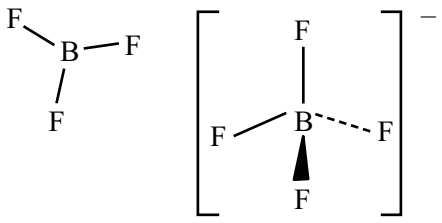
Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) 	**2**	These shapes do not have lone pairs so don't try and put them in.
	1	
BF_3 trigonal planar	**1**	BF_4^- is a regular tetrahedron.
BF_4^- tetrahedral	**1**	Learn the angle in a tetrahedron is 109° or 109.5°
equal repulsion between 4 bonding pairs	**1**	
109(½)°		
(b) lone pair donated by one atom	**1**	
from F^- to B	**1**	
dative or dative covalent or co-ordinate bonding	**1**	
2 macromolecular means a giant molecule with covalent bonding	**1**	
the white P has van der Waals forces between the P_4 molecules	**1**	If you mention the wrong type of intermolecular force you will lose marks.
and these forces are weak	**1**	
the red phosphorus has many covalent bonds that must be broken	**1**	The covalent bonds are broken on melting, not just loosened or weakened.
and covalent bonds are strong	**1**	
3 (a) electronegativity is the power of an atom to attract electron density or the bonding pair of electrons	**1**	
in a covalent bond	**1**	Learn this definition.
(b) (i) F_2 = van der Waals forces	**1**	
CH_3F = dipole–dipole forces	**1**	Don't just say 'dipole'.
HF = hydrogen bonding	**1**	Don't just write just 'H' or 'hydrogen'.
(ii) large difference in electronegativity between H and F	**1**	
$^{\delta+}H–F^{\delta-}$ dipole created	**1**	
attraction between $^{\delta+}H$ and lone pair on F	**1**	This may be shown on a diagram. Put in partial charges (δ) not full charges.

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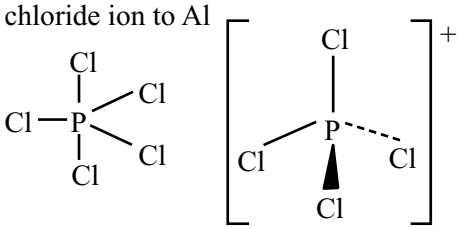
(c) (i) van der Waals forces	**1**	
increase with the increasing molecular size / mass of the hydrogen halides	**1**	
(ii) hydrogen bonding stronger than van der Waals forces	**1**	Put the comparison in. Don't just talk about one substance.
4 (a) oxygen more electronegative (than hydrogen)	**1**	Don't mention covalent bonds. Just talk about intermolecular forces and compare their strengths.
causes $H^{\delta+}$–$O^{\delta-}$	**1**	
(b) van der Waals forces between oxygen <u>molecules</u>	**1**	
hydrogen bonding between methanol molecules	**1**	
hydrogen bonding stronger than van der Waals *or* stronger intermolecular forces in methanol	**1**	
5 (a) (i) electronegativity	**1**	
(ii) HF = hydrogen bonding HCl = dipole–dipole bonding hydrogen bonding stronger	**3**	The explanation must be based on intermolecular forces.
(b) electron <u>pair</u> *or* lone <u>pair</u> donated from chloride ion to Al 	**2**	
(c) PCl_5 shown as trigonal bipyramid		You must draw in 3D and make sure that you show that the bonds are not all 90° in your diagrams!
PCl_4^+ shown as tetrahedral	**2**	
bond angle(s) 90° and 120° bond angle(s) 109° or 109.5°	**2**	

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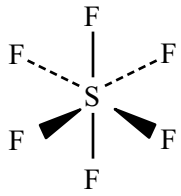
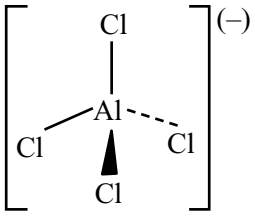
6 (a) SF_6 shape is octahedral	**1**	Make sure you include the symbols for the elements in the diagram.
bond angle = 90°	**1**	
shape = 	**1**	
equal repulsion between 6 bonding pairs of electrons	**1**	
$AlCl_4^-$ shape is tetrahedral	**1**	
bond angle = 109° to 109.5°	**1**	
shape = 	**1**	
equal repulsion between 4 bonding pairs of electrons	**1**	
(b) solvent has low boiling point *or* weak intermolecular forces	**1**	This needs a clear explanation. There are 4 marking points so you must write 4 statements which link together in order.
solvent needs energy, taken from the skin, to overcome intermolecular forces and evaporate	**1**	
perfume molecule slowly spreads through the room	**1**	
by random diffusion of the perfume	**1**	
7 (a) (i) 3 bonding pairs of electrons	**1**	Or get as far apart as possible.
repel equally	**1**	
(ii) predicted bond angle = 118°	**1**	When you predict you are usually allowed a little tolerance, in this case 117° to 119°.
lone pair	**1**	
repels more than bonding pair	**1**	
(b) shape is tetrahedral	**1**	Questions on shapes come up all the time so learn how to deduce them and how to predict the bond angles.
example: CH_4 etc.	**1**	

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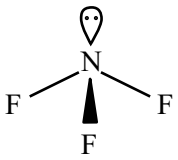
(c) (i) 90°	**1**	
(ii) lone pairs repel more than bonding pairs	**1**	
so are as far apart as possible	**1**	
(iii) square or square planar	**1**	
(d) 	**2**	
8 (a) (i) positive ions	**1**	Don't get confused with negative ions or ionic lattices. Metals have metallic lattices in which the positive ions attract the electrons that move through the metal.
attract delocalised electrons (in a sea of electrons)	**1**	
(ii) more protons in Mg^{2+} than Na^{+}	**1**	If you just say that metallic bonding is stronger this only scores one mark.
so attracts delocalised electrons more strongly	**1**	
(b) macromolecular	**1**	
covalent	**1**	
strong covalent bonds require a lot of	**1**	
energy to break them	**1**	
(c) delocalised electrons in the structure	**1**	
(d) planes	**1**	You can say van der Waals forces between planes. Planes are layers of the graphite.
weak forces between planes	**1**	