M1. (a) Iodine – molecular

Not covalent lattice

1

Graphite – macromolecular/giant covalent/giant atomic

1

(b) Layers of (C atoms)

1

Connected by covalent bonds within each layer

1

Van der Waals forces/IMF between layers/weak forces between layers

1

Many/strong covalent bonds need to be broken

If any other element mentioned other than C, CE = 0

Ignore the no of covalent bonds around the C if mentioned
The first 3 marks could be scored with a labelled diagram.
Need to label or state covalent bonds within the layers.
Covalent or ionic or metallic bonds between molecules CE = 0

1

(c) Van der Waals forces are weak or easily broken

Not vdw between atoms

1

Van der Waals between molecules (or implied)

Allow weak IMF = 2

1

(d) Does not have delocalised/free electrons

Only allow answer with respect to iodine
Not all electrons used in bonding
Ignore free ions

1

[9]

M2. (a) Hydrogen/H bonds

Not just hydrogen

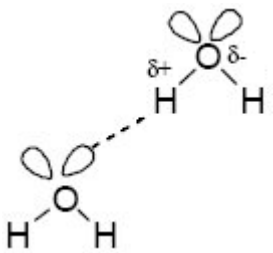
1

van der Waals/vdw/dipole-dipole/London/temporarily induced dipole/dispersion forces

Not just dipole

1

(b)



M1 for partial charges as indicated in diagram (correct minimum)
M2 for all four lone pairs
M3 for H bond from the lp to the H (δ+) on the other molecule
Lone pair on hydrogen CE = 0
OHO CE = 0
If only one molecule of water shown
CE = 0

3

(c) Hydrogen bonds/IMF (in water) stronger

OR

IMF/VDW/dipole-dipole forces (in H_2S) are weaker

OR

H bonding is the strongest IMF

Ignore energy references
Comparison must be stated or implied

1

(d) Atoms/molecules get larger/more shells/more electrons/more

surface area

Not heavier/greater Mr

1

therefore increased Van der Waals/IMF forces

Ignore references to dipole-dipole forces

1

(e) Dative (covalent)/coordinate

If not dative/coordinate CE = 0/2
If covalent or blank read on

1

(Lone) pair/both electrons/two electrons on O(H_2) donated (to H^+)
OR pair/both electrons come from O(H_2)

Explanation of a coordinate bond specific to oxygen or water required
Not just H+ attracted to lone pair since that is nearer to a H bond

1

(f) ionic

1

if not ionic CE = 0

oppositely charged ions/+ and – ions or particles

atoms or molecules loses M2 and M3

1

ions attract strongly OR strong/many (ionic) bonds must be broken

S^- loses M2
Reference to IMF loses M2 and M3

1

[13]

M3. (a) $2s^2\ 2p^6$;

If ignored the $1s^2$ given and written $1s^2 2s^2 2p^6$ mark as correct
Allow capitals and subscripts

1

(b) (i) $Na^{+}(g) \rightarrow Na^{2+}(g) + e^{(-)}$;

One mark for equation and one mark for state symbols

$Na^{+}(g) + e^{(-)} \rightarrow Na^{2+}(g) + 2e^{(-)}$;

M2 dependent on M1
Allow $Na^{+}(g) - e^{(-)} \rightarrow Na(g)$
Allow $X^{+}(g) \rightarrow X^{2+}(g) + e$ = 1 mark

2

(ii) $Na^{(2+)}$ requires loss of e^{-} from a 2(p) orbital or 2nd energy level or 2nd shell and $Mg^{(2+)}$ requires loss of e^{-} from a 3(s) orbital or 3rd energy level or 3rd shell / $Na^{(2+)}$ loses e from a lower (energy) orbital/ or vice versa;

Not from 3p

1

Less shielding (in Na);

Or vice versa for Mg

1

$e^{(-)}$ closer to nucleus/ more attraction (of electron to nucleus) (in Na);

M3 needs to be comparative

1

(iii) Aluminium /Al;

1

(c) Decreases;

If not decreases CE = 0
If blank, mark on

1

Increasing nuclear charge/ increasing number of protons;

1

Electrons in same shell or level/ same shielding/ similar shielding;

1

(d) Answer refers to Na;

Allow converse answers relating to Mg.

Na fewer protons/smaller nuclear charge/ fewer delocalised electrons;

Allow Mg is 2+ and Na is +.
If vdw CE = 0.

1

Na is a bigger ion/ atom;

1

Smaller attraction between nucleus and delocalised electrons;

If mentioned that charge density of Mg^{2+} is greater then allow first 2 marks.
(ie charge / size / attraction).
M3 allow weaker metallic bonding.

1

(e) (Bent) shape showing 2 lone pairs + 2N−H bond pairs;

Atoms must be labelled.
Lone pairs can be with or without lobes.

1

Bent / v shape/ triangular;

Not tetrahedral.
Allow non-linear.
Bent-linear = contradiction.

1

(f) Ne has full sub-levels/ can't get any more electrons in the sub-levels/ Ne has full shells;

Not $2s^2\ 2p^6$ alone.
Not stable electron configuration.

1

[16]