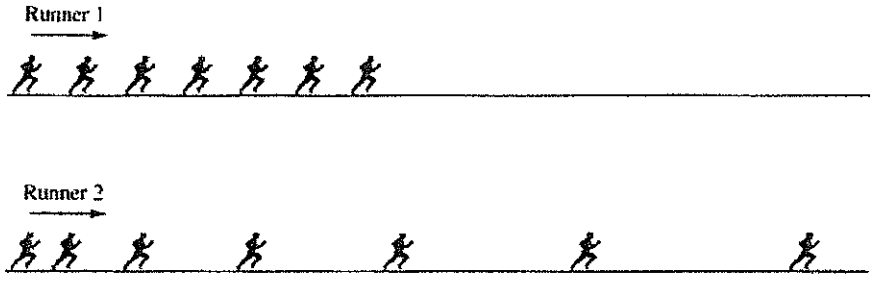
Fax to: Douglas Clark

From: Patty Littlejohn

Page 2, 3, and 10 – beginning of questions for each SPI

Examples of Constructed Response Questions



5. The picture above shows the positions of two runners at one-second intervals as they move from left to right. For each runner, indicate whether the runner's speed seems to be constant, increasing, or decreasing.

   Explain how you can tell this from the pictures.

5. Suppose you are riding in a car along the highway at 55 miles per hour when a truck pulls up along the side of your car. This truck seems to stand still for a moment, and then it seems to be moving backward.

   Tell how the truck can look as if it is standing still when it is really moving forward.

   Tell how the truck can look as if it is moving backward when it is really moving forward.

Reporting Category: PHYSICAL SCIENCE: Motion

Performance Indicator: 0707.11.2 Determine the amount of force needed to do work using different simple machines.

28 Use the equation below to solve the problem.

Force (F) = Work (w) ÷ Distance (d)

How much force was applied to a box that required 45 joules of work to push it up a 3-meter-long ramp?

F 15 newtons

G 42 newtons

H 48 newtons

J 135 newtons

16 A student performed 50 joules of work by raising an object 2 meters with a pulley.

$$\text{Force} = \frac{\text{work}}{\text{distance}}$$

$$F = \frac{w}{d}$$

What was the force on the object?

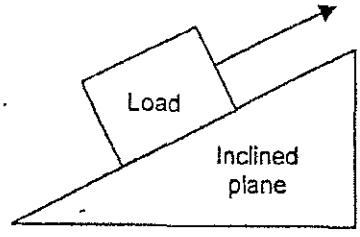
F 25 newtons

G 48 newtons

H 52 newtons

J 100 newtons

23. How could the amount of force that is needed to pull the load up the inclined plane be reduced?



A increase the sliding friction
B increase the length of the ramp
C increase the height of the ramp
D increase the mass of the load

Reporting Category: **PHYSICAL SCIENCE: Motion**

Performance Indicator: **0707.11.3 Apply proper equations to solve basic problems pertaining to distance, time, speed, and velocity.**

29 Use the equation below to solve the problem.

$s = d \div t$

A student rode a bicycle 15 miles in 1.5 hours. What was the student's average speed?

A 10.0 miles per hour

B 13.5 miles per hour

C 16.5 miles per hour

D 22.5 miles per hour

26 Use the equation to solve the problem.

Distance (d) = Rate (r) × Time (t)

A cheetah can run at a rate of 30 meters per second. How far could a cheetah travel in 60 seconds?

