**The basics of boiling ANSWSERS (online lesson)**

The type of bond (like glue!) that holds the atoms together in a molecule is very strong. It is called a

covalent bond. However, the force between molecules is very weak. It is called a weak intermolecular

force.

 Make molecules of water using plasticine and toothpicks and place them into a glass/mug.

Try to complete the diagrams below, sketch using to represent H atoms and to represent O atoms.

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| --- | --- | --- |
| *molecules of water in a beaker* |  boiling | *molecules of water in the air**after being heated above 100’C* |

A common misconception is that the atoms of oxygen and hydrogen separate from each other when water boils. However, as water molecules are heated the atoms of oxygen and hydrogen **do not separate** from each other.



**Questions**

1. Why do you think atoms of O and H do not separate from each other?

 (*tip: think about the bonding*)

\_\_because there is a very strong (covalent) bond between the O and H atoms \_\_\_\_

As water is heated the molecules of water do separate from each other.

2. Why do you think this is? (think about the forces between the molecules)

\_\_\_\_\_because the force of attraction between molecules of water is very weak \_\_\_\_

So, to conclude, the atoms in a molecule of water do not separate from each other because the covalent

bonds between the atoms are very strong. However, the weak intermolecular forces between the molecules do break so the water molecules can move around freely with high energy and separate from each other. This is also the case for a substance that is melting, forces between particles must be broken.

**State** *the change of state as water is heated* \_\_\_\_\_liquid to gas \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Describe** *what you see as the molecules of water in the kettle are heated* \_\_\_\_nothing until the water starts to boil, then steam (gaseous water) will be visible coming out of the kettle, this is because the hot steam hits cold air molecules and the hot steam condenses, so what we see is actually little droplets of liquid water in the air.

**Explain** *(in terms of bonding and forces) the changes that occur to the water molecules as the beaker of*

*water is heated* \_\_ As water is heated the particles/molecules gain heat energy and convert it to kinetic energy, this enables the particles/molecules to vibrate more. At 100 degrees celsius the particles/molecules have enough energy to separate from each other, because the weak intermolecular forces between the molecules breaks. It is very important to mention that the atoms within a molecule of water do not separate from each other because the covalent bonds between the atoms are very strong.