have a high surface area to volume ratio. ☐

3 (c) Silicon dioxide has a very high melting point.

Silicon dioxide does not conduct electricity when molten.

Use the correct answer from the box to complete the sentence.

[1 mark]

giant covalent	giant ionic	metallic

The structure of silicon dioxide is _____ .

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 61

June 2017 | CH2FP | Original Q4 | Legacy

4 This question is about sodium chloride.

4 (a) Calculate the relative formula mass (M_r) of sodium chloride (NaCl).

Relative atomic masses (A_r): Na = 23; Cl = 35.5

[1 mark]

Relative formula mass (M_r) = _____

4 (b) A student reacted hydrochloric acid and sodium hydroxide solution to produce sodium chloride and another product.

Use the correct answer from the box to complete the word equation for the reaction.

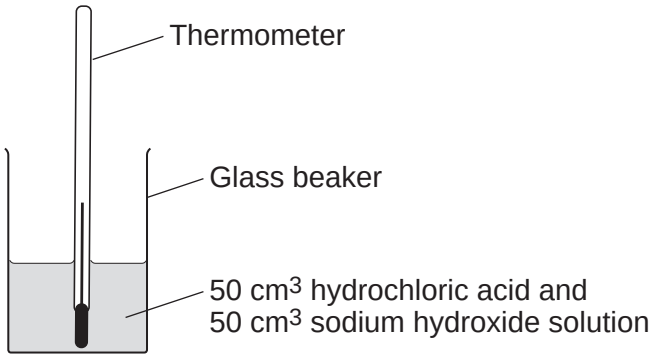
[1 mark]

chlorine	hydrogen	oxygen	water

hydrochloric acid + sodium hydroxide ⟶ sodium chloride + _____

4 (c) **Figure 7** shows the apparatus the student used to measure the temperature change in the reaction between hydrochloric acid and sodium hydroxide solution.

Figure 7



The student:

- measured 50 cm^3 hydrochloric acid into a glass beaker
- measured the temperature of the hydrochloric acid
- added 50 cm^3 of sodium hydroxide solution
- measured the highest temperature of the solution
- repeated the experiment with insulation around the glass beaker.

4.1.1.4 Relative electrical charges of subatomic particles

Question 61 · continued

4 (c) (i) Suggest **one** reason why the insulation around the glass beaker gives more accurate results.

[1 mark]

_____

_____

4 (c) (ii) The student did the investigation using the insulation three times.

Table 2 shows the results.

Table 2

Experiment number	Temperature of acid before reaction in °C	Highest temperature of solution in °C	Temperature change in °C
1	20	33	13
2	20	34	14
3	19	32	

Calculate the temperature change in **Experiment 3**.

Write your answer in **Table 2**.

[1 mark]

4 (c) (iii) How does **Table 2** show that the results are repeatable?

[1 mark]

_____

_____

4 (c) (iv) Complete the sentence.

[1 mark]

The temperature increase shows that the reaction between hydrochloric acid and sodium hydroxide is _____ .

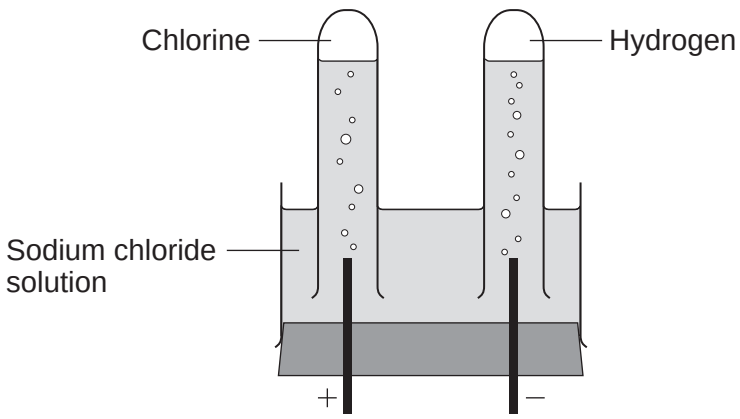
Question 4 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 61 · continued

4 (d) A student investigated the electrolysis of sodium chloride solution, as shown in **Figure 8**.

Figure 8



4 (d) (i) State, in terms of ions, why sodium chloride solution conducts electricity.

[1 mark]

4 (d) (ii) Chlorine is produced at the positive electrode.

Why are chloride ions attracted to the positive electrode?

[1 mark]

4 (d) (iii) When sodium chloride solution is electrolysed, sodium hydroxide is also produced.

What can be manufactured from sodium hydroxide?

[1 mark]

Tick (✓) **one** box.

Alloys ☐

Poly(ethene) ☐

Soap ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 61 · continued

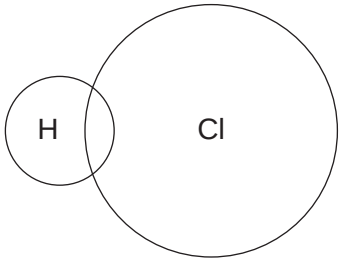
4 (d) (iv) The products chlorine and hydrogen react to form hydrogen chloride.

Hydrogen atoms have one electron in their outer shell. Chlorine atoms have seven electrons in their outer shell.

Complete **Figure 9** to show how the outer electrons are arranged in a molecule of hydrogen chloride (HCl).

[2 marks]

Figure 9



4 (d) (v) Which calculation shows the percentage of hydrogen in hydrogen chloride?

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

Relative formula mass (M_r): HCl = 36.5

[1 mark]

Tick (✓) **one** box.

$\frac{35.5}{36.5} \times 100$ ☐

$\frac{1}{35.5} \times 100$ ☐

$\frac{1}{36.5} \times 100$ ☐

$\frac{1}{72.0} \times 100$ ☐

12

4.1.1.4 Relative electrical charges of subatomic particles

Question 62

June 2017 | CH3FP | Original Q1 | Legacy

1 This question is about elements and compounds.

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

[1 mark]

densities	numbers	weights

The elements in the modern periodic table are arranged in order of their atomic _____ .

1 (a) (ii) Use the correct answer from the box to complete the sentence.

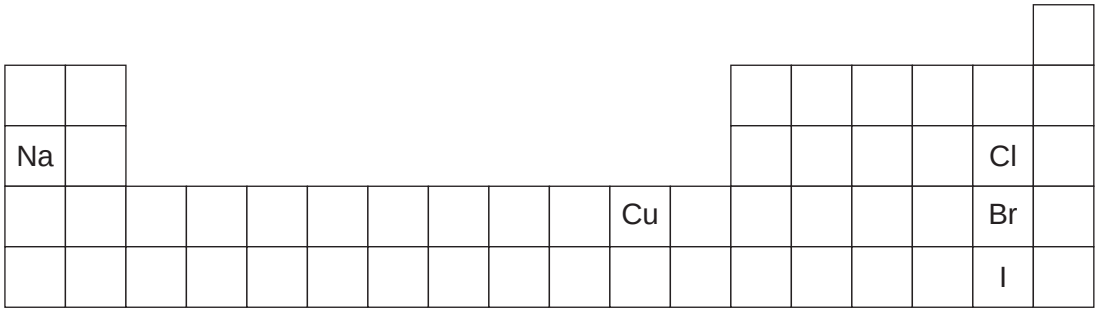
[1 mark]

electrons	neutrons	protons

The outer shells of atoms of elements in the same group have the same number of _____ .

1 (b) **Figure 1** shows the position of five elements in the modern periodic table.

Figure 1



1 (b) (i) Which **one** of the elements in **Figure 1** is a gas at room temperature?

[1 mark]

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 62 · continued

1 (b) (ii) Which **one** of the elements in **Figure 1** is a transition metal?

[1 mark]

_____

1 (b) (iii) Complete the sentence.

[1 mark]

In the modern periodic table, bromine (Br) is in Group _____ .

1 (c) Bromine reacts with sodium iodide to produce iodine.

The word equation for the reaction is:

bromine + sodium iodide ⟶ iodine + sodium bromide

1 (c) (i) What type of reaction is this?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

1 (c) (ii) Use the Chemistry Data Sheet to help you answer this question.

Which halogen would react with sodium chloride solution to produce chlorine?

[1 mark]

Tick (✓) **one** box.

Bromine ☐

Fluorine ☐

Iodine ☐

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 62 · continued

1 (d) Silver nitrate in the presence of dilute nitric acid is used to test for iodide ions.

What colour precipitate is produced?

[1 mark]

Tick (✓) **one** box.

Cream ☐

White ☐

Yellow ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 62 · continued

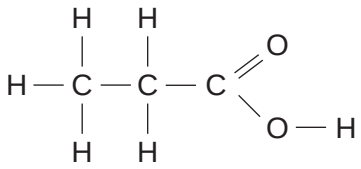
1 (e) Propanoic acid is a compound containing carbon atoms.

1 (e) (i) **Figure 2** shows the displayed structure of propanoic acid.

Draw a ring around the functional group of propanoic acid in **Figure 2**.

[1 mark]

Figure 2



1 (e) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

carbon dioxide	hydrogen	oxygen

Propanoic acid reacts with carbonates to produce _____ .

1 (e) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	esters	fuels

Propanoic acid reacts with alcohols to produce pleasant smelling compounds called _____ .

