Support Resources

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Skills Development

- Careers and the World of Work
- Curriculum Cymreig
- Developing Communication
- Developing Number
- Developing Thinking
- Personal Social Education
In this activity, pupils investigate different forces acting on an object by making a bottle rocket from waste materials.

**What you need:**
- Empty plastic pop bottles
- 15cm diameter circles cut out of card
- Scissors
- Tape
- Coloured pens or pencils

**What you do:**
- Split the class into pairs.
- Hand out enough materials for each pair to make one bottle rocket.

**Instructions to pupils:**
- Draw a dot in the centre of your circle of card.
- Using the scissors, cut a straight line from the edge of the circle of card to the dot in the centre.
- Roll the card into a cone shape and tape it in place.
- Decorate your card cone to look like a rocket.
- Put the card rocket over the top of the empty plastic bottle.
- Squeeze the bottle.

When each pair has a working rocket, ask them to explore the following questions:
- What is making your rocket move?
- How can you make your rocket travel further?
- How would altering the shape and size of your rocket change how it moves?
- Can you think of any other ways to make your rocket move?
- What would you expect to happen if you used a 2 litre pop bottle and a giant cone rocket?
An astronaut needs food, water and oxygen to survive in space.

**Years 3 and 4**

- An astronaut needs 1 kg of oxygen, 0.5 kg of food and 4 kg water to survive. How much of each are needed to spend 10 days in space?
- How many 5 kg containers would an astronaut need to take all of the food, oxygen and water needed for 10 days in space? Remember you cannot mix food, water and oxygen.
- In 10 days an astronaut produces 1.5 kg of solid waste and 35 kg of liquid waste. How many 5 kg containers would be needed to store all of this?

**Years 5 and 6**

- Every day an astronaut needs 0.8 kg oxygen, 0.6 kg food and 3.5 kg water. An astronaut produces 0.1 kg solid waste, 3.8 kg liquid waste and 1 kg carbon dioxide each day.
- On a 10 day space flight, how much food oxygen, water and food would a crew of 3 need? How much solid waste would they produce in total?
- How many 10 kg containers are needed to carry all of the food, water and oxygen? How many 5 kg containers would be needed to bring back the solid waste?
Challenge

Dan and Laura are playing with a football. Dan notices that the football bounces up in the air when it hits the ground. He says, “This ball bounces really high. I think that is because it’s very light.” Laura watches and thinks about this. “I don’t know,” she says. Then she gets a coin out of her pocket and drops it on the floor. “Well, this coin is also light but it didn’t bounce like the ball. Do you think there’s another reason why the ball bounced?”

- Explore Laura’s question.
- What different materials are balls made from?
- What things can affect whether or not something will bounce when it hits the floor?
Gather/Organise

This is the starting point for the activity. Pupils assimilate all their knowledge about the topic into their working memory. At this stage it is possible to identify what pupils already know and any gaps in their knowledge. It is also possible to begin differentiating between pupils.

Questions to ask pupils at this stage include:
- What do you know about this?
- Where have you met this before?
- What information do you have?
- How much do you understand?
- What questions do you need to ask?

Identify

Pupils explore their understanding of the task to make sure they know what is required of them. Pupils can also set the success criteria for the activity at this stage.

Questions to ask pupils at this stage include:
- What is the task?
- What are your goals?
- What are your obstacles?
- What do you need to know?
- What do you need to do this?

Generate

This is a creative and open-ended stage. Pupils may engage in brainstorming. Here all ideas about how to approach the task are valid.

Questions to ask pupils at this stage include:
- How many ideas can you find?
- Who can help you?
- Where can you find out more?
- What do other people think?
- Is there another way?

Decide

This is a logical, rational, left-brained process, in contrast to the previous stage. Pupils consider time constraints, available resources, health and safety, as well as whether the idea fulfils the brief, when making decisions.

Questions to ask pupils at this stage include:
- Which ideas are important?
- Which is the best idea?
- What will happen if…?
- What is your plan?
- What else do you need to do?

Implement

Pupils test their idea in an attempt to fulfil the criteria for the task. Teamwork is key to their success at this stage. Pupils may work to a structured plan. The focus for this stage is ‘maximum thinking, minimum recording’. This stage is all about developing thinking.

Questions to ask pupils at this stage include:
- How do you do it?
- How do you check your progress?
- Are you doing it correctly?
- Is your plan working?
- What do you do next?

Evaluate

Pupils should be realistic about their achievements and identify the next steps for improvement. Self and peer evaluation are key elements of this process.

Questions to ask pupils at this stage include:
- What have you done?
- How well did you do?
- How could you do better?
- Did you solve the problem?
- Did you work well in your group?
**Communicate**

Pupils present their findings to an audience; this could be within the class, the school or beyond. This stage can increase the pupils’ motivation and engagement.

Questions to ask pupils at this stage include:
- Who will you tell?
- How will you tell or present?
- What will you say?
- How will you explain?
- How will you interest others?

