COMPLETE INTRODUCTION TO PHYSICS (GRADES 6-8)

KT-PHYSICS

www.homesciencetools.com | 406.256.0990
Science Foundations Series

TABLE OF CONTENTS:

INTRODUCTION 2
GETTING STARTED 3
Science Skills 3
NEWTON'S FRIST LAW OF MOTION 4
Activity 1 – Objects at Rest Remain at Rest 4
Activity 2 – Force to Move Objects From Rest 6
Activity 3 – Objects in Motion Remain in Motion 9
Activity 4 – Force to Change Speed or Direction of a Moving Object 10
NEWTON'S SECOND LAW OF MOTION 13
Activity 5 – Force and Acceleration 13
Activity 6 – Force and Mass 16
NEWTON'S THIRD LAW OF MOTION 18
Activity 7 – Action and Reaction 18
NEWTON'S LAW OF UNIVERSAL GRAVITATION 20
Activity 8 – Pendulum 21
Activity 9 – Falling Objects 25
WORK AND ENERGY 29
Activity 10 – First Class Lever 29
Activity 11 – Second Class Lever 32
Activity 12 – Third Class Lever 35
Activity 13 – Balance 38
Activity 14 – Inclined Plane 42
PULLEYS 45
Activity 15 – Fixed Pulley 46
Activity 16 – Moveable Pulley 48
Activity 17 – Block and Tackle Pulley 49
IDEAS FOR FURTHER STUDY 51
GLOSSARY 52

12. Analyze your results.

Which takes more force – to start an object moving from rest or the keep an object moving?

Which takes more force – to start an object moving slowly or to start it moving quickly?

Was your hypothesis correct? Explain.

Does the cart follow Newton's first law of motion? Explain.

What happened?

The tendency of objects at rest to stay at rest or moving objects to continue moving is called **inertia**. More force is required to overcome the inertia of a body at rest than to maintain the inertia of a moving object. Without **friction**, no force would be required to keep an object in motion. Friction is defined as the resistance to the motion of two objects sliding over each other.

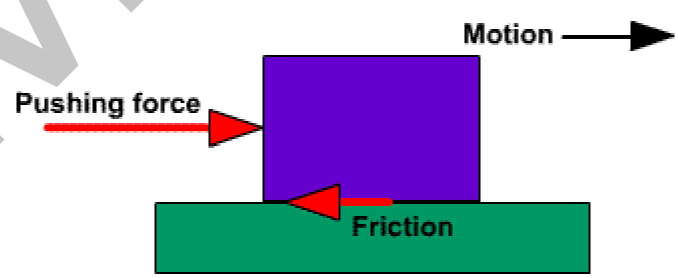

Figure 4. Friction Diagram.

You can also test Newton's first law of motion with respect to objects in motion. Find out how in the next activity.

What happened?

When you let go of the rod and cart, they each moved in opposite directions. The rod is pushed in one direction by the action force of the rubber band attached to the cart. The cart is pushed in the other direction by the reaction force of the rubber band off the rod.

The action and reaction forces are equal but in opposite directions. The rod moves further than the cart because it has less mass than the cart.

Check out another law Newton discovered in the next section.

NEWTON'S LAW OF UNIVERSAL GRAVITATION

The natural force that makes two objects move toward each other is called **gravitation**. Newton's law of universal gravitation states:
"Any two objects attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers of gravity."

Mass is a measure of the quantity of material in a body. Your body is made up of material that gives it mass. Your body has more mass than a baby's body. The mass of your body is incredibly small compared to the mass of Earth. Mass can be measured with a balance by comparing an object of known mass to an object of unknown mass.

The gravitation that we are most familiar with is the gravitational force of Earth, called gravity. **Gravity** refers to the gravitational force of Earth or any other planet that causes objects to move to the center of the planet. Your body has weight because of the gravitational force between the mass of Earth and the mass of your body. **Weight** is a measure of the force with which the mass of a body is attracted or pulled to the ground. Your weight changes with the distance you are from the center of Earth or with the mass of the planet you are on.

Because the gravitational force between two objects is directly proportional to the product of their masses, you will weigh less on planets smaller than Earth and more on planets larger than Earth. For example, if you weigh 100 pounds on Earth, you will weigh only 17 pounds on the Moon and 40 pounds on Mars. You will weigh 270 pounds on Jupiter because its mass is greater than that of Earth.

