Substitute Plan
Western International High School
Physics
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Students:

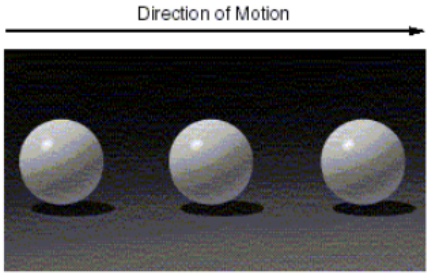
Below you will find 10 sections of multiple choice questions. The correct answer is provided. Your task is to perform the calculation and explain scientifically the correct answer.

You can work on one section per day.

Good Luck

SECTION 1: P2.1A Calculate the average speed of an object using the change of position and elapsed time. L2

1. The picture shows a ball moving 2.625 cm every 0.25 second on a photogram. Determine the velocity of the ball.



A. 3.5 cm/s
B. 10.5 cm/s
C. 14.0 cm/s
D. 28.0 cm/s

Answer: B.

2. Below is the table position (m) and time of a boat to answer questions 2 and 3. What is the average velocity of the boat over the time interval shown?

A. -12.5 m/s
B. -1.25 m/s
C. 1.25 m/s
D. 12.5 m/s

Position (m)	Time (s)
25	1
22.5	3
20	5
17.5	7
15	9
12.5	11

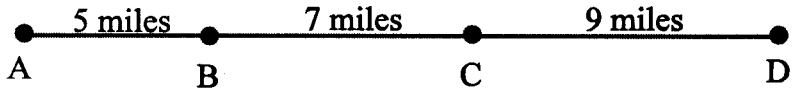
Answer: B.

3. What can be concluded about the motion of the boat from the given data?

   A. The boat is driving towards the 0m location.
   B. The boat is driving backwards towards the finish line.
   C. The boat is accelerating towards the 0m location.
   D. The boat is driving in circles around the 0m location.

Answer: A

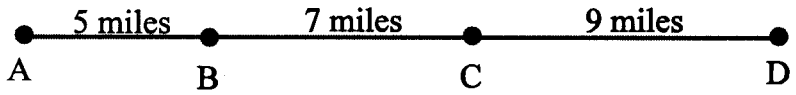
4. Four cities all lie along a straight line as shown in the diagram. A delivery driver departs from City B, drives to City D, and then Drives to City A. The total time for the trip is 0.70 hours. Use the diagram to answer questions 4, 5, 6, 7.



What is the driver's displacement at the end of the described trip?

   A. 5 miles
   B. 11 miles
   C. 21 miles
   D. 37 miles

Answer: A



5. What distance does the driver cover during the described trip?

   A. 11 miles
   B. 21 miles
   C. 37 miles
   D. 42 miles

Answer: C

6. What is the driver's average velocity during the described trip?

   A. 7.1 mi/hr
   B. 30 mi/hr
   C. 52.9 mi/hr
   D. 60 mi/hr

Answer: C

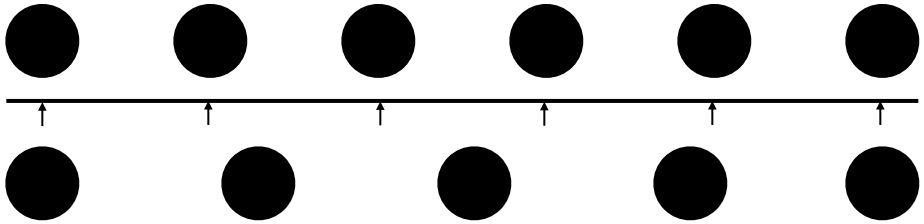
7. What is the driver's average speed during the described trip?

   A. 7.1 mi/hr
   B. 30 mi/hr
   C. 52.9 mi/hr
   D. 60 mi/hr

Answer: C

SECTION 2 P2.1B Represent the velocities for linear and circular motion using motion diagrams (arrows on strobe pictures). L2

The diagram below represents the position of two bowling balls (A & B) at one-second intervals. The arrows are 2.0 meters apart. Answer questions 1, 2 and 3.



1. What can you observe about the motion of the two bowling balls?

   A. Both balls move at the same velocity.
   B. Ball A moves faster than Ball B.
   C. Ball A moves slower than Ball B.
   D. Neither ball is moving.

