Name: _____ Class: _____ Date: _____

Motion, Force & Models Study Guide

Due the day of the test…Test Date: _____

Focus Questions

- ☐ What variables might affect the number of cycles a pendulum makes in 15 seconds?
- ☐ How does changing the mass, length, or release position of a pendulum affect the number of swings the pendulum completes in a unit of time?
- ☐ How can we use graphs to predict results?
- ☐ What happens to balls on ramps?
- ☐ What happens when objects collide?
- ☐ What is the relationship between the starting position on the ramp and the amount of force a ball can apply when it collides with an object?
- ☐ What variables affect the momentum of an object?
- ☐ How do parts of a flipper system work together to launch an object?
- ☐ What is the relationship between the length of the flip stick and the distance the object moves?
- ☐ What is the relationship between the compression of the spring and the amount of energy transferred to an object?
- ☐ What is the process to develop a model of the black box?
- ☐ How does a drought stopper work?
- ☐ What do engineers do when they create a product to solve a problem?

Content

- ☐ Any change of motion requires a force.
- ☐ Gravity is the force that pulls objects toward Earth's center.
- ☐ A variable is anything you can change that might affect the outcome of an experiment.
- ☐ Pendulum experimental data can be graphed to reveal patterns; length determines the number of cycles a pendulum completes in a unit of time.
- ☐ Patterns of motion can be observed and can be used to predict motion.
- ☐ Objects in motion have energy. The faster an object is moving, the more kinetic energy it has.
- ☐ When objects collide, energy can transfer from one object to another, changing their motion
- ☐ Kinetic energy is energy of motion; potential energy is energy of position. For identical objects at rest, the objects at higher heights have more potential energy than the objects at lower heights.
- ☐ The total balance of energy in any system is always equal to the total energy transferred into and out of the system.
- ☐ Momentum helps maintain an objects' motion.
- ☐ Any change of motion requires a force. Each force has a strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give a zero net force (they are balanced).
- ☐ The heavier an object is, the greater the force needed to achieve the same change in motion.
- ☐ For a given object, a greater force causes a greater change in motion.
- ☐ Models are explanations of objects, events, or systems that cannot be observed directly.
- ☐ Models are representations used for communicating and testing.
- ☐ Developing a model is an iterative process, which may involve observing, constructing, evaluating, and revising.
- ☐ Engineers plan designs, select materials, construct products, evaluate results, and improve ideas.

Practice

1. A bowling ball starts at Position 1, rolls down a ramp, across the floor, and stops at Position 4.

a. At which position does the bowling ball have the most kinetic energy?

(Mark the one best answer.)

- ○ **A** Position 1
- ○ **B** Position 2
- ○ **C** Position 3
- ○ **D** Position 4

b. At which position does the ball have the most potential energy?

(Mark the one best answer.)

- ○ **F** Position 1
- ○ **G** Position 2
- ○ **H** Position 3
- ○ **J** Position 4

c. At which position is the bowling ball moving fastest?

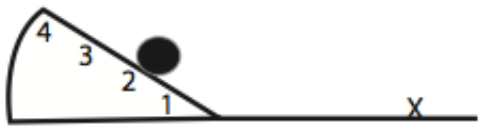
(Mark the one best answer.)

- ○ **A** Position 1
- ○ **B** Position 2
- ○ **C** Position 3
- ○ **D** Position 4

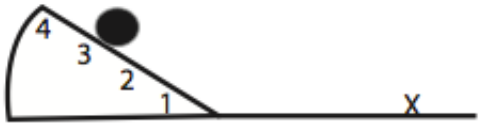
The balls on the ramps are exactly the same, but sit at different starting positions. Which ball would require the largest force to bring it to a stop when it reaches Position X?

(Mark the one best answer.)

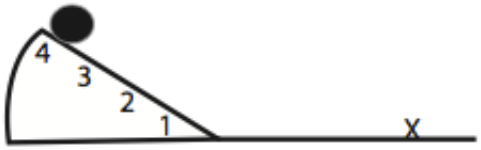
○ **F**



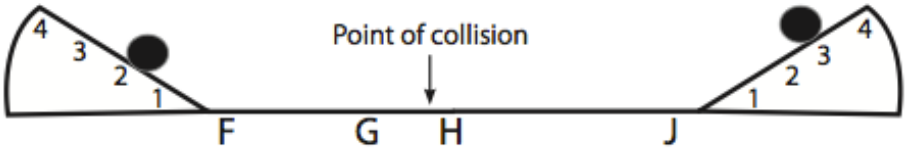
○ **G**



○ **H**



○ **J**



Two identical balls are released on ramps at the same time. Where will the ball on the right most likely come to a stop after the balls collide?

(Mark the one best answer.)

- ○ **F** Position F
- ○ **G** Position G
- ○ **H** Position H
- ○ **J** Position J

A basketball rolls down a ramp and across the floor.

a. At what position would the ball have the greatest potential energy if it started at that point?

- ○ **A** Position A
- ○ **B** Position B
- ○ **C** Position C
- ○ **D** Position D

b. If the ball crashes with a force of 200 newtons into a wall that doesn't move, how much force does the wall push back with? _____

c. If a ball slightly larger than the basketball rolled down the same ramp, it would roll _____ the basketball.

(Mark the one best answer.)