F 90 meters

G 120 meters

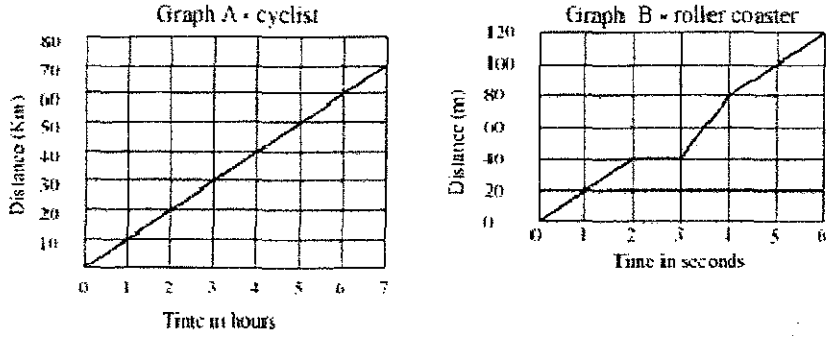
H 150 meters

J 1800 meters

_____21 What is the difference between an average speed and a constant speed?

a. A constant speed has the same speed at every point on a graph, and average speed is computed by dividing the total distance by the total time; each point on the graph could be a different speed.
b. Constant speed is faster than average speed.
c. Average speed is faster than constant speed.
d. An average speed has the same speed at every point on a graph, and a constant speed is computed by dividing the total distance by the total time; each point on the graph could be a different speed.

Use the diagram below to answer questions 33 - 37 by circling the letter that best answers each question.



_____ 33. What is the average speed of the cyclist?

a. 10 km/min.
b. 10 km/hour
c. 70 km/hour
d. 1 hour/km

_____ 34. What is the average speed of the roller coaster?

a. 20 m/sec.
b. 120 m/sec.
c. 2.4 m/sec.
d. 60 m/sec.

_____ 35. During which interval is the roller coaster's speed the greatest?

a. Between 4 sec. and 5 sec.
b. Between 3 sec. and 4 sec.
c. Between 2 sec. and 3 sec.
d. Between 1 sec. and 2 sec.

_____ 36. How might you explain the interval between the 2nd and 3rd second on the roller coaster graph?

a. The roller coaster reached a constant speed.
b. The roller coaster is at the bottom of a loop.
c. The roller coaster is at the top of a camelback.
d. The emergency brakes were applied forcing the car to a stop.

_____ 37. Which graph shows a constant speed?

a. The roller coaster graph
b. The cyclist graph

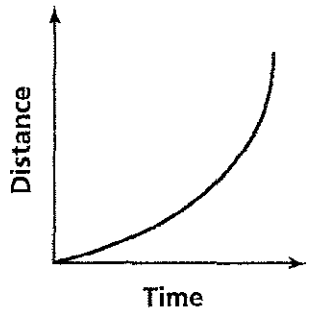
25 A student took a field trip on a bus. The student recorded the distance traveled by the bus every 10 minutes for one hour. The student's data are shown below.

Field Trip Time vs. Distance

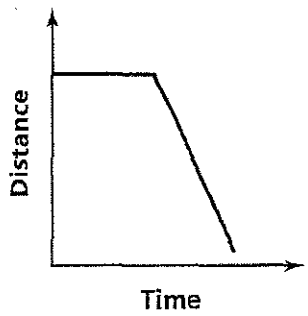
Time (minutes)	Distance from School (kilometers)
0	0
10	8
20	28
30	50
40	74
50	80
60	85

Which line best represents the data?

A



C



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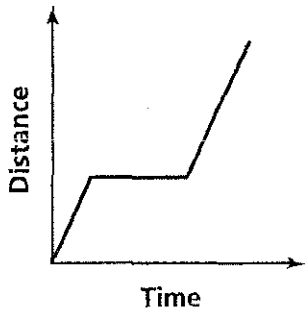

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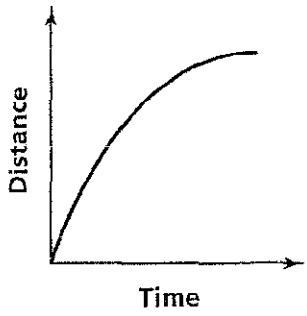


_____19.The word "acceleration" means to

a. exert a force on another object.
b. create a balanced force on another object.
c. create an unbalanced force on another object.
d. change the speed or direction.

Answer the questions below after reading the following passage.

