Practice Net Force and Acceleration Name_____

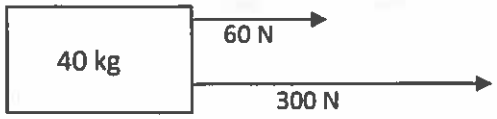
Date _____ Period_____

For each of the following problems, give the net force on the block, and the acceleration, including units.

1)

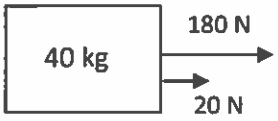
Net Force = _____ a = F/m = _____

2)



Net Force = _____ a = F/m = _____

3)



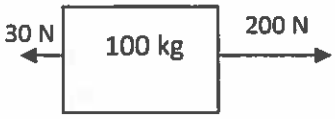
Net Force = _____ a = _____

4)

Net Force = _____

a = _____

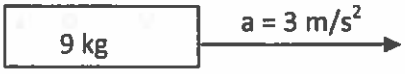
5)



Net Force = _____ a = _____

For problems 6-9, using the formula net Force = Mass • Acceleration, calculate the net force on the object.

6)



F = m•a = _____

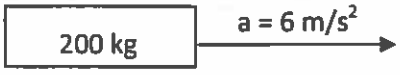
7)

F = m•a = _____

8)

F = m•a = _____

9)



F = m•a = _____

10) Challenge: A student is pushing a 50 kg cart, with a force of 600 N. Another student measures the speed of the cart, and finds that the cart is only accelerating at 3 m/s^2. How much friction must be acting on the cart? Hint: Draw a diagram showing the cart, and the two forces acting on it.

Name _____

Speed Machines

FORMULA : SPEED = Distance ÷ Time

Round answers to the nearest tenth (one decimal place)!

1. NASCAR fans love race day when they get a chance to cheer on their favorite team! If a driver was able to travel 600 miles in 3 hours, what was his average speed?

2. The fastest car on Earth, a British-made *Thrust SSC*, would win every NASCAR race in America. If it takes 0.5 hours (30 minutes) to travel 380 miles, what is its speed?

3. The fastest train on Earth, the *TGV* from France, can travel at faster speeds than trains in the United States. During a speed test, the train traveled 800 miles in 2.5 hours. What is its speed?

4. *Spirit of Australia*, a hydroplane boat, made speed records by traveling 239 miles in 0.75 hours (45 minutes). What is its record-breaking speed?

5. The fastest plane ever made, the *Lockheed SR71*, was able to travel 2200 miles per hour. Based on this speed, how far could it travel in:

a. 2 hours? b. 3 hours? c. 5 hours?

Challenge:
Which machine on this page is the fastest? _____

6. Fill in the boxes and use a calculator to determine how long it would take each machine to get to travel 60 miles. Use the speeds you calculated in miles per hour on the front of this worksheet. Round answers to the nearest tenth (one decimal place)!

60 miles	÷		=		X	60 minutes	=	

↑ Speed (mph)

A. Jeff Gordon's Car = _____ minutes

B. *Thrust SSC* Car = _____ minutes

C. *TGV* Train = _____ minutes

D. *Spirit of Australia* Boat = _____ minutes

E. *Lockheed SR71* Airplane = _____ minutes

Speed Machine Answers:

1. 600 ÷ 3 = 200 mph

2. 380 ÷ .5 = 760 mph

3. 800 ÷ 2.5 = 320 mph

4. 239 ÷ .75 = 318.67 mph

5. a. 2200 x 2 = 4400 miles, b. 2200 x 3 = 6600 miles, c. 2200 x 5 = 11,000 miles

Challenge: Lockheed SR71

6. A. 18 minutes, B. 4.7 minutes, C. 11.3 minutes, D. 11.3 minutes, E. 1.6 minutes

Name_____

Motion Graphs

Describing the motion of an object is occasionally hard to do with words. Sometimes **graphs** help make motion easier to picture, and therefore understand.

Remember:

- **Motion** is a change in position measured by distance and time.
- **Speed** tells us the rate at which an object moves.
- **Velocity** tells the speed and direction of a moving object.
- **Acceleration** tells us the rate speed or direction changes.

DISTANCE-TIME GRAPHS

Plotting distance against time can tell you a lot about motion. Let's look at the axes:

Time is always plotted on the X-axis (bottom of the graph). The further to the right on the axis, the longer the time from the start.

Distance is plotted on the Y-axis (side of the graph). The higher up the graph, the further from the start.

If an object is not moving, a horizontal line is shown on a distance-time graph.

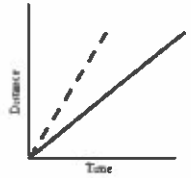
Time is increasing to the right, but its distance does not change. It is not moving. We say it is **At Rest**.

If an object is moving at a constant speed, it means it has the same increase in distance in a given time:

Time is increasing to the right, and distance is increasing constantly with time. The object moves at a **constant speed.**

Constant speed is shown by straight lines on a graph.

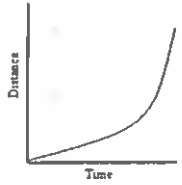
Let's look at two moving objects:
Both of the lines in the graph show that each object moved the same distance, but the steeper dashed line got there before the other one:



A steeper line indicates a larger distance moved in a given time. In other words, **higher speed.**

Both lines are **straight**, so both speeds are **constant.**

Graphs that show acceleration look different from those that show constant speed.



