Mrs. Blackburn

Science

Science Packet

*Force and Motion Unit

This is the unit for the 4th grade Force and Motion Unit.

Write the 9 Vocabulary words (paper is provided)

Students read and answer the questions on the pages

*force, friction, magnets, motion, push or pull, motion and position, balanced or unbalanced?, and measuring speed.

There are 5 Labs in the packet, choose 2 to do at home **(please do not purchase anything for the labs, use what materials you have)**

Fill out the 2 Scientific Planner and What I Learned pages for the Labs.

Key Vocabulary:

Position—the location of objects

Force—a push or a pull that causes an object to move

Motion—a change in position

Distance— the amount of space that is between two objects, a measure of how far

Friction– a force that occurs when one object rubs against the other

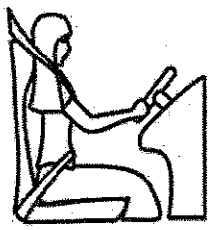
Gravity—pulls objects toward earth, a pulling force

Magnet– an object with a magnetic force—attracts many objects made of metal

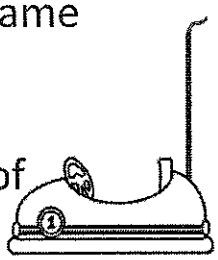
Speed— a measure of how quickly or how slowly an object moves

Direction— where an object moves from one moment to the next

I Can Statements Force and Motion



1. I can identify various push and pulls as a force and name many real life situations where force is used.
2. I can identify what friction is and provide examples of how friction works.



3. I can identify when friction can be helpful and when it can be a problem.
4. I can identify situations/examples of when a force is balanced and when it is unbalanced.
5. I can explain how force changes speed and direction.
6. I can make reasonable predictions about the direction that objects will move.
7. I can show how greater forces cause objects to go farther.
8. I can explain how magnets work and I can predict what is attracted to a magnet and what is not.
9. I can explain what will happen when two objects contact each other with force.
10. I can explain the cause and effect relationship based on a variety of forces.

Name:

Force

Opening and closing doors, kicking and batting balls, riding bikes and scooters are all examples using force to cause motion. Forces are either pushes or pulls. We use force everyday to do many routine tasks such as picking up our back packs, open or close drawers, and even brushing our hair and teeth. You also use force to change the direction that an object moves. Many athletes use force to change the direction of objects to score a goal. When more force is applied, the object will have more speed. When objects are heavier, more force is needed.

1. List 3 every day things you do that require force?

2. What is force?

3. How is the direction of an object changed?

4. How can you make your bike go faster?

5. Will a heavier or lighter object go faster when kicked? Explain.

6. Provide 3 examples of how athletes change the direction in a sport.

Name:

Friction

When two objects rub together, it creates a force called friction. The rougher the surface is, the greater the friction will be. The smoother the surface is, the less the friction will be. Friction is a force that will slow moving objects down or stop moving objects. When you are riding your bike, you will put on your brakes to slow down or to stop. The brake pads press against the wheel creating friction to slow the bike down or to stop the bike. It is easier to slide on smooth floors than it is to slide on carpeted floors because the surface on the carpet is rougher that the surface of a smooth floor without carpet.

1. What does friction do to an object that is moving?

2. Is it easier to walk on ice or on the sidewalk? Explain.

3. Why is friction important?

4. Give 3 examples of friction uses in everyday life?

5. How could you make a slide ride go faster?

6. How could you make a slide ride go slower?

Name:

Magnets

Have you ever seen a magnet stuck on a refrigerator? A magnet is an object that has magnetic force. Magnets will stick to many metal surfaces, but magnets will not stick to everything. The force that a magnet produces is called magnetism. Magnets often have two ends that are called poles. Just like on earth, one end is called the north pole and the other end is called the south pole. A magnetic force will push away or pull together. When you put two magnets together, they will push away from each other or pull toward each other. Magnets are usually made of metal, but metal is not always magnetic.

