Transfer of Energy Mini-Unit

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Major Concepts: Kinetic and Potential Energy
Energy Conservation
Transfer of Energy

Core Content Categories:

Physcial Science

III. Transfer of Energy

SC-M-1-3-1: Energy is transferred in many ways.

Science Inquiry:

The students will refine and refocus questions that can be answered through scientific investigation combined with scientific information.

The students will use appropriate equipment, tools, techniques, technology, and mathematics to gather, analyze, and interpret scientific data.

The students will design and conduct scientific investigations.

The students will communicate (graph) designs, procedures, observations, and results of scientific investigations.

Skills:

Measuring	Inferring
Collecting data	Using tools and models
Designing data tables	Designing graphs
Recognizing patterns	Communicating results

Transfer of Energy Mini-Unit

Pre-Assessment

1) What is energy?

2) Explain the difference between potential energy and kinetic energy.

3) Which has more kinetic energy?

a) a bus traveling at 25 mph

b) a motorcycle traveling at 25 mph

Explain you answer.

4) Which has more potential energy?

a) a ping-pong ball 15 meters from the ground

b) a bowling ball 15 meters from the ground

Explain your answer.

5) What can effect the kinetic energy of an object, its mass, speed or both? Explain.

Task 1: Students will be able to distinguish the correlation between increased potential energy with increased kinetic energy.

Task 1: Push em' Back, Push em' Back, Way Back!

Materials to complete all 4 parts of this unit:

Each group will need:

Pull-back car	calculators
4 meter sticks	paper/pencil
masking tape	colored pencils(red,orange,purple,silver)

graphing paper (each member of group needs one)

Part I

Procedures:

1) Design a data table to show the following information:

	Trial 1	Trial 2	Trial 3	Average
10 cm				
20cm				
30cm				
40cm				

2) Note on your data table sheet your car color (either red, orange, purple, or silver)
3) Go into the gym and mark off a starting line.
4) Place meters sticks in ascending order of measure and perpendicular to your starting line.
5) Place the back tires of the car at the 10 cm mark.
6) Pull back the car to the starting line and release.

7) After the car comes to a complete stop, record the distance traveled in centimeters on your data table. (The measurement should come from the back tire!)
8) Do 3 trials at the 10 cm mark.
9) Repeat procedures 5 through 8 at the 20cm, 30cm, and 40cm marks. (Remember to do 3 trials per pulling distance.)
10) Take up masking tape, collect car, and meter sticks and return to the classroom.

Part II

While you are waiting for each group to return to the classroom, use a calculator to figure the average distance for each pull. As a class, we will document the averages for each of the different colored cars at each pull back distance. Record this class information on your data table.

Part III

Using the information about each car, use colored pencils to design a graph to show which car transferred their potential energy to kinetic energy the best. Put the pull back distances (10cm, 20cm, 30cm, 40cm) on the vertical axis and the total distance traveled due to kinetic energy on the horizontal axis.

Part IV

Using your graph as reference, write a conclusion explaining which car transferred potential energy to kinetic energy the best and which car was the worse. Explain what variables could have come into play that could have possibly caused these results.

Pull Back Car Lab Data Sheet Name_____

Data Table 1

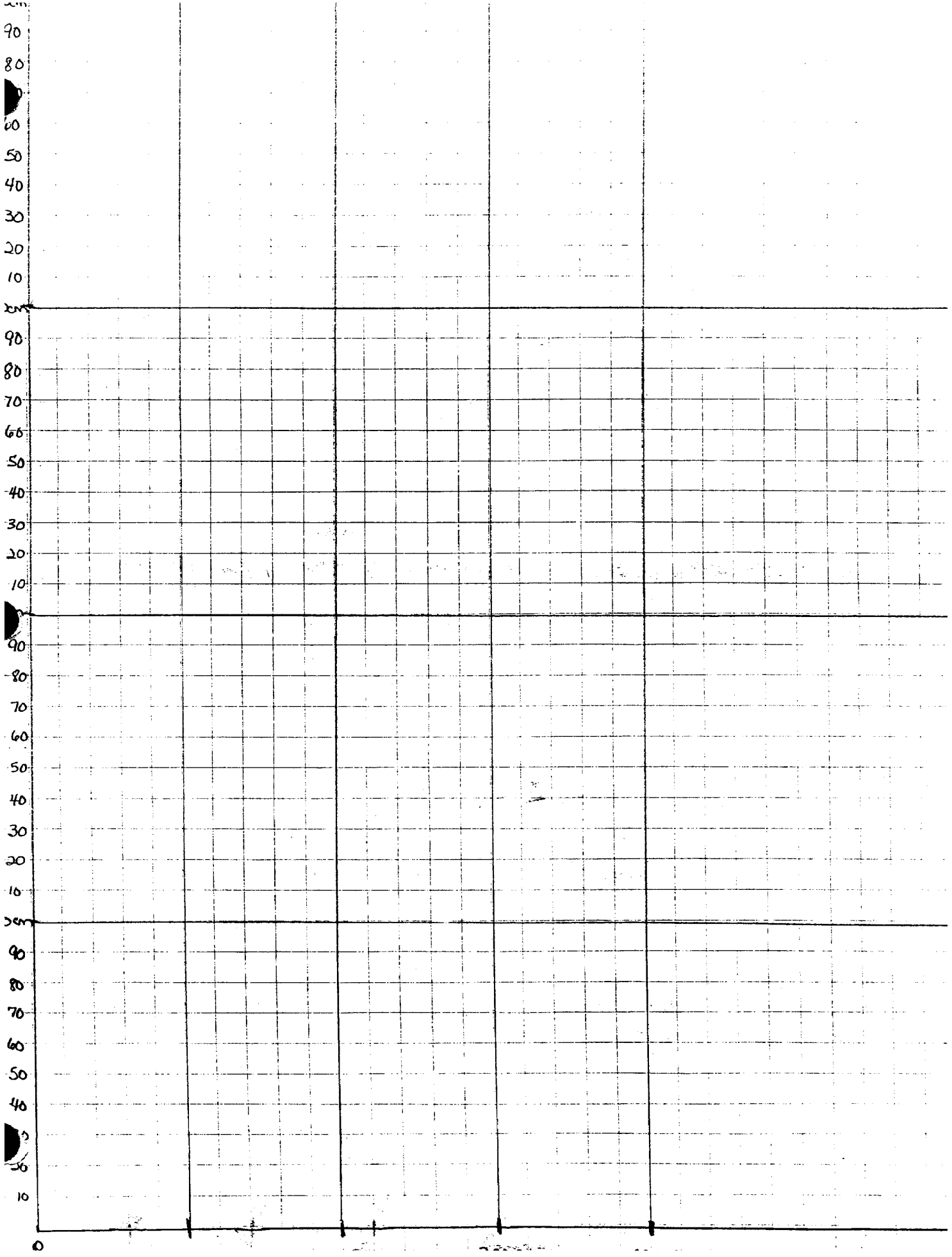
Car Color: (circle one) Red, Orange, Purple, Silver

