M1.(a) (i) The power of an atom or nucleus to withdraw or attract electrons ***OR*** electron density ***OR*** a pair of electrons (towards itself)

Ignore retain

1

In a covalent bond

1

(ii) More protons / bigger nuclear charge

1

Same or similar shielding / electrons in the same shell or principal energy level / atoms get smaller

Not same sub–shell
Ignore more electrons

1

(b) Ionic

If not ionic then CE = 0 / 3
If blank lose M1 and mark on

1

Strong or many or lots of (electrostatic) attractions (between ions)

If molecules / IMF / metallic / atoms lose M2 + M3, penalise incorrect ions by 1 mark

1

Between + and − ions / between Li^+ and F^- ions / oppositely charged ions

Allow strong (ionic) bonds for max 1 out of M2 and M3

1

(c) Small electronegativity difference / difference = 0.5

Must be comparative

Allow 2 non-metals

1

(d) (i) (simple) <u>molecular</u>

Ignore simple covalent

1

(ii) $OF_2 + H_2O \longrightarrow O_2 + 2HF$

Ignore state symbols
Allow multiples
Allow OF_2 written as F_2O

1

(iii) 45.7% O

1

$$\left(\begin{array}{cc} O & F \\ \frac{45.7}{16} & \frac{54.3}{19} \end{array}\right)$$

If students get M2 upside down lose M2 + M3
Check that students who get correct answer divide by 16 and 19 (not 8 and 9). If dividing by 8 and 9 lose M2 and M3 but could allocate M4 ie max 2

1

(2.85 2.85)
(1 1)

EF = <u>OF or FO</u>

Calculation of OF by other correct method = 3 marks
Penalise Fl by 1 mark

1

MF (= 70.0 / 35) = O_2F_2 or F_2O_2

1

[14]

M2. (a) (i) Macromolecular / giant covalent / giant molecular / giant atomic

If covalent, molecular, giant, lattice, hexagonal or blank mark *on.*

If metallic, ionic or IMF chemical error CE = 0 for (a)(i), (a)(ii) and (a)(iii).

1

(ii) Delocalised electrons / free electrons

1

Able to move / flow (through the crystal)

Allow M2 for electrons can move / flow.

Ignore electrons can carry a current / charge.

1

(iii) Covalent bonds

1

Many /strong / hard to break / need a lot of energy to break

M2 dependent on M1.

Ignore van der Waals' forces.

1

(b) (i) (Giant) metallic / metal (lattice)

If FCC or BCC or HCP or giant or lattice, mark on.

If incorrect (b)(i), chemical error CE for (b)(ii) and (c)(ii).

1

(ii) Nucleus / protons / positive ions and delocalised electrons (are attracted)

QWC Must be delocalised electrons – not just electrons.

Chemical error = 0/2 for (b)(ii) if other types of bonding or IMF mentioned.

1

Strong attraction

Allow strong metallic bonding for one mark if M1 and M2 are not awarded.

1

(c) (i) Layers of atoms/ions slide (over one another)

Do not allow just layers.

1

(ii) (Strong) (metallic) bonding re-formed / same (metallic) bonding / retains same (crystal) structure / same bond strength / same attraction between protons and delocalised electrons as before being hammered or words to that effect

If IMF, molecules, chemical error CE = 0/1 for (c)(ii).

If metallic not mentioned in (b)(i) or (b)(ii) it must be mentioned here in (c)(ii) to gain this mark.

Do not allow metallic bonds broken alone.

Ignore same shape or same strength.

1

(d) (giant) Ionic

If not ionic, chemical error CE = 0/3

1

Between + and – ions / oppositely charged ions or Mg^{2+} and O^{2-}

If molecules mentioned in explanation lose M2 and M3

Allow one mark for a strong attraction between incorrect charges on the ions.

1

Strong attraction

1

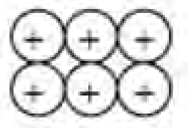
[13]

M3. (a) (i) Metallic

Allow body centred cubic

1

(ii)

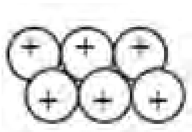


One mark for regular arrangement of particles. Can have a space between them

Do not allow hexagonal arrangement

1

OR



Na^+ Na^+ Na^+

Na^+ Na^+ Na^+

One mark for + in each

Ignore electrons

If it looks like ionic bonding then CE = 0/2

1

(b) (i) Ionic

CE = 0 for (b)(i) and (b)(ii) if not ionic

1

(ii) Strong (electrostatic) attraction

Any mention of IMF or molecules / metallic / covalent in (b)(ii) then CE 0/2

1

Between oppositely charged ions / particles

Or + and – ions

1

(c) Iodide / I^- bigger (ion) (so less attraction to the Na+ ion)

Need comparison

Do not allow iodine is a bigger atom

Ignore I^- has one more e^- shell

CE = 0 if IMF / covalent / metallic mentioned

1

[7]

M4.(a) Covalent

If not covalent CE = 0/2
If dative covalent CE = 0/2
If blank mark on
Ignore polar
If number of pairs of electrons specified, must be 3

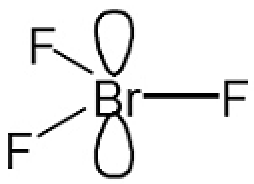
1

Shared <u>pair</u>(s) of electrons / one electron from Br and one electron from F