11

4.1.1.4 Relative electrical charges of subatomic particles

Question 63

0 2 The halogens are elements in Group 7.

0 2 . 1 Bromine is in Group 7.

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

[1 mark]

0 2 . 2 Bromine reacts with hydrogen. The gas hydrogen bromide is produced.

What is the structure of hydrogen bromide?

[1 mark]

Tick **one** box.

- Giant covalent ☐
- Ionic lattice ☐
- Metallic structure ☐
- Small molecule ☐

0 2 . 3 What is the formula for fluorine gas?

[1 mark]

Tick **one** box.

- F ☐
- F_2 ☐
- F^2 ☐
- 2F ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 63 · continued

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

Table 1 shows the student's observations.

Table 1

	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	

0 2 . 4 Explain how the reactivity of the halogens changes going down Group 7.

Use the results in **Table 1**.

[3 marks]

Question 2 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 63 · continued June 2018 | 8462/1F | Original Q2

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

0 2 . 5 What is the relative formula mass (M_r) of titanium dioxide, TiO_2?

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

[1 mark]

Tick **one** box.

64 ☐

80 ☐

128 ☐

768 ☐

0 2 . 6 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.

[2 marks]

Percentage yield = _____ %

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 64

June 2018 | 8462/1F | Original Q3

0 3 This question is about the structure of the atom.

0 3 . 1 Complete the sentences.

Choose answers from the box.

Each word may be used once, more than once, or not at all.

[5 marks]

electron	**ion**	**neutron**
nucleus	**proton**	

The centre of the atom is the _____.

The two types of particle in the centre of the atom are the proton and the _____.

James Chadwick proved the existence of the _____.

Niels Bohr suggested particles orbit the centre of the atom. This type of particle is the _____.

The two types of particle with the same mass are the neutron and the _____.

Table 2 shows information about two isotopes of element **X**.

Table 2

	Mass number	Percentage (%) abundance
Isotope 1	63	70
Isotope 2	65	30

4.1.1.4 Relative electrical charges of subatomic particles

Question 64 · continued

0 3 . 2 Calculate the relative atomic mass (A_r) of element **X** using the equation:

$$A_r = \frac{\text{(mass number} \times \text{percentage) of isotope 1 + (mass number} \times \text{percentage) of isotope 2}}{100}$$

Use **Table 2**.

Give your answer to 1 decimal place.

[2 marks]

A_r = _____

0 3 . 3 Suggest the identity of element **X**.

Use the periodic table.

[1 mark]

Element **X** is _____

0 3 . 4 The radius of an atom of element **X** is 1.2×10^{-10} m

The radius of the centre of the atom is $\frac{1}{10\,000}$ the radius of the atom.

Calculate the radius of the centre of an atom of element **X**.

Give your answer in standard form.

[2 marks]

Radius = _____ m

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 65

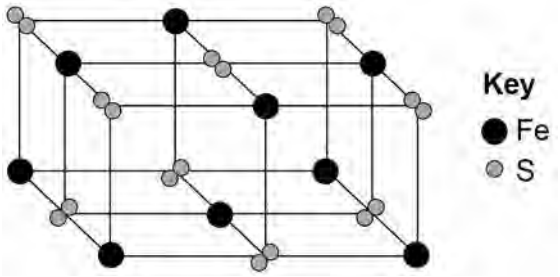
June 2018 | 8462/1F | Original Q9

0 9 This question is about metals and metal compounds.

0 9 . 1 Iron pyrites is an ionic compound.

Figure 12 shows a structure for iron pyrites.

Figure 12



Determine the formula of iron pyrites.

Use **Figure 12**.

[1 mark]

_____

0 9 . 2 An atom of iron is represented as $^{56}_{26}Fe$

Give the number of protons, neutrons and electrons in this atom of iron.

[3 marks]

Number of protons _____

Number of neutrons _____

Number of electrons _____

0 9 . 3 Iron is a transition metal.

Sodium is a Group 1 metal.

Give **two** differences between the properties of iron and sodium.

[2 marks]

1 _____

_____

2 _____

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 65 · continued

Nickel is extracted from nickel oxide by reduction with carbon.

0 9 . 4 Explain why carbon can be used to extract nickel from nickel oxide.

[2 marks]

0 9 . 5 An equation for the reaction is:

$$NiO + C \rightarrow Ni + CO$$

Calculate the percentage atom economy for the reaction to produce nickel.

Relative atomic masses (A_r): C = 12 Ni = 59

Relative formula mass (M_r): NiO = 75

Give your answer to 3 significant figures.

[3 marks]

Percentage atom economy = _____ %

11

4.1.1.4 Relative electrical charges of subatomic particles

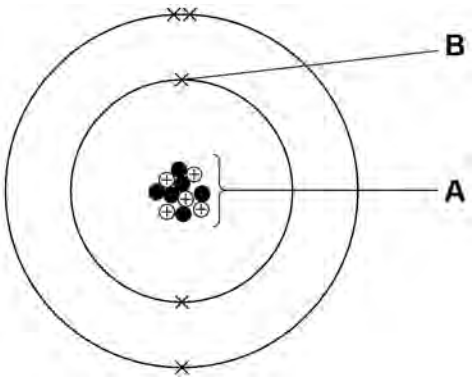
Question 66

June 2019 | 8462/1F | Original Q1

0 1 This question is about atomic structure.

Figure 1 represents an atom of element **Z**.

Figure 1



0 1 . 1 Name the parts of the atom labelled **A** and **B**.

Choose answers from the box.

[2 marks]

electron	**neutron**	**nucleus**	**proton**

A _____

B _____

4.1.1.4 Relative electrical charges of subatomic particles

Question 66 · continued

0 1 . 2 Which particle has the lowest mass?

Choose the answer from the box.

[1 mark]

electron	**neutron**	**nucleus**	**proton**

0 1 . 3 Which group of the periodic table contains element **Z**?

Use **Figure 1**.

[1 mark]

Group _____

0 1 . 4 Give the atomic number and the mass number of element **Z**.

Use **Figure 1**.

Choose answers from the box.

[2 marks]

1	**5**	**6**	**11**	**16**

Atomic number _____

Mass number _____

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 66 · continued

Bromine has two different types of atom.

The atoms have a different number of neutrons but the same number of protons.

0 1 . 5 What is the name for this type of atom?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Ion ☐
- Isotope ☐
- Molecule ☐

0 1 . 6 The different types of bromine atom can be represented as $^{79}_{35}Br$ and $^{81}_{35}Br$

The relative atomic mass (A_r) of bromine is 80

Which statement is true about the number of each type of atom in bromine?

[1 mark]

Tick (✓) **one** box.

- There are fewer $^{79}_{35}Br$ atoms than $^{81}_{35}Br$ atoms. ☐
- There are more $^{79}_{35}Br$ atoms than $^{81}_{35}Br$ atoms. ☐
- There are the same number of $^{79}_{35}Br$ atoms and $^{81}_{35}Br$ atoms. ☐

8

4.1.1.4 Relative electrical charges of subatomic particles

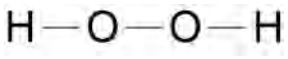
Question 67

June 2019 | 8462/1F | Original Q2

0 2 This question is about compounds of oxygen and hydrogen.

Figure 2 represents the structure of hydrogen peroxide.

Figure 2



0 2 . 1 What is the correct formula of hydrogen peroxide?

[1 mark]

Tick (✓) **one** box.

- H2O2 ☐
- HO_2 ☐
- H^2O^2 ☐
- H_2O_2 ☐

0 2 . 2 Which type of bonding is shown in **Figure 2**?

[1 mark]

Tick (✓) **one** box.

- Covalent ☐
- Ionic ☐
- Metallic ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 67 · continued

0 2 . 3 Hydrogen peroxide decomposes in the presence of a catalyst.

Which elements are often used as catalysts?

[1 mark]

Tick (✓) **one** box.

Alkali metals ☐

Halogens ☐

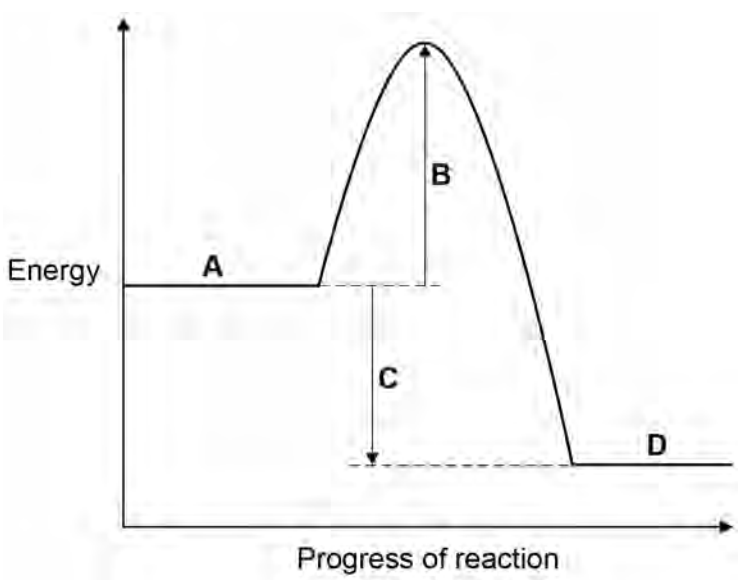
Transition metals ☐

Figure 3 shows the reaction profile for the decomposition of hydrogen peroxide.

