4 Transforming Energy

TASK:
Identifying different forms of energy and how they can be changed.

A hands-on investigation to **explore** how energy can be changed.

Teacher Background Information

Energy can be found everywhere. There is potential energy in objects at rest and kinetic energy in objects that are moving. The molecules making up all matter contain a huge amount of energy. Energy can travel in electromagnetic waves, such as heat, light, radio, and gamma rays. Our body uses metabolic energy from our food. Energy is constantly flowing and changing form. If you take your metabolic energy and rub your hands together, you make mechanical energy. Your hands heat up and the mechanical energy is turned into heat energy.

If we place a scooter at the top of a hill, it has the potential energy to roll down. If a boy jumps on the scooter and pushes off, the scooter will begin to roll, changing potential energy into kinetic energy. The boy used metabolic energy to push the scooter and mechanical energy to keep the scooter moving. The metabolic energy came from a sausage he had just eaten. The sausage had stored chemical energy. That chemical energy entered the animal when it digested a plant and broke the bonds in its molecules. The plant made the molecules by using light energy from the Sun. The Sun's light energy came from electrons in its atoms lowering energy states, and releasing energy. The energy in the atoms came from the nuclear reactions in the heart of the Sun.

So energy can change form. The energy we use every day has always been with us since the beginning of the universe and will always be with us. It cannot be destroyed, it just changes form. That is called the law of conservation of energy.

Assessment

Diagnostic assessment of student's knowledge and understanding of energy is observed throughout this lesson.

Equipment

- Balloons (1 for each group)
- SciTech journals
- Butcher's paper

Activity Steps:

- Review previous lesson (What is energy?).
- Remind the students of the heat energy that was transformed when they rubbed their hands together.
- Divide the class into groups and ask each group to discuss examples of where energy is transformed from one type to another.

- Ask the groups to record their ideas on the butcher's paper.
- Have the groups re-join the class to discuss their ideas.
- Record the suggestions on one large class display.
- Divide the class into groups, assign roles (Chief Scientist, Safety Officer, Lab Technician, Science Journalist and Science Communicator) and hand out badges included at the end of this lesson.
- Explain to the students that they are going to carry out an investigation to determine whether a balloon has energy.
- Ask Lab Technicians to collect balloons.
- Ask the students to examine the balloon and decide whether in a deflated state the balloon has energy.
- Have the students inflate the balloon without tying the end closed.
- Ask the students if the inflated balloon has energy.
- Have the students release the balloon into the air and observe what happens.
- Does the balloon have energy? Has the energy changed?
- Now ask the students to inflate the balloon again and this time stretching the neck of the balloon while they release the air.
- Does the balloon have energy? Has the energy changed?
- Have the students write a science report (example attached at the back of this lesson) of their investigation in their SciTech journals.
- Ask the students to include a table of energy types in their report and annotated diagrams.

Balloon position	Type of energy
Deflated balloon	
Inflated balloon (stationary)	
Inflated balloon released	
Stretching neck	

Interactive Resources

Ausgrid's interactive whiteboard lesson 1

- Slide 9 – Flash video of a car transforming energy
- Slide 10 – Interactive cloze passage
- Slides 11 to 12 – Find-a-word
- Slide 13 – Keyword match-up

4 How to organise a cooperative learning group

Attachment

Introduction

Students need to be taught how to work cooperatively. They need to work together regularly to develop effective group learning skills.

The benefits of cooperative learning include:

- more effective learning – students learn more effectively when they work cooperatively than when they work individually or competitively, and also have a better attitude towards their school work.
- improved self-confidence – students tend to be more successful when working in groups and this builds their self-confidence.
- better classroom management – when students work in cooperative groups they take responsibility for managing much of the equipment.

Structuring cooperative learning

Use the following ideas in planning cooperative learning with your class.

- Introduce group skills and group roles before starting the unit.
- Assign students to groups rather than allowing them to choose partners.
- Vary the composition of each group. Give students the opportunity to work with others who might have a different ability level, sex or cultural background.
- Keep groups together for two or more lessons so that students have enough time to learn to work together successfully.
- Keep a record of the students who have worked together as a group so that by the end of the year each student has worked with as many others as possible.

Group roles

Students are assigned roles within their groups (see below). Each group member has a specific role, but all members share leadership responsibilities. Each member is accountable for the performance of the group and should be able to explain how the group obtained its results. Students must therefore be concerned with the performance of all group members. It is important to rotate group jobs each time a group works together so that all students have an opportunity to perform different roles.

For this unit the groups consist of five students – Lab Technician, Science Communicator, Chief Scientist, Safety Officer and Science Journalist. Each member of the group wears a role badge. The badges make it easier for you to identify which role each student should have – and easier for the students to remember what they and their group mates should be doing. Use the template at the end of this Appendix to make role badges, or create your own.

