M1. (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]

M2. (a) Hydrogen bonding *(full name)*

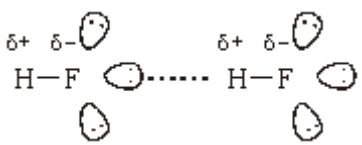
1

Diagram shows at least one $^{\delta+}$H **and** at least one $^{\delta-}$F

(If full charges shown, M2 = 0)

1

3 lone pairs shown on at least one fluorine atom
H-bond indicated, between H and a lone pair on F



(If atoms not identified, zero for diag)
('Fl' for fluorine - mark to Max 2)

*(Max 1 if only one HF molecule shown, **or** HCl shown)*

1

Dipole results from electronegativity <u>difference</u> **or** values quoted

('difference' may be inferred)

(Allow explanation – e.g. F attracts <u>bonding electrons</u> more strongly than H)

1

QoL Fluorine more/very electronegative **or** iodine less electronegative **or** electronegativity difference too small in HI
Comparison required, may be implied.

1

HI dipole weaker or bonding e^- more equally shared - wtte

1

(b) NaCl is <u>ionic</u> (lattice)

(Treat atoms/molecules as a contradiction)

(Accept 'cubic lattice')

1

Diamond is macromolecular/giant covalent/giant atomic/giant molecular

(NOT molecular or tetrahedral)

(Ionic/van der Waals' = CE = 0)

1

(Many) covalent/C-C bonds need to be broken / overcome

(NOT just 'weakened' etc.)

('Covalent' may be inferred from diagram)

(Treat diagram of graphite (without one of diamond) as a contradiction – lose M2 but allow M3/M4])

2

Which takes much energy **or** covalent bonds are strong

(References to van Der Waals' bonds breaking lose M3/M4)

1

[11]

M3.A

[1]

M4. (a) Oxygen more/very/highly electronegative (than hydrogen) *OR* oxygen has stronger attraction for <u>bonding</u> electrons / <u>bonding</u> 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 <u>molecules;</u>

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]

M5. (a) polyamide or nylon (2,4)

(allow nylon without numbers but if numbers are present they must be correct)

1

condensation

1

(b) $H_3\overset{+}{N}-CH_2-\overset{-}{COO}$

1

(c) ionic bonding in aminoethanoic acid

(can only score if includes that aminoethanoic is ionic)

1

stronger attractions than Hydrogen bonding in hydroxyethanoic acid

(e.g. stronger Hydrogen bonding in aminoethanoic acid

scores 0)

(mention of electrostatic forces between molecules scores 0)

1

[5]

M6. (a) tendency / strength / ability / power of an atom / element / nucleus to attract / pull / withdraw electrons / e - density / bonding pair / shared pair

1

in a covalent bond

1

(b) (i) F_2 = van der Waals' / induced/temporary dipole-dipole / dispersion / London forces

1

CH_3F dipole-dipole

(not just 'dipole')

1

HF = hydrogen bonding

(not just 'H' / 'hydrogen')

1

(ii) large difference in electronegativity between H and F / F most/very/much more electronegative / values '4' & '2.1' quoted

(not just 'higher')

1

$^{\delta+}H\text{-}F^{\delta-}$ dipole created or dipole clearly implied

(accept arguments such as 'uneven charge in bond'/ 'polar bond' ∴ F slightly negative / H slightly positive)

1

attraction/bond formed between δ+H and lone pair on F

(M2 / M3 may be scored from a diagram)

(CE if full charges shown - lose M2 and M3)

1

(c) (i) van der Waals' / induced/temporary dipole-dipole / dispersion / London forces / attractions

(ignore references to dipole-dipole)

1

increase with the increasing M_r / size / mass / N^0 of e^- / size of e^- cloud (in the hydrogen halides)

(if ionic, or if 'covalent bonds broken' = CE = 0)

(mark M1 and M2 separately)

1

(ii) hydrogen bonding stronger than van der Waals' attraction/forces

(accept hydrogen bonding is very strong / strongest)

(accept arguments such as 'HF has H-bonds, others <u>only</u> have van der Waals')

(not just 'HF has H-bonding')

1

[11]

M7. (a) Outer electrons are in p orbitals

1

(b) decreases

1

Number of protons increases

1

Attracting outer electrons in the same shell (or similar shielding)

1

(c) Sulfur molecules (S_8) are larger than phosphorus (P_4)

1

Therefore van der Waals' forces between molecules are stronger

1

Therefore more energy needed to loosen forces between molecules

1

(d) Argon particles are single atoms with electrons closer to nucleus

1

Cannot easily be polarised (or electron cloud not easily distorted)

1

[9]