M1.D

[1]

M2.(a) (i) 1.6734 × 10^{24} (g)

Only.

1.6734 × 10^{27} kg

Not 1.67 × 10^{24} (g).

1

(ii) **B**

1

(b) (i) $\frac{10x + 11y}{x + y}$ = 10.8

OR ratio 10:11 = 1:4 **OR** 20:80 etc

Allow idea that there are 5 × 0.2 divisions between 10 and 11.

1

abundance of ^{10}B is 20(%)

OR

$\frac{10x}{100} + \frac{11(100-x)}{100}$ = 10.8

10x + 1100 − 11x = 1080

∴ x = 1100 − 1080 = 20%

Correct answer scores M1 and M2.

1

(ii) Same number of electrons (in outer shell or orbital)

Ignore electrons determine chemical properties.

Same electronic configuration / arrangement

Ignore protons unless wrong.

1

(c) Range between 3500 and 10 000 kJ mol $^{-1}$

1

(d) $B^{+}(g) \longrightarrow B^{2+}(g) + e^{(-)}$

$B^{+}(g) - e^{(-)} \longrightarrow B^{2+}(g)$

$B^{+}(g) + e^{(-)} \longrightarrow B^{2+}(g) + 2e^{(-)}$

Ignore state symbol on electron even if wrong.

1

(e) Electron being removed from a positive ion (therefore needs more energy) / electron being removed is closer to the nucleus

Must imply removal of an electron.

Allow electron removed from a + particle / species or from a 2+ ion.

Not electron removed from a higher / lower energy level / shell.

Not electron removed from a higher energy sub-level / orbital.

Ignore electron removed from a lower energy sub-level / orbital.

Ignore 'more protons than electrons'.

Not 'greater nuclear charge'.

Ignore 'greater effective nuclear charge'.

Ignore shielding.

1

[8]

M3. (a)

Particle	Relative Charge	Relative mass
Proton	+1	1
Neutron	0	1

1

1

Need +1 for proton

(b) d block/ D block;

Or D or d

1

(c) (i) 74;

Not 74.0

1

(ii) 112;

Not 112.0

1

(d) (i) To accelerate/ make go faster;

1

To deflect/ to bend the beam;

Any order
Not just attract to negative plate

1

(ii) Electromagnet / magnet / electric field /accelerating potential or voltage;

Not electric current
Not electronic field

1

(e) None/ nothing;

If blank mark on.
If incorrect CE = 0

1

Same number of electrons (in outer orbital/shell)/ both have 74 electrons/same electron configuration;

Not just electrons determine chemical properties
Ignore protons and neutrons unless wrong statement.

1

(f) $\frac{(182 \times 26.4) + (183 \times 14.3) + (184 \times 30.7) + (186 \times 28.6)}{100}$;

If transcription error then
M1 = AE = –1 and mark
M2 consequentially

1

= 183.90; allow range from 183.90 – 184.00;

1

[12]

M4. (a) Number of protons in the nucleus

1

(b) They may have different numbers of neutrons

1

(c) (i) Mass spectrometer

1

(ii) $\frac{\text{Mean mass of an atom}}{\text{Mass of 1 atom of } {}^{12}\text{C}} \times 12$

2

(iii) $A_r = \frac{\text{sum of relative m/z} \times \text{rel. abundance}}{\text{Total abundance}}$

1

= (82 × 12 + 83 × 12 + 84 × 50 + 86 × 26)/100 = 84.16

1

(d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^0\ 4p^6$

1

(e) Krypton was thought to be an inert gas
(or has 8 electrons in outer shell)

1

(f) (i) Krypton has more protons than bromine

1

But its outer electrons are in the same shell
(or have similar shielding)

1

(ii) Al electron is in a 3p orbital, magnesium in 3s

1

Energy of 3p is greater than 3s

1

[13]

M5. *(penalty for sig fig error =1 mark per question)*

(a) neutron: relative mass = 1 relative charge = 0
(not 'neutral')

1

electron: relative mass = 1/1800 → 0/negligible *or*

5.56 × 10–4 → 0 relative charge = –1

1

(b) $^{7}O/O^{7}$ mass number (*Do not accept 17.0*)

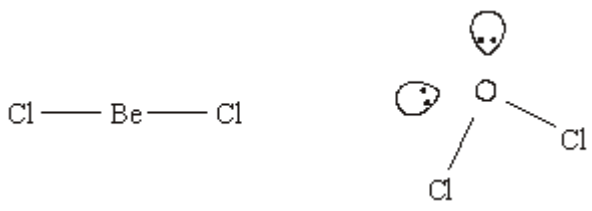
1

oxygen symbol 'O'

(if 'oxygen' + — 'mass number = 17'(1))
(if 'oxygen'+ — 'mass number = 17'(0))
(if at N^{0} given but ≠ 8, treat as 'con' for M2)
(if lp on Be, diagram = 0)
(ignore bond angles)
(not dot and cross diagrams)

1

(c)



2

QoL Linear **(1)** bent / V-shaped / angular **(1)**

(mark name and shape independently)
(accept (distorted) tetrahedral)
(if balls instead of symbols, lose M1 – can award M2)
(penalise missing 'Cl' once only)
(not 'non-linear')

2

(d) M_r ($Mg(NO_3)_2$ = 58(.3) *(if At N⁰ used, lose M1 and M2)*

1

moles $Mg(OH)_2$ = 0.0172 (conseq on wrong M2) (answer to 3+ s.f.)

1

moles HCl = 2 × 0.0172 = 0.0344 *or* 0.0343 (mol) *(process mark)*

1

vol HCl = $\frac{0.0343 \times 1000}{1}$ = 34.3 – 34.5 (cm^3) *(unless wrong unit)*

*(if candidate **used** 0.017 or 0.0171 lose M2)*
(just answer with no working, if in range = (4). if, say, 34 then =(2))
(if not 2:1 ratio, lose M3 and M4)
(if work on HCl, CE = 0/4)

1

[12]