It is better to divide your students into groups of three as it is often difficult for students to work together in larger groups. If you cannot divide the class into groups of three, form two groups of two rather than a group of four.

Lab Technician

The Lab Technician is responsible for collecting and returning the group's equipment. The Lab Technician also tells the teacher if any equipment is damaged or broken. All group members are responsible for clearing up after an activity and getting the equipment ready to return to the equipment table.

Science Communicator

The Science Communicator is responsible for asking the teacher or another group's speaker for help. If the group cannot resolve a question or decide how to follow a procedure, the Science Communicator is the only person who may leave the group and seek help. The Science Communicator shares any information they obtain with group members.

Chief Scientist

The Chief Scientist is responsible for making sure that the group understands the group investigation and helps group members focus on each step. The Chief Scientist is also responsible for offering encouragement and support. When the group has finished, the Chief Scientist helps group members check that they have accomplished the investigation successfully. The Chief Scientist provides guidance, but is not the group leader.

Safety Officer

The Safety Officer is responsible for making sure the group understands and follows the safe use of materials and equipment. The Safety Officer should be aware of all the electrical safety messages and ensure that the investigations are undertaken in a safe manner. By the end of the unit every student should have undertaken this role and be able to pass the safety test.

Science Journalist

The science journalist is responsible for writing up the investigation and recording observations.

Group skills

The use of cooperative groups focuses on social skills that will help students work together and communicate effectively.

Students will practise the following five group skills throughout the year:

- move into your groups quickly and quietly
- speak softly
- stay with your group
- take turns
- perform your role.

To help reinforce these skills, display enlarged copies of the group skills chart and the group roles chart (see the end of this attachment) in a prominent place in the classroom.

Even though the group skills seem simple, focus on one skill at a time. This will help you to monitor each group's use of the skill. Encourage students to use the skill by observing them as they work and providing them with feedback – this sends the message that working together effectively is important. Leave enough time at the end of cooperative activities to help groups assess their use of the skill.

Supporting equity

In SciTech lessons there can be a tendency for boys to manipulate materials and girls to record results. Try to avoid traditional social stereotypes by encouraging all students, irrespective of their sex, to learn to the maximum of their potential. Cooperative learning encourages each student to participate in all aspects of group activities, including handling the equipment and taking intellectual risks.

Observe students when they are working in their cooperative groups and ensure that both girls and boys are participating in the hands-on activities.

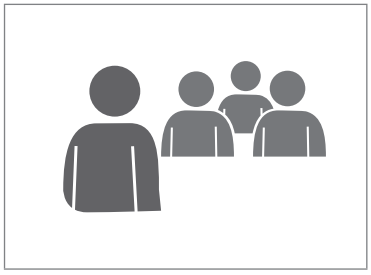
Group skills

1.	Move into your groups quickly and quietly
2.	Speak softly
3.	Stay with your group
4.	Take turns
5.	Perform your role

Group roles

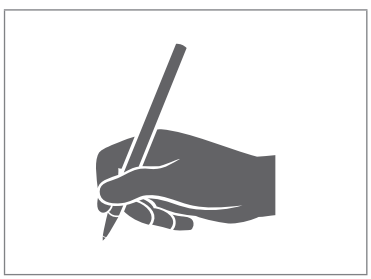
Lab Technician
Collects and returns all materials the group needs.

Science Communicator
Asks the teacher and other group speakers for help.



Chief Scientist
Makes sure that the group understands the team investigation and completes each step.

Safety Officer
Makes sure that the group understands and follows the safe use of materials and equipment.



Science Journalist
Writes up the investigation and records observations.

Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator
Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator
Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator
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Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator
Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator
Chief Scientist	Safety Officer	Lab Technician	Science Journalist	Science Communicator

4 Example of a Science Report

Attachment

Investigation

Does a balloon have energy?

Prediction

The balloon does have energy when inflated.

Equipment:

- Balloon

Method:

1. Place the deflated balloon on a table and observe.
2. Inflate the balloon without tying the end closed.
3. Holding the end tight, observe the balloon.
4. Release the balloon into the air.
5. Observe the balloons movement.
6. Inflate the balloon again and stretch the neck of the balloon while releasing the air.
7. Record your observations.
8. Draw annotated diagrams of your investigation.

Observation:

1. The deflated balloon does not move.
2. The inflated balloon sways from side to side.
3. When released, the inflated balloon pushes through the air and then spirals to the ground.
4. When the neck of the inflated balloon is stretched, a high pitched sound is produced as the air is released.

Results:

1. The deflated balloon does not possess energy.
2. The inflated stationary balloon possesses potential energy.
3. When released the potential energy is transformed into kinetic energy.
4. When the neck of the balloon is stretched, potential energy is transformed into sound energy and kinetic energy.

Conclusion:

Inflated balloons do have energy and the energy can be transformed from potential to kinetic energy.