A massive roller coaster has been built in Twin Falls, ID and you have been hired to make some calculations for their promotional brochure. The company has heard about your expertise in this area. The roller coaster has a **height of 285 meters on the first hill. The drop length is 310 meters (on the first hill).** It **takes 3 seconds** for the roller coaster car to go from the top to the bottom of the first drop. It **takes 4 seconds** to reach the top of the second hill, which is **150 meters in length**. You have realized there is a flaw in the design because the force on the second hill is too great. You notify the builders and become a local hero celebrated for your intelligence. (Oh, by the way, the mass of the roller coasters cars is **225 kg**). Draw a diagram, it will help. Attach your work process.

_____40. What was the force on the second hill?

a. -3234.36 N
b. 0.0733 N
c. -3,703 N

_____41. What is the speed on the first drop?

a. 95 m/sec.
b. 103.33 m/sec.
c. 323.22 m/sec.

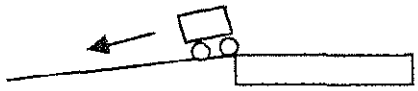
_____38. A sprinter runs the 225m in a time of 25 seconds. What is the sprinter's speed?

a. 5625 m/sec.
b. 56 m/sec.
c. 9 m/sec.
d. 9 m/hr

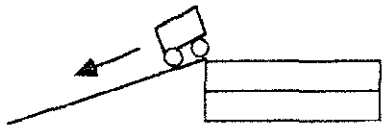
_____30. A car of a roller coaster coasts from point A to point B. The speed of the car increases because.

a. only balanced forces act on the car.
b. an inside force acts on the car.
c. only unbalanced forces act on the car.
d. no forces act on the car.

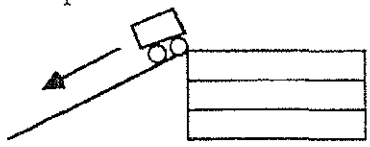
12. Craig built 3 ramps using boards and boxes. All boxes were 4 cm in height and the ramps were 1 meter in length. He rolled his car down Ramp A and found it took 3 seconds to get to the bottom. When his car rolled down Ramp B, it took 2 seconds.



3.0 seconds
Ramp A



2.0 seconds
Ramp B



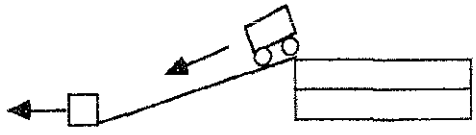
? seconds
Ramp C

How many seconds do you predict it will take to get to the bottom of Ramp C?

A. 1.5 seconds
B. 2.0 seconds
C. 2.9 seconds
D. 3.5 seconds

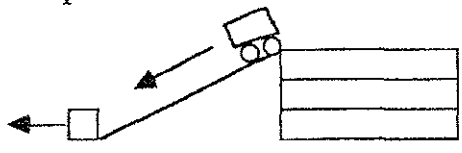
13. Craig built his ramps again. This time he put a block at the end of the ramp. When the car reached the bottom of the ramp it hit the block and made it move. Using Ramp A the block moved 20 centimeters and using Ramp B it moved 39 centimeters.

20 cm **Ramp A**



39 cm **Ramp B**

How far do you predict the block will move using Ramp C?



? cm **Ramp C**

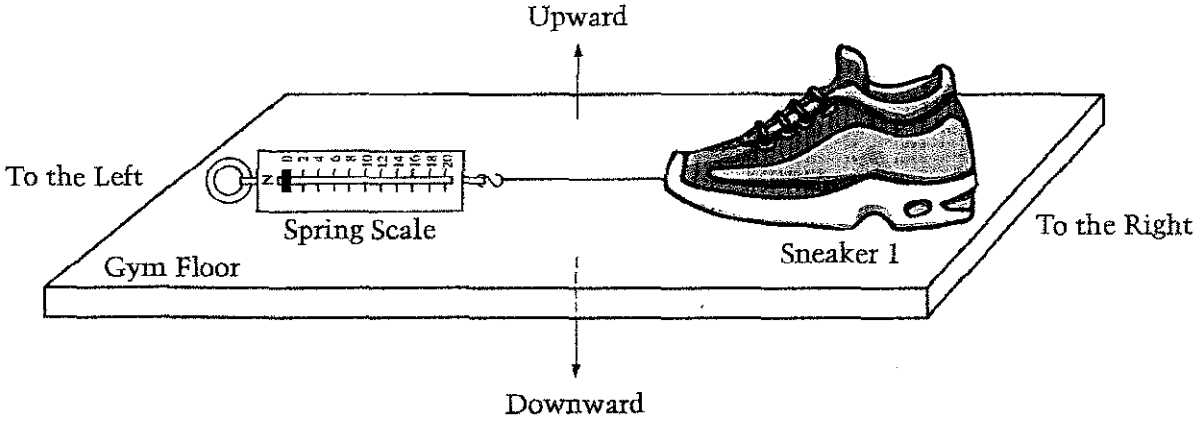
A. 24 centimeters
B. 35 centimeters
C. 56 centimeters
D. 70 centimeters