The word equation for this reaction is:

hydrogen peroxide → water + oxygen

Figure 3



4.1.1.4 Relative electrical charges of subatomic particles

Question 67 · continued

Labels **A**, **B**, **C** and **D** each represent a different part of the reaction profile.

Use **Figure 3** to answer Questions **02.4** and **02.5**

0 2 . 4 Which label shows the activation energy?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 5 Which label shows the energy of hydrogen peroxide?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 6 The decomposition of hydrogen peroxide gives out energy to the surroundings.

What type of reaction is this?

[1 mark]

Tick (✓) **one** box.

Displacement ☐

Endothermic ☐

Exothermic ☐

Neutralisation ☐

Question 2 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 67 · continued

0 2 . 7 Hydrogen and oxygen form water.

A hydrogen atom contains one electron.

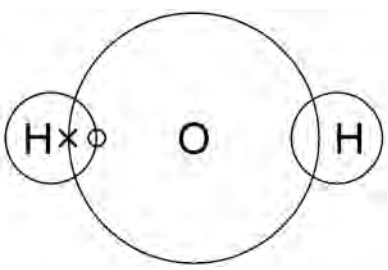
An oxygen atom contains six electrons in the outer shell.

Complete **Figure 4** to show a dot and cross diagram for a water molecule.

Show the outer electrons only.

[2 marks]

Figure 4



8

4.1.1.4 Relative electrical charges of subatomic particles

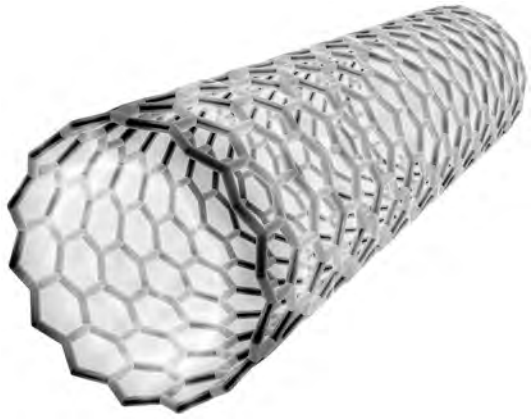
Question 68

June 2019 | 8462/1F | Original Q10

1 0 This question is about materials and their properties.

1 0 . 1 **Figure 13** shows a carbon nanotube.

Figure 13



The structure and bonding in a carbon nanotube are similar to graphene.

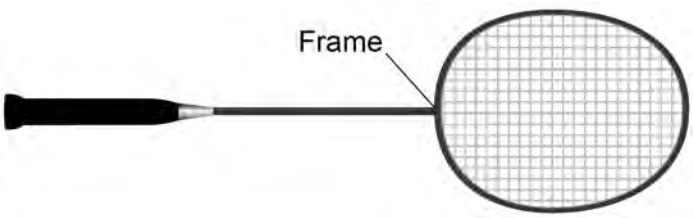
Carbon nanotubes are used in electronics because they conduct electricity.

Explain why carbon nanotubes conduct electricity.

[2 marks]

1 0 . 2 **Figure 14** shows a badminton racket.

Figure 14



4.1.1.4 Relative electrical charges of subatomic particles

Question 68 · continued

June 2019 | 8462/1F | Original Q10

Table 4 shows some properties of materials.

The materials could be used to make badminton racket frames.

Table 4

Material	Density in g/cm^3	Relative strength	Relative stiffness
Aluminium	2.7	0.3	69
Carbon nanotube	1.5	60	1000
Wood	0.71	0.1	10

Evaluate the use of the materials to make badminton racket frames.

Use **Table 4**.

[4 marks]

Question 10 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 68 · continued

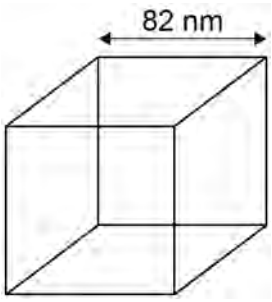
June 2019 | 8462/1F | Original Q10

Zinc oxide can be produced as nanoparticles and as fine particles.

10.3 A nanoparticle of zinc oxide is a cube of side 82 nm

Figure 15 represents a nanoparticle of zinc oxide.

Figure 15



Calculate the surface area of a nanoparticle of zinc oxide.

Give your answer in standard form.

[3 marks]

Surface area = _____ nm^2

10.4 Some suncreams contain zinc oxide as nanoparticles or as fine particles.

Suggest **one** reason why it costs less to use nanoparticles rather than fine particles in suncreams.

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

Question 69

November 2020 | 8462/1F | Original Q2

0 2 This question is about models of the atom.

0 2 . 1 Atoms were first thought to be tiny spheres that could not be divided.

Which particle was discovered to change this model of the atom?

[1 mark]

Tick (✓) **one** box.

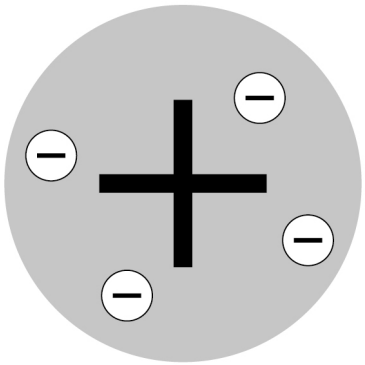
Electron ☐

Neutron ☐

Proton ☐

0 2 . 2 **Figure 2** shows another model of the atom.

Figure 2



What is the name of this model of the atom?

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

Question 69 · continued

0 2 . 3 A scientist fired particles at gold atoms.

Some of these particles were scattered.

The results led to a different model of the atom.

Which type of particle was fired at the gold atoms?

[1 mark]

Tick (✓) **one** box.

- Alpha ☐
- Electron ☐
- Neutron ☐
- Proton ☐

0 2 . 4 Which scientist first suggested that electrons orbit the nucleus at specific distances?

[1 mark]

Tick (✓) **one** box.

- Bohr ☐
- Chadwick ☐
- Mendeleev ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 69 · continued

0 2 . 5 The model of the atom used today has three subatomic particles:

- electrons
- neutrons
- protons.

Complete the sentences.

[3 marks]

Atoms of the same element have the same atomic number because they have the same number of _____.

Atoms of the same element can have different mass numbers because they have different numbers of _____.

Atoms have no overall charge because they have the same number of _____ and _____.

0 2 . 6 The radius of a nucleus is approximately 1×10^{-14} m

The radius of an atom is approximately 1×10^{-10} m

A teacher uses a ball of radius 1 cm to represent the nucleus.

What could represent the atom on the same scale?

[1 mark]

Tick (✓) **one** box.

- A ball of radius 10 cm ☐
- A sports arena of radius 100 m ☐
- An island of radius 10 km ☐
- A planet of radius 1000 km ☐

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 70

November 2020 | 8462/1F | Original Q5

0 5 This question is about aluminium.

0 5 . 1 Aluminium is a metal.

Draw **one** line from each property of aluminium to the correct reason for that property.

[2 marks]

Property	Reason
	Aluminium has delocalised electrons
Conducts electricity	Aluminium has layers of atoms which can slide
	Aluminium has strong metallic bonds
High melting point	Aluminium has weak intermolecular forces
	Aluminium has a random arrangement of atoms

0 5 . 2 Aluminium can be used to make alloys.

What is meant by an 'alloy'?

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

Question 70 · continued

Aluminium is extracted from bauxite.

Bauxite is a mixture which contains aluminium oxide.

0 5 . 3 Bauxite contains between 15% and 25% aluminium.

Aluminium oxide always contains 53% aluminium.

How does this show that bauxite is a mixture and **not** a compound?

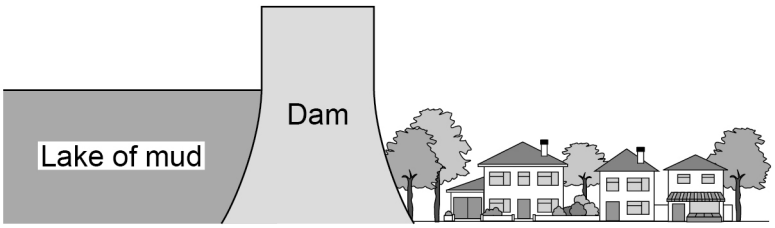
[1 mark]

0 5 . 4 The waste material from the bauxite is stored in lakes of mud.

The lakes of mud are held in place by dams.

Figure 6 shows one of these lakes.

Figure 6



Suggest **two** possible problems with storing the waste material in lakes of mud.

[2 marks]

1

2

4.1.1.4 Relative electrical charges of subatomic particles

Question 70 · continued

Aluminium is extracted by electrolysis.

The aluminium oxide is mixed with cryolite and melted.

The mixture is then electrolysed.

0 5 . 5 The formula of cryolite is Na_3AlF_6

Give the total number of atoms in the formula.

[1 mark]

Number of atoms = _____

0 5 . 6 What is the reason for adding cryolite to the aluminium oxide?

[1 mark]

Tick (✓) **one** box.

