

Creating Science – Matchstick Rockets.

Blast into space and maths with the matchstick rockets! A fun lesson with a focus on safety and scientific thinking.

Suggested Outcomes

(NOTE: This is by no means an exhaustive list of possible outcomes, neither is it intended that ONLY these outcomes can or should be met. Science is a deeply interrelated activity, and you may find cross curriculum links you can and should use.)

- Science inquiry skills: Develop and test out rocket designs: Question and Predict, Plan and Conduct, Process and Analyse, Evaluate, Communicate.
- Nature and Development of science f-7: predictions, testing.
- Use and influence of science f-7: people use science (i.e., to make rockets work)

Also

- Physical sciences 3: Heat can be produced in many ways and can move from one object to another
- Physical sciences 4: Forces can be exerted by one object on another through direct contact or from a distance
- Physical sciences 7: Change to an object's motion is caused by unbalanced forces acting on the object (and physical science f, 2)

Warning

- Rockets are hot. Do not touch directly after use or you will burn your hands. DO THIS ACTIVITY OUTDOORS OR IN A NON-CARPETED AREA.
- Rockets move fast.
- WEAR EYEWARE PROTECTION. Not only as good safety practice, someone will eventually try to catch it mid-flight and THIS IS A BAD IDEA.

Preparation

- See activity sheet and end of document

Learning Intent (student friendly)

'We are learning to' (WALT).

Success criteria

'What I'm looking for' (WILF).

Engage

⇒ Explain the learning intentions for science club

Activity - play with air powered rockets for a bit.

Focus the activity by asking students to generate questions about the toys. For example,

- Where did rockets come from?
- Who invented rockets?
- How do we make a rocket go out the window?
- How do we make a rocket to all the way to the moon?

⇒ Make sure all students write down any questions they may have generated during this phase regarding the topic for today.

Explain - today we are learning about rockets. Rockets form a vital part of space exploration.

Activity - have students develop a Learning Intention of this lesson. What do you want to learn about today? Write it down.

Student learning goals

Help students make a self-monitored learning goal for this lesson.

Explore

⇒ Encourage and validate student explanations of this phenomenon. You may like to ask students to write or draw their explanation personally to avoid embarrassment to students unfamiliar with this material. Remember, 'I don't know' is a valid explanation in science - it is the beginning of learning new things!

In world war II the Nazi scientists invented rockets that could go from one country to another country. It was terrifying - a rocket could come out of nowhere and destroy an entire building. So when the Allies defeated the Nazi's, they captured the scientists and invited them to work on using their rocket science, instead of hurting people, to build rockets that could get into space and maybe even the moon. So from the rocket science of war comes the peaceful exploration of space!

- ⇒ How do rockets help?
- They put up satellites for communication, weather and GPS.
 - Fireworks
 - Ejection seats
 - Space exploration, and more!

Explain

Rocket science is pretty easy - if you want something to go up, something else has to go down.

⇒ Demonstrate with bottle rockets. Air pushes water down, and bottle up.

⇒ Demonstrate with matchstick rocket.

Explain the process of science – use a poster.

Elaborate

Make some matchstick rockets

Show them <https://www.youtube.com/watch?v=xf0qa0c3Vrw> or give them the handout at the end of this document

Warnings

- DO NOT let kids pick up rocket right away, they are HOT.
- If you use tea light, HOT WAX WILL GET EVERYWHERE.
- Knives are not needed or recommended for this activity.

How many more match heads does your rocket need to reach outer space?

Calculate – if space is technically around 100kilometers away, and your rocket manages to go 10 meters, how many more match heads does it need to reach outer space?

How many meters in a kilometre? 1000.

And how many in 100 kilometers? 100,000 (100 * 1000)

Divided by how far the rocket can already go; 10,000 – so you need 10,000 match heads to reach space!

HOWEVER!!

We're ignoring a few facts, not the least of which is that as a rocket gets heavier, it needs even more fuel to get going.

A simple division won't help us, we need calculus – an advanced branch of mathematics dealing with changes.

You will not get into space on matchheads, because the rocket will end up being so heavy it goes nowhere.

