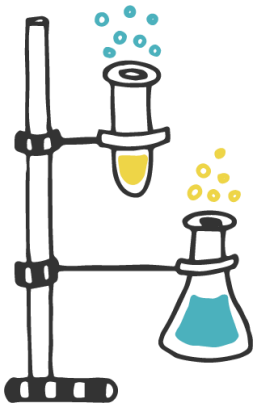
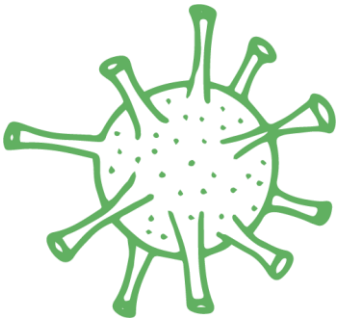
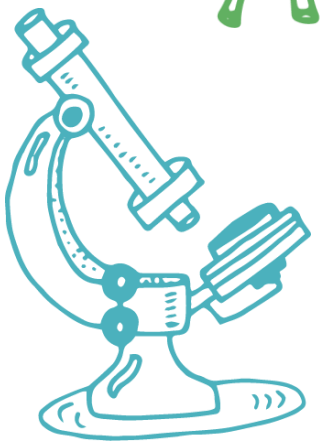






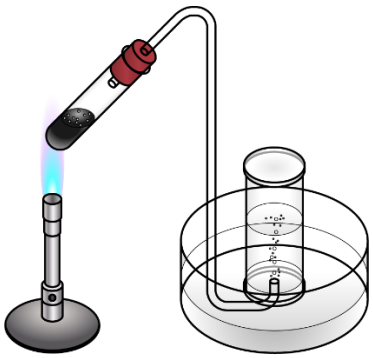
Chemical Reactions and Equations

Research/Experiment
Answers

Solution: In this experiment, you heated the bottom of a test tube containing a mixture of potassium chlorate and magnesium dioxide.

Let's have a look at some of the observations from the experiment, identify the type of chemical reaction, and balance the equation.

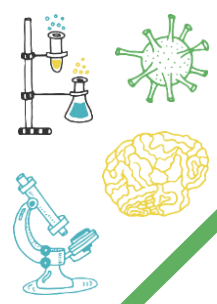
Observation:



1. When heated, potassium chlorate decomposes into potassium chloride, and a large amount of oxygen gas is released into the inverted bottle of water. Note that you will have to heat potassium chlorate at least twice for it to be able to release the oxygen gas.
2. Magnesium dioxide is only used as a catalyst to accelerate the heating process. It does not change the result of the reaction or become a part of the product.
3. Now, to determine the volume of oxygen gas, slowly turn the bottle back upright, ensuring the collected gas is not released. Then, insert a glowing wooden splint just inside the bottle, where the gas is collected. The glowing splint will re-ignite in the presence of oxygen. The splint continues to low until there is oxygen present. If there is no reaction, there is no oxygen left in the bottle.
4. Also, note that the potassium chlorate solid now changes to a milky white liquid, then creates a foam like substance, and finally changes its state back to solid, but this time, the colour is whitish grey.

Type of chemical reaction:

So, now you know that heating potassium chlorate gives you potassium chloride and oxygen. As you can see, heat is used to break a single compound or element (potassium chlorate) into two or more compounds (potassium chloride and oxygen). Hence, we can conclude that this reaction is a decomposition reaction.



Chemical Reactions and Equations

Equation for this chemical reaction:

As you observed, potassium chlorate ($KClO_3$) decomposes into potassium chloride (KCl) and oxygen gas (O_2) when heated.

The equation is:

$$KClO_3(s) \xrightarrow{\text{Heat}} KCl(s) + O_2(g)$$

Reactants	Products
You also added magnesium dioxide, a catalyst, to speed up the heating process. However, this element does not initiate any chemical reaction. It only alters the speed to fasten the heating process. So, $KCl_3(MnO_2)$	KCl O_2

Balancing the equation:

To balance the equation:

1. Count the number of atoms of each element on either side of the equation. You will notice that the atoms number of atoms of K and Cl are the same on both the sides. However, the number of atoms of O are different. There are 3 atoms of oxygen on the LHS and only 2 on the RHS.

   $$KClO_3(s) \xrightarrow{\text{Heat}} KCl(s) + O_2(g)$$

   First, you need to balance this.

2. Add coefficients in front of these elements (as shown below) to have 6 atoms of O on either side.

   $$2KClO_3(s) \xrightarrow{\text{Heat}} KCl(s) + 3O_2(g)$$

   Now, K and Cl are imbalanced! So, balance these elements as well.

3. Add a coefficient on the RHS, so that each side has 2 atoms each of K and Cl.

   $$2KClO_3(s) \xrightarrow{\text{Heat}} 2KCl(s) + 3O_2(g)$$

   The equation is now balanced!

Further analysis from this chemical reaction:

1. This reaction is also known as thermal decomposition as energy in the form of heat is required to break a compound into more complex compounds.
2. You can separate the water-insoluble catalyst (magnesium dioxide) from the chlorate salt to confirm that it is not being used up in the product.
3. Heating potassium chlorate in the absence of a catalyst takes a lot of time, and it is converted into potassium perchlorate.
4. Potassium chlorate is highly reactive and it can explode or ignite when not controlled properly. Due to its explosive nature, potassium chlorate is a key component in the production of explosive devices and fireworks.