To increase the amount of aluminium extracted ☐

To lower the melting point of the mixture ☐

To reduce the amount of aluminium oxide needed ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 70 · continued

0 5 . 7 Complete the sentences.

Choose answers from the box.

[2 marks]

aluminium	**carbon**	**fluorine**
oxygen	**sodium**	

When the molten aluminium oxide and cryolite mixture is electrolysed the product at the positive electrode is _____.

This product reacts with the positive electrode because the positive electrode is made of _____.

0 5 . 8 A sample of bauxite contains 25% aluminium.

Calculate the maximum mass of aluminium that can be extracted from 300 000 kg of the sample of bauxite.

Give your answer in standard form.

[3 marks]

_____

_____

_____

_____

_____

Maximum mass (in standard form) = _____ kg

13

4.1.1.4 Relative electrical charges of subatomic particles

Question 71

November 2021 | 8462/1F | Original Q3

0 3 This question is about Group 1 elements.

0 3 . 1 Complete **Table 2** to show the electronic structure of a potassium atom.

[1 mark]

Table 2

Atom	Number of electrons	Electronic structure
Sodium	11	2,8,1
Potassium	19	

0 3 . 2 Why do Group 1 elements have similar chemical properties?

[1 mark]

Tick (✓) **one** box.

- They have the same number of electron shells. ☐
- They have the same number of outer shell electrons. ☐
- They have two electrons in the first shell. ☐

0 3 . 3 What is the type of bonding in sodium?

[1 mark]

Tick (✓) **one** box.

- Covalent ☐
- Ionic ☐
- Metallic ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 71 · continued

Table 3 shows observations made when lithium, potassium and rubidium react with water.

Table 3

Element	Observations
Lithium	Bubbles slowly Floats Moves slowly
Sodium	1 _____ 2 _____
Potassium	Bubbles very quickly Melts into a ball Floats Moves very quickly Flame
Rubidium	Sinks Melts into a ball Explodes with a flame

0 3 . 4 Give **two** observations you could make when sodium reacts with water.

Write your answers in **Table 3**.

[2 marks]

4.1.1.4 Relative electrical charges of subatomic particles

Question 71 · continued

0 3 . 5 How does the reactivity of the elements change going down Group 1?

[1 mark]

0 3 . 6 Give **two** ways in which the observations in **Table 3** show the change in reactivity going down Group 1.

[2 marks]

1

2

0 3 . 7 Which gas is produced when Group 1 elements react with water?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Hydrogen ☐
- Nitrogen ☐
- Oxygen ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 71 · continued

0 3 . 8 Sodium fluoride is an ionic compound.

Figure 5 shows dot and cross diagrams for a sodium atom and a fluorine atom.

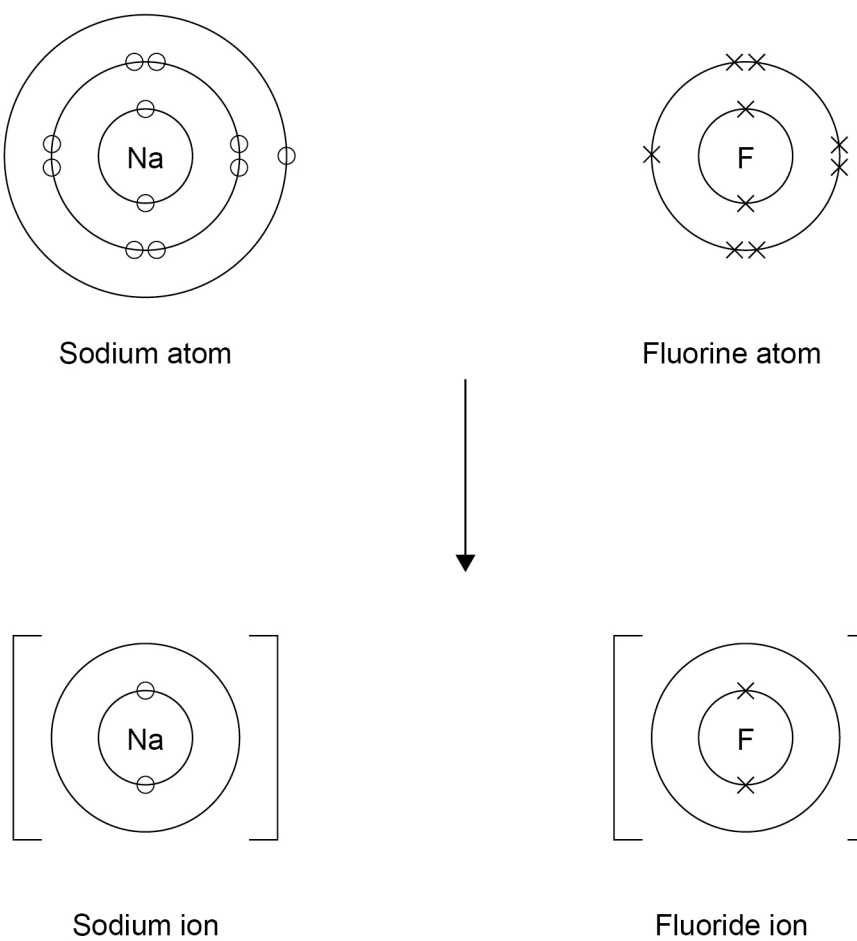
Complete **Figure 5** to show what happens when a sodium atom and a fluorine atom react to produce sodium fluoride.

You should:

- complete the electronic structures of the sodium ion and the fluoride ion
- give the charges on the sodium ion and the fluoride ion.

[3 marks]

Figure 5



12

4.1.1.4 Relative electrical charges of subatomic particles

Question 72

November 2021 | 8462/1F | Original Q9

0 9 This question is about atomic structure and the periodic table.

Gallium (Ga) is an element that has two isotopes.

0 9 . 1 Give the meaning of 'isotopes'.

You should answer in terms of subatomic particles.

[2 marks]

0 9 . 2 **Table 8** shows the mass numbers and percentage abundances of the isotopes of gallium.

Table 8

Mass number	Percentage abundance (%)
69	60
71	40

Calculate the relative atomic mass (A_r) of gallium.

Give your answer to 1 decimal place.

[2 marks]

Relative atomic mass (1 decimal place) = _____

4.1.1.4 Relative electrical charges of subatomic particles

Question 72 · continued

Gallium (Ga) is in Group 3 of the modern periodic table.

0 9 . 3 Give the numbers of electrons and neutrons in an atom of the isotope $^{69}_{31}Ga$

[2 marks]

Number of electrons _____

Number of neutrons _____

0 9 . 4 What is the most likely formula of a gallium ion?

[1 mark]

Tick (✓) **one** box.

- Ga^{+} ☐
- Ga^{-} ☐
- Ga^{3+} ☐
- Ga^{3-} ☐

0 9 . 5 Gallium was discovered six years after Mendeleev published his periodic table.

Give **two** reasons why the discovery of gallium helped Mendeleev's periodic table to become accepted.

[2 marks]

1 _____

_____

2 _____

_____

9

4.1.1.4 Relative electrical charges of subatomic particles

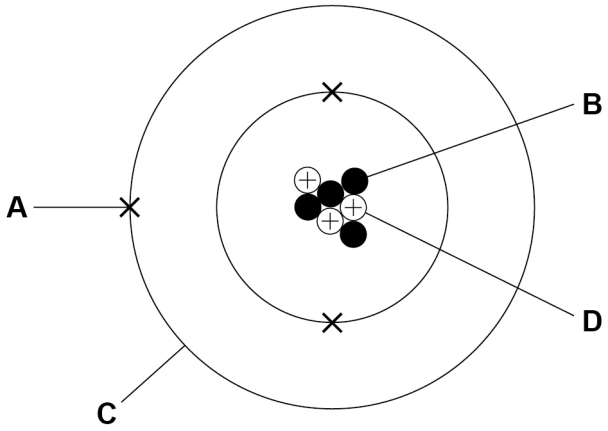
Question 73

June 2022 | 8462/1F | Original Q1

0 1 This question is about atoms.

0 1 . 1 **Figure 1** represents an atom of an element.

Figure 1



Draw **one** line from each name to the correct label.

[2 marks]

Name	Label
	A
Neutron	B
Proton	C
	D

4.1.1.4 Relative electrical charges of subatomic particles

Question 73 · continued

0 1 . 2 An atom of element **Y** has:

- an atomic number of 9
- a mass number of 19.

Give the number of electrons and the number of neutrons in this atom.

Choose answers from the box.

[2 marks]

1	**9**	**10**	**19**	**28**

Number of electrons _____

Number of neutrons _____

Question 1 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 73 · continued

Table 1 shows information about two isotopes of element **Z**.

Table 1

	Mass number	Percentage abundance (%)
Isotope **A**	39	93.3
Isotope **B**	41	6.7

0 1 . 3 Calculate the relative atomic mass (A_r) of element **Z**.

Use **Table 1** and the equation:

$$A_r = \frac{\text{(mass number} \times \text{percentage) of isotope A + (mass number} \times \text{percentage) of isotope B}}{100}$$

Give your answer to 3 significant figures.