That's why we use much more powerful fuel than matchheads to get into space.

Rocket science

There's really one very complex problem in rocket science – if you want to go further or faster, you need more fuel. The problem is that the more fuel you have, the more the rocket weighs. And the more the rocket weighs, the harder it is to send it far or fast. It quickly balloons out to making space rockets, very, very large.

Evaluate

⇒ Review with students what they felt they learnt from this unit. Did they have any questions at the start that they feel were answered?

Success criteria

⇒ Review the Learning Intentions of this lesson with students. Was it met?

Summative:

Help students consider ways they can communicate their new understanding to others, just as scientists need to do.

Present a document or talk on the topic : what makes matchstick rockets fly best? Students might like to include:

- Too many match heads just burn up. But too little and it might not even get off the launch pad. Getting the balance just right is a skill.
- Too tight, and the aluminium holds on to the skewer, yet too loose and the hot gasses slide right past the skewer and never get enough pressure to launch the rocket.
- You need to carefully pinch the end of the rocket or the hot gas flies out that way instead of launching the rocket.

So what?

The science process is important to know

Safety procedures keep us safe

Rockets are dangerous fun

Creating science

Science as a human endeavour

- Use and influence of science f-7: people use science (i.e., to make rockets work)

Science inquiry skills

- Science inquiry skills: Develop and test out rocket designs: Question and Predict, Plan and Conduct, Process and Analyse, Evaluate, Communicate.
- Nature and Development of science f-7: predictions, testing.

Science content

- Physical sciences 3: Heat can be produced in many ways and can move from one object to another
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How To Make Science Happen

Question and Predict

What would you like to learn more about? You're the scientist now!

From what you know and have experienced, gather information and then think of ideas that explain how the world works.

Communicate

Science must be shared! Consider your evidence, justify your position and present your conclusions. Can you present your findings to others to convince them of your logic and evidence? Answer the WHAT and they WHY questions.

Dr. Joe
the Travelling
Scientist, PhD
Proudly presented by **Creating Science**

Plan and Conduct

Think of ways to test your ideas. Collaborate with others, and make sure you have all the equipment you need, and that you've made a plan for recording your results.

Now: Test. Remember - safety first!

Evaluate

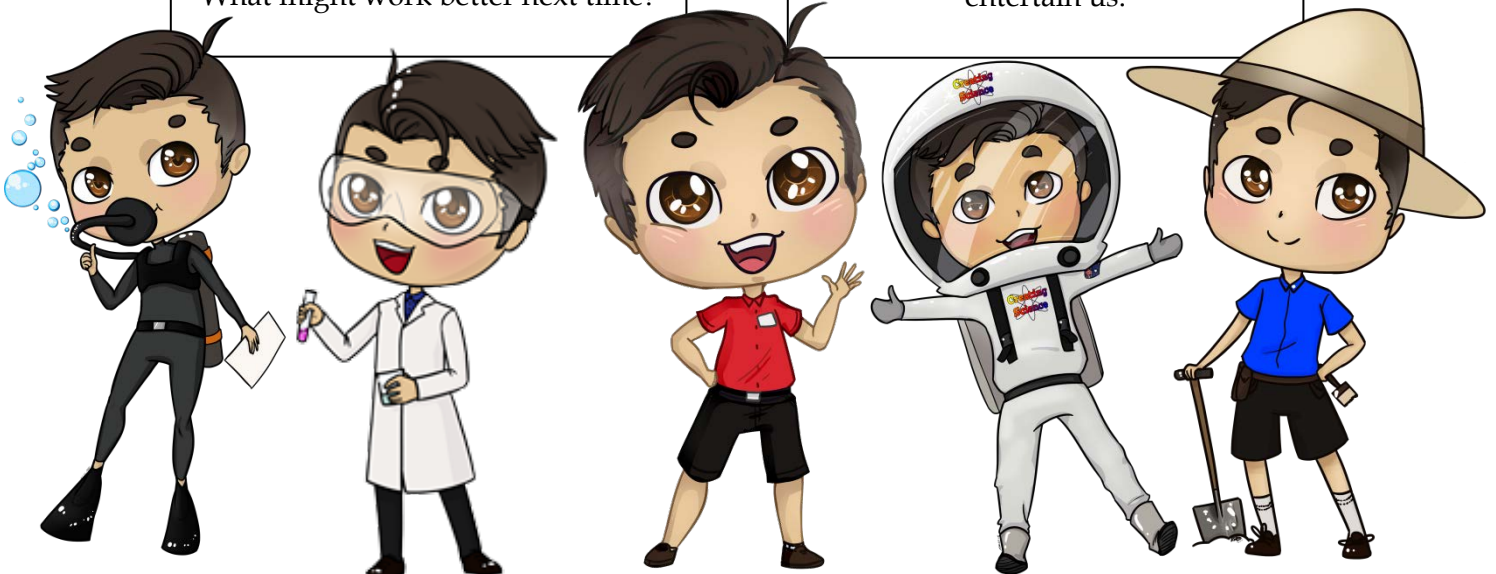
Compare your thinking, results and methods with others. What did you learn about the world? What did you learn about learning through science?