Meg designs an experiment to see which of three types of sneakers provides the most friction.

She uses the equipment listed below.

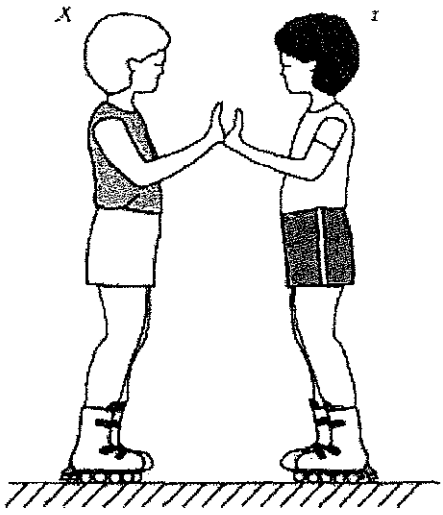
- Sneaker 1
- Sneaker 2
- Sneaker 3
- Spring scale

She uses the setup illustrated below and pulls the spring scale to the left



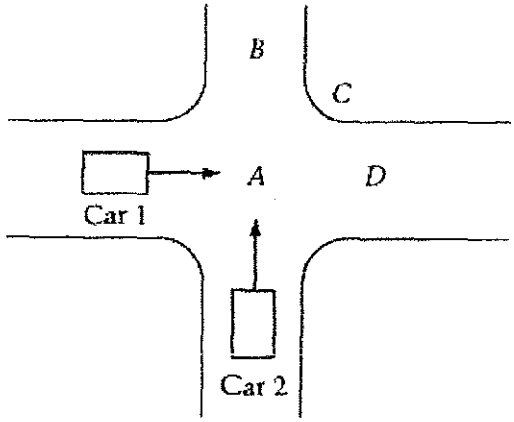
11. In what direction does the force of friction act?

A. To the left
B. To the right
C. Upward
D. Downward



Two boys wearing in-line skates are standing on a smooth surface with the palms of their hands touching and their arms bent, as shown above. If Boy X pushes by straightening his arms out while Boy Y holds his arms in the original position, what is the motion of the two boys?

A. Boy X does not move and Boy Y moves backward.
B. Boy Y does not move and Boy X moves backward.
C. Boy X and Boy Y both move backward.
D. The motion depends on how hard Boy X pushes.



Two identical cars travel at 45 miles per hour toward the center of the intersection (point A, as shown above) with equal force. The cars collide at the intersection. If after they collide the cars stick to each other and move together, they will come to rest closest to

A. point A
B. point B
C. point C
D. point D

Reporting Category: PHYSICAL SCIENCE: Motion

Performance Indicator: 0707.11.4 Identify and explain how Newton's laws of motion relate to the movement of objects.

31 An equation is shown in the box below.

$F = ma$

Which statement best describes the variables in this equation?

A An object at rest tends to stay at rest.

B For every action there is an equal and opposite reaction.

C An object will only accelerate if an unbalanced force acts upon it.

D The acceleration of an object depends upon the force acting upon it and its mass.

Reporting Category: PHYSICAL SCIENCE: Motion

Performance Indicator: 0707.11.4 Identify and explain how Newton's laws of motion relate to the movement of objects.