Answer: C

2. What is the average velocity of Ball A?

   A. 5.0 m/s
   B. 4.0 m/s
   C. 2.5 m/s
   D. 2.0 m/s
   E. 1.0 m/s

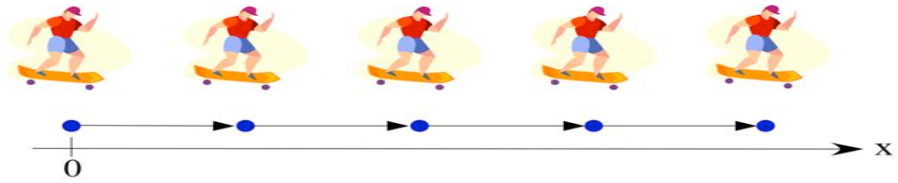
Answer: D

3. What was the average velocity of Ball B?

   A. 5.0 m/s
   B. 4.0 m/s
   C. 2.5 m/s
   D. 2.0 m/s
   E. 1.25 m/s

Answer: C

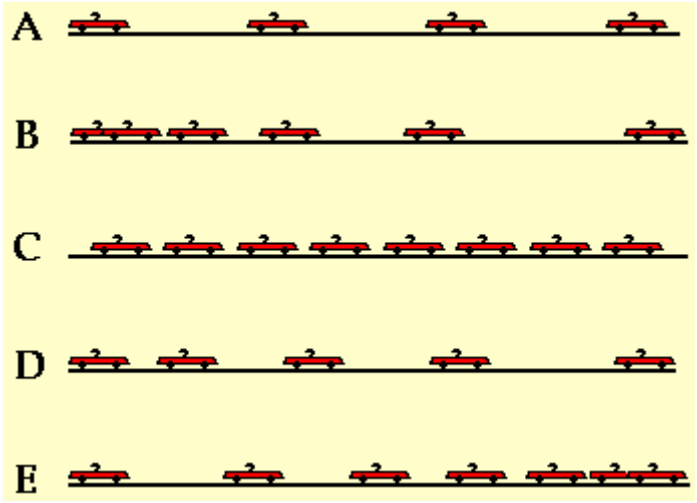
4. A skateboarder is rolling down the side walk as shown in the diagram below. We can infer from this diagram that the skateboarder is



A. moving at a constant speed.
B. moving at a constant acceleration.
C. The arrows are oriented in the direction of motion showing a negative motion.
D. The direction of the motion is unclear from the diagram.

Answer: A

5. Study the diagram below and determine which of the objects are undergoing an acceleration.



A. B and D are experiencing acceleration
B. B, D and E are experiencing acceleration
C. A only is showing acceleration
D. None of the diagrams are showing acceleration

Answer: B

SECTON 3_: P2.1C Create line graphs using measured values of position and elapsed time. L3

1. Which equation best represents the motion depicted by the data?

Time, t (s)	Position, x (m)
0	50
5	200
10	350
15	500
20	650

A. x = (150m/s)t + 0m
B. x = (150m/s)t + 50m
C. x = (30m/s)t + 0m
D. x = (30m/s)t + 50m

Answer: D

2. What is the average velocity of the car?

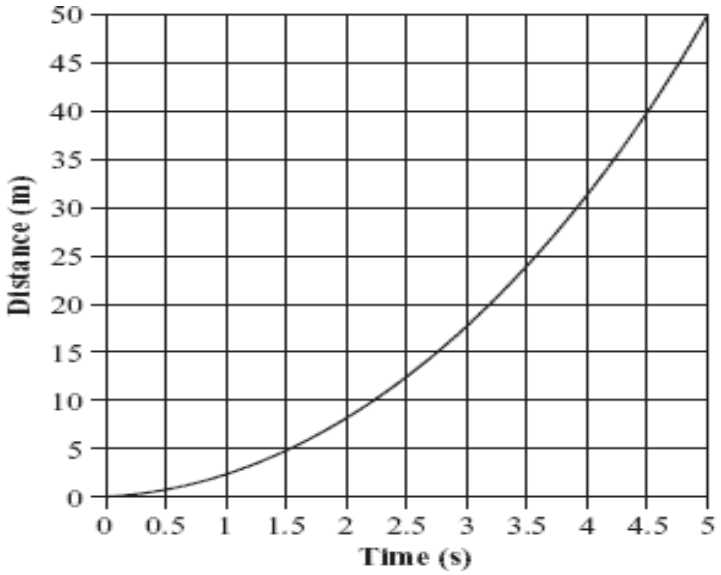
A. 30m/s
B. 35m/s
C. 40m/s
D. 50m/s

Answer: A

Time, t (s)	Position, x (m)
0	50
5	200
10	350
15	500
20	650

SECTON 4: **P2.1D** Describe and analyze the motion that a position-time graph represents, given the graph. L2