What might work better next time?

Process and Analyse

What are your results trying to teach you? Study carefully...

Remember *experiments always work* - because their job is to teach us something new, not just to entertain us.



So many different kinds of science using the same method!

Appendix: Making the Matchstick Rockets

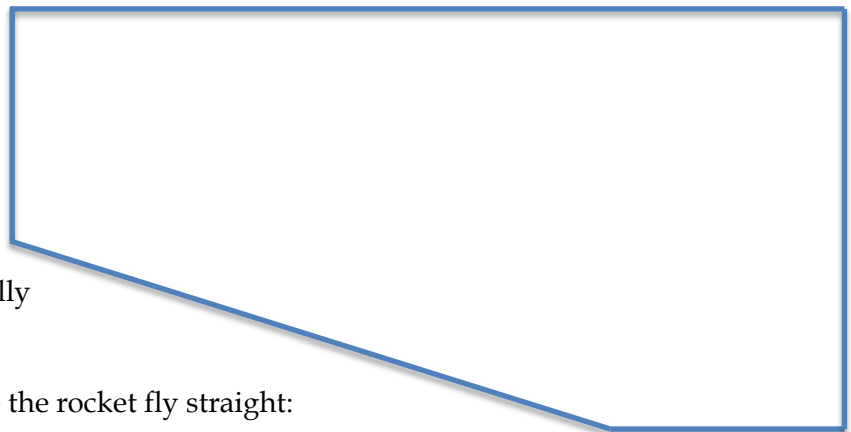
Caution, caution, caution! Matchheads burn and fire is dangerous! BE CAREFUL!

You'll need

- Aluminium foil, and lots of it for failed rockets and improved designs.
 - A box of matches – be careful and safe!
 - A wooden skewer.
 - A Launchpad – a wad of blutack might do it, or a hole cut into a box. Use your imagination.
 - A source of fire, other matches will do, but gas lighters are often better especially outdoors.
- You'll also need:
- Scissors to cut the foil
 - Pliers to squeeze the nose of the rocket closed
 - Superglue or similar to hold the fins onto the rocket so it can fly straight (-er)

Matchstick rocket instructions

- Cut the end off a skewer just at the tip, leaving a taper.
- Cut out the aluminium foil using the template below
- Cut the head off a match
- Place the head of the match and the skewer onto the foil at the long end as show
- Wrap them up TIGHT.
- Pinch the end nearest the match head closed carefully and thoroughly with pliers.



OPTIONAL: Making the fins to help the rocket fly straight:

- Cut out a 2cm square of foil
- Fold it diagonally in half, twice.
- Snip off a tiny piece at the end to fit onto your rocket
- Fold into shape
- Glue carefully to the end of your rocket using superglue or similar – be careful!



Experiment

Answer one of the following or make up your own – do more matchheads work better? Using maths, can you figure out how many matchheads you'd need to make your rocket leave the atmosphere?

Caution! Rockets are burning hot after launch – DO NOT TOUCH!