32 Which example best describes Newton's third law of motion?

F When a glass slid across a table, it spilled water when it stopped suddenly.

G An engine used less work to move a lighter car than when it moved a heavier car.

H When a passenger stepped from a boat to the shore, the boat moved away from the shore.

J A bowling ball rolled in a straight path when it was thrown towards bowling pins.

50 An object is resting motionless on a surface. According to Newton's first law, the object will only start to move if

F the net forces on the object equal zero.

G an unbalanced force is applied to the object.

H the upward force of the object is equal to its acceleration.

J two forces that are equal and opposite are applied to the object.

65 As the wheels of a train push down on a track, the track pushes back against the wheels. Which of Newton's laws is used to explain these forces?

A An object at rest tends to stay at rest unless acted upon by an unbalanced force.

B The net force of an object is equal to its mass times its acceleration.

C For every action, there is an equal and opposite reaction.

D Any two objects exert a gravitational force of attraction on each other.

_____8. According to Newton's Third Law of Motion, when a hammer strikes and exerts a force on a nail, the nail

a. creates a balanced force.
b. disappears into the wood.
c. moves at a constant speed.
d. exerts and equal and opposite force back on the hammer.

_____1. The tendency of an object to resist any change of motion is known as _____.

a. force
b. mass
c. inertia
d. balance

_____5. A book is sitting on a dashboard of a car that's stopped at a traffic light. As the car starts to move forward, the book slides off the dashboard. Pick the most correct explanation.

a. There was grease on the dashboard
b. The object had inertia.
c. A supernatural force took over.
d. Air resistance made the book move backward.

_____11. Pick the best example of Newton's First Law in action.

a. A rocket taking off from earth which pushes gasses in one direction and the rocket in the other.
b. A rocket sitting on the ground preparing for take off but it needs an outside force to overcome its inertia of a nonmoving object.
c. A rocket that is accelerating through space and exerts a great amount of force because its mass and acceleration is so large.
d. Both b and c

_____15. An example of a balanced force is

a. a car sliding on ice.
b. a tug-of-war game in which no one wins.
c. a car hitting a telephone pole.
d. a roller coaster going down the first drop.

_____10.Pick the best example of Newton's Second Law in action.

a. A rocket taking off from earth which pushes gasses in one direction and the rocket in the other.
b. A rocket sitting on the ground preparing for take off but it needs an outside force to overcome its inertia of a nonmoving object.
c. A rocket that is accelerating through space and exerts a great amount of force because its mass and acceleration is so large.
d. Both b and c.

_____9. Pick the best example of Newton's Third Law in action.

a. A rocket taking off from earth which pushes gasses in one direction and the rocket in the other.
b. A rocket sitting on the ground preparing for take-off but it needs an outside force to overcome its inertia of a non-moving object.
c. A rocket that is accelerating through space and exerts a great amount of force because its mass and acceleration is so large.
d. Both b and c.

_____22.Two main outside forces acting on most anything on earth are

a. friction and mass.
b. friction and gravity.
c. gravity and inertia.
d. gravity and mass.

_____18.When two equal forces act on the same object in opposite directions, the net force is _____.

a. crazy
b. greater than either force
c. zero
d. smaller than either force

_____16.An example of an unbalanced force (net force) is

a. a car parked in the garage.
b. a tug-of-war game in which no one wins.
c. a bridge.
d. a roller coaster going down the first drop.

Practice Questions

1. You and your much smaller friend are facing each other on a flat sidewalk. You are both wearing in-line skates. You push against each other, and you both begin to roll back. Who has greater acceleration?
   A. You both have the same acceleration.
   B. You are bigger and have greater acceleration.
   C. Your smaller friend has greater acceleration.
   D. You would need more information to answer this question.

2. A block is pushed across the table with a constant force. It travels across the table at a constant speed. Which of the following statements about the force of friction must be true.
   F. There is no friction force between the table and the block.
   G. The force of friction is less than the applied force pushing the block.
   H. The force of friction is equal to the applied force pushing the block.
   J. The force of friction is greater than the applied force pushing the block.

