

Measuring Forces Lab
Honors Integrated Science

Name: _____ Date: _____ Per. _____

Purpose:

Hypothesis:

Materials:

Procedure:

Have students pull each object at a slow, constant speed across a flat surface using the spring scale. They may need to attach the scale to the object using string. Students should record the force required to pull each object. Next, have the draw force arrows for each object. The arrows should be drawn to scale using a scale factor of 1 cm per each newton of force.

Prelab Assignment: Watch the video and answer the following **multiple-choice** questions that follow.

- _____ 1. Which of the following is a key characteristic of a vector quantity?
- A. It has only magnitude.
 - B. It has only direction.
 - C. It has both magnitude and direction.
 - D. It has neither magnitude nor direction.
- _____ 2. Based on the video, which of the following statements about the parachutist's motion is correct?
- A. The parachutist is accelerating due to the unbalanced forces.
 - B. The parachutist is falling at a constant velocity due to the balanced forces.
 - C. The parachutist is experiencing a net downward force.
 - D. The parachutist is experiencing a net upward force.
- _____ 3. In the free body diagram of the airplane, what is the relationship between the thrust force and the drag force?
- A. The thrust force is greater than the drag force.
 - B. The thrust force is less than the drag force.
 - C. The thrust force is equal to the drag force.
 - D. The thrust force and drag force are independent of each other.

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- _____ 4. What is the purpose of drawing a parallelogram in the vector diagram example?
- A. To determine the magnitude of the resultant force.
 - B. To determine the direction of the resultant force.
 - C. To determine the angle between the forces.
 - D. To determine the relationship between the forces.
- _____ 5. In the example of the runner and the wind, how would the resultant force change if the angle between the runner's force and the wind force was 60 degrees instead of 30 degrees?
- A. The resultant force would increase.
 - B. The resultant force would decrease.
 - C. The resultant force would remain the same.
 - D. There is not enough information to determine how the resultant force would change.
- _____ 6. Which of the following is not a type of force mentioned in the video transcript?
- A. Tension
 - B. Air resistance
 - C. Buoyancy
 - D. Gravitational force
- _____ 7. What is the main purpose of using free body and vector diagrams in the context of forces?
- A. To visualize the forces acting on an object.
 - B. To calculate the magnitude of the forces.
 - C. To determine the direction of the forces.
 - D. All of the above.

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Data Table: Data for regular massed weights

Massed object (g)	Mass in kilograms (kg)	Force of gravity in Newtons (calculated)	Mass in kilograms (measured)	Force in Newtons (measured)

Post-Lab Analysis: Answer the following questions in complete sentences and draw all force diagrams to scale, using graph paper.

1. Draw the force diagram for each object measured. Complete this on graph paper.

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3. What would be the effect on the direction of the net force if some people pushed the car forward while others pushed it backward?

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Calculations: Use the space below to show your calculations for this lab. Be sure to label your work. (Use an additional sheet if necessary)

Analysis: Answer the following questions in complete sentences, using the data from the lab to support your answers.

Use **EXCEL** to make a graph of the relationship between the mass of an object (x-axis) and the force (y-axis) of gravity.

1. Use the internet to explain how a spring scale works?

2. Use the internet to research information about the relationship between mass and weight.
 - a. What information did your research provide about the relationship between weight and mass?

 - b. How are they similar? Different?

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8. What happened to the force as mass was added? Give an example.

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12. Compare your calculated force of each object to the accepted force (spring scale reading) of each object. How do those numbers compare? How well did you determine the mass of each weight?

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13. Based upon the trend of your graph, what would you predict as the final force if 350 g mass was added to the spring scale?

14. Find the slope of the force-versus-mass graph to quantify the force change in Newtons per gram.

15. Explain, using specific data, what your graph tells you. Discuss the meaning of the slope in your graph.