

10 ROCKETS OF DR YURI

During Dr Yuri Blashtov's performance at Questacon, he'll try and launch 10 rockets. Dr Yuri's 'rockets' are not all rockets in fact, some are projectiles—they get given a push and then just fly through the air! Can you figure out which of the following are which?

1. HYDROGEN POWERED ROCKET

Yuri's first rocket is launched with the assistance of hydrogen, a very flammable gas. A balloon is used to hold the gas. When ignited, the hydrogen reacts with oxygen in the air to produce an explosion. While this explosion is impressive, the balloon does not make a good rocket because the force, or thrust, of the explosion pushes out in all directions. This means that only a little thrust is directed upwards, so the rocket payload doesn't go very high!



2. ROCKET BALLOON

The simple release of an inflated balloon demonstrates Newton's third law of motion – that for every action, there is an equal and opposite reaction. In this case, air is pushed out through the neck of the balloon in one direction and the balloon is pushed in the opposite direction. There is nothing to stabilise the flight of this rocket so the flight path is wobbly.

3. FINGER ROCKETS

Energy is used to pull back elastic within the rocket. When the elastic is released the rocket is pushed forward by the stored energy. When you add fins to the rocket, the flight path is much straighter because the back of the rocket is slowed slightly and stays in place.

5. AIR ROCKET

Using a foot pump, air is pushed into a plastic bottle, increasing the pressure. When the pressure is high enough the air escapes out of the narrow opening of the bottle rocket, pushing the rocket in the opposite direction. Because air does not have very much mass, the rocket does not get pushed very high.

6. WATER AND AIR ROCKET

This is the same rocket as the previous one, only a small volume of water has been added. Air is again pushed into the bottle with a foot pump. On release, water is forced out of the bottom of the rocket by the compressed air above it, and the 'reaction force' pushes the rocket in the opposite direction. The water gives a bigger push than just air because a volume of water has more mass than the same volume of air.

As the water leaves the rocket gets lighter, so the push has more effect and the rocket accelerates at a faster and faster rate. This happens with space rockets too. As fuel is used, or stages discarded, the rocket becomes lighter and so accelerates faster.



7. ROARING JUG

A small amount of liquid fuel is placed in an empty 15L water bottle. The fuel slowly evaporates, and when a match is dropped in the bottle the fuel vapour and oxygen inside quickly combust. This reaction increases the volume of gas in the bottle, and so a flame will shoot out the top.

8. ALCOHOL FUELLED ROCKET

This rocket works in a similar way to the roaring jug, with the addition of a projectile. A small amount of alcohol is misted into the chamber and evaporates, mixing with the oxygen inside. Again, the vapour is set alight, however this time the increase of volume of gas in the bottle is used to launch a projectile in to the air.

9. SMALL CHEMICAL ROCKET

A dissolving headache tablet, with a little water, is put in a film canister and tightly capped. The chemical reaction produces gas which builds up pressure inside the canister until eventually it is too much and the canister shoots upwards. The canister travels high in the air as a result of the direct push. You can produce the same effect by using citric acid, bicarbonate of soda and water.



9. POP OFF ROCKET

A dissolving headache tablet, with a little water, is put in a film canister and tightly capped. The chemical reaction produces a gas which builds up enough pressure in the canister to pop off the canister. The canister travels high in the air as a result of the direct push, the lid gets pushed downwards, but doesn't go very far because the table pushes back on it!



10. LARGE CHEMICAL ROCKET

The chemical reaction between two common kitchen ingredients (bicarbonate of soda and vinegar) produces a large amount of carbon dioxide gas. We create this reaction inside a sealed plastic bottle, which increases the pressure inside. When released, the gas pushes downwards out of the neck of the bottle, pushing the bottle upwards —similar to a space rocket where a chemical reaction produces gases which push out of a narrow opening and push the rocket in the opposite direction.