

M1. (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)

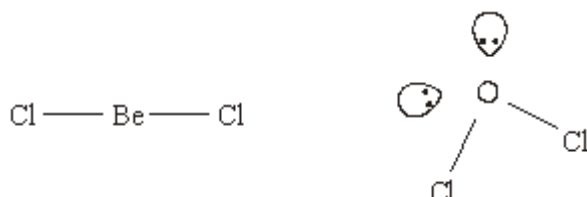
(if lp on Be, diagram = 0)

(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]

M2.B

[1]

M3. (a) (i) Atoms with the same number of protons / proton number **(1)**
NOT same atomic number

with different numbers of neutrons **(1)**

NOT different mass number / fewer neutrons

(ii) Chemical properties depend on the number or amount of
(outer) electrons **(1)** OR, isotopes have the same electron
configuration / same number of e⁻

(iii) $23/6.023 \times 10^{23}$ **(1)**

CE = 0 if inverted or multiplied

tied to M1 $3.8(2) \times 10^{-23}$ [2-5 sig figs] **(1)**

5

(b) $1s^2 2s^2 2p^6 3s^1$ **(1)**

accept subscripted figures

1

(c) Highest energy e⁻ / outer e⁻s / last e⁻ in (3)d sub-shell **(1)**

OR d sub-shell being filled / is incomplete
OR highest energy sub-shell is (3)d
NOT transition element / e⁻ configuration ends at 3d
Q of L

1

- (d) ${}^{15}_7\text{N}$ N correct symbol (1)
allow N^{15}_7

Mass number = 15 AND atomic number = 7 (1)

2

[9]

M4.D

[1]

- M5.** (a) Proton: mass 1, charge + 1 (1)
Neutron: mass 1, charge 0 (1)
Electron mass 1/1840, charge -1 (1)
Allow mass = 0, or negligible, or 1/1800 to 1/2000

Isotopes have the same number of protons (1)
OR atomic number

different number of neutrons (1)

Isotopes have the same electronic configuration (1)
OR same number of electrons

Chemical properties depend on electrons (1)

7

- (b) $\frac{\text{average(1) mass of an atom/isotopes}}{\text{mass of 1 atom of } {}^{12}\text{C}} \times 12$ (1)

$\frac{\text{mass of 1 mol of atoms}}{\text{mass of 1 atom of } ^{12}\text{C}} \times 12$ or in words

Spectrum gives (relative) abundance **(1)**
OR % or amount

And m/z **(1)**

Multiply m/z by relative abundance for each isotope **(1)**

Allow instead of m/z mass no, A , or actual value from example

Sum these values **(1)**

Divide by the sum of the relative abundances **(1)**

only award this mark if previous 2 given

Max 2 if e.g. has only 2 isotopes

7

[14]