TOPIC 3 HW MS

**1.**       (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 H2S) 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**

**[13]**

 **2.**     (a)     (i)      positive ions **(1)**(attract) delocalised electrons **(1)** *(or sea of or free or mobile)* **(1)**

*Confusion with ‑ve ions
or ionic lattice C.E. = 0*

(ii)     more protons **(1)** (or Mg2+ more charge than Na+)
attracts delocalised (or bonding) electrons more strongly **(1)
Delocalised: can be brought forward from (a) (i)**

*OR more delocalised electrons (1)
Attacks positive ions more (1)
Metallic bonding is stronger scores one mark, only given if
no other marks awarded*

**4**

(b)     macromolecular **(1)** *(or giant molecule etc)*covalent **(1)**strong covalent bonds **(1)**

*or bonds require much energy to break*

**3**

(c)     delocalised *(OR free or sea of or mobile)* electrons **(1)**

**1**

(d)     Planes **(1)**weak (bonds) forces between planes **(1)**

**2**

*or v.dw forces between planes*

**[10]**

**3.**          (a)     (i)      3 (bonding) pairs of electrons **(1)**

*allow 3 bonds*

         repel equally **(1)** *(or as much as possible)*

*Or get as far apart as possible*

(ii)     *Predicted bond angle:* 118°*(allow 117 - 119°)* **(1)***Explanation:* lone pair **(1)**repels more than bonding pair **(1)**

*Allow EXP if  < 118°
but C.E. = 0 if   120°*

**5**

(b)     *Name of shape:* Tetrahedral **(1)***Example:* CH4 etc **(1)**

*Allow correct ion*

**2**

(c)     (i)      90° **(1)**

(ii)     lone pairs (or they) repel more than bonding pairs (or most) **(1)**(so are) as far apart as possible **(1)**

*Mark independently*

(iii)     square planar **(1)**

*allow square*

**4**

(d)

*Penalise sticks (i.e. N‑) once but N must be shown*

**2**

**[13]**

**4.**       (a)     *Force 1:* Van der Waals’ **(1)**

          *Force 2:* dipole - dipole **(1)**

          *Force 3:* hydrogen bonding **(1)**

*OR London, Dispersion, temporary dipole*

**3**

(b)     (i)      covalent between atoms **(1)**

*OR within molecule*

         Van der Waals’ between molecules **(1)**

(ii)     molecular **(1)**

(iii)     Bonds (or forces) between molecules must be broken or loosened **(1)**

*OR V.dW forces*

*OR intermolecular forces*

*Mention of ions CE=0*

**4**

(c)     (i)      H-Bonding in HF **(1)**

         (dipole-) dipole in HCl **(1)**

*OR V.dW*

         H-bonding is stronger than dipole-dipole or V.dW **(1)**

*OR H-bonding is a strongest intermolecular force for 3rd mark*

(ii)     HI bigger molecule than HCl **(1)**

*OR Heavier, more e’s, more electron shells, bigger Mr, more polarisable*

         Therefore the forces between HI molecules are stronger **(1)**

*QL mark (Look for unambiguous statements using correct terminology)*

**5**

(d)     (i)      ionic **(1)**

Strong forces between ions **(1)**

*OR lots of energy required to break bonds*

(ii)     All bonds must be broken **(1)**

*mention of molecules etc CE=0*

**3**

(e)     macromolecular **(1)**

*OR giant molecule / lattice or correct diagram*

          Strong covalent bonds **(1)**

*OR lots of energy required to break bonds*

**2**

**[17]**

**5.**          (i)       *Bonding in Na2S*: ionic **(1)** *Bonding in CS2*:  covalent **(1)**

*ignore other words such as dative / polar / co-ordinate*

(ii)     Clear indication of electron transfer from Na to S **(1)**1 e– from each (of 2) Na atoms or 2 e– from 2 Na atoms **(1)**

*QoL correct English*

(iii)

Correct covalent bonds **(1)**All correct including lone pairs **(1)**

*Allow all •s or all ×s*

*M2 tied to M1*

*NOT separate e–s in S•- 2 l p*

(iv)    CS2 + 2H2O → CO2 + 2H2S **(1)**

*Ignore state symbols even if wrong*

**7**

**[7]**

**6.**      (a)     (i)      Electronegativity (difference) or suitable description **(1)**

*Accept F and Cl are highly electronegative
Not both atoms are highly electronegative*

(ii)     HF = hydrogen bonding **(1)**HCl = (permanent) dipole-dipole bonding **or** even van de Waals’ **(1)**Hydrogen bonding stronger / is the strongest IMF **(1)**

*Accept a statement that HF must have the stronger IMF, even if no IMFs identified*

*The explanation* ***must*** *be based on* ***intermolecular*** *forces/attractions*

*Note: if the explanation is clearly intramolecular = CE*

**4**

(b)     Electron pair **or** lone pair donated **(1)**

*Do not accept ‘donation of electrons’*

          From chloride ion to Al **or** AlCl3 **(1)**

*M1 can be earned by a general explanation of coordinate bonding, even if the electron pair is said to come from Al. The second mark, M2, is for this specific bond*

*Ignore missing charge*

**2**

(c)

**4**

PCl5 shown as trigonal bipyramid    PCl4+ shown as tetrahedral
[Look for:  ONE solid linear Cl-P-Cl bond]        NO solid linear Cl-P-Cl bonds]

*Bond Angle(s)* 90° and 120° **(1)**                       *Bond angle(s)* 109 or 109.5° **(1)**

**[10]**

**7.**      (a)     dative / coordinate (covalent) bond;

**1**

Lone/non-bonding pair / both electrons;

**1**

(donated) from P to H+;

**1**

(b)

pyramidal *OR* trigonal pyramid 109()°;

*(accept tetrahedral)*

**4**

**[7]**

**8.** C

**[1]**

**9.** A

**[1]**

**10.** D

**[1]**