Q1.

This question is about hydrogen chloride and sodium hydroxide.

Solutions of hydrochloric acid and sodium hydroxide are reacted and the temperature change is recorded.

(c) In the reaction, 3.65 g of hydrogen chloride reacts with 4.00 g of sodium hydroxide.

1.80 g of water is produced.

Calculate the mass of the other product.

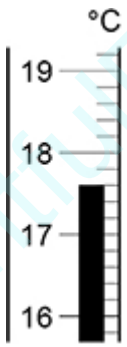
_____

Mass = _____ g

(1)

(d) **Figure 2** shows part of the thermometer used to measure the temperature.

Figure 2



What is the temperature reading on the thermometer?

Temperature = _____ °C

(1)

Q2.

Magnesium reacts with iron chloride solution.

$$3\ Mg + 2\ FeCl_3 \longrightarrow 2\ Fe + 3\ MgCl_2$$

(c) 0.120 g of magnesium reacts with excess iron chloride solution.

Relative atomic masses (A_r): Mg = 24 Fe = 56

Calculate the mass of iron produced, in mg

_____

_____

Mass of iron = _____ mg

(5)

(d) Explain which species is reduced in the reaction between magnesium and iron chloride.

$$3\ Mg + 2\ FeCl_3 \longrightarrow 2\ Fe + 3\ MgCl_2$$

Your answer should include the half equation for the reduction.

(3)

(Total 10 marks)

Q3.

This question is about elements and compounds.

(a) Magnesium and oxygen react to produce magnesium oxide.

Balance the equation for the reaction.

$$\_\_\_\_\_Mg + O_2 \longrightarrow 2\ MgO$$

(1)

(b) Suggest **one** safety precaution that should be taken when heating magnesium and

oxygen.

_____

_____

(1)

(c) Calculate the relative formula mass (M_r) of magnesium fluoride (MgF_2).

Relative atomic masses (A_r): F = 19 Mg = 24

_____

_____

_____

_____

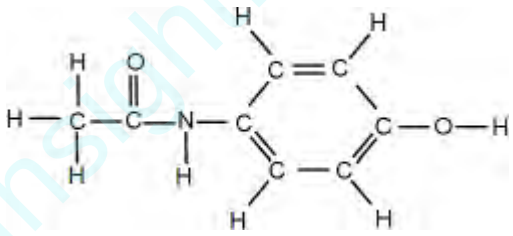
Relative formula mass (M_r) = _____

Q4.

Aqamed is a medicine for children.

(c) The main ingredient in Aqamed is a painkiller called paracetamol.

The figure below represents a molecule of paracetamol.



Give the molecular formula of paracetamol.

Calculate its relative formula mass (M_r).

Relative atomic masses (A_r): H = 1; C = 12; N = 14; O = 16

Molecular formula _____

Relative formula mass _____

_____

M_r = _____

(2)

(d) Aspirin is a medicine for use by adults.

An aspirin tablet contains 300 mg of acetylsalicylic acid.

Calculate the number of moles of acetylsalicylic acid in one aspirin tablet.

Give your answer in standard form to three significant figures.

Relative formula mass (M_r) of aspirin = 180

Number of moles = _____

(4)

(Total 9 marks)

Q5.

This question is about fluorine.

(c) Fluorine reacts with sulfur to produce sulfur hexafluoride (SF_6).

$$S + 3F_2 \rightarrow SF_6$$

Relative formula masses, M_r: F_2 = 38 SF_6 = 146

Calculate the mass of sulfur hexafluoride produced when 0.950 g of fluorine is reacted with an excess of sulfur.

Give your answer to 3 significant figures.

