TOPIC 3 HW MS

1. (a) Hydrogen/H bonds

Not just hydrogen

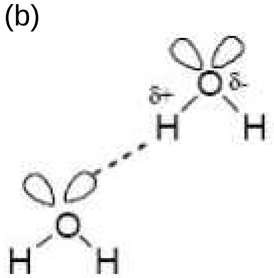
1

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 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]

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 Mg^{2+} 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)**
<u>strong</u> covalent <u>bonds</u> **(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 <u>bonding</u> pair **(1)**

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

5

(b) *Name of shape:* Tetrahedral **(1)**
Example: CH_4 etc **(1)**

Allow correct ion

2

(c) (i) 90° **(1)**

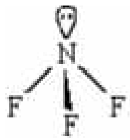
(ii) lone pairs (or they) repel more than bonding pairs (or most) **(1)**
(so are) as far apart as possible **(1)**

Mark independently

(iii) square planar **(1)**

allow square

4



3 bonds + 1 lone pair **(1)**
correct shape **(1)**
{
only give this mark if first mark also given

(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 <u>between atoms</u> **(1)**

OR within molecule

Van der Waals' <u>between molecules</u> **(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 M_r, 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 Na_2S: ionic* **(1)**

Bonding in CS_2: covalent **(1)**

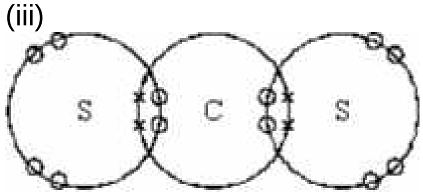
ignore other words such as dative / polar / co-ordinate

(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)**

<u>All correct</u> including <u>lone pairs</u> **(1)**

Allow all •s or all ×s

M2 tied to M1

NOT separate e⁻s in S•- 2 l p

(iv) $CS_2 + 2H_2O \rightarrow CO_2 + 2H_2S$ **(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

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

Do not accept 'donation of electrons'

From chloride ion to Al **or** $AlCl_3$ **(1)**

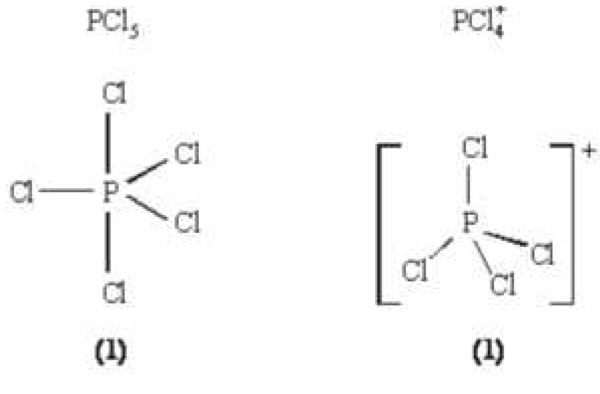
M1 can be earned by a general explanation of coordinate bonding, even if the electron pair is said to come from Al. The second mark, M2, is for this specific bond

Ignore missing charge

2

(c)

4



PCl_5 shown as trigonal bipyramid PCl_4^+ 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)**

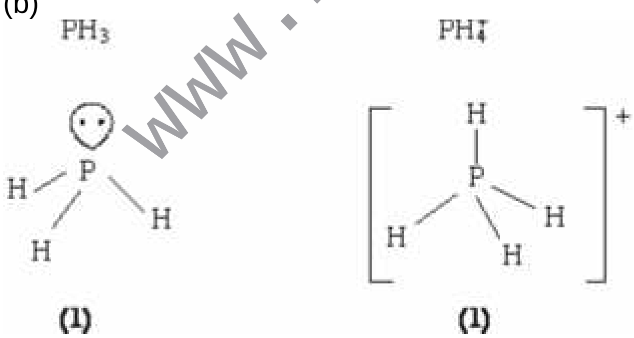
[10]

7. (a) dative / coordinate (covalent) bond 1

Lone/non-bonding pair / both electrons; 1

(donated) <u>from P</u> to H⁺; 1

(b)



pyramidal *OR* trigonal pyramid 109($\frac{1}{2}$)°;
(accept tetrahedral)

4

[7]

8. C [1]

9. A [1]

10. D [1]