1. The distance vs. time graph below shows data collected as a remote-controlled car moved across a level parking lot.



According to the graph, which of the following conclusions about the car's motion is supported?

A. The car is accelerating

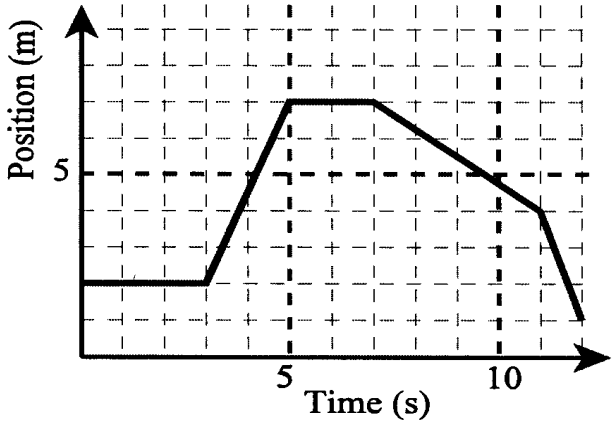
B. The car is stopping and starting

C. The car is traveling at a constant velocity

D. The car is moving through an obstacle course

Answer: A

Use the graph below to answer questions 2 and 3.



2. What is the object's average velocity from t = 0s to t = 8s?

A. 0.44 m/s
B. 0.51 m/s
C. 0.77 m/s
D. 1.75 m/s

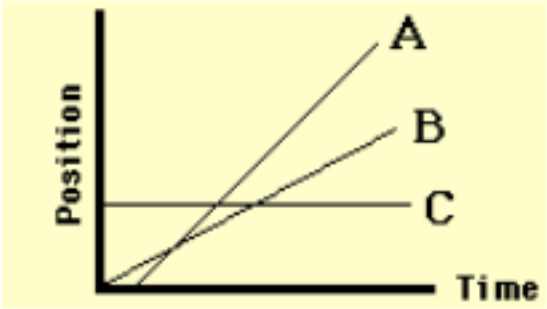
Answer: C

3. What is the object's velocity at t = 8s?

A. Δ1.33 m/s
B. Δ0.75 m/s
C. 0.75 m/s
D. 1.33 m/s

Answer: B

4. The motion of three objects (Object A, Object B, and Object C) is described by the three lines on the position-time graph at the right. Which one of the objects is moving with the greatest speed?



A. Object A
B. Object B
C. Object C
D. Hard to tell with this diagram

Answer: A

5. While on vacation, Lisa Carr traveled a total distance of 440 miles. Her trip took 8 hours. What was her average speed?

   A. 18 miles/hour
   B. 80 miles/hour
   C. 60 miles/hour
   D. 55 miles/hour

Answer: D

6. Starting from rest, a car undergoes a constant acceleration of 6 m/s^2. How far will the car travel in the first second?

   A. 6 meters
   B. 3 meters
   C. 1 meter
   D. 2 meters

Answer: B

SECTON 5 **P.1.1g** Based on empirical evidence, explain and critique the reasoning used to draw a scientific conclusion or explanation. **P2.1g** Solve problems involving average speed and constant acceleration in one dimension. L2

1. Objects *A* and *B* are dropped from rest near Earth's surface. Object *A* has mass *m* and object *B* has mass 2*m*. After 2 seconds of free fall, object *A* has a speed *v* and has fallen a distance *d*. What are the speed and distance of fall of object *B* after 2 seconds of free fall?

    A. speed = v/2 ; distance = *d/2*
    B. speed = *v*; distance = *d*
    C. speed = v/2 ; distance = 2*d*
    D. speed = 2*v*; distance = 2*d*

Answer: B

2. Becky rode her bicycle 300.00 meters due east in 30.0 seconds. She then peddled directly south for 20.0 seconds at the same speed. She then peddled 50.0 meters directly north in 5.00 seconds.

