New Document 1

Name: _____

Class: _____

Date: _____

Time: **38 minutes**

Marks: **38 marks**

Comments:

Q1.

Formulae and equations are used to describe chemical reactions.

(a) Aluminium reacts with sulfuric acid (H_2SO_4) to produce aluminium sulfate, $Al_2(SO_4)_3$ and hydrogen (H_2).

Complete and balance the equation for this reaction.

____Al + _____ ⟶ _____ + _____

(2)

(b) Calcium carbonate reacts with nitric acid to produce calcium nitrate.

Calculate the relative formula mass (M_r) of calcium nitrate, $Ca(NO_3)_2$

Relative atomic masses (A_r): N = 14; O = 16; Ca = 40

_____

_____

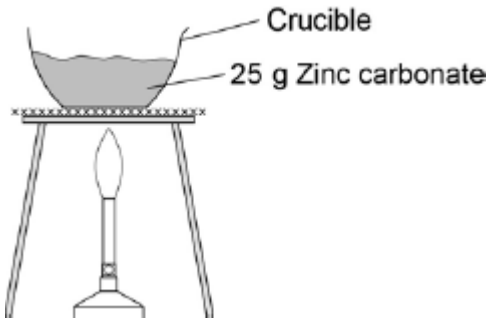
Relative formula mass (M_r) = _____

(2)

(c) Zinc carbonate decomposes when heated.

A student heated 25 g zinc carbonate ($ZnCO_3$).

The figure below shows how he set up the apparatus.



The balanced chemical equation for the decomposition reaction is:

$ZnCO_3$ (s) ⟶ ZnO (s) + CO_2 (g)

The student measured the mass of solid product after heating until there was no further change in mass.

The student did the experiment four times. The table below shows the results.

Experiment	1	2	3	4
Mass of solid product in g	17.4	19.7	17.6	16.9

Calculate the mean mass of the solid product.

Do **not** use any anomalous results in your calculation.

_____

_____

Mean mass = _____ g

(2)

(Total 6 marks)

Q2.

This question is about carbon and gases in the air.

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

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

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

(2)

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

Tick (✓) **one** box.

The atomic number ☐

The mass number ☐

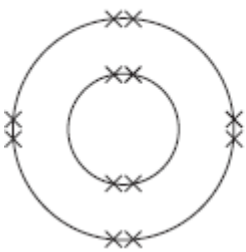
One mole of the atom ☐

(1)

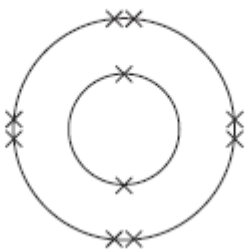
(c) An atom of carbon has six electrons.

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

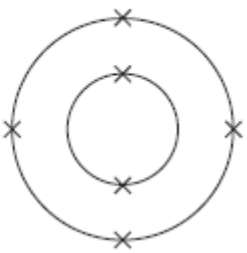
Structure A



Structure B



Structure C



The carbon atom is structure ☐

(1)

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

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

_____

(1)

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

_____

(1)

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

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

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

_____

_____

M_r of carbon monoxide = _____

(1)

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

_____

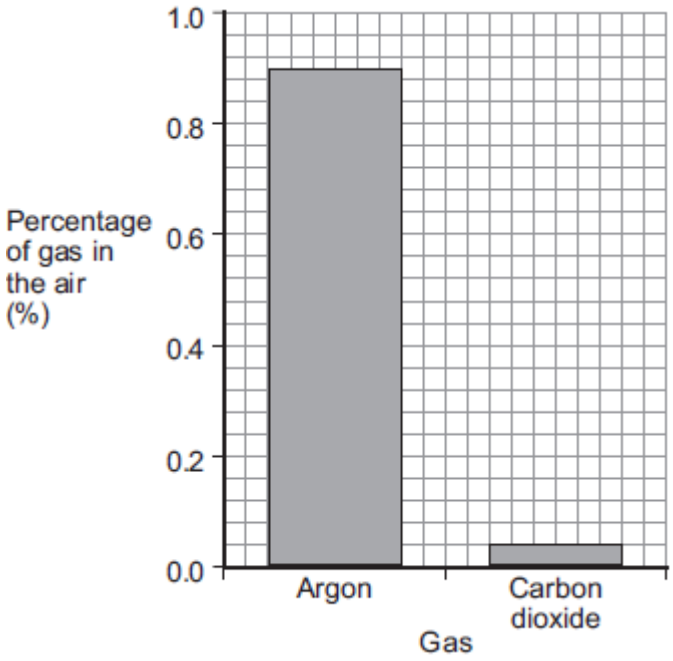
_____

Percentage by mass of carbon in carbon monoxide = _____%

(1)

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

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



What is the percentage of argon in the air?