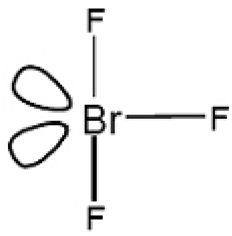
Not 2 electrons from 1 atom
Not shared pair between ions/molecules

1

(b) (i)



or



BrF_3 should have 3 bp and 2 lp and correct atoms for the mark
Penalise Fl

1

BrF_3 if trigonal planar shown = 120°

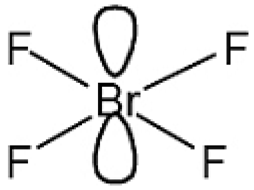
Allow 84 – 90° or 120° and ignore 180°

or if T shape shown 84 – 90°

Irrespective of shape drawn

1

(ii)



BrF_4^- should have 4 bp and 2 lp and all atoms for the mark(ignore sign)

Allow Fl

1

BrF_4^- 90°

Only

Ignore 180°

1

(c) Ionic or (forces of) attraction between ions / bonds between ions

If molecules, IMF, metallic, CE =0

If covalent bonds mentioned, 0/3, unless specified within the BrF_4^- ion and not broken

Ignore atoms

1

Strong (electrostatic) attraction / strong bonds / lots of energy needed to break bonds

1

Between K^+ and BrF_4^- ions/oppositely charged ions / + and – ions

If ions mentioned they must be correct

Strong bonds between + and – ions =3/3

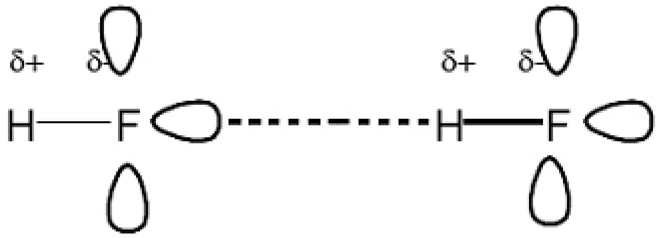
1

(d) (i) Hydrogen bonds/hydrogen bonding/H bonds/H bonding

Not just hydrogen

1

(ii)



One mark for 4 partial charges

One mark for 6 lone pairs

One mark for H bond from the <u>lone pair to the Hδ+</u>

Allow Fl

If more than 2 molecules are shown they must all be correct.Treat any errors as contradictions within each marking point.

CE = 0/3 if incorrect molecules shown.

3

(e) vdw / van der Waals forces between molecules

QoL

Not vdw between HF molecules, CE = 0/2

vdw between atoms, CE = 0/2

If covalent, ionic, metallic, CE=0/2

1

IMF are weak / need little energy to break IMF / easy to overcome IMF

1

[15]

M5.(a) Lithium / Li

Penalise obvious capital I (second letter).

1

(b) (i) Increase / gets bigger

Ignore exceptions to trend here even if wrong

1

(ii) Boron / B

If not Boron, CE = 0/3

1

Electron removed from (2)p orbital /sub-shell / (2)p electrons removed

If p orbital specified it must be 2p

1

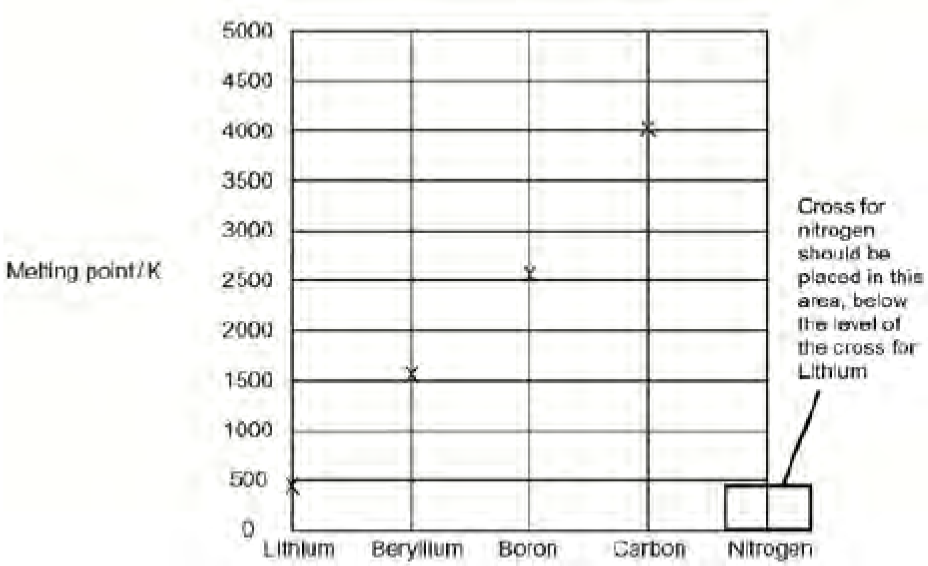
Which is higher in energy (so more easily lost) / more shielded (so more easily lost) / further from nucleus

1

(c) C / carbon

1

(d) Below Li



The cross should be placed on the diagram, on the column for nitrogen, below the level of the cross printed on the diagram for Lithium.

1

(e) Macromolecular / giant molecular / giant atomic

Allow giant covalent (molecule) = 2

1

Covalent bonds in the structure

1

Strong (covalent) bonds must be broken or overcome / (covalent) bonds need a lot of energy to break

Ignore weakening / loosening bonds

If ionic / metallic/molecular/ dipole dipole/ H bonds/ bonds between molecules, CE = 0/3

Ignore van der Waals forces

Ignore hard to break

1

[10]