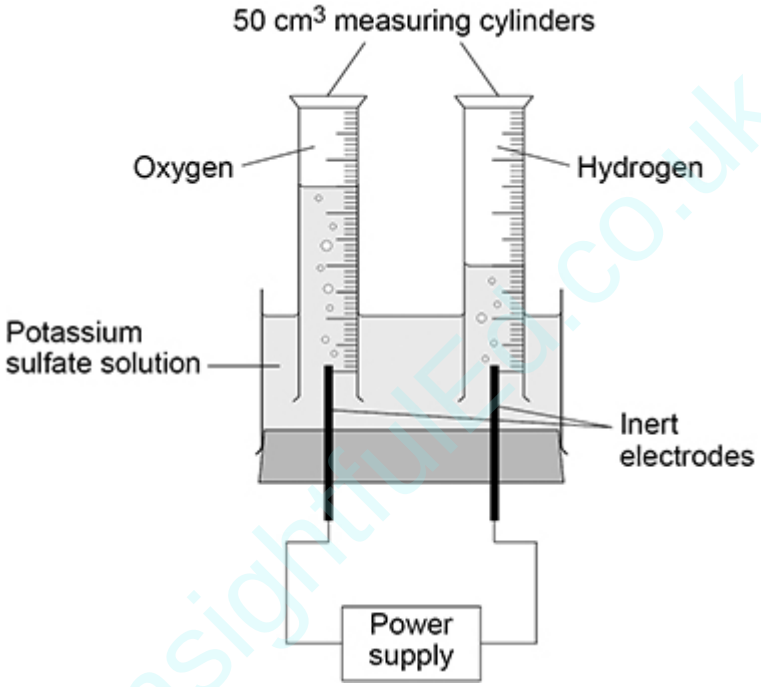
Mass = _____ g

(5)
(Total 13 marks)

Q6.

This question is about electrolysis.

The diagram below shows the apparatus used to investigate the electrolysis of potassium sulfate solution.



(a) Potassium sulfate contains K^+ and SO_4^{2-} ions.

What is the formula of potassium sulfate?

Tick (✓) **one** box.

KSO_4 ☐

K_2SO_4 ☐

$K(SO_4)_2$ ☐

$K2(SO_4)_2$ ☐

(1)

(b) What are the volumes of gases collected in the electrolysis experiment?

Use the figure above.

Volume of hydrogen = _____ cm^3

Volume of oxygen = _____ cm^3

(1)

(c) A student made the following hypothesis:

'The volumes of gases collected in this electrolysis experiment are in the same ratio as hydrogen atoms to oxygen atoms in a water molecule.'

Explain how the volumes of gases collected in the experiment in above diagram support the student's hypothesis.

Use your answer to part (b)

_____

_____

_____

_____

_____

_____

(2)

(d) The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

6 cm^3 9 cm^3 10 cm^3 11 cm^3

The mean volume of oxygen collected in the 4 experiments is 9 cm^3

The measure of uncertainty is the range of a set of measurements about the mean.

What is the measure of uncertainty in the 4 experiments?

Tick (✓) **one** box.

9 ± 1 cm^3 ☐

9 ± 2 cm^3 ☐

9 ± 3 cm^3 ☐

(1)

(e) The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in 25 cm^3 of water.

Calculate the mass of potassium sulfate needed to make 1.0 dm^3 of solution.

Mass = _____ g

(3)

(Total 8 marks)

Q7.

This question is about subatomic particles.

(c) Calculate the mass of one atom of sodium.

Avogadro constant = 6.02×10^{23} per mole.

Give your answer to 3 significant figures.

Mass of one atom of sodium = _____ g

(2)

(d) The radius of a sodium atom is 227 picometres (pm)

1 picometre = 1×10^{-12} m

What is the approximate radius of the nucleus of a sodium atom?

Tick **one** box.

2.27×10^{-12} m ☐

2.27×10^{-14} m ☐

2.27×10^{-24} m ☐

4.54×10^{-14} m ☐

(1)

(Total 9 marks)

Q8.

This question is about elements and compounds.

Sodium reacts with titanium chloride ($TiCl_4$) to produce titanium.

(b) Complete the equation.

You should balance the equation.

___Na + $TiCl_4$ → _____ + _____

(2)

(c) The reaction between sodium and titanium chloride is a redox reaction.

Write a half-equation to show that sodium is oxidised in this reaction.

_____

(2)

(d) 108 g of aluminum reacts with 1.21 kg of copper chloride to produce copper.

The equation for the reaction is:

$$2\ Al + 3\ CuCl_2 \rightarrow 3\ Cu + 2\ AlCl_3$$

Calculate the maximum mass of copper produced in grams (g).

You should determine the limiting reactant.