3. Describe what would happen to a boy wearing ice skates on a pond when he throws a heavy object forward.
   A. The object would move forward; the boy would remain at rest.
   B. The object would move forward; the boy would move quickly backward.
   C. The object would move forward; the boy would move slowly backward.
   D. The object would move forward; the boy would move backward at the same rate.

4. How is it possible for an astronaut in outer space to push and move a heavy spacecraft?
   F. There is no friction and no gravity in outer space. This means that things don't have weight, and they are easy to push.
   G. Astronauts are required to be very strong and in good physical shape, so it is easy for them to move heavy objects.
   H. Since the objects are weightless in space, any force will get them moving, even a small push from an astronaut.
   J. Since there is virtually no friction in space, a small force from an astronaut creates a net force.

62 **Students in a science class plan to investigate a factor that affects the rate at which a pendulum swings.**

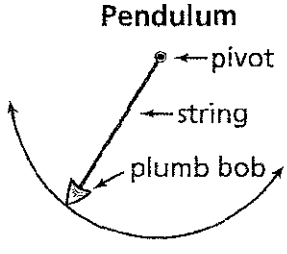
In which way should the students manipulate the variables to get valid results in this investigation?

F use equal string lengths and different plumb bob masses

G use different string lengths and different plumb bob masses

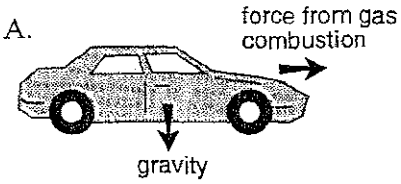
H use equal string lengths and the same plumb bob shapes

J use different string lengths and different plumb bob shapes



3. Imagine that a car is being driven with cruise control on, so it is going at a constant speed. Which diagram correctly identifies the forces acting on the car?

A.



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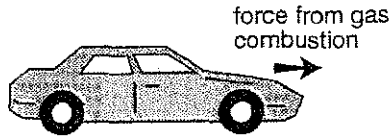

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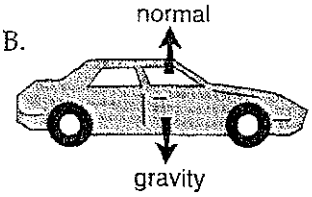
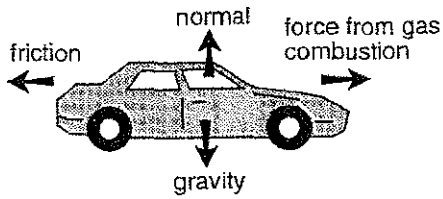


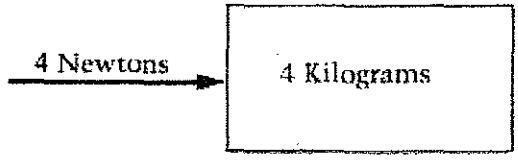
D.



4. Which of the following statements about friction is false?
   F. Friction makes things slow down.
   G. Friction is a force between two things that are touching.
   H. Friction is greater for rough surfaces than smooth surfaces.
   J. Friction is greater for fast-moving things than slow-moving things.

Each figure below shows a force measured in newtons pushing on a block. If there are no other forces pushing on the block, in which case is the acceleration of the block greatest?

A.



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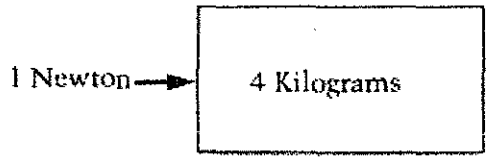
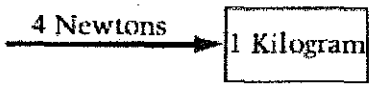


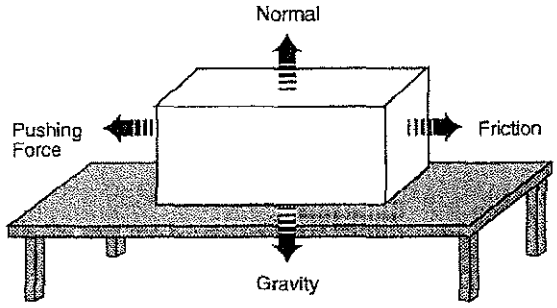
C.