    A. What was the total distance that she peddled her bicycle?
    B. What was her average speed?
    C. What was her displacement?
    D. How would you determine her average velocity?

Answers*:*

A. Total distance = 300 m + 200 m + 50.0 m = 550 m (2pts)
B. 10 m/s
C. 335.4 m -- 26.6¡ south of due east
D. total displacement divided by total time

3. The data given below were collected from two different objects.

	Object A	Object B
Time (s)	**Position (m)**	**Position (m)**
0.00	0.0	0.000
0.25	0.5	0.094
0.50	1.0	0.375
0.75	1.5	0.844
1.00	2.0	1.500
1.25	2.5	2.344
1.50	3.0	3.375
1.75	3.5	4.594
2.00	4.0	6.000

The differences in the two objects can be explained as

A. Object A is constant velocity while Object B is constant acceleration
B. Both objects start at the same location at the same time
C. Both objects are moving in the same direction
D. All of the above

Answer: D

SECTION 6: P2.2A Distinguish between the variables of distance, displacement, speed, velocity, and acceleration. L2

1. An object is observed to have zero acceleration. Which of the following statements must be true?

    A. The object is motionless.
    B. The object is moving in a circular path.
    C. There is no friction acting on the object.
    D. The object has a constant velocity.

Answer: D

2. A car driving down the freeway has a constant velocity. Which of the following statements must be true?

    A. The car has zero acceleration.
    B. The car is moving in a circular path.
    C. There is no friction acting on the car.
    D. The car is speeding up.

Answer: A

3. The following table gives the position of a boat at various times.

Position (m)	Time (s)
25	1
22.5	3
20	5
17.5	7
15	9
12.5	11

How can the motion of the boat best be described?

A. The boat has a constant, non-zero velocity.
B. The boat has zero velocity, but non-zero acceleration.
C. The boat has a constant, non-zero acceleration.
D. There is insufficient data here to accurately describe the boat's motion.

Answer: A

4. One of the oldest rides at an amusement park is the Merry-go-round. It is a favorite of very young children, but not exciting enough for high school age students. There is still much physics that can be studied with the Merry-go-round. Consider the following Merry-go-round. The inner radius of the rider's platform is 10 ft. The outer radius is 20 ft. There are four rows of animals to ride in that 10 foot distance on the platform. When the Merry-go-round is moving at full speed it takes just 40 seconds to make a complete rotation. Some of the horses on the Merry-go-round move up and down in a periodic manner.

   The horse on the innermost row of animals is located 12.0 ft from the center of rotation. The horse on the outermost row of animals is located 18.0 ft from the center of rotation.

   Answer the following as it relates to the above.

   The person riding on the inner horse would feel an acceleration that is

   A. zero once the ride gets up to speed
   B. the same as the acceleration of a person on the outer horse
   C. about 2/3 the acceleration of a person on the outer horse
   D. about 3/2 the acceleration of a person on the outer horse

Answer: D

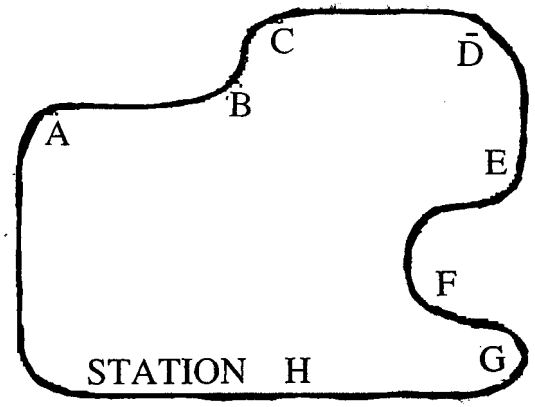
5. The kinetic energy of a person riding on the inner row as compared to the kinetic energy of the same person riding on the outer row

   A. is the same since they both take the same time to make one revolution.
   B. is equal to the ratio of their respective radii of rotation.
   C. is equal to the inverse ratio of their respective radii of rotation.
   D. is equal to the ratio of the square of their respective radii of rotation.

