Lesson Plan: Discover pumped hydro

Year 8: Science

Lesson plan discover pumped hydro part 1

Materials list

Discover pumped hydro kit contents* or teacher to organise	15 x 1 litre plastic soft drink bottles 4 hot glue guns to be shared among groups 15 lengths of plastic tubing 15 trays 15 pairs of scissors
Teacher needs to organise	Computer/projector PDF of Boyle's self-flowing flask to display 750 ml bottle of soda water per group of two students. 750 ml bottle of water per group of two students Print Discover pumped hydro student folios – one per student
Recommended media	• TedEd video on perpetual motion machines: https://www.youtube.com/watch?v=A-QgGXbDyR0 • Video from Hydro Tasmania on pumped hydro power: https://www.youtube.com/watch?v=_PH0IJ-_qOI.

*The Discover pumped hydro kit can be sourced by emailing education@hydro.com.au it has enough materials for 30 students.

Teacher preparation

- Email education@hydro.com.au to book a kit that has the materials you will need.
- Gather the soda water and water you will need.
- Organise the materials from the kit for students to gather. Each pair of students will need:
  - 1 empty bottle with a hole in the lid
  - 1 length of plastic tubing
  - 1 tray
  - Pair of scissors.
- Set up hot glue gun stations
- Have students sit with partners.

Method

Begin with a **class discussion** on energy. Have students share what they know about energy in our world. Questions to get the class thinking could be:

- *Where does energy come from?*
- *Can we create it? (Listen but don't confirm the answer to this last question just yet. Students will likely know it).*

Show students the 5 minute TedEd video on perpetual motion machines (see link in Materials List).

Discuss how scientists have been trying to invent machines that create energy for centuries. Now it's the students' turn to create a perpetual motion machine: Boyle's self-flowing flask.

1) Show the Boyles Self-Flowing Flask PDF on a projector and discuss instructions for the experiment. Leave them up for the duration of the experiment.
2) Hand out student folios. Students begin to fill them out including the predictions of the experiment.
3) Each group collects their supplies for the experiment.
4) Students cut empty plastic soft drink bottle in half width-wise. The end with the lid is what the students will need.
5) Students take the bottle lid and use heated glue guns to glue one end of the plastic tube to the hole in the lid, creating a seal. If the tube fits inside the hole, push it through. If it does not, seal it so that the glue does not block the hole. (It is a good idea to have hot glue gun stations set up around the room with cardboard or mats underneath to protect table surfaces).
6) Students will then screw the lid back on the half-bottle.
7) While one person holds the bottle with tube over the tray, as shown in the diagram, the other partner will pour some water in their bottle. Do not pour too much water in the bottle so it overflows. Ensure the tubing loops back into the open end of the bottle. Students make observations and record them in their folio.
8) Students empty their bottles down the sink or into a bucket and start with the soda water. Students make observations and record them in their folio.
9) Soda water can be poured into a sink or bucket.
10) Students complete the student folio and write their conclusions.

Discussion

Have a class discussion about the findings of the experiment.

- *Did the perpetual motion machine work?*
- *Why or why not?*

Note: At the end of this lesson, students should be able to explain why their self-flowing flask did not work. It did not work because of the Law of Conservation of Energy: energy can neither be created nor destroyed. Energy can only be transformed from one form to another. The carbonated beverage may have appeared to work but it was only the carbonation that resulted in the flow. As the carbonation slows, the flow stops.

Lesson plan discover pumped hydro part 2

Materials list

This activity is designed to be carried out in pairs or small groups so they share information.

Teacher resource	• **Video from Hydro Tasmania on pumped hydro power: https://www.youtube.com/watch?v=_PH0IJ-_qOI.**
Student research resources	• https://www.energy.gov.au/government-priorities/energy-supply/pumped-hydro-and-snowy-20 • https://www.hydro.com.au/clean-energy/battery-of-the-nation/pumped-hydro • https://kids.kiddle.co/Hydroelectricity • https://www.tvakids.com/electricity/hydro.htm • https://www.kidsnews.com.au/environment/pm-announces-4-billion-snowy-hydro-expansion-to-start-within-a-week/news-story/0b7be95a635dd3073fff7fa7197b9d76 • https://www.canstarblue.com.au/electricity/hydro-power-australia/ • https://www.originenergy.com.au/about/community/energy-for-schools/students/hydro-energy-years-5-8.html • https://www.nationalgeographic.com/environment/energy/reference/renewable-energy/ • https://www.youtube.com/watch?v=lsSUPpwtqhQ • https://www.youtube.com/watch?v=66YRCjkxIcg
Materials the students will need.	• Student folio for reference. • Laptop to prepare presentation on or other materials or resources students may require depending on the medium they choose for their presentation.

Teacher preparation

- Connect your students with a class of younger students that they can present their projects to.

Method

1. Looking at energy transfer: while at their desks, have students demonstrate the transfer of potential energy to kinetic energy by sitting still and then jumping up.

   Discuss how our bodies get energy *[we get energy from our cells (metabolic energy), which get energy from the foods we eat (chemical energy), which get energy from the sun (radiant energy). It's all energy transformation].*

   What about the energy we use to heat our homes, power our tablets, iPhones and refrigerators? Discuss where the energy that we use every day in our homes comes from. *(It's energy transfer as well. If it's hydro power, it comes from the kinetic energy of moving water).*

   In Australia, over 80 percent of the energy generated each year is from non-renewable resources. The rest (20 percent) is from renewable energy generation, 88 percent of which is generated in Tasmania using hydro power.

2. Briefly **review** why renewable energy is so important now and into the future. A portion of future renewable energy in Tasmania will be pumped hydro power, and has been called the 'Battery of the Nation'.
   - Have students heard of pumped hydro power? *Tasmania will be producing more renewable energy than it can use and will be an important part of energy generation for the nation.*

3. Begin a **discussion** on stored energy:
   - Can energy be **stored**? *Batteries can store energy. Batteries are not a perfect solution as they eventually need to be recharged or disposed of and they are made of chemicals that are not good for the environment.*
   - Why is it important to store electricity (electrical energy) for later use? *So we have energy when we need it. For example, energy from the sun and wind is intermittent as the sun is not always shining and the wind is not always blowing.*
   - Can we store renewable energy such as wind or solar? *Not for long periods of time.*

   Show students the video from Hydro Tasmania on pumped hydro power: https://www.youtube.com/watch?v=_PH0IJ-_qOI.

   - Why is it ideal to use more than one renewable energy source together?
   - Invite an expert from Hydro Tasmania to answer questions about pumped hydro that students may have.

Criteria for Project

Students can work in small groups for this project.

Students should respond to the following question:

- **What is pumped hydro power?**
- **How does it work?**
- **Why is it so important?**

1. Presentations can use a range of mediums (PowerPoint, create a model, role play, stop motion, etc.)
2. All three questions are thoughtfully answered in the presentation. Show students the rubric/assessment tool listed in the teacher guide.
3. Each project needs to meet the comprehension level of the audience. Be creative yet simple.
4. Students need to first research their topic so they fully understand pumped hydro power. (Share the list of resources with the students).
5. Research must be shown and references listed.
6. Each project should be presented in 10 minutes or less to a group of younger students.
7. After presenting, students should seek feedback from the audience.

Extension

Research the proposed Cethana Pumped Hydro site to learn what type of considerations need to be made when deciding on where to locate pumped hydro. Contact education@hydro.com.au for more advice.

Add further context by booking a free power station tour for your class.

Reflection

As a class group review:

- What they enjoyed, what they found challenging, what went well and what they would do differently next time.
- What methods did they use to gain feedback from their audience?