The line on this graph is curving upwards. This shows an **increase in speed**, since the line is getting steeper:

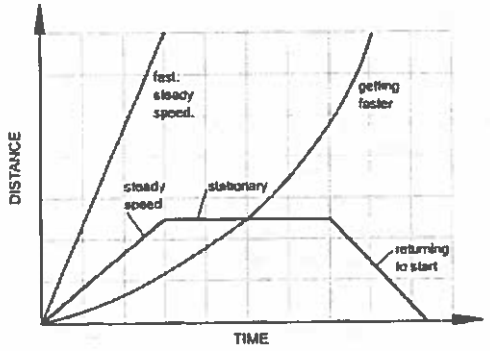
In other words, in a given time, the distance the object moves is change (getting larger). It is **accelerating.**

44

Summary:

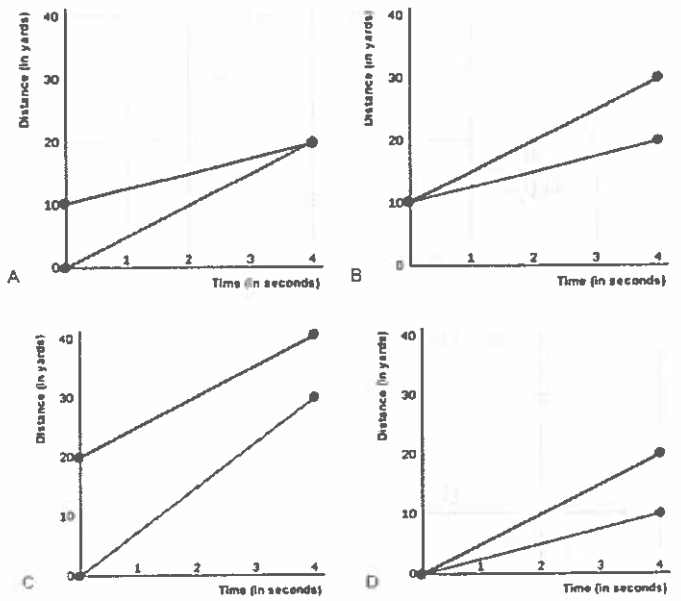
A distance-time graph tells us how far an object has moved with time.

- The steeper the graph, the faster the motion.
- A horizontal line means the object is not changing its position - it is not moving, it is at rest.
- A downward sloping line means the object is returning to the start.



(Graph from:
http://www.bbc.co.uk/schools/gcsebitesize/physics/forces/speedvelocityaccelerationfhrev2.shtml)

Examine the graphs below.

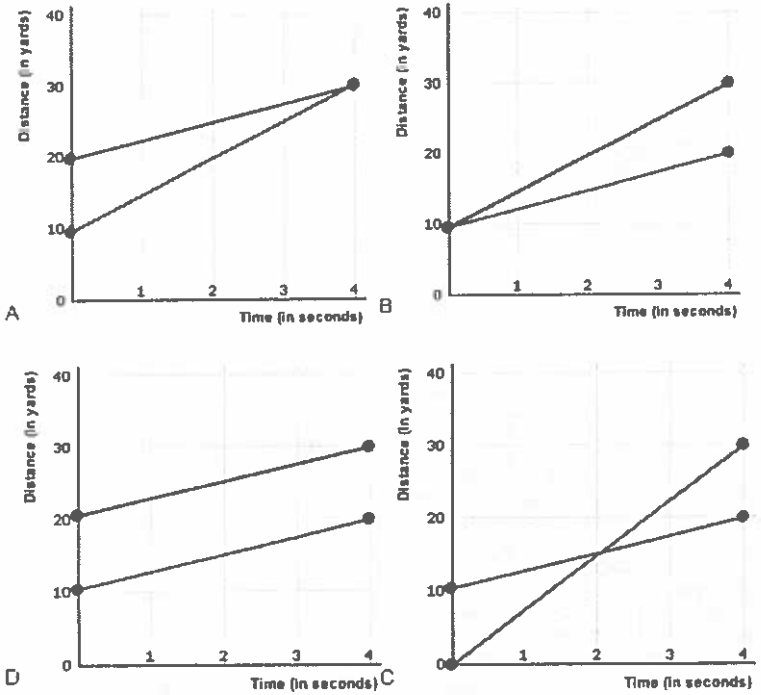


Which of the graphs shows that one of runners started 10 yards further ahead of the other? Explain your answer.

28

In which of the following graphs below are both runners moving at the same speed?

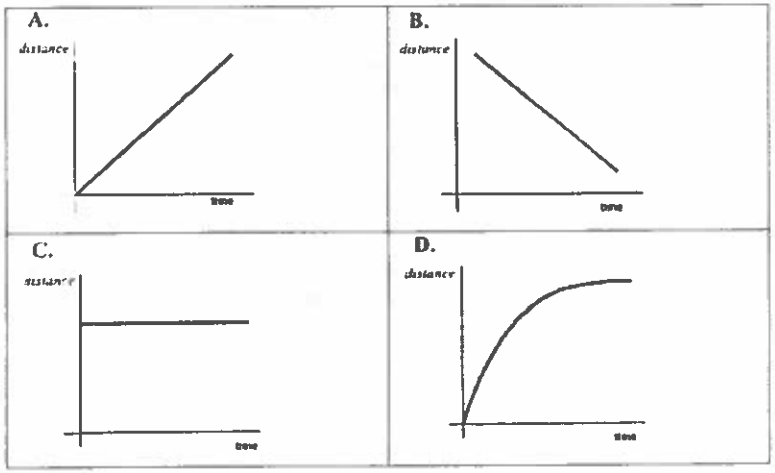
Explain your answer.



The distance-time graphs below represent the motion of a car. Match the descriptions with the graphs. **Explain your answers.**

Descriptions:

1. The car is stopped.
2. The car is traveling at a constant speed.
3. The speed of the car is decreasing.
4. The car is coming back.



Graph A matches description _____ because _____.

Graph B matches description _____ because _____.

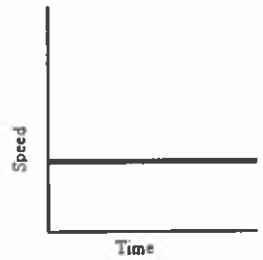
Graph C matches description _____ because _____.

