

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_



## **FORCE COUNTERFORCE**

**INTRODUCTION:** A force is an agency or influence that, if applied to a free body, results in an acceleration of the body. Gravity is such a force. As the force of gravity on a body increases, the acceleration of the body increases. Air resistance and friction act as counterforces to gravity.

### **OBJECTIVE:**

Perform an experiment that will confirm predictions about the effect of gravity on the motion of a body.

### **MATERIALS:**

- 30-inch Length of string
- Small free rolling toy car
- Paperclip opened to serve as a hook
- A variety of weights that can be attached to the paper-clip hook
- Stopwatch

### **PROCEDURE:**

1. Tie one end of the string onto the toy car and the other end to the paper-clip hook.
2. Place the car on a flat surface and hang the paper-clip hook over the edge of the table.
3. Predict below how the cars will move if different weights are hung from the paper-clip hook and allowed to fall to the floor.

PREDICTION: \_\_\_\_\_

\_\_\_\_\_

4. Support your prediction by creating an illustrated diagram below using arrows and labels to indicate the forces and counterforces acting on the car.
5. Now conduct the experiment by using the cars, weights, and stopwatch to confirm or refute your prediction. Record your results in the Data Table

**OBSERVATIONS:**

DATA TABLE 1

WEIGHT	TIME
#1	
#2	
#3	
#4	
#5	

**ANALYSIS AND QUESTIONS:**

1. Which of Newton's laws does this experiment illustrate? \_\_\_\_\_

\_\_\_\_\_

2. Determine a mathematical relationship between the mass of the car and the weight of the object attached to the paperclip hook.

3. Describe in terms of forces and counterforces what causes an object to experience acceleration.

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4. FORCE: Identify the counterforces or forces for the activities in the Data Table 2.

DATA TABLE 2

ACTIVITY	FORCE/COUNTERFORCE
A soccer ball to rest as it rolls across a field	FORCE/COUNTERFORCE
Accelerate a rocket off a launch pad	
A leaf as it drifts down to the forest floor	
the forest floor	

5. **MOTION:** Identify the force/counterforce and speed for the activities in Data Table 3.

DATA TABLE 3

ACTIVITY	FORCE/COUNTERFORCE	SPEED (Constant Or Acceleration)
A punted football		
An ice skater		
A satellite		

6. When an object is in motion, counterforces sometimes seem to get in the way. If gravity didn't act as strongly on the space shuttle, for instance, launching would be a lot easier. This is not always the case, however. Sometimes, counterforces are invaluable, as when air resistance keeps a skydiver's parachute in proper working order.
- In Data Table 4, list five different moving objects you have observed in the past 24 hours.
  - Identify the forces and counterforces that were acting on.
  - Determine whether the object was experiencing constant speed or acceleration

DATA TABLE 4

MOVING OBJECT	FORCE/ COUNTERFORCE	ACCELERATION/ CONSTANT SPEED

7. Analyze the motion of a skydiver falling to the ground.
- When are the forces and counterforces acting on the skydiver in balance?

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- When are they not in balance?

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- Describe the motion experienced by the skydiver in each situation.

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