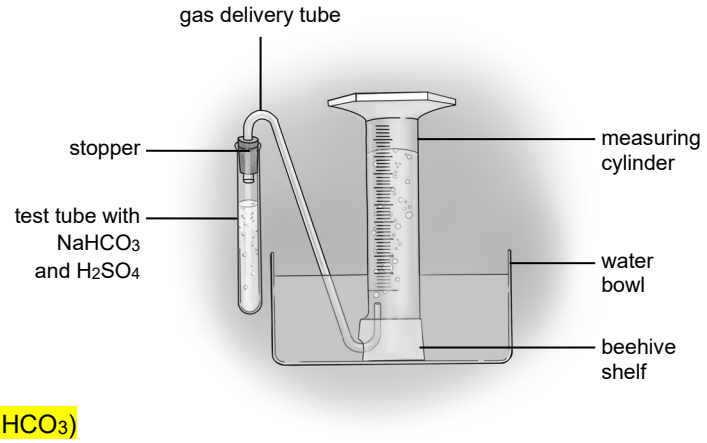
Practical activity that forms part of the Gr 10 Physical Sciences 3-in-1 Class text and Study Guide. See p. 127 MODULE 3 TOPIC 2 Unit 1 for the theory.

PRACTICAL EXPERIMENT

Investigate the relationship between the amount of products and reactants during a chemical reaction

Materials

- ○ syringe
- ○ water bowl
- ○ 2 test tubes
- ○ measuring cylinder (50 mℓ)
- ○ long gas delivery tube
- ○ stopper
- ○ beehive shelf
- ○ chemical scale/mass meter
- ○ glass disc
- ○ sodium hydroxide carbonate ($NaHCO_3$)
- ○ dilute sulphuric acid (H_2SO_4)



Method

1. Fill a measuring cylinder with water and invert it on top of a beehive-shelf in a water bowl as shown in the setup.

PRECAUTION

Ensure that the measuring cylinder is filled to the brim with water (there are no air bubbles) and cover it with a glass disc. Firmly hold the disc in place with one hand and quickly invert the cylinder with the other hand onto the beehive shelf. Ensure that the opening is completely submerged before removing the disc.

2. Weigh out 0,17 g of $NaHCO_3$ into a test tube and seal the test tube with a rubber stopper.
3. Attach one side of a gas delivery tube to the test tube and insert the other, open end under the beehive shelf so that it leads into the lower end / opening of the measuring cylinder in the water bowl.
4. Fill a syringe with 5 mℓ dilute H_2SO_4.
5. Quickly open the test tube, add the H_2SO_4 to the $NaHCO_3$, and close the rubber stopper again.

6. Note the release of a gas. The gas collects in the measuring cylinder through the downward displacement of water.
7. Once the gas has stopped bubbling, use a glass disk to close the measuring cylinder while it is still under water.
8. Turn the measuring cylinder the right way up and read off the volume of gas that was collected in the cylinder.
9. Repeat the experiment by weighing out the same amount of $NaHCO_3$, i.e. 0,17 g, into the second test tube, but now add 10 mℓ H_2SO_4.
10. Record your results in the table below.

	Experiment 1 $NaHCO_3$ + 5 mℓ H_2SO_4	**Experiment 2** $NaHCO_3$ + 10 mℓ H_2SO_4
Volume of reactant (H_2SO_4)		
Volume gas (CO_2)		

Observations and discussion

- When $NaHCO_3$ reacts with H_2SO_4 a gas, CO_2, is produced.
- The gas flows through the delivery tube and is collected in the measuring cylinder through the downward displacement of water.
- When the volume of H_2SO_4 is increased to 10 mℓ in the second experiment, double the volume of CO_2 gas is collected.

Conclusion

The amount of the products depends on the amount of the reactants, i.e. more reactants will form more products.

The equation for this reaction is:

$$2NaHCO_3(s) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(\ell) + CO_2(g)$$

0,2 g	5 mℓ	x mℓ
0,2 g	10 mℓ	$2x$ mℓ

NOTE

Initially there must be enough $NaHCO_3$ to react with 10 mℓ H_2SO_4 in total. This amount can be determined with the help of stoichiometric calculations.