OXFORD
INTERNATIONAL
AQA EXAMINATIONS

Topic Test: OxfordAQA International GCSE Combined Science 9204 Chemistry

Quantitative chemistry

Name: ____________________

Class: ____________________

Date: ____________________

Time: **45 minutes**

Marks: **45 marks**

Comments:

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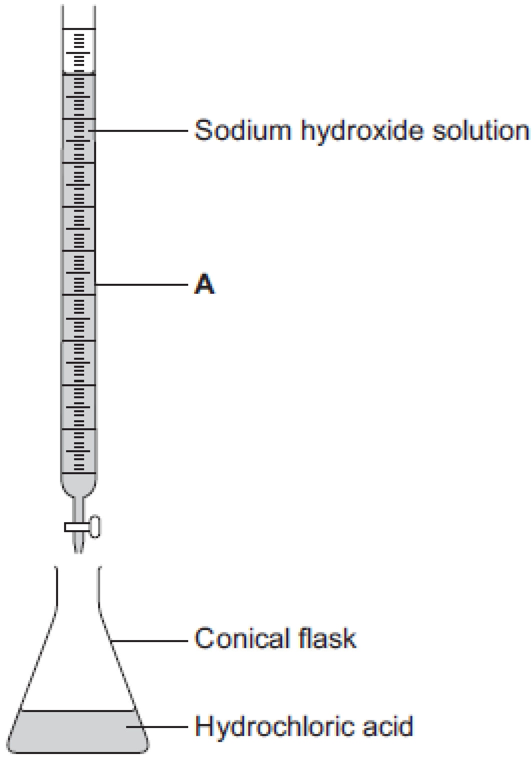
1 (a) A student used the apparatus in the figure below to do a titration.



(i) What is the name of the piece of apparatus labelled **A**?

Draw a ring around the correct answer.

burette **measuring cylinder** **test tube**

(1)

(ii) What should the student add to the acid in the conical flask?

Draw a ring around the correct answer.

catalyst **indicator** **water**

(1)

(iii) What would the student see when the end point of the titration has been reached?

____

(1)

(b) The student does the titration three times.

(i) State **one** variable that the student needs to keep the same to make it a fair test.

____

(1)

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

Titration	**Volume of sodium hydroxide solution added in cm^3**
1	22.40
2	22.20
3	22.30

Calculate the mean volume of sodium hydroxide solution added.

______________________ cm^3

(1)

(Total 5 marks)

2 Ammonium chloride, NH_4Cl, is made up of nitrogen, hydrogen and chlorine atoms.

(i) Complete the table to show the number of atoms of each element present in NH_4Cl.

Element	**Number of atoms in NH_4Cl**
nitrogen	1
hydrogen	
chlorine	

(1)

(ii) Calculate the relative formula mass of ammonium chloride, NH_4Cl.

(Relative atomic masses: H = 1, N = 14, Cl = 35.5)

____

____

____

____

Relative formula mass = _________________________

(2)

(Total 3 marks)

3 Follow the steps to find the percentage of iron in iron oxide.

Relative atomic masses: O 16; Fe 56.

(i) Step 1

Calculate the relative formula mass of iron oxide, Fe_2O_3.

____

____

(1)

(ii) Step 2

Calculate the total relative mass of just the iron atoms in the formula, Fe_2O_3.

____

(1)

(iii) Step 3

Calculate the percentage (%) of iron in the iron oxide, Fe_2O_3.

____

____

Percentage of iron ________________ %

(1)

(Total 3 marks)

4 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)

5 (a) A chemist was asked to identify a nitrogen compound. The chemist carried out an experiment to find the relative formula mass (M_r) of the compound.

The M_r of the compound was **44**.

Relative atomic masses: N = 14, O = 16

Draw a ring around the formula of the compound.

NO $\mathbf{NO_2}$ $\mathbf{N_2O_4}$ $\mathbf{N_2O}$

(1)

(b) Potassium nitrate is another nitrogen compound. It is used in fertilisers. It has the formula $\mathbf{KNO_3}$.

The $\mathbf{M_r}$ of potassium nitrate is **101**.

Calculate the percentage of **nitrogen** by mass in potassium nitrate.

Relative atomic mass: N = 14.

____

____

Percentage of nitrogen = _______________ %

(2)

(Total 3 marks)

6 Iron is an essential part of the human diet. Iron(II) sulfate is sometimes added to white bread flour to provide some of the iron in a person's diet.

(a) The formula of iron(II) sulfate is $FeSO_4$

Calculate the relative formula mass (M_r) of $FeSO_4$

Relative atomic masses: O = 16; S = 32; Fe = 56.

____

____

The relative formula mass (M_r) = _______________

(2)

(b) What is the mass of one mole of iron(II) sulfate? Remember to give the unit.

____

(1)

(c) What mass of iron(II) sulfate would be needed to provide 28 grams of iron?