Answer: D

6. One of the easier rides at a local amusement park is the steam engine driven train. The train follows the track shown in the diagram below. The total length of the track is 1.4 miles. It takes the train 12.0 minutes to cover the length of the track. The train takes 4 sec. from stop to reach its speed, which it then maintains through the entire course until it takes 6 sec. to stop back at the station.

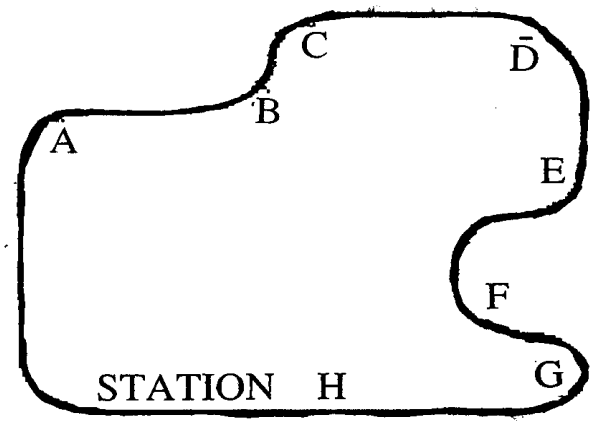
Answer the following questions as they relate to the above.



If you are going to determine the force acting on you at point B on the track you will need to know all of the following *except*

A. the radius of curvature of the track at point B
B. the speed you are moving at point B
C. your mass
D. how long it took you to get to point B from the station.

Answer: B



7. The *average velocity* of the train during the 12 minute ride is

   A. zero
   B. 11.7 mi/hr
   C. 7.0 mi/hr
   D. 10.3 ft/s

Answer: A

8. The *average speed* of the train during the 12 minute ride is

   A. zero
   B. 11.7 mi/hr
   C. 7.0 mi/hr
   D. 10.3 ft/s

Answer: C

SECTION 7: P2.2B Use the change of speed and elapsed time to calculate the average acceleration for linear motion. L2

1. A ball starting from rest accelerates uniformly at 5.0 meters per second as it rolls 40 meters down an incline. How much time is required for the ball to roll the 40 meters?

    A. 2.8 s
    B. 8.0 s
    C. 16 s
    D. 4.0 s

Answer: B

2. The speed of a car is decreased uniformly from 30 meters per second to 10 meters per second in 4.0 seconds. The magnitude of the car's acceleration is

    A. 5.0 m/s2
    B. 10. m/s2
    C. 20. m/s2
    D. 40. m/s2

Answer: A

3. What is the average acceleration of a car that goes from rest to 60 km/hr in 8 seconds.

    A. 8 km/hr ·s
    B. 13 km/hr ·s
    C. 7.5 km/hr ·s
    D. None of the above

Answer: C

4. How long does it take to accelerate an object from rest to 10 m/s if the acceleration was 2 m/s^2?

    A. 10 seconds
    B. 5 seconds
    C. 15 seconds
    D. 2 seconds

Answer: B

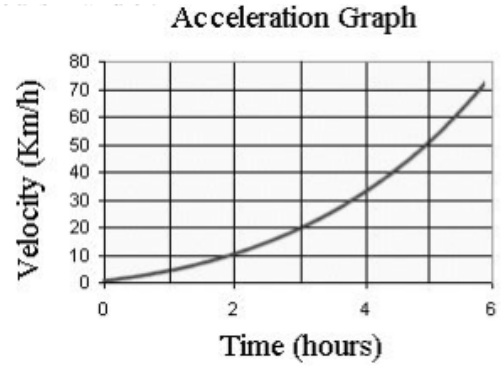
5. Carl started to run at 10 km/h when he left his house. He arrived at school 30 minutes later. How fast was he running when he arrived there? Assume that his average acceleration was 30 km/h^2.

    A. 25 km/h
    B. 3 km/h
    C. 1 km/h
    D. 30 km/h

Answer: A

SECTION 8: P2.2C Describe and analyze the motion that a velocity-time graph represents, given the graph. L2

1. The graph below shows the velocity of a car over a period of six hours. What is the car's acceleration between hours 2 and 3?