[3 marks]

A_r (3 significant figures) = _____

4.1.1.4 Relative electrical charges of subatomic particles

Question 73 · continued

0 1 . 4 Suggest the identity of element **Z**.

Use the periodic table.

[1 mark]

Element **Z** _____

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

electrons	**neutrons**	**protons**

Isotopes of the same element have different mass numbers because the isotopes have different numbers of _____.

9

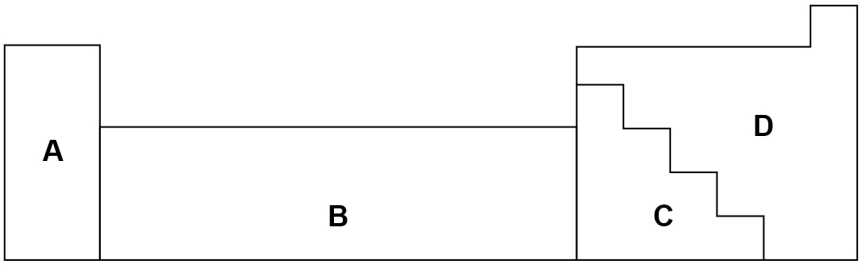
4.1.1.4 Relative electrical charges of subatomic particles

Question 74

0 9 This question is about metals and non-metals.

Figure 15 shows an outline of part of the periodic table.

Figure 15



0 9 . 1 Element **Q** is a dull solid with a melting point of 44 °C.

Element **Q** does not conduct electricity.

Which section of the periodic table in **Figure 15** is most likely to contain element **Q**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 9 . 2 Element **R** forms ions of formula R^{2+} and R^{3+}

Which section of the periodic table in **Figure 15** is most likely to contain element **R**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 9 . 3 Give **two** differences between the physical properties of the elements in Group 1 and those of the transition elements.

[2 marks]

1 _____

_____

2 _____

_____

4.1.1.4 Relative electrical charges of subatomic particles

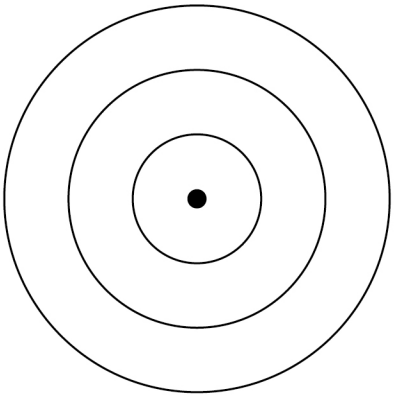
Question 74 · continued

0 9 . 4 Complete **Figure 16** to show the electronic structure of an aluminium atom.

Use the periodic table.

[1 mark]

Figure 16



0 9 . 5 Aluminium is a metal.

Describe how metals conduct electricity.

Answer in terms of electrons.

[3 marks]

0 9 . 6 Name the type of bonding in compounds formed between metals and non-metals.

[1 mark]

4.1.1.4 Relative electrical charges of subatomic particles

Question 74 · continued

0 9 . 7 Magnesium oxide is a compound formed from the metal magnesium and the non-metal oxygen.

Describe what happens when a magnesium atom reacts with an oxygen atom.

You should refer to electrons in your answer.

[4 marks]

13

4.1.1.4 Relative electrical charges of subatomic particles

Question 75

June 2023 | 8462/1F | Original Q1

0 1 This question is about atoms.

Atoms contain three types of particle:

- electrons
- neutrons
- protons.

0 1 . 1 Which particle has no electrical charge?

[1 mark]

Tick (✓) **one** box.

Electron ☐

Neutron ☐

Proton ☐

0 1 . 2 Which particles have the same relative mass?

[1 mark]

Tick (✓) **one** box.

An electron and a neutron ☐

An electron and a proton ☐

A neutron and a proton ☐

0 1 . 3 The formula of a compound is N_2O

How many of each type of atom are in one molecule of N_2O?

[2 marks]

Nitrogen _____

Oxygen _____

4.1.1.4 Relative electrical charges of subatomic particles

Question 75 · continued

An atom of element **Z** contains:

- 3 electrons
- 4 neutrons
- 3 protons.

0 1 . 4 Give the name of element **Z**.

Use the periodic table.

[1 mark]

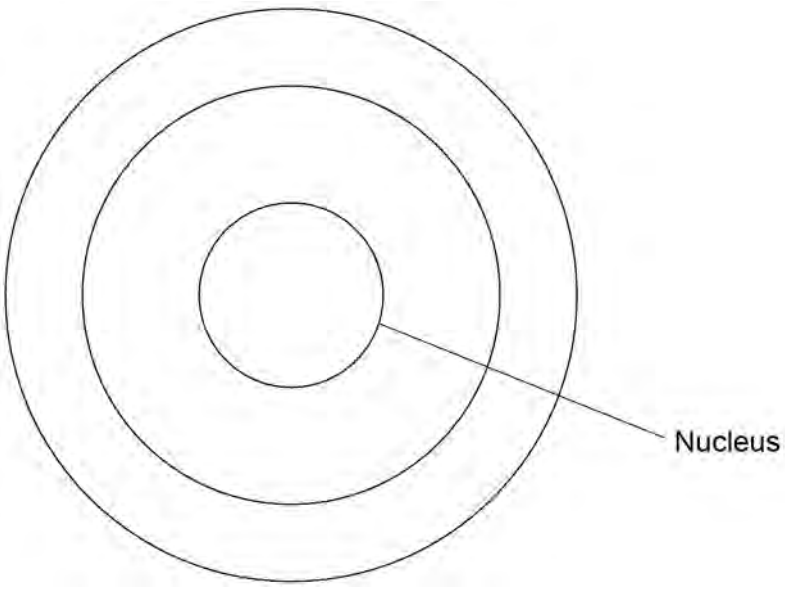
0 1 . 5 Complete **Figure 1** to show the position of the particles in an atom of element **Z**.

Use the symbols:

× = electron
● = neutron
○ = proton

[4 marks]

Figure 1



9

4.1.1.4 Relative electrical charges of subatomic particles

Question 76

0 3 This question is about carbon.

0 3 . 1 Which type of substance is carbon?

[1 mark]

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

0 3 . 2 Carbon has isotopes with mass numbers 12, 13 and 14.

Complete the sentences.

Choose answers from the box.

[2 marks]

electrons	**ions**	**molecules**	**neutrons**	**protons**

The isotopes of carbon have the same number of _____.

The isotopes of carbon have a different number of _____.

4.1.1.4 Relative electrical charges of subatomic particles

Question 76 · continued

0 3 . 3 12 g of carbon contains 6.02×10^{23} atoms.

Which expression is used to calculate the mass of one atom of carbon?

[1 mark]

Tick (✓) **one** box.

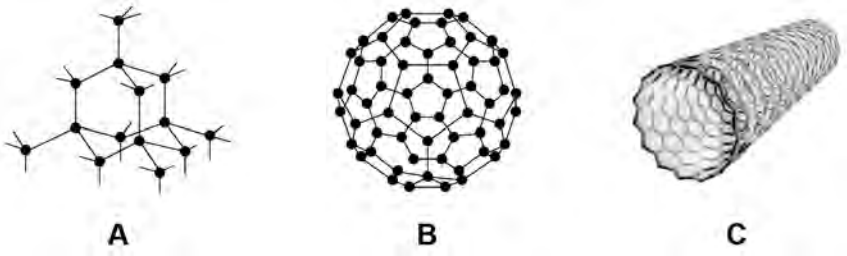
$\frac{12}{6.02 \times 10^{23}}$ ☐

$\frac{6.02 \times 10^{23}}{12}$ ☐

$12 \times 6.02 \times 10^{23}$ ☐

0 3 . 4 **Figure 2** shows diagrams that represent different forms of carbon.

Figure 2



Which diagram in **Figure 2** represents Buckminsterfullerene?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

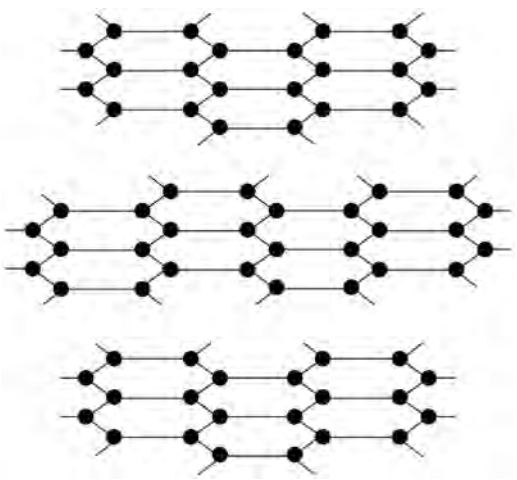
Question 3 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 76 · continued

0 3 . 5 **Figure 3** represents part of the structure of graphite.

Figure 3



Draw **one** line from each property of graphite to the structural feature that is the reason for that property.

[2 marks]

Property	Structural feature
	Graphite has hexagonal rings of carbon atoms.
Graphite conducts electricity.	The bonds between carbon atoms in the layers are strong.
Graphite is soft.	There are no covalent bonds between layers of atoms.
	There are delocalised electrons in graphite.