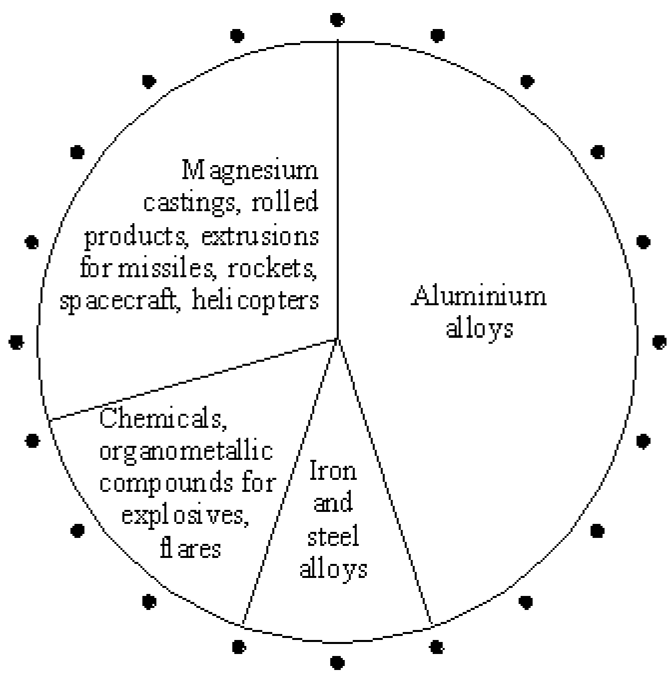
Remember to give the unit.

____

(1)

(Total 4 marks)

7 280 000 tonnes of magnesium are produced in the world each year. The pie chart below shows the ways in which magnesium is used.



(a) (i) Use the pie chart to calculate the percentage of magnesium used to make aluminium alloys.

____________________ %

(1)

(ii) How many tonnes of magnesium are used to make aluminium alloys each year?

____________________ tonnes

(1)

(b) Magnesium is produced by the electrolysis of molten magnesium chloride. The reactions which take place at the electrodes are represented by the equations below.

$Mg^{2+} + 2e^- \rightarrow Mg$

$2Cl^- - 2e^- \rightarrow Cl_2$

(i) Calculate the mass of chlorine produced when one kilogram of magnesium is made.
(Relative atomic masses: Mg = 24, Cl = 35.5)

____

____

____

____

(3)

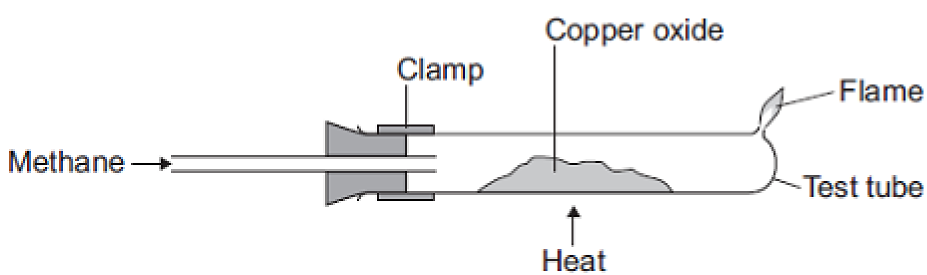
(ii) Give a use for chlorine.

____

(1)

(Total 6 marks)

8 This apparatus is used for the reaction of copper oxide (CuO) with methane (CH_4).



(a) The symbol equation for this reaction is shown below.

$$4\ CuO(s) + CH4(g) \rightarrow 4\ Cu(s) + 2\ H_2O(g) + CO_2(g)$$

The water and carbon dioxide produced escape from the test tube.

Use information from the equation to explain why.

____

____

(1)

(b) (i) Calculate the relative formula mass (M_r) of copper oxide (CuO).

Relative atomic masses (A_r): O = 16, Cu = 64

____

____

____

Relative formula mass (M_r) = ______________

(2)

(ii) Calculate the percentage of copper in copper oxide.

____

____

____

Percentage of copper = ______________ %

(2)

(iii) Calculate the maximum mass of copper that could be produced from 4.0 g of copper oxide.

____

____

Mass of copper produced = _____________________ g

(1)

(c) The experiment was done three times.

The mass of copper oxide used and the mass of copper produced were measured each time.

The results are shown in the table.

	Experiment		
	1	**2**	**3**
Mass of copper oxide used in g	4.0	4.0	4.0
Mass of copper produced in g	3.3	3.5	3.2

(i) Calculate the mean mass of copper produced in these experiments.

____

____

Mean mass of copper produced = ______________ g

(1)

(ii) Suggest how the results of the experiment could be made more precise.

____

____

(1)

(iii) The three experiments gave different results for the amount of copper produced.

This was caused by experimental error.

Suggest two causes of experimental error in these experiments.

1. ____

____

2. ____

____

(2)

(Total 10 marks)

9 A student carried out a titration to find the concentration of a solution of sulphuric acid. 25.0 cm^3 of the sulphuric acid solution was neutralised exactly by 34.0 cm^3 of a potassium hydroxide solution of concentration 2.0 mol/dm^3. The equation for the reaction is:

$2KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$

(a) Describe the experimental procedure for the titration carried out by the student.

____

____

____

____

____

____

____

____

(4)

(b) Calculate the number of moles of potassium hydroxide used.

