Creating Science – Movement Energy and Hovercraft

*Things don't stop because they 'run out of energy', but because something **makes them stop**. Can you make a device that goes further without adding any energy to its push at all?*
#CreatingScienceHovercraft

Suggested outcomes

(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 use.)

Science understanding

- Physical sciences F: The way objects move depends on a variety of factors, including their size and shape.
- Physical sciences 4: Forces can be exerted by one object on another through direct contact or from a distance.

Science as a human endeavour

- Use and influence of science 4: Science knowledge helps people to understand the effect of their actions (ACSHE062)

Science inquiry skills

- Evaluating 4: Reflect on investigations, including whether a test was fair or not (ACSIS069)

Science vocabulary words

Tier 1 (Everyday words) – hovercraft, air, force (push and pull)

Tier 3 (Specialised vocabulary)

- Friction – a force that opposed motion and turns it into heat.
- Thermodynamics – the study of heat.

Warning

- Balloons and hot melt glue guns – please exercise all appropriate caution.

Preparation

- Bring CDs – one per student.
- Pop top lids, or a small piece of plastic tubing that can fit into the mouth of a balloon.

Suggestions for other year levels

As always, more material is presented here than can be used by the average class during the average lesson time. However, since the students' questions can and should guide student learning, more material is presented for your convenience. Remember, it is not uncommon for students to only remember those points which answered their personal questions.

Younger:

This activity is well suited to this age group.

Children at this age can have difficulty with focus. Avoid tangents if you're attempting to make a key point.

Middle:

This activity is very well suited to this age group.

Teen:

Please provide extra challenges or they may get bored. Perhaps you can arrange distance races across a long, flat surface, or perhaps help students to experiment with different balloons.

Engage

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

Review previous material

- What is stored energy?
- What is electrical energy?
- What is light energy?
- What is sound energy?

Play with and explore some science toys:

- ⇨ Ask – what is similar about sound, light, heat and electricity?

Explore

Help students realise that sound, light, heat and even electrical energy are all forms of Movement energy.

- ⇨ Therefore, the universe only contains two kinds of energy;
  - Things that are moving (kinetic energy), or things that are trying to move but can't yet (potential energy).

Explain

Thermodynamics

Set up your own teacher hovercraft which you have prepared earlier. Do not blow up the balloon yet.

Explain that there is a rule in science called the law of thermodynamics number 1: Energy cannot be crated or destroyed.

Explain: so if I push this car/hovercraft/etc it should never run out of movement energy!

- ⇨ Demonstrate that it does eventually stop.
- ⇨ Ask why, if energy cannot be destroyed?

It is due to rule number 2. Maybe energy cannot be created or destroyed, but it can be changed or transferred into other kinds of energy. And in every energy exchange…

- ⇨ SOME ENERGY IS LOST BY TURNING INTO SOMETHING WE CAN'T USE!!! (usually heat) This is the rule of thermodynamics number 2.

Play with various toys. Can you figure out how energy is being lost?

- In a Newton's Cradle we want it to move, and probably even click. But some energy goes into making the air move out of the way, and that slows it down.
- A gyroscope will spin for ages, but some energy turns into heat as friction rubs along the axel, which slows the spinning down. Space satellites use gyroscopes for balance or turning, but it's no good if they keep slowing down. They use magnets to prevent the gyroscope touching anything, and since there's no air to slow it down some spinning gyroscopes will spin, theoretically, forever.

Elaborate

- ⇨ Ask students if they can design new ways to test this explanation, is it really sufficient? Can they think of further or better explanations, and the experiments needed to test them?

Invite students to build and test factors that make the hovercraft work more effectively, for example, they could test;

- Does balloon colour effect the distance the hovercraft will move?
- What kind of flooring is best for the hovercraft?
- Are more full balloons better, or does the extra air weigh it down?
- Are older, stretchier balloons better or brand new ones?
- And there are many, many other ideas students could try.

Encourage students to be considerate of the Fair Testing

- Keep every other factor possible the same except the one they're testing. Is the floor the same for both hovercraft? Are they all getting exactly the same push off at the start (and how will they be sure of that?)

And for every other factor that cannot be controlled for, we use multiple testing!

- Make sure students test their designs and hypothesis 'as many times as reasonable' in order to create the best knowledge possible.

Extension

Therefore – if energy is always lost or wasted in every energy exchange, it means that while energy is never created or destroyed, high quality energy SOURCES can be wasted and used up.

For example:

- Coal can be used to create electricity, but it won't last forever, what can be done about this?
- Solar power is likely to last the next five billion years at least, so what, if any, are the problems with using it more often?
- Discuss further as students are inspired.

Extended extension

The fear is the universe may eventually experience a 'heat death' in billions of billions of years' time, when the stars all go out and there is nothing but cold matter floating around in a universe with no high quality energy sources – it's all spread out as heat. This is a bit of an ironic term, since the heat in the universe suffering heat death would only be a few degrees above absolute zero (that is, everything would be frozen). A very boring end to the universe indeed!!

Evaluate

⇨ Review with students what they felt they learnt from this lesson. 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?

At the end of each class, review the learning objective and see how we did. Ask:

⇨ Did you achieve your learning goal?
⇨ What did You learn?
⇨ What worked to help you achieve it?
⇨ What might you do better next time?
⇨ (If needed) where can you go for extra help or information?

Assessment

Prior learning:

Take time to focus on planned content material during the engage phase, for example, helping students understand that things that are moving relative to them have movement energy.

Formative:

Make sure students are keeping up by giving them the chance to ask questions for clarity, and explain their observations.

Summative:

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

So what

- All forms of energy are either movement or potential energy
- Laws of thermodynamics 1 & 2 - Energy is never lost or destroyed, only changed into something we can't use.
    - So we need to be very sensible with our energy sources.
- Powerful decisions can only be made by informed people. As we research which energy sources are wisest, we help contribute to developing a sustainable future for our culture.

Science understanding

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Tips from the masters

Floors can be fun but don't stick your mouth on that CD anymore!

Tables are muuuch better!