M1.A

[1]

M2.C

[1]

M3.C

[1]

M4. (a) **4**LiH + $AlCl_3 \rightarrow LiAlH_4$ + **3**LiCl

1

(b) H^- = $1s^2$ **or** $1s_2$

1

(c) Tetrahedral or diagram

(Not distorted tetrahedral)

1

(Equal) repulsion

1

between four bonding pairs / bonds

(Not repulsion between H atoms loses M2 and M3)

(Not 'separate as far as possible')

('4' may be inferred from a correct diagram)

1

(d) Dative (covalent) or coordinate

1

Lone pair **or** non-bonding pair of electron **or** both e^-

1

QoL Donated from H^- to Al **or** shared between H and Al

(tied to M2)

(Not 'from H atom') (Not 'to Al ion') (Not 'e^-s transferred')

1

[8]

M5.C

[1]

M6. (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 $\angle$ *< 118°*

but C.E. = 0 if $\angle \geq$ *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)**

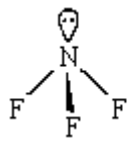
(so are) as far apart as possible **(1)**

Mark independently

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

allow square

4

(d) 

3 bonds + 1 lone pair **(1)**

correct shape **(1)**

{

only give this mark if first mark also given

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

2

[13]

M7. (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** $AlCl_3$ **(1)**

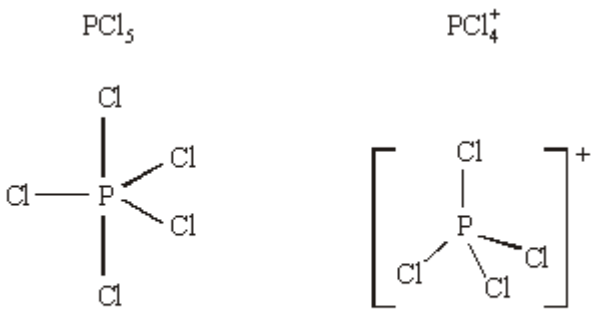
M1 can be earned by a general explanation of coordinate bonding, even if the electron pair is said to come from Al.
The second mark, M2, is for this specific bond

Ignore missing charge

2

(c)

4



(1) (1)

PCl_5 shown as trigonal bipyramid [Look for: ONE solid linear Cl-P-Cl bond]

Bond Angle(s) 90° and 120° **(1)**

PCl_4^+ shown as tetrahedral NO solid linear Cl-P-Cl bonds]

Bond angle(s) 109 or 109.5° **(1)**

[10]

M8. (a) (i) Covalent **(1)**

(ii) Co-ordinate **(1)** (or dative)

(iii) Both / two / pair electrons come from nitrogen **(1)**

(iv) 4 bonding / electron pairs **(1)**

repel equally **(1)**
OR are identical

as far apart as possible **(1)**
OR to position of minimum repulsion

tetrahedron **(1)**

7

(b) Power (or ability) of an element / atom to attract electron pair**/**electrons/ an electron/electron density **(1)**

in a covalent bond **(1)**

Allow attract from, withdraw in, do not allow remove from, withdraw from.

2

(c) (i) Electron deficient **(1)**

Or small, slight, partial positive charge

(ii) H < N **(1)**

2

[11]

M9. (a) SF_6 shown as octahedral / square based bipyramid **(1)**
Bond angle: 90° **or** 180° and 90° **(1)**
Shape = octahedral **(1)**

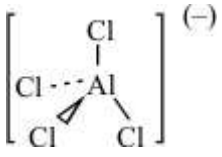
If lone pair shown then C.E. = 0 / 4

Wrong symbols - no diagram mark

Equal repulsion between 6 bonding **or** shared electron pairs **QoL (1)**

$AlCl_4^-$ shape shown as tetrahedral **(1)**
Bond angle = 109° to 109.5° **(1)**
Shape = tetrahedral **(1)**

If lone pair shown then C.E = 0/4



(Equal repulsion between) 4 bonding pairs **or** shared electron pairs **(1)**

QoL may be awarded here also
Mark all points independently

8

(b) Solvent has low bp or weak intermolecular forces **or** evaporates quickly **(1)**

(Solvent) needs energy to evaporate **(to overcome intermolecular forces) or** valid reference to latent heat of vaporisation **(or evaporation is endothermic) (1)**

OR higher energy or faster molecules more likely to escape so mean energy (and hence temperature) falls

Energy taken from the skin (and so it cools) **(1)**

Fragrance or perfume (molecules) slowly spreads (through the room) **(1)**

By random movement **or** diffusion (of the perfume / fragrance) **(1)**

4

[12]