Effect of mno2 on the decomposition of hydrogen peroxide

Chemistry Catalyst Report Aim I am trying to investigate the effect of the mass of magnesium dioxide used on the speed of the reaction of $2H_2O_2(aq)$? $2H_2O(l) + O_2(g)$.

I hypothesize that the speed of the reaction is proportional to the rate of decomposition. Independent Variable The mass of MnO_2 used Dependent Variable The rate of decomposition through the amount of mass lost Controlled Variables Environment of the experimentStay in the same place to carry out the experiment and finish the experiment as fast as possible in case of a sudden change in some areas of the environment Volume of H_2O_2 usedMeasure the volume using a measuring cylinderUncontrollable Variable The temperature of the H_2O_2 cannot be controlled because the process, which I am trying to speed up through adding catalysts, is an exothermic reaction, meaning that heat is given off in the process. Because it gives off heat, the temperature cannot be controlled and this would affect my results, as there would be more than one dependent variable. I was only allowed H_2O_2 from the same source, which means no fresh source of H_2O_2 at a controlled temperature.

I could not wait for the H_2O_2 to decompose to a certain temperature because that would take too long. I could not use the catalysts to help the H_2O_2 to decompose to that temperature for the experiment to start because it would be difficult to gage when to take out the catalyst and catalysts are unable to be used up. Equipment ? Top pan balance ? H_2O_2 – 300ml ? MnO_2 –5g ? 50ml Beakers – 10 ? Conical flasks – 5 ? Spatula ? Cotton Wool ? Measuring cylinder Diagram Method 1. Gather the equipment and set it up like in the diagram above. 2.

Using a top pan balance, a beaker and a spatula, measure 0. 1g, 0. 2g, 0. 3g, 0. 4g and 0.

5g of MnO2 and place them in different beakers. 3. Measure 50ml of H2O2 using a measuring cylinder and fill 5 beakers with 50ml of H2O2 each. 4. Place a new conical flask and enough cotton wool to cover the hole of the conical flask on the top pan balance.

Hit the “ TARE” button. 5. Pour in 50ml of H2O2 6. Record the mass shown 7. Pour in 0.

1g of MnO2 and cover the hole of the conical flask with the cotton wool 8. The total weight of the solution would then be the mass recorded in step 5 plus the mass of the MnO2 in step 7 9. Start timing when the MnO2 is added. 10. Record the mass shown on the top pan balance every 5 seconds. This experiment is to run for only a minute.

11. form a results table 12. Repeat steps 4 to 10 with the different masses of MnO2 and with new cotton wool ? Mass of MnO2(g)0. 10. 20.

30. 40. 5 Time(s)????? ?????? 050. 9551.

0250. 6648. 7248. 16 550.

9451. 0150. 6548. 748. 15 1050. 945150.

6248. 6848. 12 1550. 945150.

6348. 6748. 09 2050. 9450.

9950. 5748. 6548. 06 2550. 9350.

9950. 6148. 6348. 04 3050. 9350.

9850. 6148. 6148. 00 3550. 9350.

9850. 648. 5847. 97 4050.

9350. 9750. 5948. 5547. 92 4550.

9250. 9650. 5848. 5247. 89 5050.

9250. 9550. 5748. 4947. 84 5550.

9250. 9450. 5648. 4647. 78 60?? 50.

9250. 350. 5548. 4347.

72 Evaluation Catalysts are substances, which help speed up chemical reactions. Reactions happen when the two reacting particles collide, but if the force of their collision is not above a certain level, the reaction would not happen. This minimum amount of energy required for the reaction to take place between the particles is called activation energy. Catalysts are useful because they provide an alternative surface for the particles to react, with a lower activation energy.

The disadvantage of using a catalyst is that the reactions are not as energetic and thus the product is less. For this reaction, less oxygen would be produced. Catalysts are never used up. And because they are never used up, we are able to collect them back after the reaction, still as good as before without changing chemically.

Before adding the catalysts, only some particles have enough energy to react. It is represented by the green section. The rest of the particles that cannot pass the activation energy barrier is represented by the blue. After adding the catalysts, the catalysts provide an alternative path for the particles to react.

The average activation energy is lowered and now, more particles are able to react. This graph shows the before and after effect of adding a catalyst on the activation energy required for the reaction to start. Through the results obtained, it is clear that the mass of catalyst used is proportional to the speed of the reaction. The higher the mass of catalyst used, the more particles of catalyst is in the solution, the more alternative paths of reacting is given to the particles, therefore the faster the reaction. It can thus be concluded theoretically and practically that the more mass of catalyst used, the faster the reaction rate. Mass of catalyst(g)0.

10. 20. 30. 40.

5 Gradient of the graph-0. 00498-0. 00519-0. 00184-0.

00476-0. 00838 I have graphed the results from the experiment. The above table shows the gradients I had derived from the graphs. All the results fit my hypothesis except for 0.

3g and 0. 4g. From the graph, it can be derived that even though the rate of reaction is proportional to the catalyst, it is not directly proportional. Sources of Error ? Results from obtained from this lab experiment can never be accurate because of a few reasons. Firstly, catalysts and reaction are sped up by heat.

The decomposition of hydrogen peroxide to water and oxygen is an exothermic reaction. This means that the decomposition reaction gives off heat. Because there is no way I could do all the experiment at the same time, the temperature of the hydrogen peroxide changes every time I start the experiment. I have explained this more clearly in the section of uncontrollable variables.

? Next, the beakers that the hydrogen peroxide was stored in were not washed clean and not washed by the lab technicians. This meant that the beakers were washed by the previous batch of students who used them and they might not have washed them properly. Because the students are also not provided with chemicals to wash the beaker such that it is clean of impurities, some of the beakers used may have been contaminated. ? When I was pouring the hydrogen peroxide into the conical flask using a funnel, because of liquid having a tension property, some of the hydrogen peroxide " stuck" on to the funnel. This meant that not all of the 50ml of hydrogen peroxide was poured in.

? Because it would be hard to measure 0. g of MnO_2 in a conical flask, I measured it in a beaker. By putting it in a beaker, when I tried to pour it into the conical flask, some of the powder got stuck onto the beaker, due to static electricity. Ways to improve ? Have the lab technician clean the equipment with proper cleaning methods first, preventing contamination. ? Use freshly made hydrogen peroxide and use it for the experiment straight away or use the hydrogen peroxide for the experiment after a timed period of maybe 5 minutes, this way all the hydrogen peroxide used from the fresh source is always decomposed to that same level.

Use a conical flask with a larger neck or use a big beaker, this way I would not have had to use a beaker because the reaction is not very violent, the liquid from the spewing bubbles would not burst out of the beaker if it was big enough. ? Because the masses of MnO2 was small, I could have measured the mass of the MnO2 on another spatula. If the MnO2 still stuck to the spatula due to static electricity, even less MnO2 would be stuck to the spatula because the surface area of which the MnO2 is exposed to is smaller.