**EXPERIMENT: Baking soda - vinegar rocket**

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**Aim**: explore acid-base reactions through baking soda – vinegar rockets, learning that they are exothermic i.e. typically a lot of energy is released in acid-base reactions; it also provides a transition to gravity and Newton’s laws of motion.

**Age**: 8+

**Complexity**: Medium

**Cost**: Low

**Location**: Outdoor

**Materials & Equipment** baking soda (1 to 2 spoonfuls), vinegar (160 mL), paper nose cone (for visual and aerodynamics), plastic bottle (0.5 L), sturdy straws or pencils to stabilize the rocket, sellotape, paper tissue, clean or rinsed cork, an open outdoor area at least four metres from buildings and other people (e.g. a large garden or a quiet park).

A smaller-scale alternative is a plastic film canister with a lid and tight seal (for example Fuji or Kodak): <https://www.scientificamerican.com/article/bring-science-home-homemade-rockets/>

**Outline** from <https://www.bbc.co.uk/programmes/p01tbhw8>

- Place the paper nose cone on the back of the bottle and the straws as fins on the front of the bottle (see video).

- Fill the bottle about a third of the way up with vinegar (white vinegar is preferred as it will make the least mess).

- Make a baking-soda release parcel: put 1 to 2 spoonfuls of baking soda onto tissue paper (start with 1 spoonful; 2 spoonfuls will launch the rocket higher), fold the corners up and twist the wrap to hold the powder (see video).

- Put on your safety goggles at this point!

- Put the soda parcel in the bottle, without disturbing it, and then push the cork in firmly behind.

- Keep the bottle away from your face and shake it, quickly put it on a flat surface on its fins, and **take a couple of steps back quickly** (something like five steps – see video - it should take a few second for the rocket to launch after the soda parcel and vinegar get into contact).

- Note that the rocket can reach quite some height, i.e. easily 6 m judging by the BBC video.

**Learning outcomes:**

- Learn about acid-base reactions as exothermic reactions.

- Learn about Newton’s law of motion (‘action and opposite, equal reaction’).

- Learn about gravity i.e. about how rockets need to overcome Earth’s gravity.

**RISK ASSESSMENT**

**Adult supervision is absolutely required for this experiment!**

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| HAZARD | Likelihood and Seriousness of Injury | Control Measures | Remaining Risk |
| Physical injury | Medium | Appropriate age group, parental supervision, wear eye protection when launching rocket. | Low |
| Eye irritation/injury | Medium | Appropriate age group, parental supervision, wear eye protection when adding baking soda to vinegar and when launching rocket. | Low |

**First Aid: this experiment uses household products; in case of eye irritation, rinse eyes with clean water; have a first-aid kit or similar at hand in case of physical injury.**

**Remember - never do experiments alone!**