LESSON 10
Plane and Simple

Goal 2. Simple Machines - The student will use scientific skills and processes to explain that simple machines such as levers, pulleys, and inclined planes reduce the amount of effort required to do work.

Essential Objectives: The student will be able to compare the amount of force required to pull and lift objects with and without using an inclined plane.

The student will use the following skills and processes of science:
- Use metric units when measuring or collecting data. (MLO)
- Use appropriate instruments (e.g., calculators, spreadsheets, databases, and graphing programs) to collect, organize, and display data on charts, tables, graphs, or with drawings. (MLO)

Teacher Background:
An inclined plane is a simple machine with a sloping surface. A ramp is a familiar example of an inclined plane. An inclined plane reduces the effort force needed to do work, but the distance over which the force is applied is increased.

Teacher Preparation:
- Make transparencies of SRB pp. 27-28, "Plane and Simple, Parts I and II)
- Find four identical large books such as dictionaries for each group.

Materials Provided in the Kit:

For Teacher Demonstration – None

For Each Group of Four Students:
- Spring scale
- Wooden block with hook

For Each Student - None

Materials Provided by Your School:

For Teacher Demonstration:
- Transparencies of SRB pp. 27-28

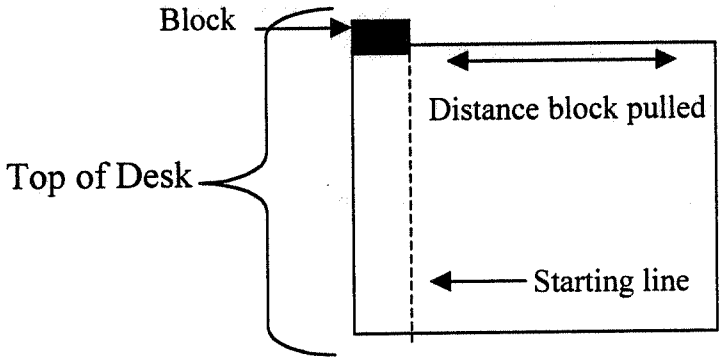
For Each Group of Four Students:
- Calculator
- Four large textbooks
- Meter stick

For Each Student: Student Response Bookle

Plane and Simple – Part I

Answer Key

1. Place a block at one end of your desk. The block should be able to sit behind the starting line without hanging over the edge of the desk.



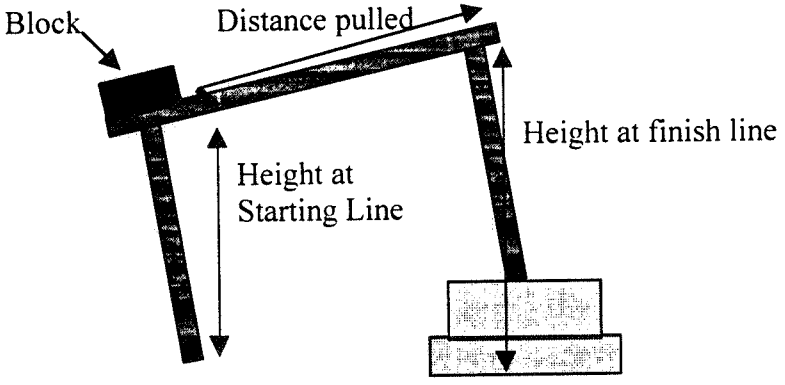
2. Measure the distance in meters (e.g., 35cm = 0.35m) from the <u>starting line</u> to the opposite edge of the desk. This will be the distance you will be pulling your blocks using an inclined plane.

3. Place this answer on the chart below under the column labeled Distance Blocked Pulled.

Work Using an Inclined Plane

# of Blocks	Force (N)	Distance Block Pulled (m)	Work (J)
1 block			

4. Place two textbooks under the legs of the desk opposite the starting line to make your first ramp.



5. Attach one block to your spring scale. Pull the block from behind the starting line to finish with a flow steady motion. Record the force used on the chart above.

6. Use a calculator to find the work done and record this data on the chart.

Answer Key

Plane and Simple – Part II (continued

2. How was **distance** affected when you used the inclined plane to move the block the same height as you lifted the block? Use evidence from the investigation to support your answer.

The distance increased because of the gradual slope of the incline plane. Response should refer to measurements made in Parts I and II.

3. Is more **work** needed to move a block with an inclined plane or without an inclined plane? Explain your answer.

Although effort is reduced, the work is about the same because using the inclined plane increases the distance. Responses should refer to work calculations in Parts I and II.