Graph D matches description _____ because _____.

bt

SPEED-TIME GRAPHS

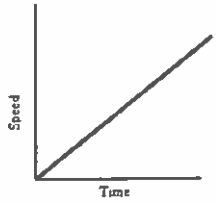
Speed-Time graphs are also called Velocity-Time graphs.



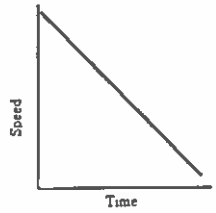
Speed-Time graphs look much like Distance-Time graphs. Be sure to read the labels!! Time is plotted on the X-axis. Speed or velocity is plotted on the Y-axis.

A straight horizontal line on a speed-time graph means that speed is constant. It is not changing over time.

A straight line does not mean that the object is not moving!

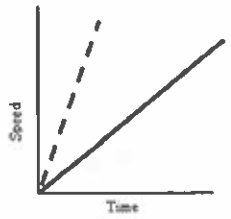


This graph shows increasing speed. The moving object is **accelerating**.



This graph shows decreasing speed. The moving object is **decelerating**.

What about comparing two moving objects at the same time?



Both the dashed and solid line show increasing speed.

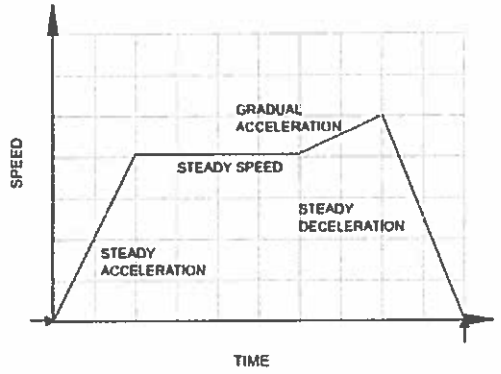
Both lines reach the same top speed, but the solid one takes longer.

The dashed line shows a greater acceleration.

Summary:

A speed - time graph shows us how the speed of a moving object changes with time.

- The steeper the graph, the greater the acceleration.
- A horizontal line means the object is moving at a constant speed.
- A downward sloping line means the object is slowing down.

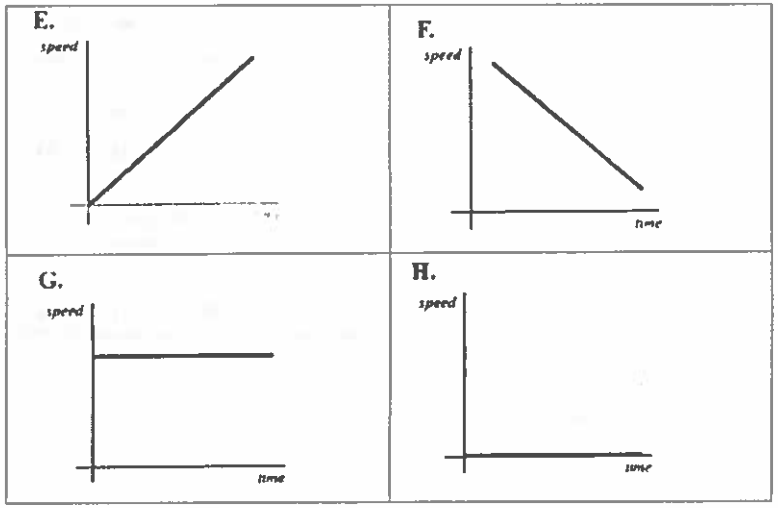


(Graph from:
http://www.bbc.co.uk/schools/gcsebitesize/physics/forces/speedvelocityaccelerationfhrev2.shtml)

The speed-time graphs below represent the motion of a car. Match the descriptions with the graphs. **Explain your answers.**

Descriptions:

5. The car is stopped.
6. The car is traveling at a constant speed.
7. The car is accelerating.
8. The car is slowing down.



Graph E matches description _____ because _____.

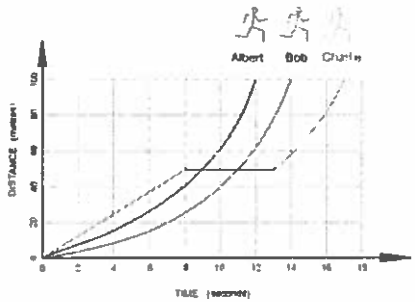
Graph F matches description _____ because _____.

Graph G matches description _____ because _____.

Graph H matches description _____ because _____.

Questions:

(Some questions adapted from
http://www.bbc.co.uk/schools/ocsebitesize/physics/forces/speedvelocityaccelerationfhrev2.shtml)



Look at the graph above. It shows how three runners ran a 100-meter race.

Which runner won the race? Explain your answer.

Which runner stopped for a rest? Explain your answer.

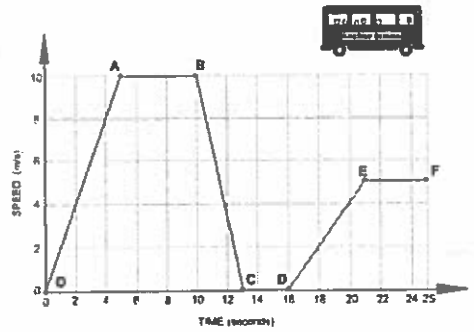
How long was the stop? Explain your answer.

How long did Bob take to complete the race? Explain your answer.

Calculate Albert's average speed. (Figure the distance and the time first!)

8
1

The graph below shows how the speed of a bus changes during part of a journey



Choose the correct words from the following list to describe the motion during each segment of the journey to fill in the blanks.

- accelerating
- decelerating
- constant speed
- at rest

Segment 0-A The bus is _____. Its speed changes from 0 to 10 m/s in 5 seconds.