7

4.1.1.4 Relative electrical charges of subatomic particles

Question 77

June 2023 | 8462/1F | Original Q9

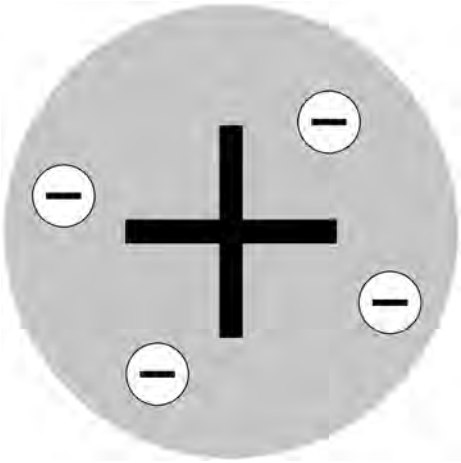
0 9 Discoveries in chemistry led to a better understanding of atomic structure.

0 9 . 1 Atoms were originally thought to be tiny spheres that could not be divided.

The plum pudding model of the atom was then developed.

Figure 10 represents the plum pudding model of the atom.

Figure 10



Describe the plum pudding model of the atom.

[2 marks]

0 9 . 2 Atoms contain electrons, neutrons and protons.

Write these three particles in order of their discovery.

[1 mark]

Earliest _____

_____

Latest _____

4.1.1.4 Relative electrical charges of subatomic particles

Question 77 · continued

Very few atoms of the element tennessine (Ts) have ever been identified.

The atomic number of tennessine is 117

0 9 . 3 Predict the number of outer shell electrons in an atom of tennessine.

Give **one** reason for your answer.

Use the periodic table.

[2 marks]

Number of outer shell electrons _____

Reason _____

_____

0 9 . 4 Tennessine was first identified by a small group of scientists in 2010.

Suggest **one** reason why tennessine was **not** accepted as a new element by other scientists until 2015.

[1 mark]

_____

_____

Question 9 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 77 · continued

0 9 . 5 The discovery of isotopes explained why some relative atomic masses are not whole numbers.

Element **R** has two isotopes.

Table 5 shows the mass numbers and percentage abundances of the isotopes of element **R**.

Table 5

Mass number	Percentage abundance (%)
6	7.6
7	92.4

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

Give your answer to 1 decimal place.

[3 marks]

Relative atomic mass (1 decimal place) = _____

9

4.1.1.4 Relative electrical charges of subatomic particles

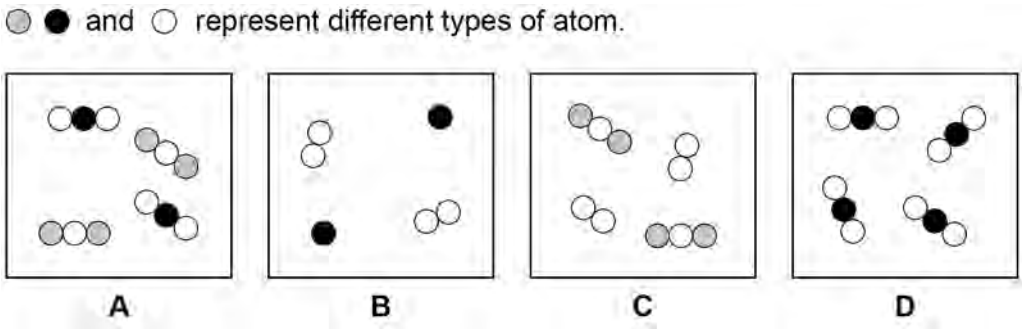
Question 78

June 2024 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

Figure 1 shows diagrams which represent the atoms and molecules in different substances.

Figure 1



0 1 . 1 Which diagram in **Figure 1** represents a pure compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

0 1 . 2 Which diagram in **Figure 1** represents a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

Question 1 continues on the next page

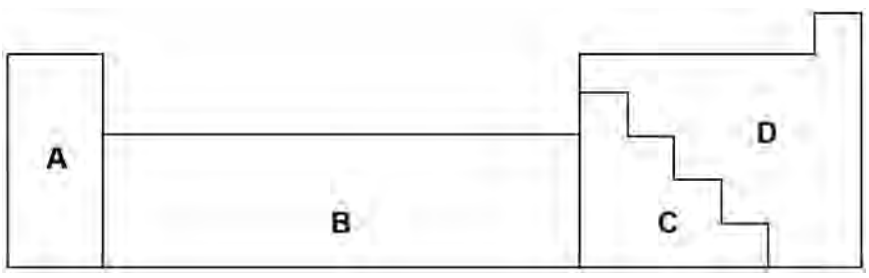
4.1.1.4 Relative electrical charges of subatomic particles

0 1 . 3 Elements are metals or non-metals.

Figure 2 shows an outline of the periodic table.

The periodic table is divided into sections.

Figure 2



Where are metals found in the periodic table?

[1 mark]

Tick (✓) **one** box.

Section **A** only ☐

Sections **A**, **B** and **C** ☐

Sections **B**, **C** and **D** ☐

Section **D** only ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 78 · continued

0 1 . 4 Which **two** of the following are typical properties of a transition metal?

[2 marks]

Tick (✓) **two** boxes.

- Can be bent and shaped ☐
- Good conductor of electricity ☐
- Low density ☐
- Low melting point ☐
- Poor conductor of heat ☐

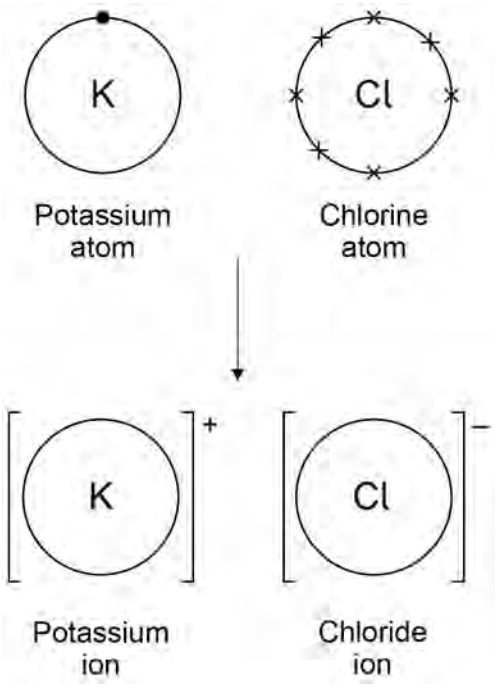
0 1 . 5 Potassium and chlorine react to produce potassium chloride.

An atom of potassium loses an electron to form a potassium ion.

An atom of chlorine gains an electron to form a chloride ion.

Complete the dot and cross diagram.

[2 marks]



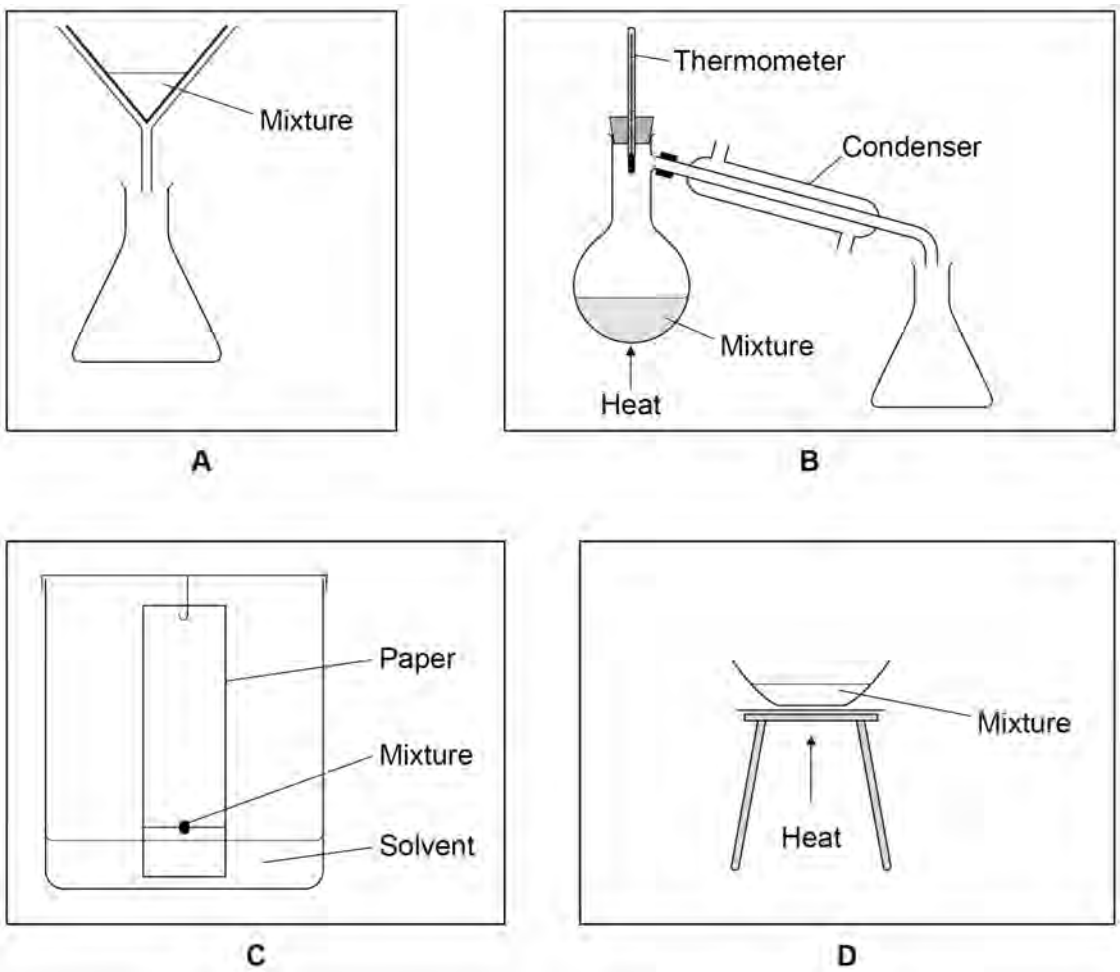
4.1.1.4 Relative electrical charges of subatomic particles

Question 78 · continued

Mixtures are separated by different methods.

