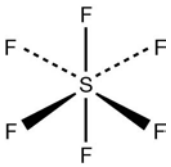
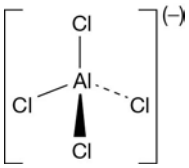
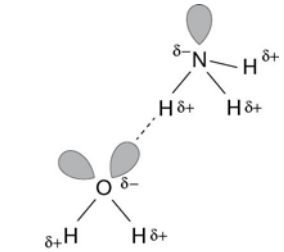
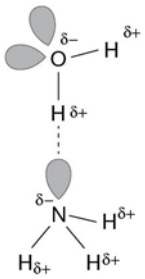
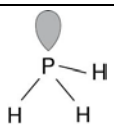
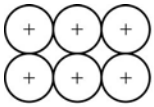
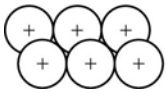
Question number	Answer	Marks	Guidance
1	macromolecular means a giant molecule with covalent bonding the white P has van der Waals forces between the P_4 molecules and these forces are weak the red phosphorus has many covalent bonds that must be broken and covalent bonds are strong	1 1 1 1 1	 If you mention the wrong type of intermolecular force you will lose marks. The covalent bonds are broken on melting, not just loosened or weakened.
2 (a)	SF_6 shape is octahedral bond angle = 90° shape =  equal repulsion between 6 bonding pairs of electrons $AlCl_4^-$ shape is tetrahedral bond angle = 109° to 109.5° shape =  equal repulsion between 4 bonding pairs of electrons	1 1 1 1 1 1 1	Make sure you include the symbols for the elements in the diagram.
2 (b)	solvent has low boiling point *or* weak intermolecular forces solvent needs energy, taken from the skin, to overcome intermolecular forces and evaporate	1 1	This needs a clear explanation. There are 4 marking points so you must write 4 statements which link together in order.

	perfume molecule slowly spreads through the room by random diffusion of the perfume	1 1	
3 (a)	Hydrogen bonding / hydrogen bonds / H-bonding / H-Bonds	1	Not just hydrogen.
3 (b)	 *OR* 	3	One mark for minimum of 4 correct partial charges shown on the N-H and O-H One mark for the 3 lone pairs. One mark for H bond from the lone pair on O or N to the $H^{\delta+}$ The N-H-O should be linear but can accept if the lone pair on O or N hydrogen bonded to the H If wrong molecules or wrong formula, CE = 0/3
3 (c)	(Phosphine) does not form hydrogen bonds (with water)	1	
4 (a)		1	Need to see 3 P-H bonds and one lone pair (ignore shape).
4 (b)	Coordinate / dative Pair of electrons on P(H_3) donated (to H+)	1 1	If not coordinate / dative then chemical error CE=0 unless blank or covalent then M1 = 0 and mark on. Do not allow a generic description of a coordinate bond
4 (c)	109.5 ° / $109\frac{1}{2}$ / 109 ° 28’	1	Allow answers in range between 109#° to 109.5#°
4 (d)	Difference in electronegativity between P and H is too small	1	Allow P not very electronegative / P not as electronegative as N, O and F / P not electronegative

			enough / P not one of the 3 most electronegative elements. Do not allow phosphine is not very electronegative.
5 (a) (i)	Metallic	1	Allow body centred cubic
5 (a) (ii)	 OR  Na^+ Na^+ Na^+ Na^+ Na^+ Na^+	1 1	One mark for regular arrangement of particles. Can have a space between them Do not allow hexagonal arrangement One mark for + in each Ignore electrons If it looks like ionic bonding then CE = 0/2