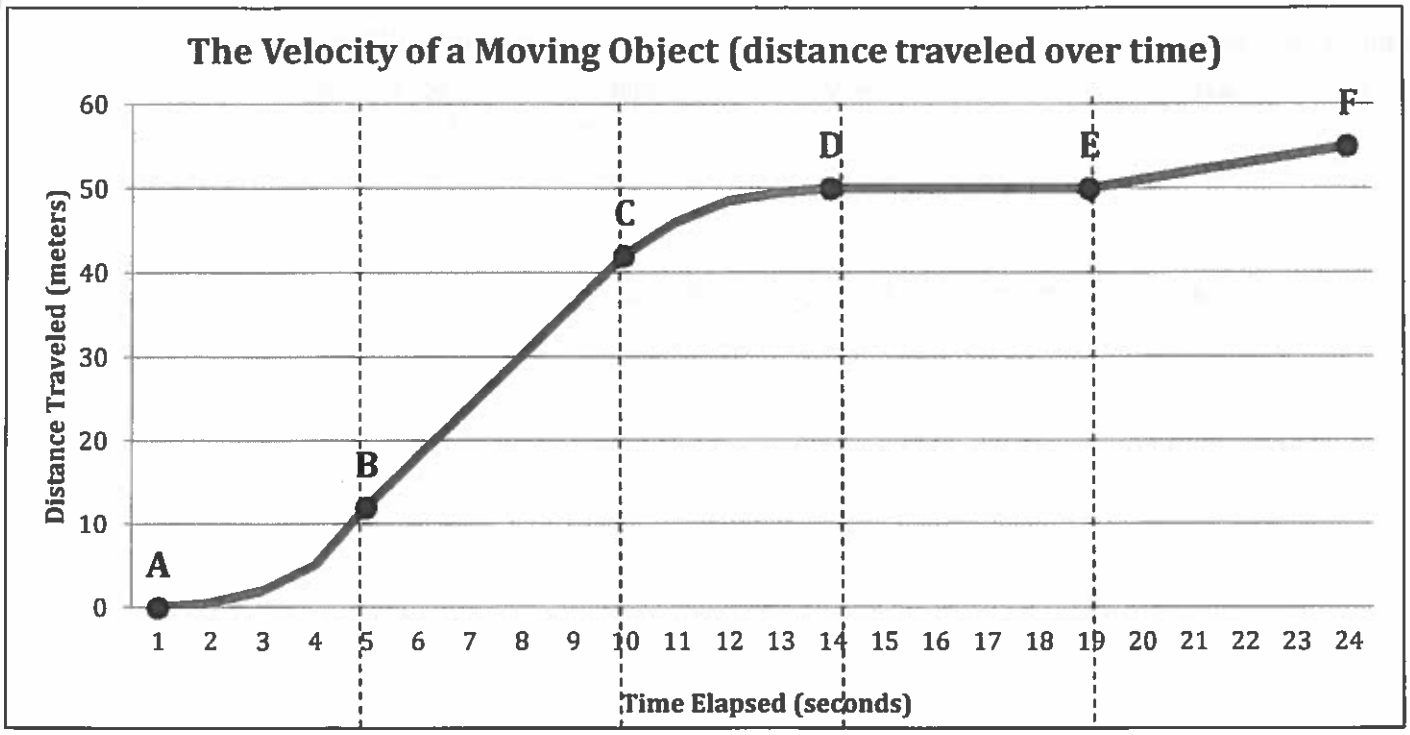
Segment A-B The bus is moving at a _____of 10 m/s for 5 seconds.

Segment B-C The bus is _____. It is slowing down from 10 m/s to rest in 3 seconds.

Segment C-D The bus is _____. It has stopped.

Segment D-E The bus is _____. It is gradually increasing in speed.

Practice 10 Motion Graph Analysis Name_____



Instructions:

1. Cut out the entire graph area above along the outside solid border line.
2. Make a horizontal fold across your graph near the top (under the title). The title of the graph should be folded down with the crease of your fold **at exactly the 60 meter mark** of the graph area.
3. Now fold the title back up so it's visible again, but now you should have a creased line along the top just above the vertical dotted lines.
4. Next, carefully cut along all four vertical dotted lines up to your fold, but no more! You should have cut the graph into sections flapping freely from the top, but still attached to the title.
5. Last, tape your graph into your packet
   along the top edge along the title. The flaps should not be taped so they can open freely.

Practice 10 Motion Graph Analysis Name_____

Analysis Questions: *Answer the following questions in your journal below your foldable graph.*

1. Underneath each flap, write down the type of motion that is occurring for each section of the graph (ie. constant velocity, positive acceleration, negative acceleration, no motion, etc.)

2. Between which two letters is the rate of speed the fastest? Why?

3. The least amount of distance covered occurs between which two letters?

4. Identify the type of motion occurring between letters C and D? Give evidence to support your reasoning.

5. During the total journey, how many total seconds pass when the object not in motion?

6. Calculate the average speed between letters B and C.

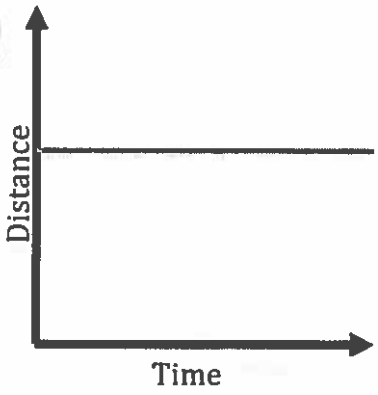
7. How much distance did the object cover over the entire journey?

8. Calculate the average speed for the entire journey from point A to point F.

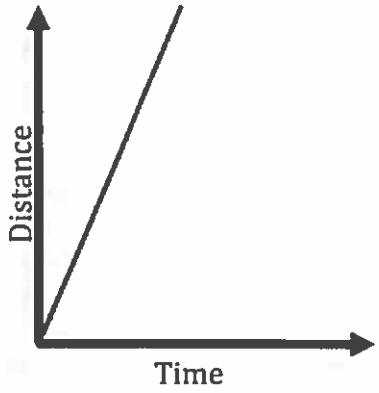
9. Write a short story (3-5 sentences) that describes a situation with the motion experienced in the graph.