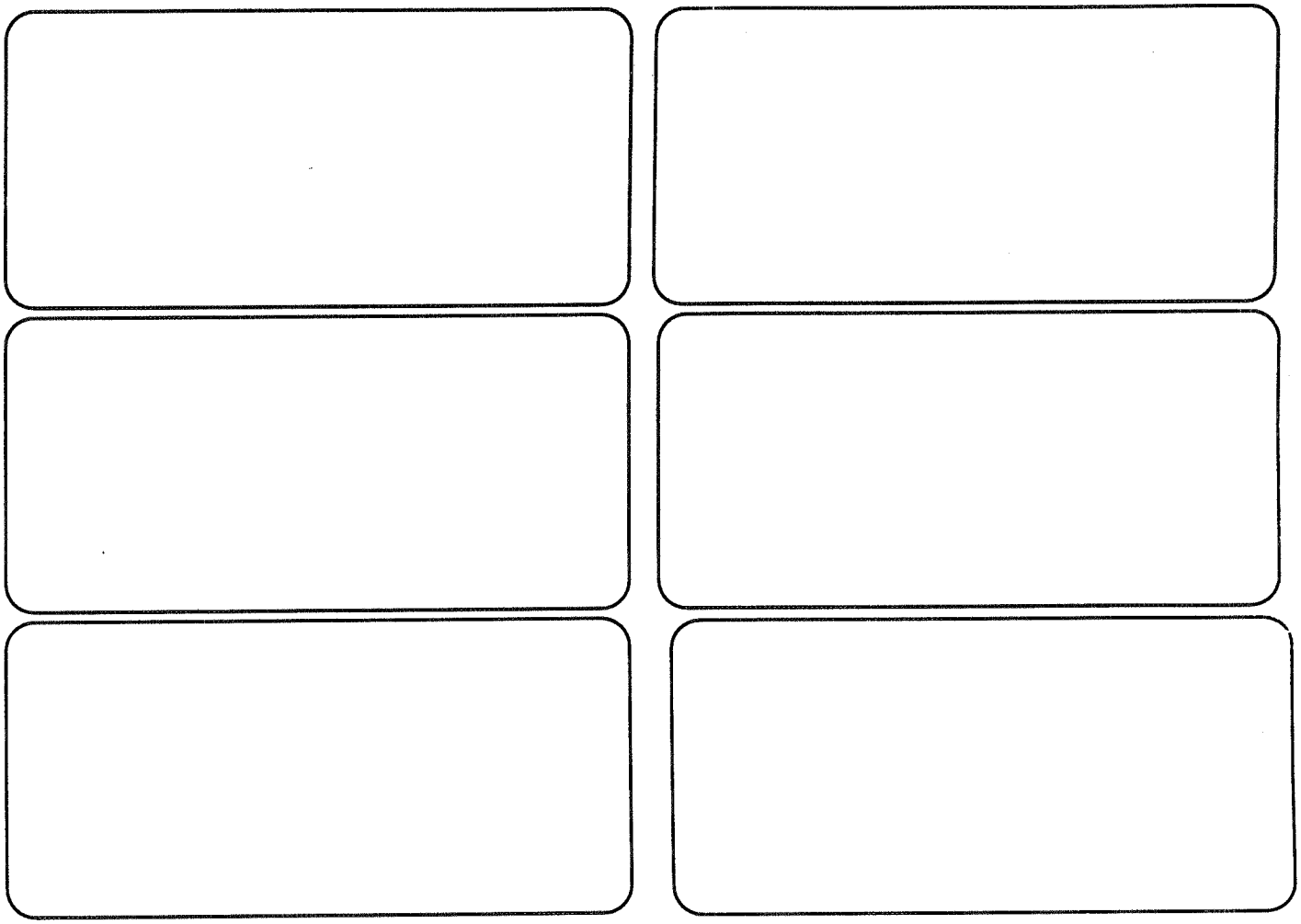
NAME:
DATE:

FORCES REVIEW looking back at data gathered in labs.....

question.....	Title of lab and major concept covered	Data from labto support concept learned.
Which would you rather pull, something over wax paper, sand paper, construction paper or aluminium foil or cloth?	wax paper b/c it has least amount of friction required the least amount of force used	* wax paper .04 N × 1m = Nm sand paper .4 N × 1m = Nm alumi. foil .06 N × 1m = Nm cloth .5 N × 1m = Nm
Does using a lever make force easier or harder? Does it make work easier or harder?	makes BOTH force + work easier.* b/c it is a simple machine	LIFT 1 block = .7 N × 1m = .7 Nm LEVER 1 block = .1 N × 1m = .1 Nm
Does using an inclined plane make force easier? Does it make work easier?	force is easier but work is about same. 	LIFT 1 block = .7N × .05 m = .04 Nm INCLINED PLANE 1 block = .1 N × .50 m = .05 Nm
Does using a fixed pulley make force easier? Does using a moveable pulley make force easier? Work?	single fixed pulley - force appox. same work appox. same single moveable - force is halved but is doubled work is same	Fixed .6 N × .25 m Moveable .2N × .50 m LIFT .7 N × .25

name:_____ # Forces Review

1. Identify the 6 simple machines below and then draw a picture of each machine (be sure to use labels when appropriate)



2. Give 3 examples of the following simple machines (used in every day life....)

INCLINED PLANE _____ _____ _____

PULLEY _____ _____ _____

LEVER _____ _____ _____

3. Give 2 examples of the following simple machines (used in every day life....)

WEDGE _____ _____

WHEEL AND AXLE _____ _____

SCREW _____ _____

NAME:
DATE:

FORCES REVIEW looking back at data gathered in labs.....

question.....	Title of lab and major concept covered	Data from labto support concept learned.
Which would you rather pull, something over wax paper, sand paper, construction paper or aluminium foil or cloth?		
Does using a lever make force easier or harder? Does it make work easier or harder?		
Does using an inclined plane make force easier? Does it make work easier?		
Does using a fixed pulley make force easier? Does using a moveable pulley make force easier? Work?		

Name _____ Date _____

Forces / Simple Machines *Study Guide*

Friction - opposes force; the more friction that is caused, the *more force (or effort) it takes* to overcome that friction and move the load.

Fulcrum - is the *pivot* or turning point that changes the direction of the force.

Levers - are simple machines that use fulcrums at different distances away from the load. They help *reduce the amount of effort force AND work* required to move the load.

Inclined Plane - ramp used at a slant. Helps to *reduce the effort force*, but *work remains about the same* (because distance traveled becomes greater).

Single Fixed Pulley - grooved wheel with a rope around it that is stationary. When using this, the *force AND work remain about the same.* However, this is still a simple machine because it does make work easier by giving us another way or option to do the work needed.

Double Moveable Pulley - two grooved wheels with rope around them; one is stationary, the other moves with the rope. This *reduces the amount of effort force by about half*, but *increases the amount of distance needed by about double.* This allows the amount of *work done to remain the same.*