Relative atomic masses (A_r): Al = 27 Cu = 63.5

Relative formula masses (M_r): $CuCl_2$ = 134.5 $AlCl_3$ = 133.5

_____

_____

_____

_____

_____

_____

Limiting reactant is _____

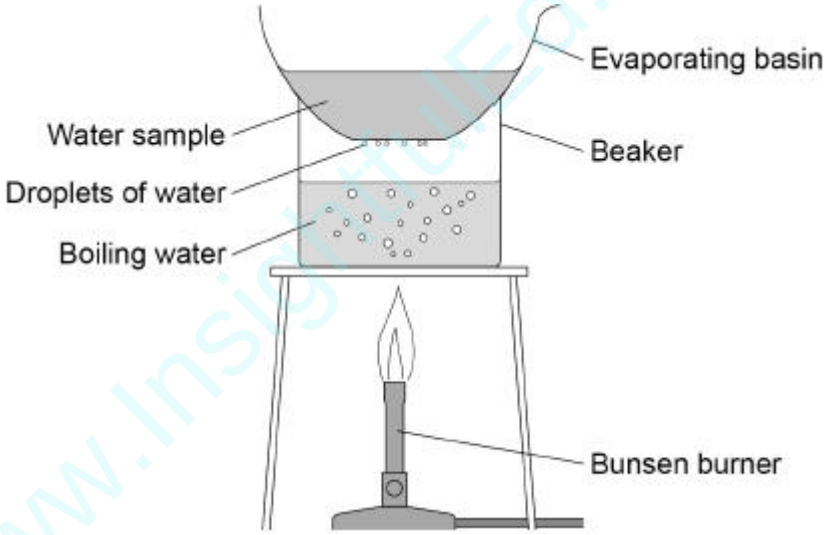
Mass of copper = _____ g

(6)

Q9.

A student investigated the mass of dissolved solids in four water samples **A**, **B**, **C** and **D**.

The diagram below shows the apparatus used.



This is the method used.

1. Record the mass of a dry evaporating basin.
2. Pour 25 cm^3 of water sample **A** into the evaporating basin.
3. Place the evaporating basin on the beaker for 10 minutes.
4. Record the mass of the evaporating basin and contents.
5. Repeat steps 1 to 4 with water sample **A** three more times.
6. Repeat steps 1 to 5 with water samples **B**, **C** and **D**.

(a) What type of variable is the mass of dissolved solids?

Tick (✓) **one** box.

Categoric ☐

Control ☐

Dependent ☐

Independent ☐

(1)

(b) The method produced an error in the mass recorded in step 4.

Suggest what caused the error.

How could the error be avoided?

Error _____

_____

Avoided by _____

_____

(2)

Another student carried out the investigation correctly.

The table below shows the results.

Water sample	**Mass of dissolved solids in g**				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Mean**
A	0.22	0.23	0.20	**X**	0.21
B	0.03	0.08	0.02	0.03	0.04
C	0.45	0.60	0.49	0.58	0.53
D	0.80	0.91	0.79	0.86	0.84

(c) Calculate value **X** in the table above.

_____

_____

_____

_____

X = _____ g

(2)

(d) Which water sample has the greatest range of masses of dissolved solids?

Give the reason for your answer.

Water sample _____

Reason _____

_____

_____

(2)

(e) Water companies measure the volume of water used by households in cubic metres (m^3).

25 cm^3 of a different water sample contained 0.016 g of dissolved solids.

Calculate the mass of dissolved solid in 1 m^3 of this water sample.

1 m^3 = 1000 dm^3

Give your answer in standard form.

_____

_____

_____

_____

_____

_____

_____

_____

Mass (in standard form) = _____ g

(4)

(Total 11 marks)

Q10.

This question is about Group 1 elements.

(a) Sodium reacts with chlorine to produce sodium chloride.

Balance the equation for the reaction.

$$\_\_\_\_\_\ Na + Cl_2 \rightarrow \_\_\_\_\_\ NaCl$$

(1)

(b) 4.6 g of sodium reacts with chlorine to produce 11.7 g of sodium chloride.

What mass of chlorine reacted?

