Chapter 3: Energy

Skills Lab 3.1: Draw flow diagrams of energy transfer

Experiment worksheet answers (pages 40–43 and 168)

Discussion

Station 3

Gently tap the forked end of the tuning fork on the table. What do you notice happens?

The forked end of the tuning fork will vibrate, producing a sound.

Station 4

Connect the multimeter to the wires and check the voltage reading. What energy does the multimeter read at this station? Where did this energy come from?

It comes from the chemical energy in the battery.

Station 5

Hold the plastic windmill over a boiling kettle while being careful not to burn yourself with the steam. Where is the energy coming from this time?

The kinetic energy in the steam provides the energy to turn the plastic windmill. The steam gets its energy from the thermal energy provided by the kettle.

Station 6

Allow the car to roll down the ramp and along the floor. How far did the car roll? Where did the energy for the car to move come from? How could you increase this energy?

The distance the car will roll will vary. The car receives its energy from being lifted to the top of the ramp. This energy could be increased by increasing the height of the ramp.

Results

Copy and complete Table 9.4 and identify the object where you first see evidence of the energy, and the object where you last see the energy.

|  |  |  |
| --- | --- | --- |
| STATION | WHERE DOES THE ENERGY COME FROM? | WHICH OBJECT OR PART OF THE OBJECT HAS THE ENERGY LAST? |
| 1 | The person winding up the toy; the spring | The toy |
| 2 | The battery | The buzzer |
| 3 | The person tapping the tuning fork | The tuning fork; the vibrating air |
| 4 | The salt water and metal strips | The wires or multimeter |
| 5 | The kettle; the steam | The windmill |
| 6 | The person lifting the car; the car | The car |

Experiment 3.2: What if the amount of elastic potential energy was increased?

Experiment worksheet answers (pages 46–47 and 170)

Discussion

1 Did you collect qualitative or quantitative data for this experiment? Explain.

quantitative data, to measure a numerical distance

2 Why did you make three attempts at each propeller rotation to determine the average distance travelled?

Once is random. Twice is coincidence. Three times is evidence. Repeating an experiment three times allows a random error to be identified.

3 What type of energy was the elastic potential energy converted to?

kinetic movement energy of the boat

4 Your hands provided the energy to wind the propeller. Where did this energy come from?

from the chemical energy in the food that was eaten

Conclusion

Describe the relationship between the potential energy given to the propeller and the distance the boat moved.

The more potential energy given to the propeller, the more kinetic energy was given to the boat and the greater the distance the boat moved.

Challenge 3.3: Exploring sound energy

Experiment worksheet answers (pages 46–47 and 171)

Discussion

1 How do you change the way you play a recorder so that it gives out more sound energy?

You can blow harder, providing more kinetic energy to the air blown into the recorder.

2 How does a pianist manage to play some notes softly and others very loudly?

A pianist plays softly when they use less kinetic energy to kit the keys. If more kinetic energy is used to hit the keys, then the note sounds louder.

3 When you want to yell or speak louder, how do you make the sound coming from your mouth louder?

Yelling louder means the air moving through the vocal cords and out of the mouth has more kinetic energy than talking softly.

4 How do drummers make their drums sound louder?

By hitting the drums harder (using more kinetic energy).

Challenge 3.4: Energy converters

Experiment worksheet answers (pages 48–49 and 171)

Discussion

Student answers will vary for this challenge based on their own discussion and devices they choose to extend the list.

Experiment 3.5: What if you bounced a ball?

Experiment worksheet answers (pages 50–51 and 172)

Discussion

1 Describe the results of your experiment.

Student results will vary.

2 Did your experiment provide evidence that supported your hypothesis?

Student answers will vary.

3 What type of energy did the ball have:

a before it was dropped?

b just before it hit the ground?

c as it touched the ground?

a gravitational potential energy

b kinetic energy

c elastic potential energy

4 Where did the waste energy go?

sound and thermal (heat) energy

5 Draw a flow diagram of the energy transformation.

gravitational potential energy > kinetic energy > elastic potential energy + sound energy + thermal energy > kinetic energy > gravitational potential energy

6 Draw a flow diagram of the energy transfer.

ball > ball + surface > ball

7 Describe the evidence that supported or refuted your hypothesis.

Student answers will vary.

Challenge 3.6: Design an energy-efficient house

Experiment worksheet answers (pages 52–53 and 173)

Processing, analysing and evaluating

Student responses for this challenge will vary based on their own planning and evaluation of their experiment design.

Communicating

Present the various stages of your investigation in a formal experimental report

Student answers will vary, but should include discussion of their design and results.

Challenge 3.7: During what time of the day does the Sun produce the most energy?

Experiment worksheet answers (pages 54–55 and 174)

Discussion

1 At what time of day does the Sun produce the most light energy?

The Sun produces the same amount of light energy throughout the day, however, more of this light energy reaches the Earth in the middle of the day.

2 Why should you take readings over several days?

The amount of light energy reaching the solar panels will vary according to pollution and cloud cover present.

3 Why did you record the weather conditions?

Cloud cover and pollution will affect the light energy recorded.

4 Draw a flow diagram that shows the energy transformations for your challenge.

light energy > electrical energy

Experiment 3.8: Investigating structures and materials using icy pole sticks

Experiment worksheet answers (pages 56–57 and 175)

Discussion

1 The ‘beams’ were both the same size. What comments can you make about the difference between the two ways the ‘beams’ were tested?

The beams were tested at different angles, with the weight hanging off the side or the flat surface of the beam.

2 Were you surprised by the difference in how much water was needed to make the ‘beams’ break?

Student answers will vary.

3 Which orientation do you think would be more suitable for construction? Use your investigation to justify your answer.

Student answers will vary. The side of the icy pole stick should support a greater weight.

Conclusion

What do you know about how the structural capacity of the beam is affected by its orientation?

Student answers will vary. Answers should reflect the structural capacity of the beam being increased by being turned on its side.

Challenge 3.8: Leakywater Council swimming pool and waterslide

Experiment worksheet answers (pages 56–57 and 176)

Processing, analysing and evaluating

1 Is the tower freestanding?

Student answers will vary.

2 How much weight does the tower support? Does it need to be stronger?

Student answers will vary.

3 Is there any room for improvement? What other materials could be used to improve the performance of the tower?

Student answers will vary.

4 What is the cost of the prototype? How would this relate to the cost of the full size water slide?

Student answers will vary.

Communicating

Present the various stages of your investigation in a formal experimental report.

Student answers will vary.