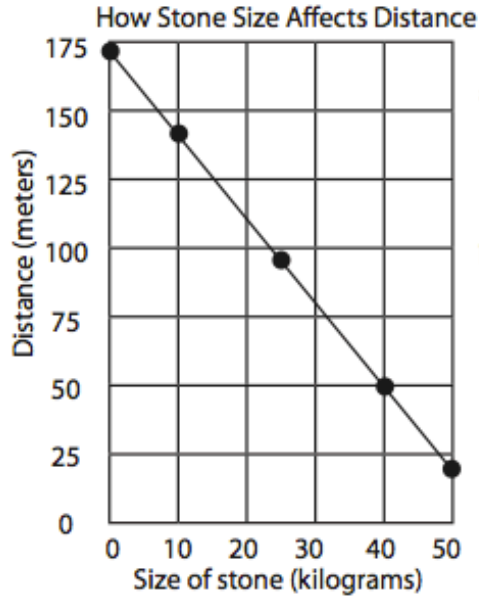
- ○ **F** faster than
- ○ **G** slower than
- ○ **H** at the same speed as

d. If a ball slightly smaller than the basketball rolled down the same ramp, it would roll _____ the basketball.

(Mark the one best answer.)

- ○ **A** faster than
- ○ **B** slower than
- ○ **C** at the same speed as

A student wanted to see if the size of a stone affects the distance it will travel when launched by a catapult. He did an experiment and graphed his results.



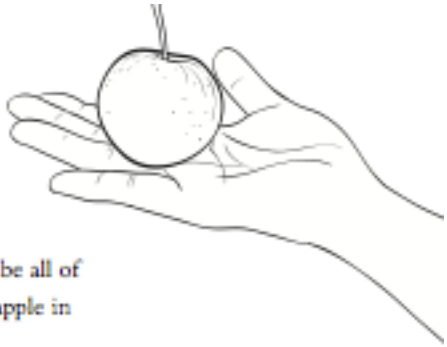
a. What distance would a stone weighing 30 kilograms travel? _____

b. What size stone would most likely travel 115 meters? _____

c. What is the relationship between the weight of the stone launched and the distance it travels according to the graph?

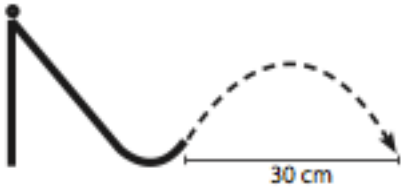
(Mark the one best answer.)

- ○ **F** The larger the stone, the farther it travels.
- ○ **G** The larger the stone, the more force needed to launch it.
- ○ **H** The smaller the stone, the farther it travels.
- ○ **J** The smaller the stone, the faster it travels.



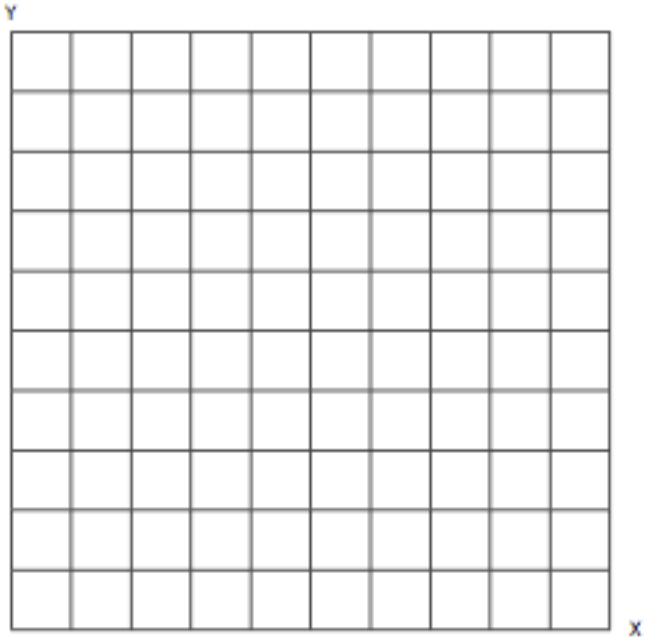
Explain why the apple is not moving. Describe all of the forces at work when you are holding an apple in your hand as you see in the picture.

A student is building a toy contraption. She wants to include a ramp that a marble will run down and fly through the air for 30 centimeters (cm). She needs to test the ramp-marble system to find out how high the marble should be placed on the ramp. Here is a data table she made of her test runs so far.

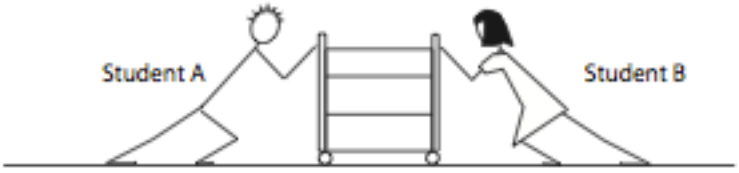


Starting height	Distance
10 cm	15 cm
30 cm	45 cm
15 cm	23 cm
23 cm	34 cm

a. On the grid below, draw a graph of the data collected so far.



b. At what height does she need to start the marble for it to fly 30 cm? _____



Student A pushes on a cart with 500 newtons (N) of force. Student B pushes on the other side of the cart. The cart doesn't move. How much force is Student B applying?

(Mark the one best answer.)

- ○ **F** Student B is applying more than 500 N of force.
- ○ **G** Student B is applying 500 N of force.
- ○ **H** Student B is applying less than 500 N of force.
- ○ **J** There is not enough information to know for sure.