Motion Graph Analysis

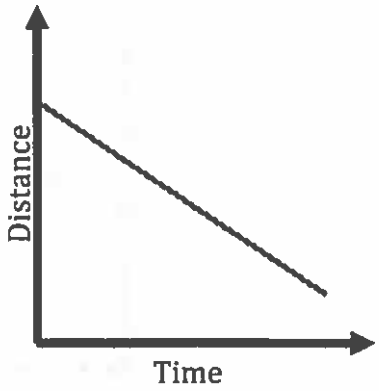
A.



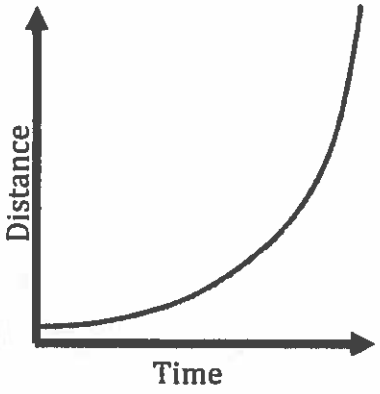
B.



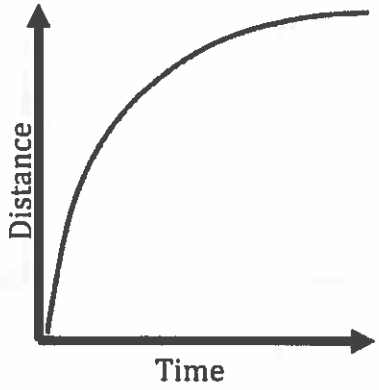
C.



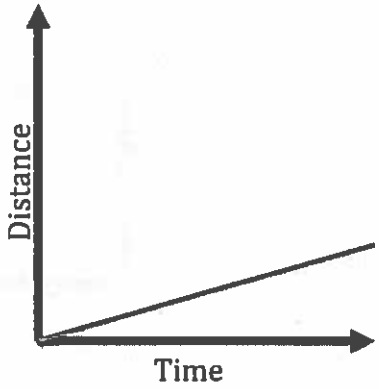
D.



E.



F.



Descriptions of Motion

1. Acceleration
2. Constant Speed (high rate of speed)
3. Constant Speed (low rate of speed)
4. Negative Acceleration (deceleration)
5. No Motion (stopped)
6. Moving Backwards (constant velocity in reverse)

Graph A matches description _____ because _____.

Graph B matches description _____ because _____.

Graph C matches description _____ because _____.

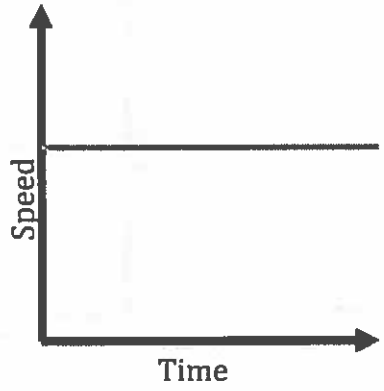
Graph D matches description _____ because _____.

Graph E matches description _____ because _____.

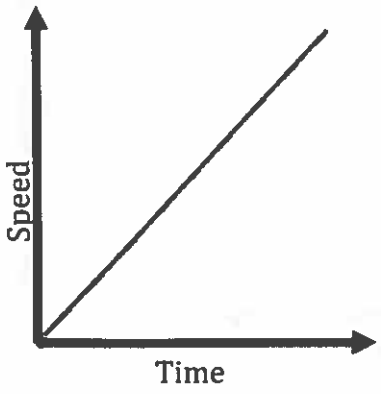
Graph F matches description _____ because _____.

Motion Graphs - Part 2

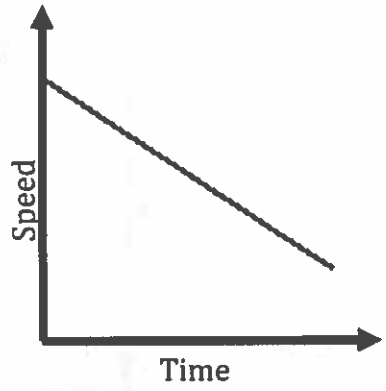
A.



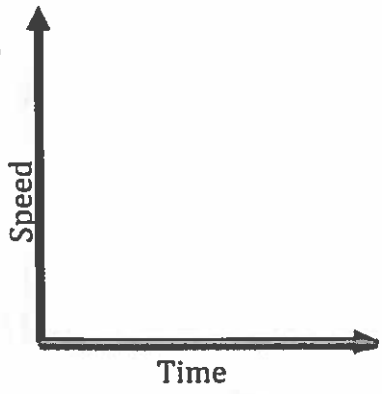
B.



C.



D.



Descriptions of Motion

1. No Motion (stopped)
2. Constant Speed
3. Acceleration
4. Negative Acceleration (deceleration)

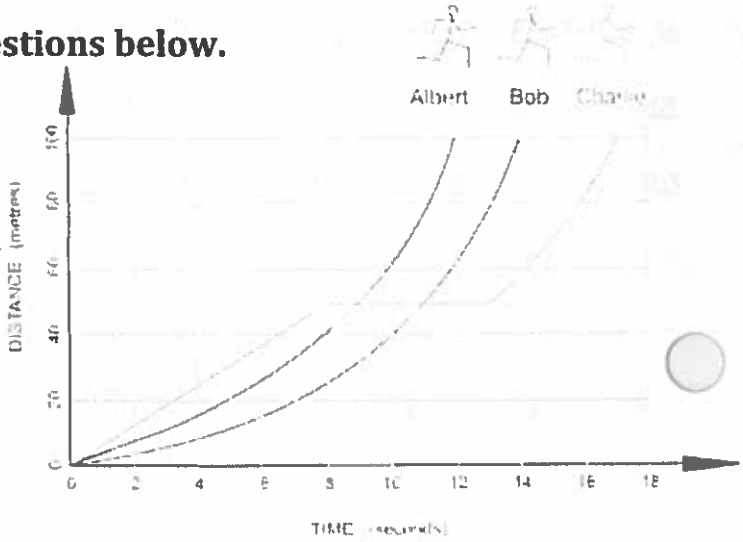
Graph A matches description _____

Graph B matches description _____

Graph C matches description _____

Graph D matches description _____

Use the graph to the right to answer the questions below.