D.

Practice Questions

Directions: A large block is being pushed to the left, at a constant speed, across a tabletop as shown below. The forces acting on the block are labeled. Use this illustration to answer Numbers 1 and 2.



1. What is true about the relative size of the forces?
   A. The normal force is greater than the force of gravity.
   B. The normal force is equal to the pushing force.
   C. The normal force is less than the force of friction.
   D. The normal force is equal to the weight of the object.

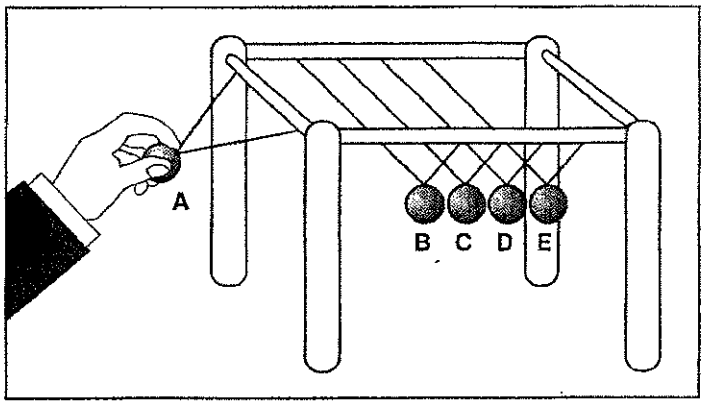
2. Which statement about the block is true?
   F. Since the block is moving at a constant speed, the block is in equilibrium.
   G. Since the block is moving to the left, the pushing force is greater than the force of friction.
   H. Since the block is moving to the left, the pushing force must be greater than the weight of the block.
   J. Since the block is moving to the left, there are net forces acting on the block to the left.

3. Which of the following is an example of an action/reaction pair?
   A. You push against a wall, and the wall pushes back on you.
   B. You sit on a chair (pushing down), and the floor pushes up on the chair.
   C. You sit on a chair (pushing down), and the chair pushes down on the floor.
   D. A book pushes down on a desk, and you push down on the book.

4. What would happen if the forces of an action/reaction pair were to suddenly become uneven (or unbalanced)?
   F. One of the forces would overwhelm the other, causing motion.
   G. Equilibrium would be lost, and the object would remain at rest.
   H. The object would begin moving as soon as equilibrium was achieved.
   J. Both forces would disappear because they are no longer action/reaction.

Practice Questions

Directions: Study the illustration below



1. Tom and Mikayla were discussing their science teacher's toy shown in the drawing. Which of the following statements would be the most accurate if Tom let Ball A drop?
   A. Ball A would hit Ball B and bounce back.
   B. Balls B, C, D, and E would all move away from Ball A.
   C. All five balls would swing in the direction that Ball A falls.
   D. Ball E would swing out to about the same height from which Ball A started.

2. If Mikayla dropped both Ball A and Ball B at the same time, which of the following would you predict would take place?
   F. Ball A and Ball B would hit Ball C and fly apart.
   G. All five balls would swing back and forth together.
   H. Balls D and E would swing out to about the same height from which Balls A and B started.
   J. Ball E only would swing out to about the same height from which Balls A and B started.

Practice Questions

1. Imagine that an object is moving in a straight line and at a constant speed. Which of the following statements about that object must be true?
   A. There are no forces acting on the object.
   B. The forces acting on the object are balanced.
   C. Only gravity is acting on the object because gravity is always present.
   D. There is only one force acting on the object.

2. Which of the following statements is closest to Newton's first law?
   F. Objects in motion will always slow down and stop.
   G. Objects at rest will stay at rest unless the forces acting on them change.
   H. Objects that have outside forces acting on them will move in a straight line.
   J. Objects in motion will stay in motion no matter how many forces are acting on them.