Figure 3 shows the apparatus for separating four different types of mixture.

Figure 3



4.1.1.4 Relative electrical charges of subatomic particles

Question 78 · continued

0 1 . 6 Which apparatus could be used to collect water from sodium chloride solution?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 7 Which apparatus shows filtration?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 79

June 2024 | 8462/1F | Original Q5

0 5 This question is about carbon and carbon compounds.

An atom of carbon is represented as:

(Mass number) 13
(Atomic number) 6
C

0 5 . 1 What is the number of protons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

0 5 . 2 What is the number of neutrons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

0 5 . 3 What is the number of electrons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

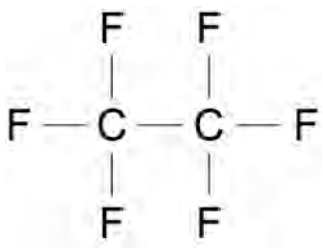
Question 5 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 79 · continued

0 5 . 4 **Figure 10** shows the structure of a carbon compound.

Figure 10



Complete the formula of the carbon compound.

[1 mark]

C__ F__

0 5 . 5 Methane:

- is a carbon compound
- exists as small molecules
- has a low boiling point.

What is the reason for the low boiling point of methane?

[1 mark]

Tick (✓) **one** box.

Covalent bonds **and** intermolecular forces are weak. ☐

Only covalent bonds are weak. ☐

Only intermolecular forces are weak. ☐

4.1.1.4 Relative electrical charges of subatomic particles

Question 79 · continued

0 5 . 6 Buckminsterfullerene (C_{60}) is a form of carbon.

Buckminsterfullerene was the first fullerene to be discovered.

What is the shape of a buckminsterfullerene molecule?

[1 mark]

Tick (✓) **one** box.

- Cubic ☐
- Cylindrical ☐
- Spherical ☐

Question 5 continues on the next page

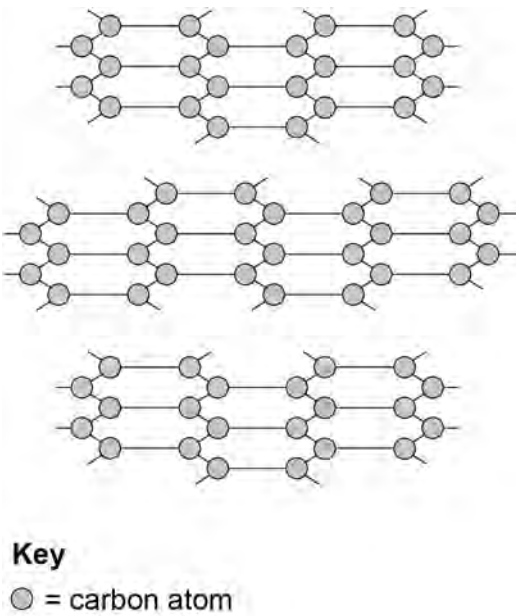
4.1.1.4 Relative electrical charges of subatomic particles

Question 79 · continued

0 5 . 7 Graphite is a form of carbon.

Figure 11 represents the structure of graphite.

Figure 11



How many covalent bonds does each carbon atom form in graphite?

[1 mark]

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

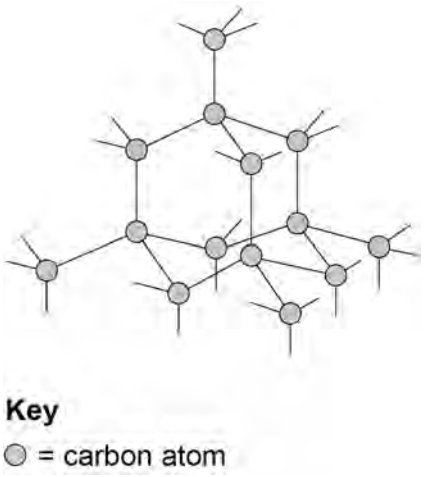
4.1.1.4 Relative electrical charges of subatomic particles

Question 79 · continued

0 5 . 8 Diamond is another form of carbon.

Figure 12 represents the structure of diamond.

Figure 12



Describe the structure and bonding in diamond.

[3 marks]

10

4.1.1.4 Relative electrical charges of subatomic particles

Question 80

June 2024 | 8462/1F | Original Q9

0 9 This question is about the periodic table.

Sodium and potassium are in Group 1 of the periodic table.

0 9 . 1 Give **one** similarity and **one** difference between the electronic structures of sodium and potassium.

[2 marks]

Similarity _____

_____

Difference _____

_____

Group 1 elements react with water.

0 9 . 2 Give **two** observations made when potassium reacts with water.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 3 Potassium hydroxide solution is produced when potassium reacts with water.

What is the colour of universal indicator when added to potassium hydroxide solution?

Give **one** reason for your answer.

[2 marks]

Colour of universal indicator _____

Reason _____

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 80 · continued

Table 4 shows the densities of some of the elements in Group 0 of the periodic table.

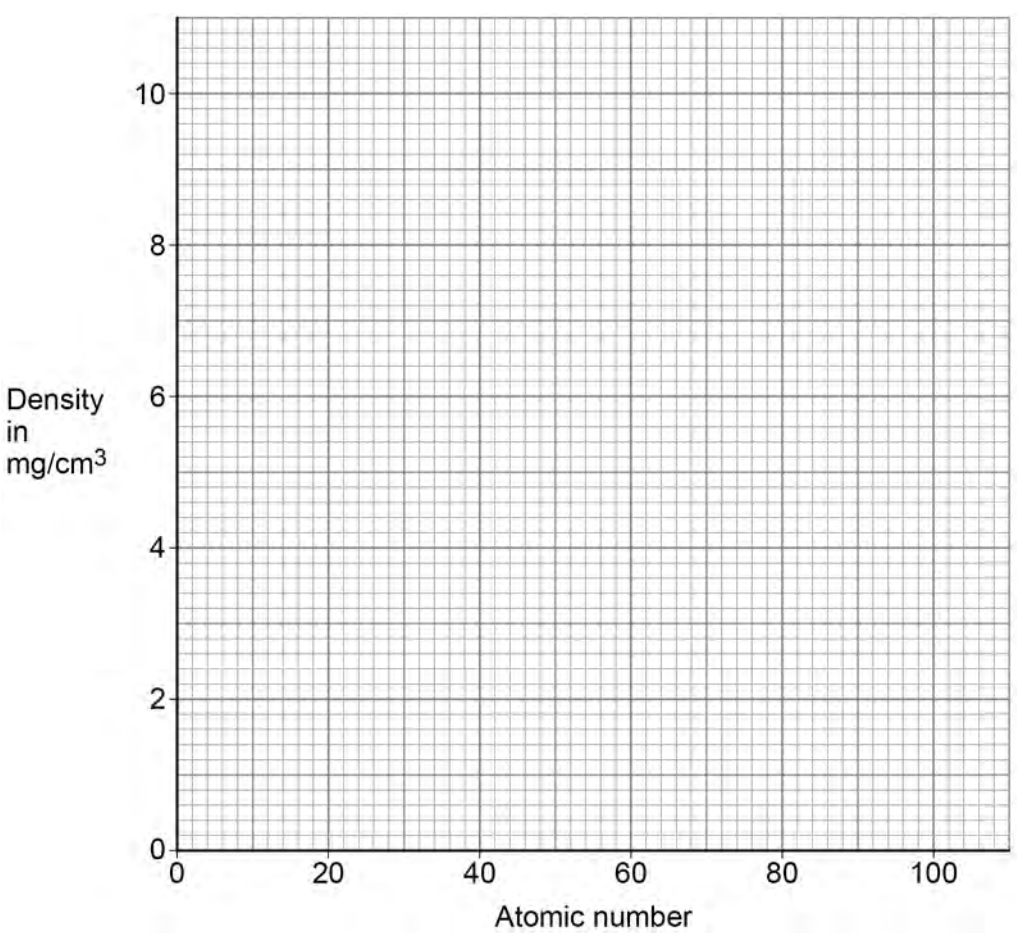
Table 4

Element	Atomic number	Density in mg/cm^3
Helium	2	0.2
Neon	10	0.8
Argon	18	1.6
Krypton	36	**X**
Xenon	54	5.4
Radon	86	9.1

0 9 . 4 Plot the data from **Table 4** on **Figure 15**.