Which runner won the race? _____

Which runner stopped for a break? _____

How long was the stop? _____

Calculate each racer's average speed over the race.

Albert - _____

Bob - _____

Charlie - _____

Name: _____ Period: _____ Date: _____

Newton's Laws of Motion

Part I: *Fill in the blanks below to state Newton's three laws of motion:*

- **Newton's 1st Law →** All objects will remain at _____, or will continue to move at a constant _____ in the same _____ unless acted upon by an unbalanced _____. This property is called _____.

- **Newton's 2nd Law →** Unbalanced forces cause an object to _____. This can be stated mathematically by the formula:

  F = _____ * _____

- **Newton's 3rd Law →** Every action produces an equal and opposite _____. When one object exerts a force on another object, the second object pushes back with the same amount of _____.

Part II: *Use Newton's 2nd Law of motion to solve each problem. Show your work in your science journal. Then record the correct answer here (with proper units!)*

1) How much force is needed to accelerate a 66 kg skier at 2 m/s^2?

2) What is the force on a 1,000 kg elevator that is falling freely at 9.8 m/s^2?

3) What is the acceleration of a 50 kg object pushed with a force of 500 newtons?

4) The mass of a large car is 1000 kg. How much force would be required to accelerate the car at a rate of 3 m/s^2?

5) A 50 kg skater pushed by a friend accelerates 5 m/s^2. How much force did the friend apply?

6) A force of 250 N is applied to an object that accelerates at a rate of 5 m/s^2. What is the mass of the object?

7) A bowling ball rolled with a force of 15 N accelerates at a rate of 3 m/s^2; a second ball rolled with the same force accelerates 4 m/s^2. What are the masses of the two balls?

8) If a 60 kg person on a 15 kg sled is pushed with a force of 300 N, what will be person's acceleration?

9) A force of 20 N acts upon a 5 kg block. Calculate the acceleration of the object.

10) An object of mass 300 kg is observed to accelerate at the rate of 4 m/s^2. Calculate the force required to produce this acceleration.

11) A 5 kg block is pulled across a table by a horizontal force of 40 N with a frictional force of 8 N opposing the motion. Calculate the acceleration of the object.

12) An object of mass 30 kg is in free fall in a vacuum where there is no air resistance. Determine the acceleration of the object.

13) An object of mass 30 kg is falling in air and experiences a force due to air resistance of 50 newtons.
   A. Determine the net force acting on the object and
   B. Calculate the acceleration of the object.

14) A student pushes on a crate with a force of 100 N directed to the right. What force does the crate exert on the student?

15) A force of 200 N is exerted on an object of mass 40 kg that is located on a sheet of perfectly smooth ice.
   A. Calculate the acceleration of the object.
   B. If a second object identical to the first object is placed on top of the first object, what acceleration would the 200 N force produce?

16) Just before opening her parachute a skydiver of mass 50 kg reaches terminal velocity. Calculate the force of air resistance.

17) For a person who has a mass 60 kg, calculate the weight in newtons. If 1 lb equals 4.45 N, then what is the person's weight in pounds?

18) An object of mass 10 kg is accelerated upward at 2 m/s^2. What force is required?

Name: _____ Teacher: _____ Pd. ___ Date: _____

Newton's Second Law of Motion Problems Worksheet

Newton's Second Law of Motion, sometimes called the **law of force and motion** or **law of acceleration**, states that:

> **An object acted on by an unbalanced force will accelerate in the direction of that force, in direct proportion to the strength of the force, and in inverse proportion to the mass of the object.**

Newton's second law is best described with a mathematical equation that relates three variables, force, acceleration and mass, to one another. The equation can be stated in three forms:

force = mass • acceleration **f = m•a**

$$\text{mass} = \frac{\text{force}}{\text{acceleration}} \qquad \boxed{m = f/a}$$

$$\text{acceleration} = \frac{\text{force}}{\text{mass}} \qquad \boxed{a = f/m}$$

In the first set of problems below, you will be given the mass of an object and the acceleration of that object, and then will need to solve for force, using the equation F = ma. In other words, you will need to multiply the mass times the acceleration to calculate the force. Be sure to convert any mass stated in grams into kilograms, by dividing it by 1000 (moving the decimal place over three places to the left). For example, 1000 grams is equal to 1 kilogram. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.

1. An object with a mass of 2.0 kg accelerates 2.0 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

2. An object with a mass of 5.0 kg accelerates 8.0 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

3. An object with a mass of 1500 g (grams) accelerates 10.0 m/s^2 when an unknown force is applied to it. What is the amount of the force?

_____

4. An object with a mass of 6.0 kg accelerates 4.0 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

5. An object with a mass of 7.5 kg accelerates 8.3 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

6. An object with a mass of 2000 g accelerates 8.3 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

In the second set of problems below, you will be given the force applied to an object and the acceleration of that object, and then will need to solve for mass, using the equation m = F/a. In other words, you will need to divide the force by the acceleration to calculate the mass. Show your work in the space provided. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.