____

Number of moles = ____________________

(2)

(c) Calculate the concentration of the sulphuric acid in mol/dm^3.

____

____

____

____

Concentration = ________________ mol/dm^3

(3)

(Total 9 marks)

Mark schemes

1 (a) (i) burette

1

(ii) indicator

1

(iii) colour change

1

(b) (i) any **one** from:

- volume of (hydrochloric) acid

  allow amount of (hydrochloric) acid
- concentration of (hydrochloric) acid
- concentration of (sodium) hydroxide

  allow concentration of alkali

1

(ii) 22.3(0)

1

[5]

2 (i) 4 **and** 1

both answers must be correct

1

(ii) 53.5

if incorrect relative formula mass
allow 1 mark for correct working

accept e.c.f. from c(i) for 2 marks

2

[3]

3 (i) 160

ignore units

1

(ii) 112

ignore units

1

(iii) 70

*do **not** carry forward errors*

1

[3]

4 (a) 56g

for 1 mark

1

(b) 44 tonnes

for 1 mark

1

[2]

5 (a) N_2O

1

(b) 13.8 to 14

gains full marks without working

if answer incorrect
*13 gains **1** mark*
or
*14/101 × 100 gains **1** mark*

2

[3]

6 (a) 152 correct answer with **or** without working = **2 marks**
56 + 32 + (4 ×16) gains **1** mark

ignore any units

2

(b) 152g(rams)

ecf from the answer to (a) and g

must have unit g / gram / gramme / grams etc

*accept g / mol **or** g per mole **or** g mole^{-1} **or** g/mol **or** g per mol **or** g mol^{-1}*

*do **not** accept g m*

*do **not** accept G*

1

(c) 76(g)

ecf from their answer to (a) or (b) divided by 2

ignore units

1

[4]

7 (a) (i) 45%

for 1 mark

1

(ii) 126 000 (consequential on (i))

for 1 mark

1

(b) (i) Cl_2 = 71
1 × 71/24 or correct mathematical attempt

for 1 mark

(If Cl_2 wrong take figure given)

for 1 mark

= 2.96 kg

gains 3 marks

(or alternative methods)
(if units not given - 3 marks. If units wrong - 2 marks)

3

(ii) any sensible eg. bleach/disinfectant/antiseptics/kill bacteria/ sterilise water/solvents/refrigerents/CFCs/PVC
(not water treatment or warfare)

for 1 mark

1

[6]

8 (a) because they are gases

ignore vapours / evaporate / (g)

allow it is a gas

1

(b) (i) 80 / 79.5

*correct answer with or without working = **2** marks*
ignore units

*if no answer **or** incorrect answer then evidence of 64 / 63.5 + 16 gains **1** mark*

2

(ii) 79.375 - 80

*correct answer with or without working = **2** marks*

*if no answer **or** incorrect answer then evidence of*

$\frac{64}{80}$ *or* $\frac{63.5}{79.5}$ *(×100) gains **1** mark*

accept (ecf) $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}}$ *× 100 for **2** marks*

if answer correctly calculated.

if incorrectly calculated evidence of $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}}$ *(× 100) gains **1** mark*

2

(iii) 3.2

*correct answer with or without working = **1** mark*

allow (ecf)
*4 x ((b)(ii)/100) for **1** mark if correctly calculated*

1

(c) (i) 3.3

*accept 3.33……**or** 3 1 / 3 **or** 3.3•*
***or** 3.3r*

1

(ii) (measure to) more decimal places **or** (use a) more sensitive balance / apparatus

*allow use small<u>er</u> scale (division) **or** use a small<u>er</u> unit*
ignore accurate / repeat

1

(iii) any **two** from:

ignore systematic / human / apparatus / zero / measurement / random / weighing / reading / recording errors unless qualified

different balances used **or** faulty balance

ignore dirty apparatus

reading / using the balance incorrectly

accept incorrect weighing of copper / copper oxide

spilling copper oxide / copper

allow some copper left in tube

copper oxide impure

allow impure copper (produced)

not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used

accept not all copper oxide (fully) reacted

<u>heated</u> for different times
<u>heated</u> at different temperatures

if neither of these points awarded allow different amounts of heat used

accept Bunsen burner / flame at different temperatures

some of the copper produced is oxidised / forms copper oxide

some of the copper oxide / copper blown out / escapes (from tube)

ignore some copper oxide / copper lost

some water still in the test tube

2

[10]

9 (a) any four from:

- sulphuric acid measure by pipette
  or *diagram*
- potassium hydroxide in burette
  or *diagram*
- if solutions reversed, award
- note initial reading
- use of indicator
- note final reading **or** amount used

4

(b) $\frac{34 \times 2}{1000}$ **1**

= 0.068 **1**

(c) ½ or 0.5 moles H_2SO_4 react with 1 mole KOH **1**

moles H_2SO_4 in 25.0 cm^3 = 0.068 × 0.5 **1**

∴ moles H_2SO_4 in 1 dm^3 = $\frac{0.068 \times 0.5 \times 1000}{25}$ = 1.36 mol/dm^3 **1**

[9]