Answers to exam questions for Chapter 6 Molecules and intermolecular forces

Question 1

a Hydrogen bonding **A**

b 1. Water 2. Ammonia **A (both correct)**

Question 2

The forces in aluminium that have to be overcome to melt it are strong metallic bonds between the atoms and in silicon it is the strong covalent bonds in the giant covalent network, while in chlorine it is the weak van der Waals' forces between the discrete covalent molecules, making the melting point much lower.

A = some mention of different bonds present, M = partial answer mentioning bonds and particles present, E = all forces/bonds, particles and links to MP considered

Question 3

Angle $\alpha = 109^{\circ}$

There are four regions of electron density (including one lone pair), so it is a tetrahedral angle.

Angle $\beta = 120^{\circ}$

There are three regions of electron density (no lone pair) **[not 3 bond pairs]**, so it is a trigonal planar angle.

A = both angles correct, but no/incorrect justification OR one correct with justification, M = angles correct and number of electron clouds correct, but does not distinguish between bonding and non-bonding, E = angles correct and all electron clouds, bonding and non-bonding, given and linked to angle

Question 4

a **i** gas

ii liquid **A = both correct**

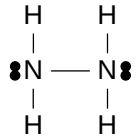
iii Gas has a BP < 25°C, while the liquid MP < 25°C < b pt

A = correct reasons, M = plus reference to 25°C

b Oxygen is non-polar, its intermolecular forces (instantaneous dipoles) are very weak, so it has a very low MP. Methanol is polar and has hydrogen bonds between its molecules, so the intermolecular forces are stronger and m pt is much greater as more energy is required to separate the molecules.

A = partial explanation, M = full explanation – types of bonds and strengths

c Hydrazine



A

d Hydrazine has more hydrogen bonds and a closer packing, hence its MP is higher.

A = one point, M = both points