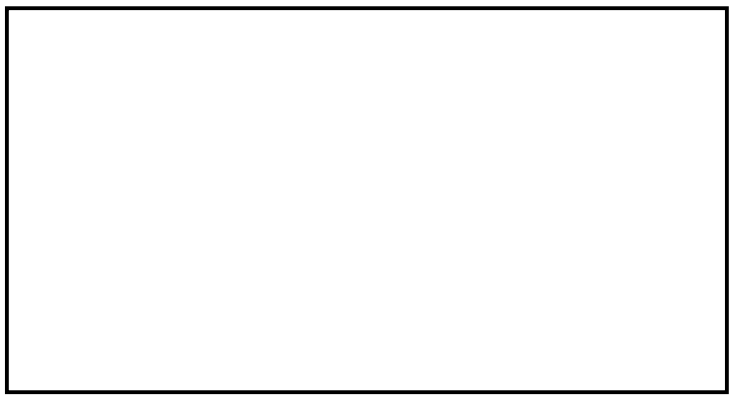
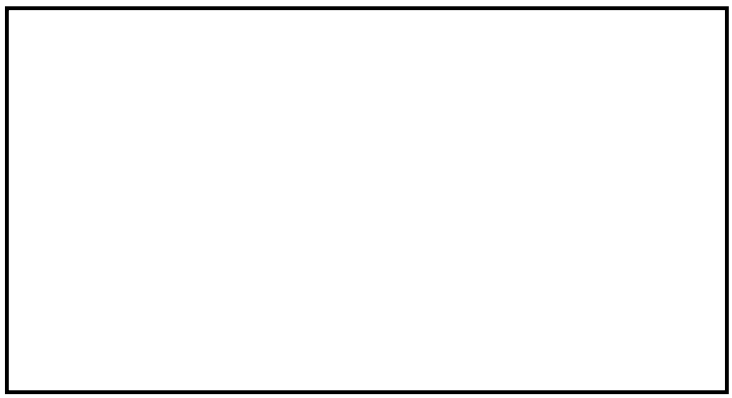
Monday April 10 Names_____

1. Draw a picture of a cloud of water vapor in a closed container. Show the individual molecules. Consider this container as your system.



2. Now imagine that the container is put in a refrigerator and cooled to 10 °C. Draw a picture of water molecules in the box.



Describe the process of the gas condensation at the molecular level as thermal energy is transferred. Why does cooling the container allow the gas to condense? Which way does the heat transfer? What is the sign of ΔH

The outside of the box is cooled by collisions with the colder air molecules in the fridge – energy transfers from the box to the air molecules. When the water vapor in the box collides with the sides – energy is transferred from the H2O molecules, which reduces their kinetic energy. Eventually they lose enough KE so that the molecules cannot break apart when they stick together (by intermolecular attractions). Larger and larger clumps of molecules form and eventually form macroscopic drops that fall to the floor of the container – join together and form a liquid.

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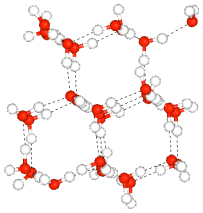
3. Now imagine the water has been cooled further. Make models of at least 10 water molecules (you can join with another group if you need more). See if you can connect them to make a model of solid water (remember to make the H-bonds – you can represent them as regular bonds – but remember that they are not "real"). Draw a picture below:

Here they should be able to reproduce the hexagonal symmetry of the water structure – which naturally falls out when you form the H-Bonds.



4 What structural features of your solid water emerge? Can you see how there are large empty spaces (holes) in the structure.

Hexagonal shape with "holes"

5. How does the structure of ice explain why liquid water is more dense than solid water? (what would happen if your ice were melted – would the water molecules get closer together or further apart?)

When water (ice) melts – the structure collapses in on itself – more molecules per unit volume – making liquid water more dense than ice – meaning that ice floats on water (highly unusual – most solids are more dense than liquids)