1. a) NH_3 has hydrogen bonding and HCl has dipole-dipole. Hydrogen bonding is a stronger IMF than dipole-dipole, and the stronger the intermolecular force, the higher the boiling point.
   b) Bromobenzene has a higher boiling point than chlorobenzene because Br is larger than Cl, and the larger the atom, the higher the boiling point because they both have dipole-dipole, and Bromine has larger LD forces which gives it the higher boiling point.
   c) CBr_4 has only LD, while bromomethane (bromide) has dipole-dipole IMF, and DD forces are stronger than LD, and for stronger the IMF the higher the boiling point.
2. a) As increase in IMF, so **decrease** in vapor pressure
   b) As increase in IMF, so **increase** in boiling point
   c) As increase in IMF, so **increase** in heat of vaporization
   d) As increase in IMF, so **increase** in surface tension
3. a) NH_3 has Hydrogen bonding, NO_2 has dipole-dipole, PCl_3 has dipole-dipole, F_2 has London dispersion, $FeCl_3$ has ionic bonding F_2 < NO_2,PCl_3 < NH_3 < $FeCl_3$
4. a) CO_2 London dispersion, Ar London dispersion, CF London dispersion, NiF London dispersion, LiCl ionic bonding. LiCl has highest bp Ar has lowest bp because it has the lowest Molar mass.
   b) $CaCO_3$ ionic bonding, methanol Hydrogen bonding, dimethyl ether Dipole-Dipole, methane London dispersion. $CaCO_3$ has the highest Methane has the lowest
5. SO_2 Molecular, dipole-dipole, molecules
   H_2O Molecular, hydrogen bonding, molecules
   CH_3CL_3 Molecular, dipole-dipole, molecules
   SiO_2 Molecular, dipole-dipole, molecules
   PCL_5 Molecular, London dispersion, molecules
   Bronze Covalent Network, covalent bonding, atoms
   MgF Ionic, Strong electrostatic interaction, ions
   CO Molecular, dipole-dipole, molecules
   Cu Metallic, Metallic bonding, atoms
   $C_{(graphite)}$ Covalent Network, covalent bonding, atoms
   MgO Ionic, Strong electrostatic interaction, ions
6. a) Ethanol, Dimethyl ether, propane
   b) I_2, Br_2, Cl_2
7. a) CO_2 has highest vapor pressure because it has a weaker IMF, CO_2 has London dispersion, while SO_2 has dipole-dipole IMF. **The weaker the IMF the higher the vapor pressure!**
   b) Dimethyl ether does because the IMF is dipole-dipole, while methanol has hydrogen bonding.
8. a) CH_3CCl_3 has ionic bonding, NH_3CL has hydrogen bonding, H_2CCl_2 has higher bp.
   b) PCl_3 has dipole-dipole, HBr has dipole-dipole, HBr is larger so higher bp.
   c) CH_3Cl has hydrogen bonding, H_2S has dipole-dipole, H_2Cl has higher bp.
9. a) As group 1 atoms go down the family, the larger they get, so the atoms are spread farther apart so the farther the metallic atoms the lower the boiling point.
   b) Halogens have molecular forces and metallic like group 1, and as molecules get larger, the IMF get stronger, and for stronger the IMF the higher the boiling point.