

- 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]

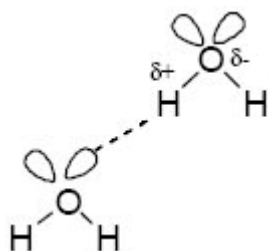
M2. (a) Hydrogen/H bonds
Not just hydrogen

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(H₂) donated (to H⁺)

OR pair/both electrons come from O(H₂)

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

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M3. (a) 2s² 2p⁶;

*If ignored the 1s² given and written 1s²2s²2p⁶ mark as correct
Allow capitals and subscripts*

1

- (b) (i) $\text{Na}^+(\text{g}) \rightarrow \text{Na}^{2+}(\text{g}) + \text{e}^{-}$;
One mark for equation and one mark for state symbols
- $\text{Na}^+(\text{g}) + \text{e}^{-} \rightarrow \text{Na}^{2+}(\text{g}) + 2\text{e}^{-}$;
M2 dependent on M1
Allow $\text{Na}^+(\text{g}) - \text{e}^{-} \rightarrow \text{Na}(\text{g})$
Allow $\text{X}^+(\text{g}) \rightarrow \text{X}^{2+}(\text{g}) + \text{e} = 1$ mark
- 2
- (ii) $\text{Na}^{(2+)}$ requires loss of e^{-} from a 2(p) orbital or 2nd energy level or 2nd shell and $\text{Mg}^{(2+)}$ requires loss of e^{-} from a 3(s) orbital or 3rd energy level or 3rd shell / $\text{Na}^{(2+)}$ 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]