Your weight also changes inversely with the square of your distance from the center of a planet. The surface of the earth is 4000 miles from its center. If you weigh 100 pounds on the surface of Earth, you will weigh only one fourth as much, or 25 pounds, when you are twice the distance from its center (i.e. 4000 miles above the surface of Earth).

increased as the effort location is moved closer to the fulcrum, because the mechanical advantage is decreased as the effort force lever arm decreases.

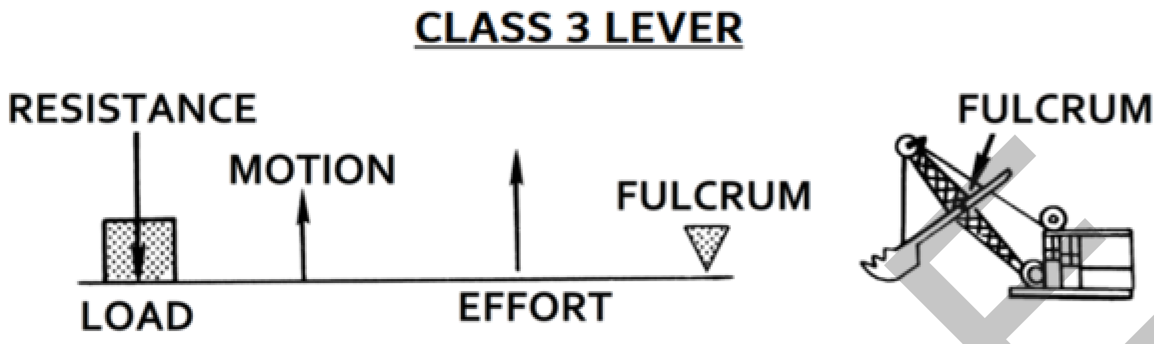

Figure 16. Third Class Lever Diagram.

Use your knowledge of levers in the following activities on balance and inclined planes.

ACTIVITY #13 – BALANCE

FROM THE KIT: Ring stand, half meter stick, S-hook, knife-edge clamp, paper clips, and right angle clamp.

Assemble a Simple Balance

1. Attach the right angle clamp near the top of the ring stand. Make sure the clamp is positioned so the opening is facing downward on the side of the clamp not attached to the ring stand.
2. Slide the S-hook over the screw on the side of the clamp not attached to the ring stand.
3. Tighten the screw fully to hold the S-hook in place.
4. Slide the knife-edge clamp over the half meter stick until the center of the clamp is over the 25 cm marking.
5. Tighten the knife-edge clamp to the meter stick and then hang it from the S-hook. Be sure the

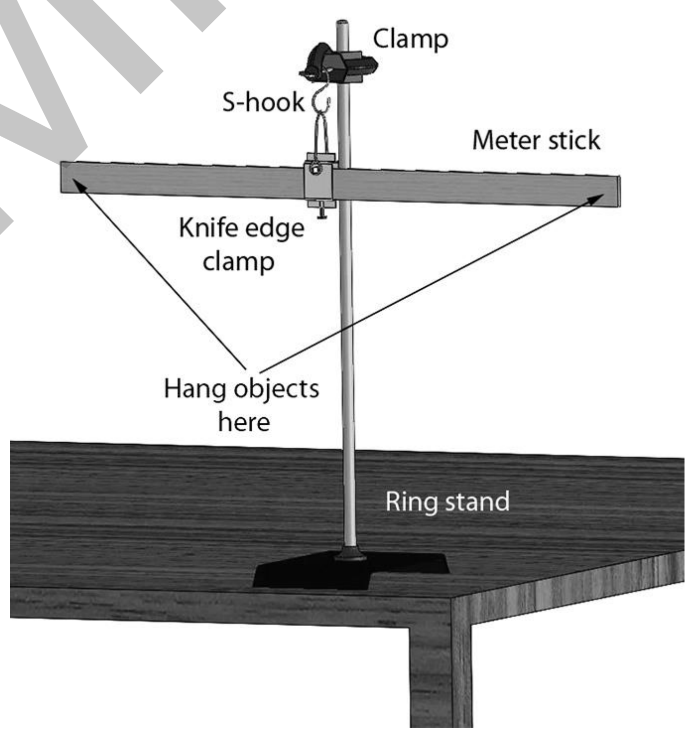

Figure 17. Assembled Balance Diagram.