7. An object accelerates 3.0 m/s^2 when a force of 6.0 newtons is applied to it. What is the mass of the object? _____

8. An object accelerates 12.0 m/s^2 when a force of 6.0 newtons is applied to it. What is the mass of the object? _____

9. An object accelerates 5.0 m/s^2 when a force of 20.0 newtons is applied to it. What is the mass of the object? _____

10. An object accelerates 2.0 m/s^2 when a force of 12.0 newtons is applied to it. What is the mass of the object? _____

11. An object accelerates 7.2 m/s^2 when a force of 4.0 newtons is applied to it. What is the mass of the object? _____

12. An object accelerates 16.3 m/s^2 when a force of 4.6 newtons is applied to it. What is the mass of the object? _____

In the third set of problems below, you will be given the force applied to an object and the mass of that object, and then will need to solve for acceleration, using the equation a = F/m. In other words, you will need to divide the force by the mass to calculate the acceleration. Be sure to convert any mass stated in grams into kilograms, by dividing it by 1000 (moving the decimal place over three places to the left). For example, 1000 grams is equal to 1 kilogram. Show your work in the space provided. Be sure to state the proper units in your answer, and state each answer to the nearest tenth of a unit, to match the accuracy of the measurements.

13. An object with a mass of 2.0 kg has a force of 4.0 newtons applied to it. What is the resulting acceleration of the object? _____

14. An object with a mass of 5.0 kg has a force of 20.0 newtons applied to it. What is the resulting acceleration of the object? _____

15. An object with a mass of 20.0 kg has a force of 5.0 newtons applied to it. What is the resulting acceleration of the object? _____

16. An object with a mass of 3.0 kg has a force of 9.0 newtons applied to it. What is the resulting acceleration of the object? _____

17. An object with a mass of 2300 g has a force of 6.2 newtons applied to it. What is the resulting acceleration of the object? _____

18. An object with a mass of 3.2 kg has a force of 7.3 newtons applied to it. What is the resulting acceleration of the object? _____

In the following problems, solve for the missing variable, using the two variables provided.

19. An object accelerates 8.2 m/s^2 when a force of 20.1 newtons is applied to it. What is the mass of the object? _____

20. An object with a mass of 6.3 kg has a force of 7.1 newtons applied to it. What is the resulting acceleration of the object? _____

21. An object with a mass of 6.5 kg accelerates 12.3 m/s^2 when an unknown force is applied to it. What is the amount of the force? _____

Name: _____

Period: _____

Isaac Newton's 3 Laws of Motion

Sir Isaac Newton (1642-1727) was an English physicist and mathematician. Before the age of 30 he formulated the laws of motion and invented calculus. Much of our modern science is based on Newton's

Newton's Laws of Motion

Law One – Law of Inertia
An object at rest will stay at rest unless acted on by an unbalance force.
An object in motion will stay in motion unless acted upon by an unbalanced force.

OR

Things keep moving or stay at rest, unless a net force acts upon them.

Law Two – F = ma
The acceleration of an object is proportional to the force acting on it and inversely proportional to its mass.

OR

Force causes acceleration, while mass resists acceleration

Law Three – Law of Equal and Opposite Forces.
Whenever one object exerts a force on another object, the second exert an equal and opposite force on the first.

OR

For every action there is an equal and opposite reaction.

Inertia

Inertia is the property of an object that resists change of motion.

Moving objects have inertia: they want to keep moving; stopped objects have inertia: they want to stay at rest.

More mass = more inertia!

Something that is harder to push has more inertia!

More mass, more inertia

Less mass, less inertia

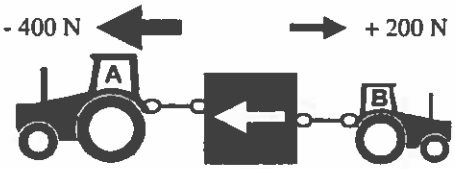
Force

A *force* is any action that can change or cause motion.
A force is any push or pull.
We use Newtons (N) to measure force.

Net Force

Net force is the sum of all the forces and has direction.
(Be sure to make right positive and left negative.)

An object will move in the direction of the net (or unbalanced) force.



Net Force = + 200 N – 400 N = – 200 N (left)

Newton's Second Law

Force (in Newtons) → **F = ma** ← Mass (in kg)

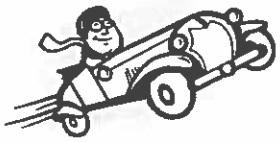
Acceleration (in m/sec^2)

Force equals mass times acceleration.

F = ma tells us:

For the same acceleration, **more mass requires more force.**

For the same mass, **more acceleration requires more force.**



Newton's 2nd Law tells us that when you accelerate (stomp on the gas) or decelerate quickly (brake fast) you use more force and wear out engine parts and brakes faster.

Ex. How big a force does it take to give a 50 kg object an acceleration of 40 m/s^2.

Variables:
40 m/s^2 = a
50 kg = m
F = ?

Equation:
F = ma

Solve:
F = ma
F = 50(40)
F = 50 x 40
F = 2000N

Ex. If a 50 N force pulls on a 10 kg object, how much acceleration will occur?

Variables:
50 N = F
10 kg = m
a = ?

Equation:
F = ma

Solve:
F = ma
50 = 10a
$\frac{50}{10} = \frac{10a}{10}$
a = 5m/s^2

Ex. A force of 49 N causes a 7 m/s^2 acceleration. Find the mass of the object it was pulling.

Variables:
49 N = F
7 m/s^2 = a
m = ?

Equation:
F = ma

Solve:
F = ma
49 = m7
$\frac{49}{7} = \frac{m7}{7}$
m = 7 kg

Name: _____ Ch.3:1

Period:

1. F = _____	125 kilograms
2. m = _____	23 kgm/s
3. a = _____	3 m/s^2
4. v = _____	29 meters/sec
5. D = _____	228 meters
6. p = _____	6 newtons

1. Inertia	A. An action that can causes motion.
2. Mass	B. Force pulling all object toward each other.
3. Gravity	C. The amount of matter in an object
4. Net force	D. Total of all of the forces on an object.
5. Force	E. Ability of an object to resist change of motion.

Number these from least (1) to most (5) inertia.

