1. **QoL** Bonding Both covalent
(linked statement)

1

Structure Iodine = molecular /I_2 *(stated or in diagram)*
[treat incorrect diagram as contradiction]

1

Diamond = giant molecular/macromolecular/giant covalent / giant atomic (stated only)
Reference to van der Waals' /dipole-dipole = contradiction

1

QoL Iodine Weak van der Waals' forces / induced dipole-induced dipole

1

Diamond Covalent bonds would need to be broken

1

Many / strong covalent bonds **OR** much energy needed
Tied to M5 *or near miss*
[If ionic/metallic structure suggested then CE for that substance]
[If hydrogen bonding suggested, for I_2 lose M2 & M4; for diamond lose M3,M5&M6]

1

[6]

2. (a) Ability/power of an atom/element/nucleus to withdraw electron density or electron cloud or a pair of electrons (towards itself);
Not withdraw an electron
If ref to ionic, metallic , imf etc then CE = 0

1

From a covalent bond or from a shared pair of electrons;
Not distort
Not remove electrons

1

(b) Van der Waals/ vdw/London/ temporary (induced) dipole/ dispersion forces;

1

Hydrogen bonds/H bonds;
Not just hydrogen

1

(c) (Large) electronegativity difference between N + H/ difference of 0.9/ N very electronegative;

Insufficient to say N= 3.1 and H = 2.1

1

Forms N δ– / H δ+ or dipole explained in words;

Not N becomes (fully) negative or vice versa

1

Lone pair on N attracts/forms weak bonds with H (δ+);

QWC
Can score M2 and 3 from a diagram

1

(d) Co-ordinate/dative;

If not correct then CE = 0. If covalent/blank mark on.

1

Both electrons/ lone pair (on P/PH_3)

Not lone pair on hydrogen

1

Shares/donated from P(H_3)/ to H(δ+);

1

(e) 3 bonds and 1 lp attached to As;

Must label H and As atoms
Accept distorted tetrahedral not bent tetrahedral

1

Pyramidal/tetrahedral/ trigonal pyramidal;

Not bipyramidal/triangular

1

(f) (Only) weak Van der Waals forces between molecules /AsH_3 has weaker IMF /ammonia has hydrogen bonding/ more energy needed to break IMF's in ammonia/ Van der Waals weaker than H bonds;

Accept has no H bonds.
Ignore dp-dp in AsH_3 provided ammonia has stronger IMF.
If between atoms mentioned CE=0
Break bonds CE = 0

1

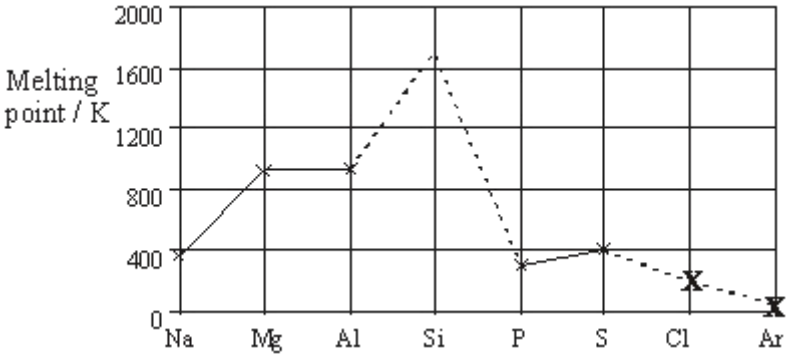
(g) $4AsCl_3 + 3NaBH_4 \rightarrow 4AsH_3 + 3NaCl + 3BCl_3$;

Accept multiples

1

[14]

3. (a) (i)



M1 Si: cross ≥ 1200

1

M2 Cl: cross below S

1

M3 Ar: cross below Cl

[allow, even if M2 wrong)

[If Cl cross missing and Ar below S, allow M3]

1

(ii) Si is macromolecular/giant molecular/giant covalent/ giant atomic

1

Covalent bonds need to be broken/accept 'overcome'

[Not loosened/weakened]

1

Covalent bonds are strong / many covalent bonds involved/ requires much energy/hard to break

[Tied to 'break' or near miss in M2] [Not 'structure' is broken]

[Must mention 'covalent' somewhere in part (a)(ii) to earn M2/M3]

[If van der Waals'/IMF mentioned M2/M3 = CE = 0.

[If ions mentioned M1/M2/M3 = CE = 0]

1

(iii) Intermolecular force = van der Waals'/induced dipole–dipole/dispersion forces

1

QoL Sulphur has greater M_r / size / surface area/more electrons/more atoms **so** stronger intermolecular forces (comparison)

[Mark separately] [Not 'more shells']

1

(b) Trend: Decreases

[If trend wrong = CE = 0]

1

Increase in size of ion/atom / more shells / decrease in charge density / decrease in charge size ratio

1

Weaker attraction for delocalised/free/sea of electrons / weaker metallic bonding

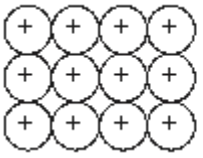
[Ignore shielding]

[van der Waals' etc. = CE = 0 for M2 and M3]

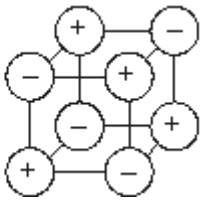
1

[11]

4. (a)



(1)



(1)

[Diagrams must be complete and accurate]

2

(b) (i) Attraction /electrostatic forces/bonds/attractions between (positive) ions/lattice and delocalised/free electrons/sea of electrons.

[Not metallic bonding]

[Not just 'forces']

1

(ii) Electrostatic attractions/forces between ions or attractions between (oppositely charged) ions/ Na^+ & Cl^-

[Not ionic bonding]

1

(iii) (Here) the ionic bonding in NaCl is stronger/requires more energy to break than the metallic bonding in Na

QoL Accept 'bonding/forces of attraction in NaCl is stronger than in Na'

[If IMF/molecules/van der Waals'/dipole–dipole mentioned in parts(i) or (ii), then CE = 0 for parts (i) and/or(ii) and CE = 0 for part(iii)]

1

(c) Comparison:
Sodium conducts **and** sodium chloride does NOT conduct

Allow 'only Na conducts'

Accept 'Na conducts, NaCl only conducts when molten'

[Do not accept sodium conducts better than sodium chloride etc.]

1

Explanation:
(Delocalised) electrons flow though the metal

1

Allow e^- move/carry current/are charge carriers/transfer charge.

[Not 'electrons carry electricity']

[Not 'NaCl has no free charged particles']

Ions can't move in solid salt

1

(d) Layers can slide over each other – idea that ions/atoms/particles move

[Not molecules]

[Not layers separate]

1

[12]

5. (a) Oxygen more/very/highly electronegative (than hydrogen) *OR* oxygen has stronger attraction for bonding electrons / bonding electrons drawn towards oxygen;

1

causes higher e^- density round oxygen atom / causes $H^{\delta+}$ $O^{\delta-}$;

1

(b) van der Waals' forces between oxygen molecules;

1

Hydrogen bonding between methanol molecules;

1

H-B stronger than van der Waals' *OR* stronger IMF in methanol;

(if dipole-dipole forces in O_2 or methanol, allow comparison, hence max 2)

(if ionic/covalent etc. max 1)

(mention of bond break = CE = 0)

1

[5]

6. B

[1]

7. C

[1]

8. C

[1]

9. A

[1]

10. B

[1]