_____

_____

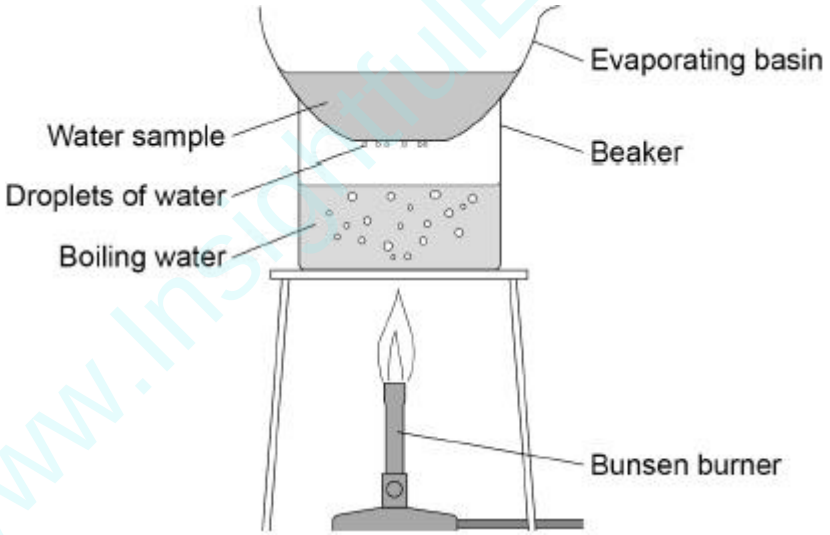
Mass of chlorine = _____ g

(1)

Q11.

A student investigated the mass of dissolved solids in water samples.

The diagram below shows the apparatus used.



This is the method used.

1. Record the mass of a dry evaporating basin.
2. Pour 25 cm^3 of the water sample into the evaporating basin.
3. Place the evaporating basin on the beaker for 10 minutes.
4. Record the mass of the evaporating basin and contents.

(a) What is used to find the mass of the evaporating basin?

Tick (✓) **one** box.

Balance ☐

Beaker ☐

Measuring cylinder ☐

Thermometer ☐

(1)

One error is that droplets of water collect on the bottom of the evaporating basin.

(b) Suggest how this error affects the mass of the evaporating basin and contents.

_____

_____

(1)

(c) How can this error be corrected?

_____

_____

(1)

(d) Another error in the method is that not all the water was removed from the water sample.

How can this error be corrected?

Tick (✓) **one** box.

Add more boiling water to the beaker. ☐

Heat until the mass of the evaporating basin and contents is constant. ☐

Stir the water sample in the evaporating basin with a glass rod. ☐

(1)

(e) The water in the water sample turns into steam.

What is the name of this process?

_____

(1)

Another student did the experiment correctly with three water samples **A**, **B** and **C**.

The table below shows the results.

Water sample	Mass of dissolved solids in g			
	Test 1	**Test 2**	**Test 3**	**Mean**
A	0.23	0.23	0.20	**X**
B	0.03	0.07	0.02	0.04
C	1.45	1.60	1.45	1.50

(f) The range is the difference between the largest value and the smallest value.

Which water sample has the greatest range of results?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

(1)

(g) Calculate the mean mass **X** for water sample **A**.

Use table above.

_____

_____

_____

_____

X = _____ g

(2)

(h) What is the dependent variable in this experiment?

Tick (✓) **one** box.

Mass of dissolved solids ☐

Time taken for water to heat ☐

Type of water sample ☐

Volume of boiling water ☐

(1)

(i) A different water sample contains 3.6 g of dissolved solids in 150 cm^3

Calculate the mass of dissolved solids in 25 cm^3 of this sample.

_____

_____

_____

_____

Mass = _____ g

(2)

(Total 11 marks)

Q12.

(f) 500 cm^3 of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 cm^3 of this copper chloride solution.

_____

_____

_____

Mass = _____ g

(2)

Q13.

This question is about hydrocarbons.

(d) 30 g of another hydrocarbon contains 24 g of carbon.

Which calculation gives the percentage of carbon in the hydrocarbon?

Tick (✓) **one** box.

$\frac{24 \times 30}{100}$ ☐

$\frac{100 \times 30}{24}$ ☐

$\frac{24 \times 100}{30}$ ☐

$\frac{24}{30 \times 100}$ ☐

(1)

Hydrocarbons can be cracked.

(g) Balance the equation for the cracking of C_6H_{14}

$$C_6H_{14} \rightarrow C_2H_6 + \_\_\_\_\_ C_2H_4$$

(1)

(Total 8 marks)

Q14.

A student investigated the temperature change when metal **X** was added to copper sulfate solution.

This is the method used.

1. Add 25 cm^3 of copper sulfate solution to a beaker.
2. Measure the temperature of the copper sulfate solution.
3. Add 1.0 g of metal **X** and stir.
4. Measure the highest temperature reached when metal **X** is added to copper sulfate solution.
5. Repeat steps 1 to 4 with different metals.

Figure 1 shows the apparatus used.

