Name: _________________________**Class:** _____ **Date:** __________

Simple Machines – The right machine for the job

Learner outcomes:

- Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time.
- Illustrate how a common need has been met in different ways over time (*e.g. development of different kinds of lifting devices*)

Key Terms:

Simple machine	Screw	Mechanical
Lever	Pully	advantage
Inclined plane	Wheel and axle	Force
Wedge		

Background Information: Have you ever tried to lift a heavy object. Did you need to have another person help you, or maybe you used a simple machine to help you? In this activity, you will investigate a variety of simple machines to determine which machine is best suited for lifting a mass.

Research Question: Which simple machine requires the least amount of force to lift a 1 Kg mass?

Materials:

30 cm of string	fulcrum	2 pulleys
metre stick loops	10 N spring scale	ramp
1 Kg mass	metre stick	

Procedure:

Part 1: Lifting without a machine.

1. Tie a loop at one end of a 30 cm length of string and fit the loop over the hook on the spring scale. Tie the other end of the string to a 1 kg mass.

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9*. Toronto, ON: Addison Wesley.

2. Lift the spring scale just so that the mass is hanging from the scale and then raise the load up 10cm. Measure and record the force needed to lift the mass.

Part 2: Lifting with a ramp.

1. Set up the ramp so that the highest point of the ramp is 10cm above the surface that it is sitting on.
2. Place the mass at the bottom of the ramp and using the spring scale, pull the mass up the ramp.
3. Measure and record the force needed to lift the mass.

Part 3: Lifting with a Pulley

1. Hold or clamp a pulley system at least 30 cm above the table.
2. Tie one end of a 60 cm string to the 1 kg mass and feed the string through the pulley. Tie the loose end of the string to the spring scale.
3. Pull the spring scale downward to lift the mass 10 cm.
4. Measure and record the force needed to lift the mass.

Part 4: Lifting with a Lever

1. Position a fulcrum about 5-10 cm away from the edge of a table. Place a meter-stick on the fulcrum so that the fulcrum is in the middle. Hang the mass from the table end of the lever so that it just rests on the table and attach the spring scale to the end above the floor.
2. Pull down on the spring scale so that the mass is raised 10cm.
3. Measure and record the force needed to lift the mass.
4. Repeat steps 1-3 positioning the fulcrum first closer and then farther away from the mass.

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Observations:

Title: ____

Simple machine	Mass lifted	Distance Lifted	Force Required	What is the advantage of this machine?
None				
Ramp				
Pulley				
Lever (fulcrum in middle)				
Lever (fulcrum close to mass)				
Lever (fulcrum away from mass)				

Analysis:

1. What was the most difficult method of raising the mass? What was the easiest?

2. For the lever, what effect did changing the location of the fulcrum have on the distance that your hand moved and on the force required to move the mass 10 cm?

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3. What feature of the lever made it easier to lift the load?

4. Predict what would happen if you used a longer ramp. Explain your prediction.

5. How is a screw like a ramp?

6. Predict what might happen if you used two pulleys instead of one. Explain your prediction.

7. What other simple machine does the pulley look like? Explain how they are similar.

Conclusion: Answer the research question.

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Extension:

1. Identify at least 5 everyday objects that act as simple machines to make our work easier. Draw a diagram of each to identify what simple machines are at work and how they help to give us a mechanical advantage.

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