[2 marks]

Figure 15



4.1.1.4 Relative electrical charges of subatomic particles

Question 80 · continued

0 9 . 5 Estimate the density (**X**) of krypton.

Use **Figure 15** and **Table 4**.

[1 mark]

Density = _____ mg/cm^3

0 9 . 6 The elements in Group 7 are called the halogens.

A more reactive halogen can displace a less reactive halogen from a solution of its salt.

Which combination of solutions will produce a reaction when mixed?

[1 mark]

Tick (✓) **one** box.

- Chlorine and potassium fluoride ☐
- Chlorine and potassium bromide ☐
- Bromine and potassium fluoride ☐
- Bromine and potassium chloride ☐

0 9 . 7 Which of the following describes the trends going down Group 7?

[1 mark]

Tick (✓) **one** box.

- Relative molecular mass decreases and boiling point decreases. ☐
- Relative molecular mass decreases and boiling point increases. ☐
- Relative molecular mass increases and boiling point decreases. ☐
- Relative molecular mass increases and boiling point increases. ☐

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4.1.1.4 Relative electrical charges of subatomic particles

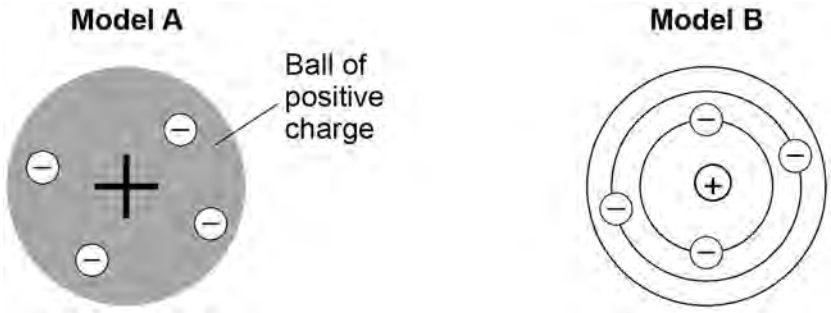
Question 81

June 2024 | 8462/1F | Original Q10

1 0 This question is about models of the atom.

Figure 16 shows two early models of the atom.

Figure 16



1 0 . 1 Name the models of the atom shown in **Figure 16**.

[2 marks]

Model **A** _____

Model **B** _____

1 0 . 2 Compare model **A** with the model of the atom used today.

Use **Figure 16**.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

4.1.1.4 Relative electrical charges of subatomic particles

Question 81 · continued

June 2024 | 8462/1F | Original Q10

1 0 . 3 Chadwick's experiments showed the existence of neutrons in an atom.

This led to an understanding of isotopes.

Define the term 'isotopes'.

Refer to subatomic particles in your answer.

[2 marks]

8

4.1.1.4 Relative electrical charges of subatomic particles

Question 82

June 2025 | 8462/1F | Original Q8

0 8 This question is about elements in the periodic table.

0 8 . 1 Describe where the non-metallic elements are found in the periodic table.

[1 mark]

0 8 . 2 Gallium (Ga) is a metallic element in Group 3.

Which of these properties of gallium is **not** typical of most metals?

[1 mark]

Tick (✓) **one** box.

- A boiling point above 1000 °C ☐
- A melting point below 100 °C ☐
- Conducts electricity when solid ☐
- Forms positive ions ☐

4.1.1.4 Relative electrical charges of subatomic particles

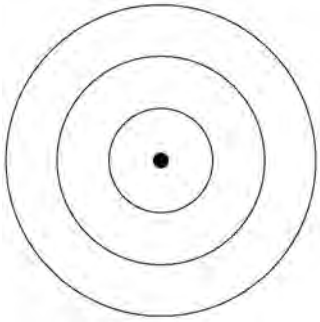
Question 82 · continued

0 8 . 3 A sodium atom can be represented as $^{23}_{11}Na$

Complete **Figure 12** to show the electronic structure of a sodium atom.

[1 mark]

Figure 12



0 8 . 4 Mendeleev created an early periodic table.

Mendeleev placed most of the elements in order of atomic weight.

Tellurium and iodine were not placed in order of atomic weight.

Why did Mendeleev **not** place tellurium and iodine in order of atomic weight?

[1 mark]

0 8 . 5 Argon is an element in Group 0 of the periodic table.

Explain why argon is unreactive.

[2 marks]

4.1.1.4 Relative electrical charges of subatomic particles

Question 82 · continued

An element **X** consists of two isotopes.

0 8 . 6 What is meant by 'isotopes'?

Answer in terms of subatomic particles.

[2 marks]

0 8 . 7 **Table 5** shows the mass numbers and percentage abundances of the isotopes of **X**.

Table 5

Mass number	Percentage abundance (%)
113	4
115	96

Which is the closest estimate to the relative atomic mass of **X**?

[1 mark]

Tick (✓) **one** box.

~113 ☐ ~114 ☐ ~115 ☐

9

4.1.1.4 Relative electrical charges of subatomic particles

Question 83

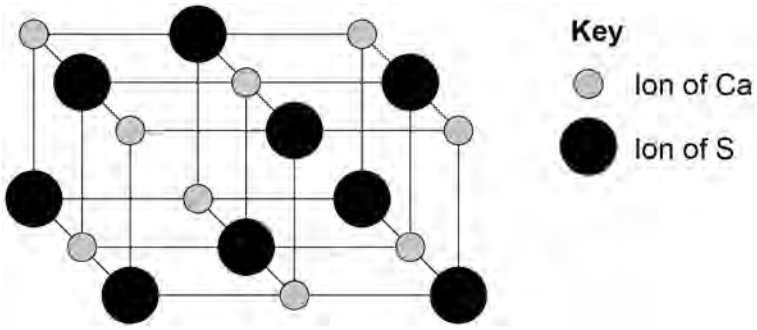
June 2025 | 8462/1F | Original Q9

0 9 This question is about structure and bonding.

Calcium sulfide is an ionic compound.

Figure 13 represents the structure of calcium sulfide.

Figure 13



0 9 . 1 Determine the empirical formula of calcium sulfide.

[1 mark]

Empirical formula _____

Question 9 continues on the next page

4.1.1.4 Relative electrical charges of subatomic particles

Question 83 · continued

0 9 . 2 Calcium is in Group 2 of the periodic table.

Sulfur is in Group 6 of the periodic table.

Describe what happens when a calcium atom reacts with a sulfur atom.

Answer in terms of electrons and ions.

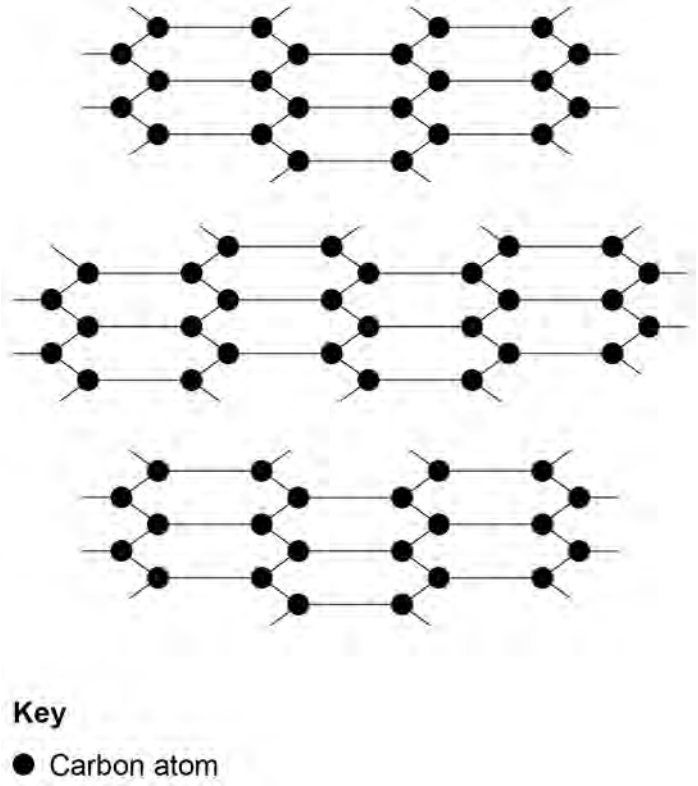
[4 marks]

4.1.1.4 Relative electrical charges of subatomic particles

Question 83 · continued

Figure 14 shows the structure of graphite.

Figure 14



0 9 . 3 Describe the structure and bonding of graphite.

[4 marks]

Extra space

4.1.1.4 Relative electrical charges of subatomic particles

Question 83 · continued June 2025 | 8462/1F | Original Q9

0 9 . 4 Substances that consist of small molecules do **not** conduct electricity.

Give **one** reason why.

[1 mark]

0 9 . 5 Methane consists of small molecules.

Poly(ethene) is a polymer.

Why does poly(ethene) have a higher melting point than methane?

[1 mark]

Tick (✓) **one** box.

- Poly(ethene) has more covalent bonds to break than methane. ☐
- Poly(ethene) has no intermolecular forces to overcome. ☐
- Poly(ethene) has stronger covalent bonds to break than methane. ☐
- Poly(ethene) has stronger intermolecular forces to overcome than methane. ☐

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