Figure 1

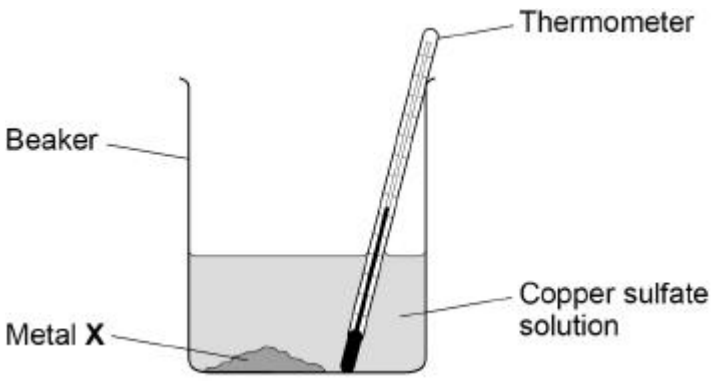
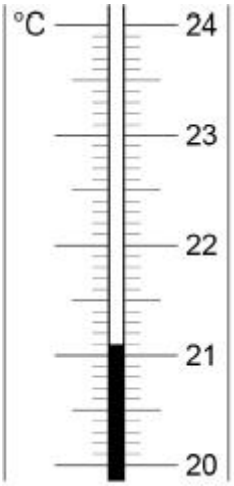


Figure 2 shows the thermometer reading of the copper sulfate solution at the start of the investigation.

Figure 2



(a) The highest temperature reached when metal **X** was added to copper sulfate solution was 35.5 °C

Determine the temperature change when metal **X** is added to copper sulfate solution.

Use **Figure 2**.

Highest temperature = 35.5 °C

Temperature at start = _____ °C

Temperature change = _____ °C

(2)

(b) Give **two** variables the student should keep the same in this investigation.

1. _____

_____

2. _____

_____

(2)

(c) The student repeated the experiment with metal **Y**.

Table 1 shows four results for metal **Y**.

Table 1

	Test 1	**Test 2**	**Test 3**	**Test 4**
Temperature change in °C	9.2	7.3	9.5	9.2

Calculate the mean temperature change for metal **Y**.

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

_____

_____

_____

_____

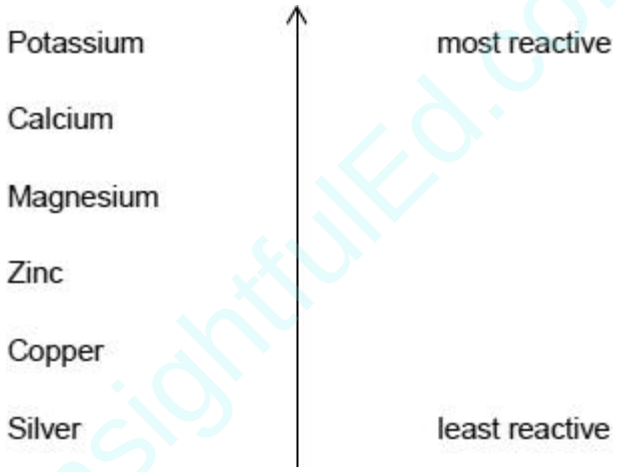
Mean temperature change = _____ °C

(2)

The more reactive the metal added to copper sulfate solution, the greater the temperature change.

Figure 3 shows a reactivity series.

Figure 3



(d) The student repeated the experiment.

The student added:

- magnesium to copper sulfate solution
- an unknown metal **A** to copper sulfate solution.

Table 2 shows the results.

Table 2

Metal	**Temperature change in °C**
Magnesium	12
Metal **A**	8

The student concludes metal **A** is zinc.

Give **one** reason why the student is correct.

Use **Figure 3** and **Table 2**.

_____

_____

(1)

(e) The student did the experiment with silver and copper sulfate solution.

What happens to the temperature of the mixture?

Use **Figure 3**.

Tick (✓) **one** box.

Decreases ☐

Increases ☐

Stays the same ☐

(1)

(f) Suggest **one** reason why the student should **not** add potassium metal to copper sulfate solution.

_____

_____

(1)

(g) 100 cm^3 of the copper sulfate solution contains 1.8 g of copper sulfate.

Calculate the mass of copper sulfate in 25 cm^3 of this copper sulfate solution.

_____

_____

_____

_____

Mass = _____ g

(2)

(Total 11 marks)

Q15.

(c) The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm^3 of salty water.

Calculate the concentration of sodium chloride in grams per dm^3

_____

_____

_____

_____

_____

_____

Concentration of sodium chloride = _____ g/dm^3

(3)

Q16.

Magnesium is in Group 2 of the periodic table.