**Learn from Experience**

This final stage focuses on metacognition; this is ‘thinking about thinking’. In this stage pupils reflect on and discuss their learning. This stage can significantly enhance the impact of the learning experiences.

Questions to ask pupils at this stage include:
- What have you learned?
- How have you changed?
- What do you think and feel now?
- How can you use what you have learnt?
- How would you use this again?
Concept Photos

These ‘concept photos’ have been developed to promote discussion and to stimulate scientific thinking. They show different people discussing an everyday situation and presenting alternative explanations for what can be observed. Because of this, they are a good tool for demonstrating real life applications of science. Each concept photo shows one of Techniquest’s exhibits or an everyday situation linked to the science-based topic. Open questions can be used to stimulate thinking and discussion. All pupils’ ideas and points of view should be treated equally.

Developing your own images

To do this:

• Use everyday contexts that pupils are familiar with.
• Provide three or four alternative statements for discussion.
• Use positive rather than negative statements.
• Refer to research on common pupil misconceptions for guidance on statements.
• Include the scientifically acceptable viewpoint.

Photo 1

The following questions can be used:

• Do you agree with any of the people in the picture? Who? Why?
• Do you disagree with any of the people in the picture? Who? Why?
• Can you think of any other explanations that are not included here?
• How can we find out which point of view is the most suitable?
• Is it possible that more than one point of view is suitable here?
• Why do you think different pupils have different points of view?

Photo 2

For this activity, only one of the speech bubbles has been filled in. The following open questions can be used:

• Do you agree or disagree with this statement? Why?
• Can you think of any other explanations that are not included here? These should be filled in on the image.
• Now we have some explanations, which do you agree or disagree with? Why?
• Is it possible that more than one point of view is suitable here?
I think whether or not the egg breaks depends on how far it falls.

I think it will depend on how hard it is thrown.

I think it depends on what materials are used.
I think to make this a fair test, we all need to do the same thing.
Range
How Things Work
Pupils are given opportunities to study:
• Forces of different kinds, e.g. gravity, magnetic and friction, including air resistance.

The Sustainable Earth
Pupils are also given some opportunities to study:
• The relative positions and key features of the Sun and planets in the solar system.
• A comparison of the features and properties of some natural and made materials.
• The properties of materials relating to their uses.

Skills
Communication
Pupils are given opportunities to:
• Search for, access and select relevant scientific information, from a range of sources, including ICT.
• Communicate clearly by speech, writing, drawings, diagrams, charts, tables, bar charts, line graphs, videos, and ICT packages, using relevant scientific vocabulary.
• Use standard measures and S.I. units, e.g. kg, s, N, m.

Enquiry
Planning
Pupils decide upon and give some justification for each of the following:
• The choice of success criteria.
• Predictions using some previous knowledge and understanding.
• Where and how to find relevant information and ideas when carrying out a fair test, the key variables that need to be controlled and how to change the independent variable whilst keeping other key variables the same.
• The observations or measurements that need

Developing
Pupils are given opportunities to:
• Use apparatus and equipment correctly and safely.
• Make comparisons and identify and describe trends or patterns in data and information.
• Use some prior knowledge to explain links between cause and effect when concluding.
• Form considered opinions and make informed decisions.

Reflecting
Pupils think about what they have done in order to consolidate learning and transfer skills by:
• Beginning to evaluate outcomes against success criteria.
• Deciding whether the approach/method was successful.
• Describing any amendments made to the planned approach/method.
• Suggesting how the approach/method could have been improved.
• Describing how they have learned and identifying the ways that worked the best.
• Linking the learning to similar situations, within and outside school.
Skills Framework

Developing Thinking

Plan
- Asking questions.
- Activating prior skills, knowledge and understanding.
- Gathering information.
- Determining the process/method and strategy.
- Determining success criteria.

Develop
- Generating and developing ideas.
- Valuing errors and unexpected outcomes.
- Entrepreneurial thinking.
- Thinking about cause and effect and making inferences.
- Thinking logically and seeking patterns.
- Considering evidence, information and ideas.
- Forming opinions and making decisions.
- Monitoring progress.

Reflect
- Reviewing outcomes and success criteria.
- Reviewing the process/method.
- Evaluate own learning and thinking.
- Linking and lateral thinking.

Developing ICT

ICT Skills Framework
- Finding and developing information and ideas.
- Creating and presenting information and ideas.

Developing Communication

Oracy
- Developing information and ideas.
- Presenting information and ideas.

Reading
- Locating, selecting and using information.
- Using reading strategies.
- Responding to what has been read.

Writing
- Organising ideas and information.
- Writing accurately.

Wider Communication Skills
- Communicating ideas and emotions.
- Communicating information.

Developing Number

Use Mathematical Information
- Using numbers.
- Measuring.
- Gathering information.

Calculate
- Using the number system.
- Using a variety of methods.

Interpret and Present Findings
- Talking about and explaining work.
- Comparing data.
- Recording and interpreting data and presenting findings.

Key

- Main focus
- No intended focus
- Incidental focus