(6)

Factors Affecting Reaction Rates

Theory: reaction rate - speed of a reaction per unit time

Purpose: to investigate factors that can speed up or slow down chemical reactions

FACTORS AFFECTING REACTION RATES
Chem IH Prelab

1. List the 4 factors that affect reaction rate.
   i) temperature, ~~pressure~~, concentration, ~~surface~~ surface area / particle size
   catalysts
2. Write the formulas for hydrogen peroxide, iron (III) chloride, sodium chloride, iron (III) nitrate, potassium nitrate, calcium chloride, hydrochloric acid
   ~~2(HO)~~ $Fe(Cl)_3$ NaCl $Fe(NO_3)_3$ KNO_3 ~~$CaCl_2$~~ HCl
   3 H_2O_2 -2
3. In Part A, explain or draw how an ice bath is set-up. Do the same for a hot water bath.
   Fill a 250 mL beaker with lots of ice covered in water.
   Place a 250 mL beaker with water onto a hot plate or over a flame.
4. Where is the "mouth of a test tube?"
   near the opening
5. If you take too much hydrochloric acid, how do you neutralize it before putting it in the sink?
   ~~yes~~ Add baking soda + dump in hazardous waste bin.
6. How are particle size and surface area related?
   the smaller the particle size, the larger the surface area

Procedure Summary

PART A: Fill 3 test tubes with HCl and put 1 in ice bath & hot water bath. Place zinc in each TT and test with a burning splint.
PART B: Make hydrogen peroxide test solution. Put 5mL into 7 TT. Add various solutions & flick to mix. Record gas production rate & catalyst activity.
PART C: Fill 5 test tubes with varying HCl molarities. Drop in zinc pieces. Record start & end times & OBS.
PART D: Record mass of zinc & place in test tube. Place same amount in another TT. Add ~~a~~ HCl to both. Record OBS of serval minutes.

Data:

PART A

	TEMPERATURE START TIME	TEMPERATURE END TIME	DURING	SPLINT TEST
ICE	1:30	1:40	immidiate small bubbles, gradually increased	No result
ROOM	1:30	1:40	immidiate heavier bubbles, white and foamy	No result REDO: faint pop
HOT	1:30	1:40	biggest, fastest bubbles, clearer	No result

PART B: CATALYST

	.1M $FeCl_3$	.1M $Fe(NO_3)_3$	$CaCl_2$
OXYGEN	many tiny bubbles, fast reaction-	big bubbus, not many though. fast reaction-	no bubbles
CATALYTIC	high	high	none

PART C: CONCENTRATION

	START	END	DURING	OBS
3M	11:37	exceeded time	small rapid bubbles makes liquid white and foggy	chunks at top fizzing sound
6M	11:39	exceeded time	more aggressive, small to big bubbles @ top clearer, small black chunks flying	got cloudier with time chunks to top also fizzing sound

PART D: PARTICLE SIZE + SURFACE AREA

SUBSTACE	OBS
sheet	a lot of bubbles, like a lot
powdered	nothing really, a few bubbles

Analyses:

1. $2HCl + Zn \rightarrow ZnCl_2 + H_2$
2. $2H_2O_2 \rightarrow 2H_2O + O_2$
3. The $FeCl_3$ .1M and $Fe(NO_3)_3$ .1M were the 2 ionic compounds we tested that were effective catalysts.
4. Both compounds have Fe.
5. Our splint test in Part A did not work properly, but idealy the highest temp.'s 'pop' should be louder than ours at room temp.
6. Surface area increases as particle size decreases.

7. As temperature rises the rate of reaction rises also. Higher temperature causes particles to move and collide more rapidly and frequently.
8. Higher concenstration also increases reaction rate. The more particles result in more collisions in a given space.

Error analysis: In Part A, our original splint tests did not work. I think we waited too long after putting the zinc in to cover making too much gas escape. We may have also waited too long after uncovering to do the actual test, also letting gasses escape. When we re-did the room temp splint test, we moved faster and it resulted in a soft pop.

Conclusion: Through this lab, we expirimented with 4 factors that affect reaction rates. Both higher concentration and higher temperature increases particle collisions which increases reaction speed. We learned the ~~Fe~~ iron can be used at a catalyst because in part B, those were the only 2 to react. Because the powdered zinc in Part D had a larger surface area, the reaction was quicker. The longer duration of bubbles of the chunck of zinc shows how its larger particles size decreases surface area slowing the reaction.

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