A baseball	A small car	A truck	A feather	A large train

Number these from least (1) to most (5) momentum.

Fast car	Parked truck	Slow car	Fast baseball	Fast feather

Which of Newton's Three Laws Applies?
Law 1, 2, or 3?

___ When you put a book on a table the table pushes on the book.

___ A person is pushed forward into their seatbelt when a car stops.

___ A larger car takes more force to move.

___ A person leans on a wall and the wall pushes back.

___ A brick sits on a table until you push on it.

Understanding Net Force — Which way will it accelerate?

30 N ← M → 25 N _____

6 N ← M → 8 N _____

15 N ← M → 15 N _____

A sled is being pulled to the left by 5 dogs, each dog pulling with 6 Newtons of force. Find the net force.

_____

If a person pulls on a cart to the right with a force of 10 N and a second person pulls to the left with a force of 3 N, what is the net force (+ direction) on the cart?

_____

A 2 N and 6 N force pull on an object to the right and a 4 N force pulls to the left a 0.5 kg object. What is the net force on the object?

A 20 kg bike accelerates at 10 m/s^2. With what force was the person pedaling?

_____

If a person is pushing a cart with a force of 40 Newtons and it accelerates at 0.5 m/s^2, what is the mass of the cart?

_____

What is the acceleration of a 3 kg rock that is thrown with a force of 18 N?

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Name_____ **Test on:**_____

Parent Signature_____

Physics Review

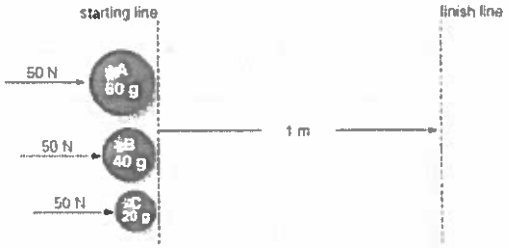
1. George pushed a 20kg desk with a force of 50N. What was her acceleration?

2. How much force is needed to accelerate an object at $10m/s^2$ that has a mass of 20kg?

3. What is the velocity of a bus that travels 100 miles in 5 hours to the North?

4. Which object in above diagram will have the greatest acceleration? Explain.

5. Which object in the above diagram will have the least acceleration? Explain.



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6. How much force is being applied in the above diagram?

7. Which ball in the above diagram will have the greatest acceleration?

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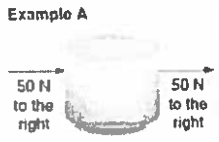
8. What is the net force acting on the object in example A?

9. Are the forces balanced or unbalanced for example A?

10. What direction will the object move in example A?



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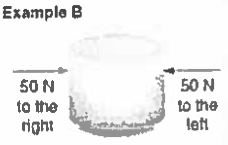
11. What is the net force acting on the object in example B?

12. Are the forces balanced or unbalanced for example B?

13. What direction will the object move in example B?



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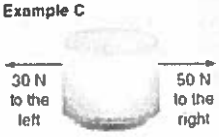
14. What is the net force acting on the object in example C?

15. Are the forces balanced or unbalanced in example C?

16. What direction will the object move in example C?



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17. Complete the chart below.

Force	Describe the motion
Balanced	
Unbalanced	

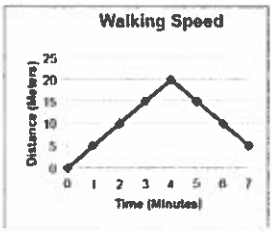
18. The graph below shows the speed of a student walking to the mailbox and returning home.

A. Describe the motion from 0 to 4 minutes.

B. Describe the motion from 4 to 7 minutes?

C. What is the speed from 0 to 4 minutes?

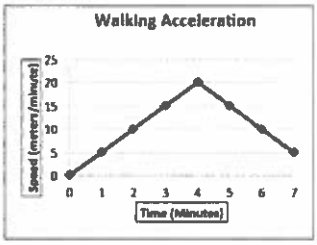
D. What is the speed from 4 to 7 minutes?



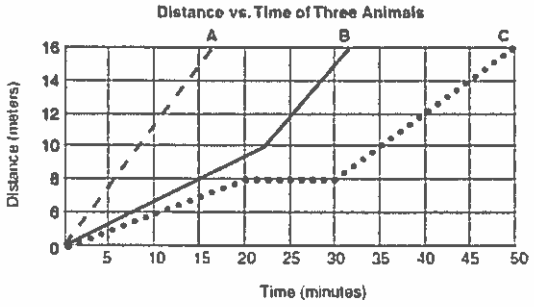
19. The graph below depicts the acceleration of a student walking home from school.

A. Describe the motion from 0 to 4 minutes.

B. Describe the motion from 4 to 7 minutes.



20. Use the graph below to find the average speed of animal A in meters per second. Hint: 60 seconds in 1 minute.



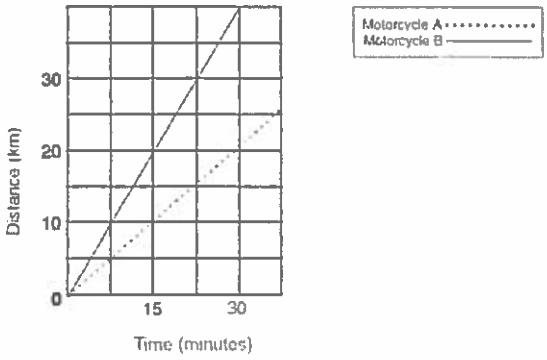
21. Determine the relationship between force, mass and acceleration. Circle the correct answer.

Mass increases	Acceleration increases or decreases
Force increases	Mass increases or decreases
Mass increases	Force increases or decreases

22. The graph below shows the speed of 2 motorcycles.

    A. Which motorcycle moves the fastest? Explain.

    B. Which motorcycle accelerates the fastest?



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23. Define and give an example of each of Newton's 3 Laws of Motion.