1.0 g of magnesium reacted with chlorine to produce magnesium chloride.

(b) Write the word equation for the reaction when magnesium reacts with chlorine.

_____ + _____ → _____

(1)

(c) What apparatus was used to measure the mass of 1.0 g of magnesium?

Tick (✓) **one** box.

Balance ☐

Beaker ☐

Ruler ☐

(1)

(d) What mass of magnesium chloride was produced?

Tick (✓) **one** box.

Less than 1.0 g ☐

1.0 g ☐

More than 1.0 g ☐

(1)

(e) Magnesium reacts with oxygen to produce magnesium oxide.

Calculate the percentage mass of magnesium in magnesium oxide (MgO).

Relative atomic mass (A_r): Mg = 24

Relative formula mass (M_r): MgO = 40

_____

_____

_____

Percentage mass of magnesium = _____ %

(2)

Magnesium carbonate decomposes to produce magnesium oxide and carbon dioxide.

The word equation for the reaction is:

magnesium carbonate → magnesium oxide + carbon dioxide

Four students heated 2.00 g of magnesium carbonate for 10 minutes.

The table below shows the results.

Mass of carbon dioxide produced in g				
Student 1	**Student 2**	**Student 3**	**Student 4**	**Mean**
0.97	0.91	0.50	0.95	**X**

(f) What is the most likely reason for **Student 3**'s anomalous result?

Tick (✓) **one** box.

The student heated more than 2.00 g of magnesium carbonate. ☐

The student heated the magnesium carbonate for less than 10 minutes. ☐

The student used a higher temperature. ☐

(1)

(g) Calculate value **X** in the table above.

Do **not** use the anomalous result.

Give your answer to 2 significant figures.

_____

_____

_____

_____

X (2 significant figures) = _____ g

(3)

(Total 10 marks)

Mark schemes

Q1.

(c) 5.85 (g)

1

(d) 17.6 (°C)

1

Q2.

(c) (Mg) $\frac{0.12}{24}$ or 0.005 (moles)

mark is for ÷ by 24

1

(Fe) $\frac{2}{3} \times 0.005 = 0.00333$ (moles)

mark is for $\times \frac{2}{3}$

1

(mass Fe) = 0.00333 × 56

mark is for × 56

1

= 0.1866 (g)

1

= 187 (mg)

1

*an answer of 280 (mg) scores **4** marks*

*an answer of 0.280 scores **3** marks (no ratio from equation)*

*184 scores **0** [= (3 × 24) + (2 × 56)]*

OR

(Mg) $= \frac{0.12}{(3 \times 24 =)72}$ (1)

$= 0.00166$ **or** $\frac{1}{600}$ (moles) (1)

(mass of Fe) = 0.00166

or $\frac{1}{600} \times 112 (2 \times 56)$ (1)

= 0.1866 (g) (1)

187 (mg) (1)

OR

72 g Mg ⟶ 112g Fe (1)

$1\ g\ Mg \rightarrow \frac{112}{72}$ **or** 1.56 g Fe (1)

$0.12\ g\ Mg \rightarrow \frac{112}{72} \times 0.12$ (1)

= 0.1866 (g) (1)

= 187 (mg) (1)

*an answer of 185−190 (mg) scores **5** marks*

*an answer of 0.185−0.19 scores **4** marks*

(d) Fe^{3+}

1

(because) reduction is gain <u>of electrons</u>

allow change in oxidation state / (+)3 to 0

1

$Fe^{3+} + 3e^{(-)} \longrightarrow Fe$

1

[10]

Q3.

(a) **2** Mg + O_2 ⟶ 2 MgO

allow multiples

1

(b) any **one** from:

- wear safety glasses / goggles
- do not look directly at burning magnesium

allow look through blue glass

- wear heat proof glove.

allow use tongs

allow tie hair back

1

(c) (M_r =) 24 + (2 × 19)

1

= 62

1

Q4.

(c) $C_8H_9NO_2$

any order of elements

1

151

1

(d) mass of acetylsalicylic acid = 0.3 g

1

$= \frac{0.3}{100}$ (mol)

method mark – divide mass by M_r

1

= 0.00167 (mol)

allow 0.0016666(66)

1

1.67×10^{-3} (mol)

*correct answer with or without working scores **4** marks*

allow ecf from steps1, 2 and 3

1

[9]

Q5.