Percentage of argon = _____ %

(1)

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

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

_____

_____

(1)

(Total 10 marks)

Q3.

Calcium oxide (quicklime) is made by heating calcium carbonate (limestone).

calcium carbonate	→	calcium oxide	+	carbon dioxide
100 g		?		44 g

(a) 44 grams of carbon dioxide is produced when 100 grams of calcium carbonate is heated.

Calculate the mass of calcium oxide produced when 100 grams of calcium carbonate is heated.

_____

mass _____ g

(1)

(b) What mass of carbon dioxide could be made from 100 tonnes of calcium carbonate?

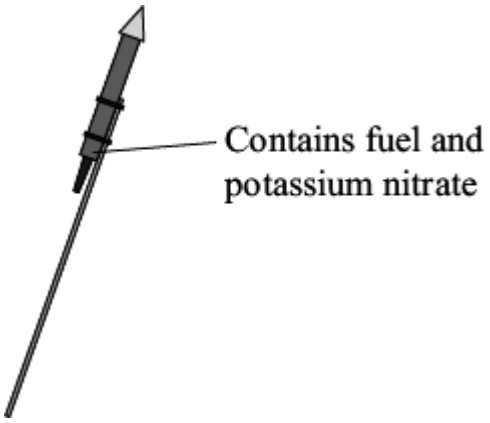
mass _____ tonnes

(1)

(Total 2 marks)

Q4.

Firework rockets contain fuel and potassium nitrate.



The potassium nitrate provides oxygen for the fuel to react.

(a) The table shows how a student worked out the relative formula mass (M_r) of potassium nitrate.

Some of the numbers are missing.

Relative atomic masses (A_r): N = 14; O = 16; K = 39.

Name of atom (symbol)	**Number of atoms**	**A_r**	**Mass**
potassium (K)	1	39	39
nitrogen (N)	1	14	14
oxygen (O)		16	
		The M_r of potassium nitrate =	101

(i) The mass of oxygen is not shown in the table.

Draw a ring around the correct mass of oxygen.

16 **32** **48**

(1)

(ii) Draw a ring around the number of oxygen atoms in the formula of potassium nitrate.

1 **2** **3**

(1)

(b) When the fuel reacts with the oxygen an *exothermic* reaction takes place.

What does *exothermic* mean?

_____

_____

_____

_____

(2)

(c) The fuel contains carbon. Carbon reacts with oxygen to make carbon dioxide.

Which **two** statements in the table explain why carbon dioxide is a gas at room temperature?

Tick (✓) the **two** statements.

Statement	**Tick (✓)**
It has a giant structure	
It has a low boiling point.	
It is made of small molecules.	
It is made of ions.	

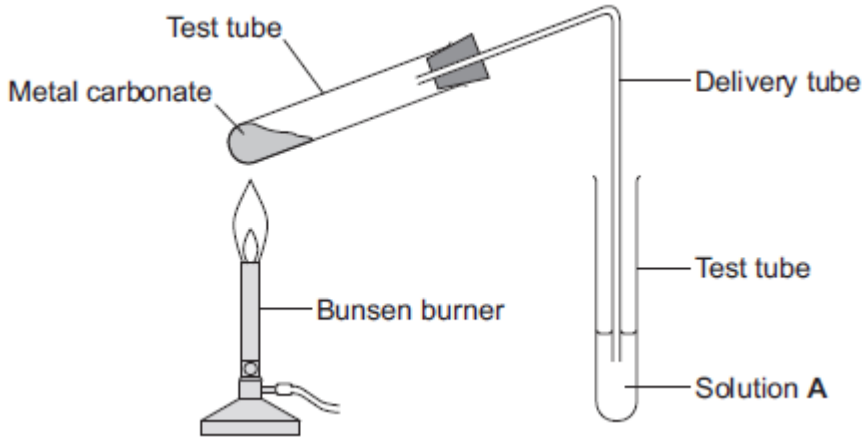
(2)

(Total 6 marks)

Q5.

A student investigated heating metal carbonates.

The student used the apparatus in the figure below.



The student's results are shown in the table below.

Metal carbonate	**Colour before heating**	**Colour after heating**	**Mass before heating in g**	**Mass after heating in g**	**Solution A**

Copper carbonate	Green	Black	12.4	8.0	Turns cloudy
Potassium carbonate	White	White	13.8	13.8	Stays colourless
Zinc carbonate	White	White	12.5	8.1	Turns cloudy

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

black **green** **white**

The colour of copper oxide is _____ .

