W 933

LEARNING ON THE MOVE

Kinetic Energy Cars

Leigh Fuson, UT/TSU Extension Agent, Tennessee 4-H Youth Development
Jennifer Richards, Curriculum Specialist, Tennessee 4-H Youth Development

Real. Life. Solutions.™

UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Learning on the Move

Kinetic Energy Cars

Skill Level
Intermediate

Learner Outcomes
The learner will be able to:
- Explain and define gravitational potential energy and kinetic energy
- Demonstrate how force affects energy transfer
- Explain the difference in mass and weight
- Demonstrate how mass and weight affect energy transfer

Educational Standard(s) Supported
6.PS3

Success Indicator
Learners will be successful if they:
- Explain the difference in potential and kinetic energy and how energy is transferred in everyday objects

Time Needed
30 minutes

Materials List
1 Ziploc bag per group containing the following items:
Small toy car or truck
Different sized washers
Rubber bands or masking tape
Ruler (preferably one with indentions on the back)
Small paper tray or box
Pencil
Worksheet
Car Track, optional

Introduction to Content

In this lesson, students will learn more about the types of energy and understand that the force of gravity affects energy transfer. Students will explain the difference in weight and mass as well as how they affect force.

Introduction to Methodology

Students will use toy cars or trucks to conduct an experiment to see how weight and mass affect energy transfer. Weight will be added to the car during each trial to see how far the car can push a tray or box after traveling down a ramp. Students will see the energy transfer for gravitational potential to kinetic energy as the car travels.

Author

Fuson, Leigh. 4-H agent UT/TSU Extension in DeKalb County

Terms and Concepts Introduction

Potential energy – stored energy
Kinetic energy – energy in motion
Gravitational potential energy – stored energy in an object that is affected by gravity; object is at a higher position compared to a lower position
Force – push or a pull
Weight – the measure of gravity on an object; how heavy something is
Mass – how much matter an object contains or how much space it takes up
Law of Energy Conservation (Transfer) – energy cannot be created or destroyed, only transferred from one type to another

Setting the Stage and Opening Questions

Ask students: What is potential energy? What is kinetic energy? Can anyone name the different types of potential energy (gravitational, elastic, chemical, nuclear, electric, etc.)?

Tell students: Today, we will focus on gravitational potential energy. **Potential energy** is stored energy, while **kinetic energy** is energy in motion. If a big rock is sitting on top of a hill, it has gravitational potential energy. It could move if a **force** is applied. It has the *potential* to move.

What is force? What is the force all around us? That would be **gravity**. If someone applies a force or gravity is applied, the rock will start rolling down the hill and the potential energy is now transferred to kinetic energy!

Tell students: Energy is not created or destroyed.

Tips for Engagement

Have materials prepared in individual resealable bags. Have groups put all material back into bags as they found it for the next group.

Use paper trays or soil boxes.

Tell students to be careful when wrapping rubber bands or tape around the car to not let it drag the ground causing friction.

If the classroom has baseboards, use these to balance the ruler or track.

Go through the directions on the worksheet before dividing into groups and review before beginning the experiment.

Visit groups to see if they are working together or need help.

Experience

1. Divide students into groups of 3-5. Students may be assigned jobs like recorder, driver, measurement taker, track manager, mechanic, etc. or have students take turns.
2. Form a hypothesis.
3. Take one piece of track or ruler and lean against a taller surface (chair leg, bookshelf, baseboard, etc.)
4. Place paper tray or box at the end of the track.
5. Place car at the top of the track and let the car or truck go.
6. Measure to see how far the car or truck pushes the box. Record your data on your worksheet.
7. Calculate speed (v=D/T, where v=speed, D=distance, and T=time) by using the room clock, stopwatch or a smart device. Record your data on your worksheet.
8. Rubber band or tape a small washer to the car.
9. Repeat steps and add washers as directed by your handout.

Note: Students can try different lengths of tracks, different heights, other size cars or trucks or other types of weights. Students could also graph their results on the worksheet. Students can also weigh their vehicles then add additional items, like washers and reweigh.

Share

Ask students to volunteer their results. You can collect their worksheets to see how the groups compare. **Ask students:** What happened when washers were added to the car? They should note the box will usually travel farther the more weight added. **Ask students:** Why do you think you got those results? Were your predictions correct? If your box did not travel farther as more washers were added, what do you think happened? They may mention friction from the rubber band, user error and force not being applied equally. Remember, science isn't always perfect!

Process

At the top of the track, the car or truck has potential energy. When you let the vehicle go, gravity (a type of force) allows that potential energy to transfer to kinetic energy. This form of kinetic energy is called **gravitational**. Adding washers changes the weight and mass of the car. Increase in weight and mass allows the gravitational force to become stronger, pushing the car further!

Generalize

Show students the short video on mass versus weight.

Have students illustrate the difference between mass and weight using post-it notes, drawing paper or an online tool such as Mural or Jamboard.

Ask student volunteers to share their illustrations and explain the difference in weight and mass.

Life Skill(s)

6th Grade Hands, Working
Use skills, effort, or ability to accomplish a goal.
Accept responsibility for one's part of a shared task.

Coordinate the interaction to complete the task (work together).

7th Grade Health, Being
Consistently demonstrate characteristics of healthy well-being.
As part of a group, identify and agree on a common task.

8th Grade Head, Thinking
Learn to form ideas, make decisions, and think critically.

Apply

Let's say we take a field trip to the moon. Raise your hand if you think your weight changes on the moon. Raise your hand if you think your mass changes on the moon. Because there is less gravity, and gravity affects weight, we do weigh less. However, we take up the same amount of space on the moon as on Earth, so our mass does not change.

Can anyone think of other every day energy transfers that you see?

Supplemental Information
Educational Standards Met

6.PS3: Energy

Analyze the properties and compare sources of kinetic, elastic potential, gravitational potential, electric potential, chemical, and thermal energy.

Construct a scientific explanation of the transformations between potential and kinetic energy.

Analyze and interpret data to show the relationship between kinetic energy and the mass of an object in motion and its speed.

W 933 10/20 21-0079 Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.

Kinetic Energy Cars Experiment
Data Sheet

Group Members:

Hypothesis:

_____

_____

_____

_____

_____

Record, in inches, how far the paper tray moves when pushed.

Trials	Distance (inches)	Speed (v=D/T)
Trial 1 – Car with no weight		
Trial 2 – Car with one small washer		
Trial 3 – Car with one small washer and one large washer		
Trial 4 – Car with one small washer and two large washers		

Kinetic Energy Cars Experiment
Data Sheet

(Extension)

Graph your results on the x-axis (distance, in inches) and y-axis (triall #) below. Make sure to label your axes.