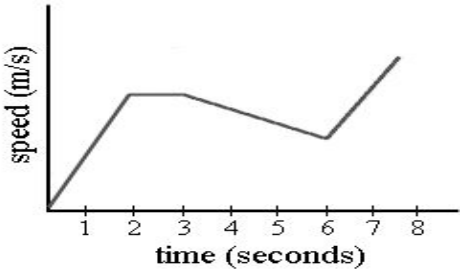


A. 0 km/h^2
B. $^-$10 km/h^2
C. 20 km/h^2
D. 10 km/h^2

Answer: D

2. A graph of a car's motion is shown below. Which statement best describes the car's motion between 3 seconds and 6 seconds?

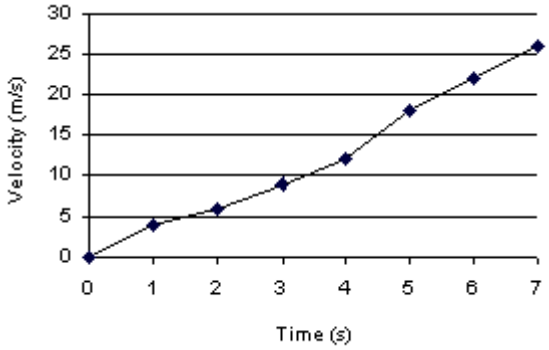
A. The car is accelerating
B. The car is decelerating
C. The car has a constant velocity
D. The car is stopped.



Answer: B

3. What is the instantaneous acceleration of the object when t = 0 in the diagram below? For example, the instantaneous acceleration when t = 3 at the below graph is 3 m/s^2, since the graph has a slope of 3 when t = 3.

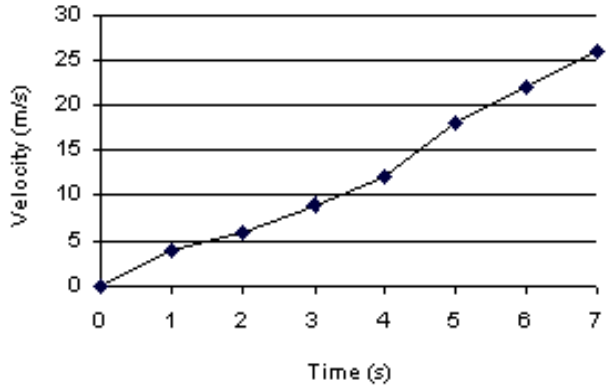
A. 4 m/s
B. 3 m/s
C. 0 m/s
D. 1 m/s



Answer: A

4. For example, the instantaneous acceleration when t = 3 at the below graph is 3 m/s^2, since the graph has a slope of 3 when t = 3. What is the average acceleration of the whole trip? (When t = 7, velocity = 26 m/s)

A. 18.2 m/s^2
B. 4 m/s^2
C. 3.7 m/s^2
D. 26 m/s^2



Answer: C

SECTION 9: P3.1A Identify the force(s) acting between objects in "direct contact" or at a distance. L1

1. A car is parked on the side of a hill. Which of the following most likely prevents the car from moving down the hill?

   A. The car has too much mass to move easily.
   B. There is friction in the door hinges of the car.
   C. There is friction between the tires and the road.
   D. The weight of the car is mostly on the front wheels.

Answer: C

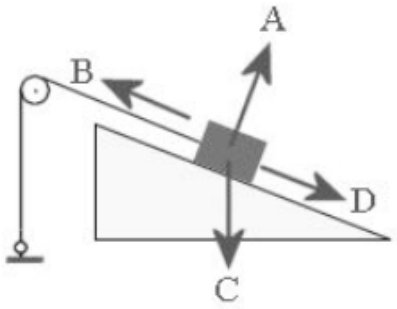
1. What force is acting throughout the length of the rubber band shown below?

   A. kinetic force
   B. frictional force
   C. torque
   D. tension

Answer: D

4. What force acting on the block is labeled B in the diagram below?

   A. normal
   B. tension
   C. friction
   D. gravity



Answer: B

SECTION 10: P3.1d Identify the basic forces in everyday interactions. L1

1. Each of the following situations describes some kind of motion. Identify which of Newton's three laws of motion might best explain the motion.

    a. 1st Law: Law of Inertia
    b. 2nd Law: F = ma
    c. 3rd Law: Action/Reaction