(c) amount of $F_2 = \frac{0.95}{38}$ = 0.025 moles

mark is for ÷ 38

1

amount of $SF_6 = \frac{1}{3} \times 0.25$ = 0.008333 moles

mark is for ×1/3

1

mass of SF_6 = 0.008333 × 146

mark is for ×146

1

mass = 1.2166666

1

mass = 1.22 (g) 3 sig figs

1

[13]

Q6.

(a) K_2SO_4

1

(b) (volume of hydrogen) 30 (cm^3)
and

(volume of oxygen) 15 (cm^3)

1

(c) (because) the ratio of volume of hydrogen : oxygen is 2 : 1

1

(and this is the) **same** as the ratio of hydrogen (atoms) : oxygen (atoms) in (formula of) H_2O

1

OR

(because) the ratio of volume of hydrogen : oxygen is **not** 2 : 1 (1)

must *relate to the volumes given in part* ***(b)***

(and this is) **different** to the ratio of hydrogen (atoms) : oxygen (atoms) in (formula of) H_2O (1)

(d) 9 ± 3 cm^3

1

(e) (conversion)

$\frac{25}{1000}$ =) 0.025 (dm^3)

1

(concentration =)

$\frac{0.86}{0.025}$

allow correct use of incorrect / no conversion

1

= 34.4 (g per dm^3)

allow 34 (g per dm^3*)*

1

OR

(conversion)

$\frac{1000}{25}$ (1)

= 40 (1)

(40 × 0.86)
= 34.4 (g per dm^3) (1)

allow correct use of incorrect / no conversion
allow 34 (g per dm^3*)*

OR

(concentration =)

$\frac{0.86}{25}$ (1)

= 0.0344 (1)

(conversion)
(0.0344 × 1000)
= 34.4 (g per dm^3) (1)

allow 34 (g per dm^3)

[8]

Q7.

(c) $\frac{23}{6.02 \times 10^{23}}$

1

3.82×10^{-23}

answer to 3 significant figures

1

(d) 2.27×10^{-14}

1

[9]

Q8.

(b) $4\ Na + TiCl_4 \rightarrow 4\ NaCl + Ti$

allow multiples

*allow **1** mark for NaCl **and** Ti with incorrect / no balancing*

2

(c) $Na \rightarrow Na^+ + e^-$

allow multiples

*allow **1** mark for $Na \rightarrow Na^+ + e^-$ with incorrect balancing*

2

ignore state symbols

(d) **method 1:**

(moles of Al = $\frac{108}{27}$ =) 4

1

(moles $CuCl_2$ = $\frac{1210}{134.5}$ =)
8.996

allow 9

1

(identifying limiting reagent)
4 moles Al gives 6 moles Cu
8.996 moles $CuCl_2$ gives
8.996 moles Cu

allow correct use of an incorrectly calculated value(s) for moles of Al and / or $CuCl_2$

1

therefore aluminium is the limiting reagent

must follow on from MP3

1

(mass of Cu = 2 × 3 × 63.5)
= 6 × 63.5

1

= 381 (g)

1

method 2:

$2\ Al + 3\ CuCl_2 \rightarrow 3\ Cu + 2\ AlCl_3$

(2 × 27) (3 × 134.5) (3 × 63.5)

54 (g) 403.5 (g) 190.5 (g)
(1) (1) (1)

(so)
108 g Al (reacts with 807 g $CuCl_2$) to produce 381 g Cu (1)

allow correct use of an incorrect calculation of mass for Al / $CuCl_2$ / Cu

(so) there is excess $CuCl_2$

or

807 g $CuCl_2$ is less than 1210 g $CuCl_2$(1)

therefore aluminium is limiting reactant (1)

must follow on from MP4 / MP5

method 3:

134.5 g $CuCl_2$ produces 63.5 g Cu (1)

(mass conversion 1.21 kg $CuCl_2$ =) 1210 (g) (1)

1210 g $CuCl_2$ produces ($\frac{63.5}{134.5}$ × 1210 =) 571 g Cu (1)

allow correct use of an incorrect / no conversion of mass of $CuCl_2$

54 g Al produces 190.5 g Cu (1)

108 g Al produces ($\frac{190.5}{54}$ × 108 =) 381 (g) (1)
(therefore) aluminium is the limiting reactant (1)

must follow on from MP3 and MP5

Q9.

