Q1.

(a) a metal and a non-metal

1

(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]

Q2.

(a) (Group) 0
or
noble gases

1

(b) B

1

(c) A

1

(d) (atoms with the) same number of protons

allow atoms with the same atomic number

allow atoms of the same element

ignore the same number of electrons

1

(but with) different numbers of neutrons

ignore (but with) different mass numbers

*do **not** accept (but with) different relative atomic mass*

1

(e) $\frac{(39 \times 93.1) + (41 \times 6.9)}{100}$

1

= 39.138

1

= 39.1

*allow correctly rounded answer to **1** decimal place from an incorrect calculation using all the values given in the question*

1

[8]

Q3.

(a) (mass of oxygen = 0.20 – 0.12) = 0.08 (g)

1

(moles of oxygen) = $\frac{0.08}{32}$

1

= 0.0025

*allow **1** mark for 0.005*

if derived from $\frac{0.08}{16}$

1

(b) (without a lid the) mass of magnesium oxide was less

1

(because) products escaped allow magnesium oxide escaped

1

(c) (mass of copper oxide =)

$\frac{79.5}{63.5} \times 0.5$

1

= 0.62598 (g)

1

= 0.626 (g)

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses all the values in the question

1

(d) 3:2 ratio Fe : O_2 (molecules)
or
3:4 ratio Fe : O (atoms)

1

(formula) Fe_3O_4

*allow **1** mark for Fe_3O_2 from 3:2 ratio Fe : O (atoms) (MP2 but not MP1)*

1

3 Fe + 2 O_2 □ Fe_3O_4

allow multiples

allow correct use of incorrectly determined formula

*allow **1** mark for Fe, O_2 and Fe_3O_4*

or

*allow **1** mark for Fe, O_2 and incorrectly determined formula*

2

[12]

Q4.

(a) atoms have a positively charged nucleus.

1

mass is concentrated in the nucleus in the centre of atoms.

1

(b)

$$\frac{4 \times 10^{-7}}{2400}$$

1

$= 1.66666 \times 10^{-10}$

1

$= 1.67 \times 10^{-10}$ (m)

allow 0.000 000 000 167 (m)

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question

1

(c) (moles Au = $\frac{0.175}{197}$ =) 0.000888

1

(moles Cl_2 = 0.000888 × $\frac{3}{2}$ =) 0.00133

allow a correct calculation using an incorrectly

calculated value of moles of gold

1

(mass Cl_2 =) 0.00133 × 71

allow a correct calculation using an incorrectly calculated value of moles of chlorine

1

= 0.0946 (g)

1

= 94.6 (mg)

allow a correct conversion using an incorrectly calculated mass of chlorine

1

alternative approach:

(from equation 2 moles of Au reacts with 3 moles of Cl_2)
(so) 394 g Au reacts with 213 g Cl_2 (1)

1 g Au reacts with ($\frac{213}{394}$ =)
0.54 g Cl_2 (1)

allow a correct calculation using an incorrectly calculated value of mass of gold and / or chlorine

0.175 g Au reacts with
0.54 × 0.175 g Cl_2 (1)

allow a correct calculation using an incorrectly calculated value of mass of gold and / or chlorine

= 0.0946 (g) (1)

= 94.6 (mg) (1)

allow a correct conversion using an incorrectly calculated mass of chlorine

[10]