(1)

(b) Solution **A** is used to test for carbon dioxide.

Carbon dioxide turns Solution **A** cloudy.

What is the name of Solution **A**?

_____

(1)

(Total 2 marks)

Q6.

This question is about lithium and sodium.

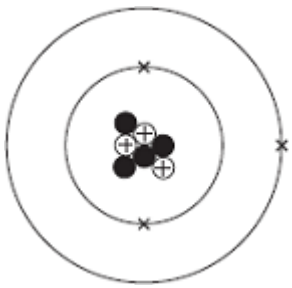
(a) Use the Chemistry Data Sheet to help you to answer this question.

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

(1)

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

The diagram represents the lithium atom.



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

What is the name of these particles?

_____

(1)

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

What is the name of these particles?

_____

(1)

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

3	**4**	**7**

The mass number of this atom of lithium is ☐

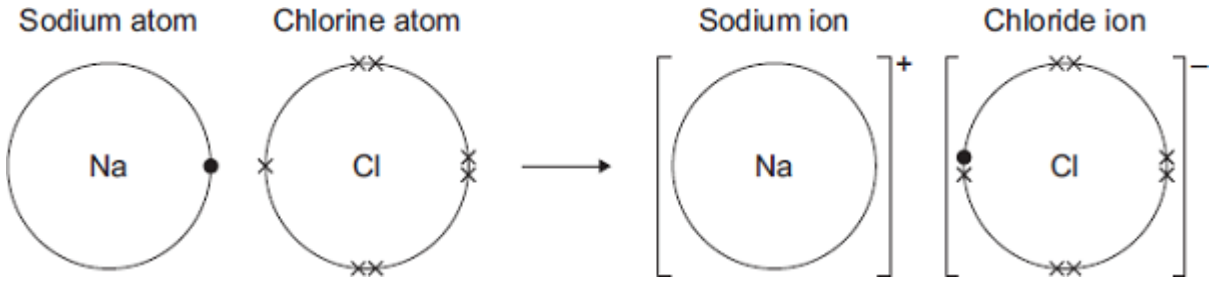
(1)

(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.

(i) A sodium atom changes into a sodium ion by

gaining
losing
sharing

an electron.

(1)

(ii) A sodium ion has

a negative
no
a positive

charge.

(1)

(iii) The ions in sodium chloride are held together by

strong

covalent
electrostatic

forces.

magnetic

(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)

(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)

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

The relative formula mass of a substance, in grams,

is one | ion | isotope | mole | of the substance.

(1)

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

What are nanoparticles?

_____

_____

(1)

(Total 12 marks)

Mark schemes

Q1.

(a) $2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$

formulae correct

1

balancing correct

1

(b) 40 + 2(14 + (3 × 16))

1

= 164

*allow 164 with no working shown for **2** marks*

1

(c) (17.4 + 17.6 + 16.9) / 3

1

= 17.3

*allow 17.3 with no working shown for **2** marks*

1

[6]

Q2.

(a) 1

must be in this order

1

very small

accept negligible, 1 / 2000
allow zero

1

(b) The mass number

1

(c) C

1

(d) (i) 2

1

(ii) 3

1

(e) (i) 28

1

(ii) 42.9

accept ecf from (e)(i)
accept 42 - 43

1

(f) (i) 0.9

1

(ii) any **one** from:

- accurate
- sensitive
- rapid
- small sample.

1

[10]

Q3.

(a) 56g

for 1 mark

1

(b) 44 tonnes

for 1 mark

1

[2]

Q4.

(a) (i) 48

1

(ii) 3

1

(b) heat / energy

1

given out / transfers to surroundings

the mark for given out / transfers to cannot be awarded without heat / energy

allow given off

1

(c) it has a low boiling point

1

it is made of small molecules

1

[6]

Q5.

(a) black

1

(b) limewater

accept calcium hydroxide (solution)

1

[2]

Q6.

(a) 1 / one

1

(b) (i) protons

1

(ii) neutrons

1

(iii) 7

1

(c) (i) losing

1

(ii) a positive

1

(iii) electrostatic

1

(d) high melting points

1

strong bonds

1

(e) (i) 58.5

1

(ii) mole

1

(f) very small (particles) **or**

ignore tiny / small / smaller / microscopic etc.

1-100nm in size **or**

(particle with a) few hundred atoms

1

[12]