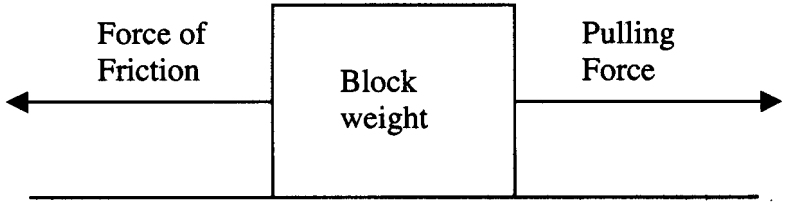
_____ 1. A child riding without a safety restraint is propelled through the windshield of the car when it is involved in an accident.
_____ 2. Your friend lets you shoot his new shot gun and it makes your shoulder sore.
_____ 3. A car on an icy road slides off the road while trying to negotiate a curve.
_____ 4. After sitting in class for nearly an hour you are ready to announce that you are suffering from tired bottom.
_____ 5. A drag race is mostly all engine and tires.
_____ 6. You have to walk to town after your car becomes stuck in the sand and you are unable to push it out.
_____ 7. A fighter plane uses a drag parachute to aid in stopping.
_____ 8. In a fit of anger you swing your fist at the wall putting a hole in the wall and breaking your hand.

Answers:

1. a
2. c
3. a
4. c
5. b
6. a
7. b
8. c

SECTION 10: P1.1f Predict what would happen if the variables, methods, or timing of an investigation were changed.

A steel block is pulled along a steel surface. An experiment is conducted that compares the forces needed to overcome friction when the weight is changed.



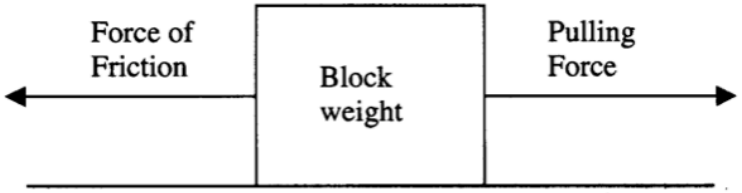
	Block weights		
	5kg	**10kg**	**15kg**
Smooth steel surface	0.75kg	1.5kg	2.25kg

Answer the following questions as they relate to the above.

1. What happens to the frictional force as the weight of the block increases?

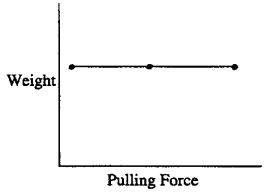
   A. The frictional force stays the same.
   B. The frictional force increases.
   C. The coefficient of friction increases.
   D. The coefficient of friction decreases.

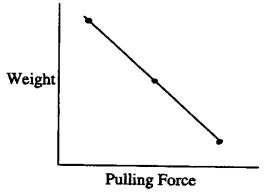
Answer: B

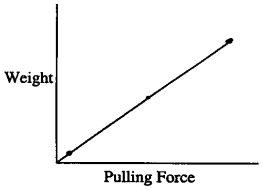


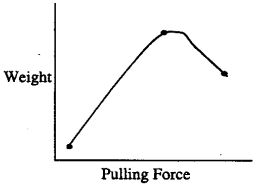
	Block weights		
	5kg	**10kg**	**15kg**
Smooth steel surface	0.75kg	1.5kg	2.25kg

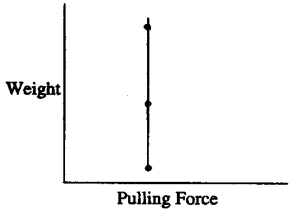
2. Which graph depicts the change in frictional force of the smooth steel surface?

A.


B.


C.


D.


E.


Answer: C

SECTION 10 continue: P1.1f Predict what would happen if the variables, methods, or timing of an investigation were changed.

Some students conducted experiments using different brands of adhesive tape, one kind each of paper and plastic, a board, and a spring scale.

Experiment 1

A student stuck one end of a piece of tape onto the edge of a board that was wrapped with paper. The other end of the tape was clamped to a spring scale, as shown in Figure 1.

While one student held the board, a second student pulled the spring scale until the tape came off the paper wrapping; a third student recorded the force in newtons, N, indicated on the spring scale at the moment the tape came off the paper wrapping. The procedure was repeated for 3 different brands of tape; each brand of tape came in many different widths, of which 2 or 3 were tested. The results are in Table 1.

