

M1.D

[1]

M2.(a) (i) 1.6734×10^{24} (g)

Only.

$$1.6734 \times 10^{27} \text{ kg}$$

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

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

$$10x + 1100 - 11x = 1080$$

$$\therefore x = 1100 - 1080 = 20\%$$

Correct answer scores M1 and M2.

1

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

Ignore electrons determine chemical properties.

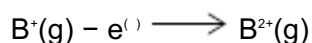
Same electronic configuration / arrangement

Ignore protons unless wrong.

1

(c) Range between 3500 and 10 000 kJ mol⁻¹

1



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)
$$\frac{(182 \times 26.4) + (183 \times 14.3) + (184 \times 30.7) + (186 \times 28.6)}{100}$$
; 1

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 = $1/1800 \rightarrow 0$ /negligible or
 $5.56 \times 10^{-4} \rightarrow 0$ relative charge = -1

1

(b) $^{17}\text{O}/\text{O}^{17}$ 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° given but $\neq 8$, treat as 'con' for M2)

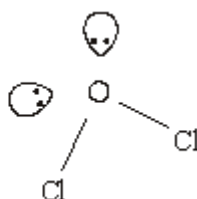
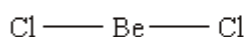
(if lp on Be, diagram = 0)

(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) $M_r(\text{Mg}(\text{NO}_3)_2) = 58(.3)$ (if At N° used, lose M1 and M2)

1

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

1

moles HCl = $2 \times 0.0172 = 0.0344$ or 0.0343 (mol) (process mark)

1

vol HCl = $\frac{0.0343 \times 1000}{1} = 34.3 - 34.5$ (cm³) (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]