	Trial 1	Trial 2	Trial 3	Average
10cm				
20cm				
30cm				
40cm				

Data Table 2 (Class findings)

	Red Car	Orange Car	Purple Car	Silver Car
10cm				
20cm				
30cm				
40cm				

Use data to make a graph.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Conclusion.

Explain which car transferred potential energy to kinetic energy the best and which car was the worse. Explain what variables could have come into play which could have possibly caused these results.

Task 2: Students will determine how kinetic energy can be affected by gravitational and frictional forces.

Task 2: All Pumped Up!

Materials per group:

Trundle wheel	triple-beam balance
Pump-up car	masking tape
3 stop watches	calculator
paper/pencil	graphing paper
colored pencils	

Procedures:

** Remember, all data must be recorded on your lab write-up sheet!**

Part I

1) Go to the football track and mark off the following measurements with masking tape: Starting line, 5 meter, 10 meter, 15meter (finishing line)
2) Place a person to act as timer at each marked distance.
3) Choose a driver to operate the car and start the timers.
4) Read through all the directions and each person can design a data table to record their results.
5) Pump the car 15 times, release the valve from the car, and give the car a gentle push. (Do several practice trials to get the hang of it!)
6) Each timer will record the time as the front of the car crosses their mark.
7) Do 3 mistake-free trials. Record your data.
8) Move to the ramp between the track and the parking lot and repeat procedures 1-7.
9) Gather up materials and return to classroom.

Part II

1) Using the data collected from the level ground runs, average the times for each distance mark (5m, 10m, 15m). Put this in a new data table.

2) Follow the same procedure for the results on the ramp runs.

3) Graph your results. Put the time measurements on the vertical axis and the distance measurements on the horizontal axis. Use one colored pencil to represent the level run and another color for the ramp run.
4) Using the formula for speed, figure the speed for each run (one for the level run and one for the ramp run). Use the time measurement from the 15 meter mark.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Part III

1) Find the mass of your car.
2) Use your average speeds (Step 4 on Part II) and find the kinetic energy for the car on level ground and the car on ramp.

Kinetic energy = ½ mass X speed 2 (squared)

3) Write a conclusion. Make sure you discuss how gravitational forces could have affected your findings. Also, discuss the possibility of friction playing a part in your results.

Task 3: Students will design a track to successfully maneuver a car through a course using the transfer of gravitational potential energy to kinetic energy.

Task 3: Making Tracks!

Materials per group:

1 hot wheel track kit
1 hot wheel car
triple-beam balance
meter stick
stop watch

Procedures:

1) Using the materials in the kit, design and construct your own track. Your track can be at any height and can be of any length but must include one loop and one vertical jump. All materials in the kit do not have to be used. Construct your track and find a car that can successfully complete the course.

2) Once you have successfully gotten your car through your course, take measurements (mass of car, height of ramp, length of course, and speed of car). Place these measurements into a data table.

3) Do open response item to end this activity.

Making Tracks! Open Response

Congratulations on building a successful course. Keeping in mind all the information we have learned about potential energy, kinetic energy, transfer of energy, friction, etc, write a detailed description about how you accomplished this task. Include in your writing the following information:

* Describe your successful course design.
* Measurements (incoporate this in your writing...don't just list)
*How potential energy was transfered to kinetic energy.