Intermolecular forces Free Response I

1. A) I) They are both non polar and have London dispersion forces. Iodine is bigger making it more polarizable than Cl. So iodine has stronger London dispersion forces and as a result exists as solid at 25 degrees and 1 atm while Cl$_2$ is a gas.
   II) SiO$_2$ is a covalent network solid so the entire structure of one macromolecule is held together with strong covalent bonds. NF$_3$ is held together with dipole dipole forces and they are much weaker than covalent bonds, less energy is required to sever those IMFs.

B) I) NH$_3$ is London and H bond and CH$_4$ has London
   II) Both species have approximately have same size. H bonds of NH$_3$ are much stronger than London forces of CH$_4$. As a greater amount of energy is required to break stronger forces of attraction the boiling point of NH$_3$ is higher.

C) I) London
   II) CF$_4$ is larger and has more electrons making it more polarizable than CH$_4$. So CF$_4$ has greater London forces so greater amount of energy is required to break stronger forces of attraction the boiling point in CF$_4$ is higher.

D) I) SO$_2$ has dispersion and dipole dipole. F$_2$ only has dispersion forces.
   II) IMF between two SO$_2$ molecules are greater than they are between two F$_2$ molecules. As greater amount of E is needed to break the stronger forces of attraction between SO$_2$ molecules its value for Hvap is greater.

E) Both structures have approx. same size and same number of electrons. Both have H bonds and London.
   London is stronger in structure A due to its shape. So A is likely to be solid at room temp.
   Structure a is saturated so carbon chain has linear structure overall. As a result molecules stack up well as there are many points of contact between molecules so more locations for London forces can be established.
   Structure B is unsaturated as it has double bonds between two carbons. This causes whole structure to bend at that point. Because of that kink the molecules don’t stack up well so less points of contact between two molecules so fewer locations of London.
Intermolecular Forces II Free Response

1. A) I) They are both non-polar and have London. Br is larger and more electrons so it is more polarizable and has greater London dispersion forces. Because of stronger forces of attraction Br will be solid while O2 will be gas.

II) Graphite is covalent network solid. So the structure of one macromolecule held together is held with strong covalent bonds while CH4 is held together by London dispersion forces which are weaker.

b) I) NH3 has London and H bonds and NF3 has London and dipole-dipole

II) H – bonds are stronger than dipole-dipole. Greater amount of energy is required to break stronger forces of attraction so BP of NH3 is stronger.

c) I) graphite is a network solid and each sheet is one molecule where carbons are covalently bonded together. For it to melt you have to supply heat to break covalent bonds.

d) HCl has London and dipole-dipole and H2O has London and H-bonds.

II) The IMF between two water molecules are stronger than HCL molecules. Greater amount of E is greater to break them apart so Hvap is greater.

e) both are similar in size and share potential polarizalities that are comparable. Structure I can form H bonds in two locations and structure II can only form H in one location. Because of this structure I has higher melting point.