Table 1

Tape brand	Tape width (cm)	Force (N) to remove tape:			
		Trial 1	Trial 2	Trial 3	Average
X	1.0	1.6	1.9	2.2	1.9
	2.0	3.9	3.7	4.1	3.9
	3.0	6.0	5.6	5.8	5.8
Y	2.0	4.0	4.5	4.3	4.3
	2.5	5.4	5.1	5.7	5.4
Z	1.0	2.2	1.6	1.8	1.9
	2.0	4.1	3.9	3.6	3.9

Experiment 2

The students performed an experiment similar to Experiment 1, except that the paper wrapping was replaced by a plastic wrapping. The results are shown in Table 2.

Table 2

Tape brand	Tape width (cm)	Force (N) to remove tape:			
		Trial 1	Trial 2	Trial 3	Average
X	1.0	1.7	1.5	1.6	1.6
	2.0	3.2	3.2	3.3	3.2
	3.0	5.0	5.0	5.1	5.0
Y	2.0	4.3	4.3	4.3	4.3
	2.5	5.5	5.4	5.4	5.4
Z	1.5	2.8	2.8	2.9	2.8

1. The results of the two experiments support the conclusion that, for a given brand of tape, as the tape's width increases, the force required to remove the tape from a given wrapping:

    A. increases only.
    B. decreases only.
    C. remains constant.
    D. varies, but with no particular trend.

Answer: A

2. In Experiment 2, had Brand X tape in a 4.0 cm width been tested, the force required to remove the tape from the plastic wrapping would have been closest to:

    A. 5.0 N.
    B. 7.0 N.
    C. 9.0 N.
    D. 11.0 N.

Answer: C

3. Based on the average results of Experiments 1 and 2, which of the following brands of tape adhered better to the paper than to the plastic?

    A. Brand X
    B. Brand Y
    C. Brands X and Y
    D. Brands Y and Z

Answer: A

4. Which brand(s) of tape was/were used at only 2 different widths in both experiments?

    A. Brand X only
    B. Brand Y only
    C. Brand Z only
    D. Brands Y and Z only

Answer: B

5. For the students to determine the force required to remove tape from a wrapping, which of the following attractive forces had to exceed the adhesive force between the tape and the wrapping?

    A. The force between the clamp and the tape.
    B. The force between the clamp and the paper or plastic wrapping.
    C. The force between the Earth and the wrapping.
    D. The force between the Earth and the tape.

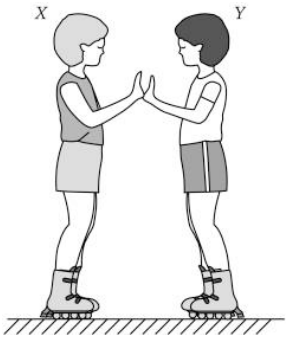
Answer: A

6. The students' instructor have them a strip of tape that was 2.5 cm wide and asked them to identify the brand. The students repeated the procedures from Experiments 1 and 2 using the tape and obtained average forces of 4.9 N for paper and 4.1 for plastic. Which of the following brands would most likely have produced these results?

    A. Brand X only
    B. Brand Y only
    C. Brands X and Y only
    D. Brands Y and Z only

Answer: A

P3.2A Identify the magnitude and direction of everyday forces (e.g., wind, tension in ropes, pushes and pulls, weight). L2



1. 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.

Answer: C

2. A parachutist in free fall first reaches terminal velocity

    A. at the time of collision with the earth
    B. when the force of gravity is greater than the air resistance
    C. when the force of gravity is just balanced by the air resistance
    D. after the parachute is opened.

Answer: C

3. During an experiment, you notice that as you increase the mass on a spring scale (used to measure weight) that the reading on the scale also increases. Which statement best describes the relationship between the variables in this experiment?

    A. Weight directly influences the amount of mass.
    B. Mass has little influence on weight.
    C. As mass increases, weight will increase.
    D. Weight and mass are identical.

Answer: C

4. Identify of action-reaction force pairs in the following diagram.

    A. The elephant's feet push backward on the ground; the ground pushes forward on its feet.
    B. The right end of the right rope pulls leftward on the elephant's body; its body pulls rightward on the right end of the right rope. The left end of the right rope pulls rightward on the man; the man pulls leftward on the left end of the right rope. \
    C. The tractor pulls leftward on the right end of the left rope; the left end of the left rope pulls rightward on the tractor.
    D. All of the above

Answer: D