(a) dependent

1

(b) not all water had been removed from the sample

allow description of process

1

heat to constant mass

1

alternative approach:

mass included (droplets of) water on the bottom of the evaporating basin (1)

allow bottom of evaporating basin was wet
ignore spillages
ignore weighing errors

dry the bottom of the evaporating basin (1)

allow wipe off droplets

(c)

$$\frac{0.22 + 0.23 + 0.20 + \mathbf{X}}{4} = 0.21$$

1

(**X** =) 0.19 (g)

1

(d) **C**

*allow ecf from question **(c)***

1

biggest difference between the maximum and minimum values

*allow calculated range if all ranges are shown **A** 0.04; **B** 0.06; **C** 0.15 and **D** 0.12*

1

(e) (conversion m^3 to cm^3) 1 m^3 = 1 x 10^6 cm^3

1

(mass =) $1 \times 10^6 \times \frac{0.016}{25}$

allow correct use of an incorrect / no conversion value

1

= 640 (g)

1

= 6.4×10^2 (g)

allow a correctly calculated answer in standard form from an incorrect calculation of mass

1

[11]

Q10.

(a) 2 Na + Cl2 ⟶ 2 NaCl

allow multiples

1

(b) 7.1 (g)

1

Q11.

(a) balance

1

(b) mass was greater / more than expected

1

(c) dry the bottom of the evaporating basin

or

use an electric heater

1

(d) heat until the mass of the evaporating basin and contents is constant.

1

(e) evaporation

ignore boiling

1

(f) **C**

1

(g) $\frac{0.23 + 0.23 + 0.20}{3}$ **or** $\frac{0.66}{3}$

1

= 0.22 (g)

1

(h) mass of dissolved solids

1

(i) $\frac{25}{150} \times 3.6$ **or** $\frac{1}{6} \times 3.6$

1

= 0.6 (g)

1

[11]

Q12.

(f) $\frac{40.0}{500} \times 6.50$

1

= 0.52 (g)

1

Q13.

(d) $\frac{24 \times 100}{30}$

1

(g) $C_6H_{14} \rightarrow C_2H_6 + \mathbf{2}\ C_2H_4$

allow multiples or halves

1

Q14.

(a) 21.1 (°C)

1

14.4 (°C)

allow correct use of an incorrect start temperature

1

(b) any **two** from:

- surface area of metal
- 25 cm^3 / volume of copper sulfate solution
- concentration of copper sulfate solution
- mass / 1 g of metal

ignore amount
ignore temperature
ignore stirring

2

(c) $\frac{9.2 + 9.5 + 9.2}{3}$ or $\frac{27.9}{3}$

1

= 9.3 (°C)

*if no other mark awarded allow **1** mark for 8.8 (°C)*

1

(d) (metal **A** / zinc) is less reactive (than magnesium)
or
(metal **A** / zinc) is lower in reactivity series
or
change in temperature is lower (with metal **A** / zinc)

allow converse

1

(e) stays the same

1

(f) too dangerous
or
too reactive

allow potassium would react with water

1

(g) $\frac{25}{100} \times 1.8$ **or** $\frac{1}{4} \times 1.8$

1

= 0.45 (g)

1

[11]

Q15.

(c) (conversion)
$\frac{150}{1000}$ =) or 0.15 (dm^3)

1

(concentration =)
$\frac{2.4\ (0)}{0.15}$

allow correct use of incorrect / no conversion

1

= 16 (g/dm^3)

1

OR

(conversion)
$\frac{1000}{150}$ (1)

= 6.67 (1)

(6.67 × 2.4)
= 16 (g/dm^3) (1)

OR

(concentration =)
$\frac{2.4}{150}$ (1)

= 0.016 (1)

(conversion)
(0.016 × 1000)
= 16 (g/dm^3) (1)

[10]

Q16.

(b) magnesium + chlorine → magnesium chloride

allow Mg for magnesium
allow Cl_2 for chlorine
allow $MgCl_2$ for magnesium chloride

1

(c) balance

1

(d) more than 1.0 g

1

(e) $(\% =) \frac{24}{40} \times 100$

1

= 60 (%)

1

(f) the student heated the magnesium carbonate for less than ten minutes

1

(g) $\frac{0.97 + 0.91 + 0.95}{3}$ **or** $\frac{2.83}{3}$

1

= 0.943333 (g)

*allow for **1** mark*
$\frac{0.97 + 0.91 + 0.50 + 0.95}{4}$ **or** $\frac{3.33}{4}$
= 0.8325 (g)

1

= 0.94 (g)

allow an answer correctly rounded to 2 significant figures using values from the table

1

[10]