1. What type of surfaces will magnets stick to?

2. What is the force that a magnet creates called?

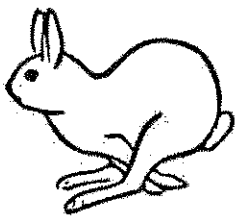
3. What are the ends of a magnet called?

4. What are magnets made of?

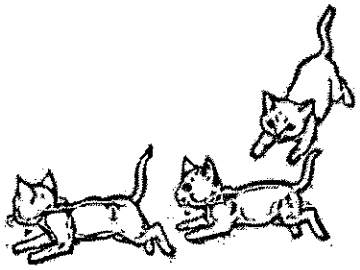
5. What are some things magnets are used for?

6. Why do you think magnets are called an invisible force?

Name:



Motion



Motion is everywhere! Everything around us is moving including Earth! Look around you to see how many things are moving right now. Somebody walking to sharpen a pencil, somebody writing, somebody scratching an arm are all examples of motion. Motion is about forces and a change in position. A force needs to happen for motion to happen. You don't have to actually see something in motion to know that motion has happened. If you see a leaf on the ground, you know that motion happened as the leaf likely fell from the tree. Types of motion can include, straight line, zig zag, circular, and back and forth. Motion can also be described by speed, faster or slower. Sir Isaac Newton is famous for his three laws of motion.

1. Write your own definition of motion.

2. Name two motions that you can't see but you know happened.

3. Explain why there needs to be a force before motion can happen.

4. List 5 descriptive words for how motion happens.

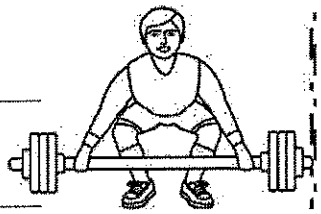
5. Who is famous for the laws of motion?

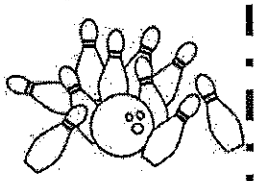
6. Look around you, list 7 motions that are happening right now.

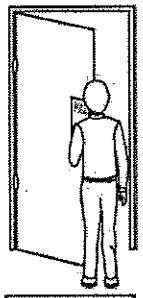
Name:

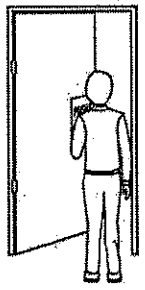
Push or Pull

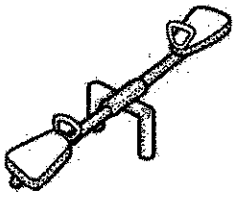
You can sometimes predict direction by looking at position. Look at each picture and decide if the force is a push or a pull, explain your answers:

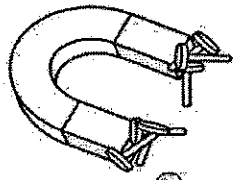












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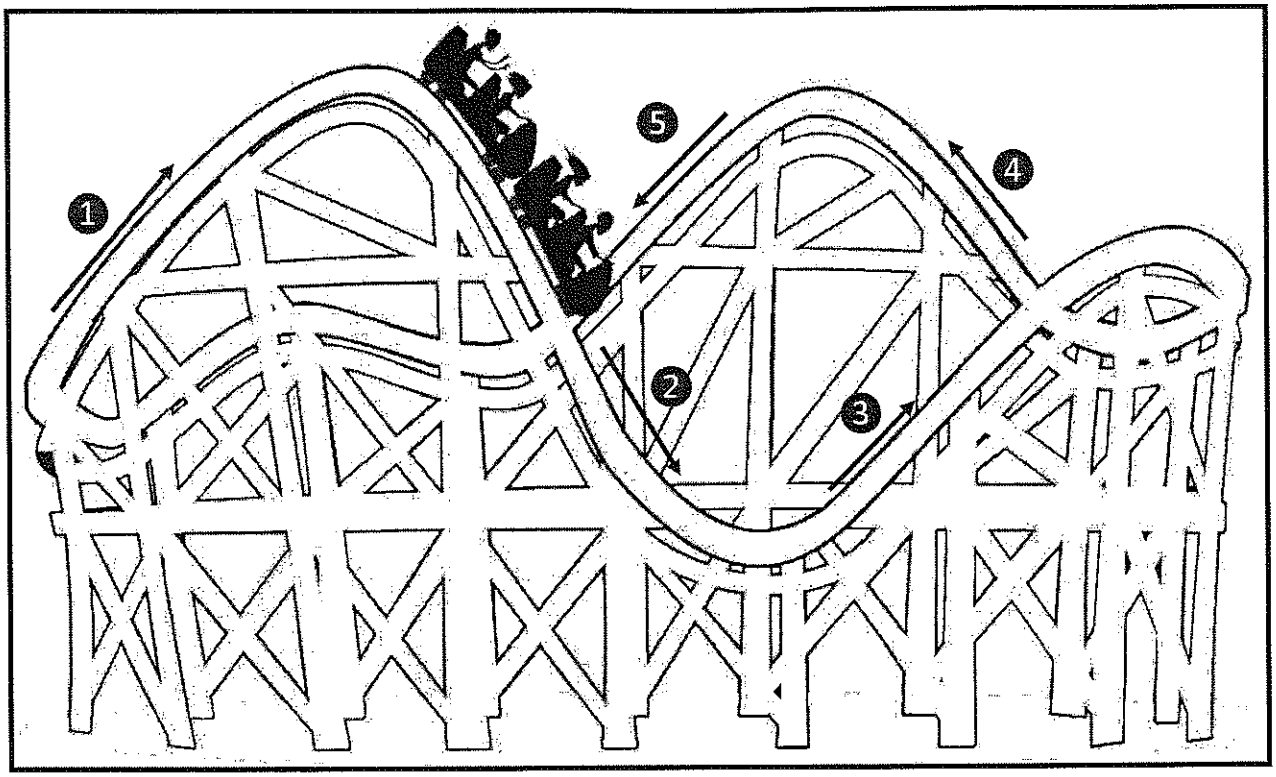
Motion and Position



Describe the speed of the roller coaster by it's position and arrow indicated with a number: ***(Going faster, slower..) Explain why you think so.***

1

2

3

4

5

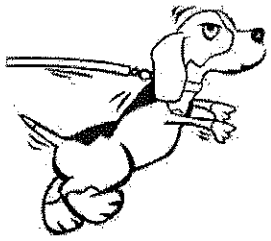
On the back, explain when there might be 'no motion'.

Name:

Balanced Or Unbalanced?

Balanced forces occur when two forces push or pull in opposite directions and it results in no movement. Unbalanced forces occur when two forces push or pull and one is stronger than the other, and it results in movement.

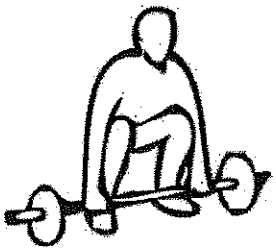
Decide if each of the situations is *'balance or unbalanced'*.



1) A book sitting on a table.
2) An arm wrestle and you won.
3) A dog pulling on a dog toy with you and it's a tie.
4) A birdhouse hanging on a tree.
5) A tug of war with a team that fell down.
6) A hammer coming down on a nail.

7) A cup sitting in a saucer.
8) A tennis ball going over the net.
9) A boy pushing on a boulder that won't move.
10) A bowling ball sitting on the alley.

11) A bowling ball moving down the alley.
12) Peaches falling off the tree.
13) Your mom pushing the shopping cart.
14) A person leaning against a pole.
15) A dart stuck on a dart board.
16) A person pushing on a wall.

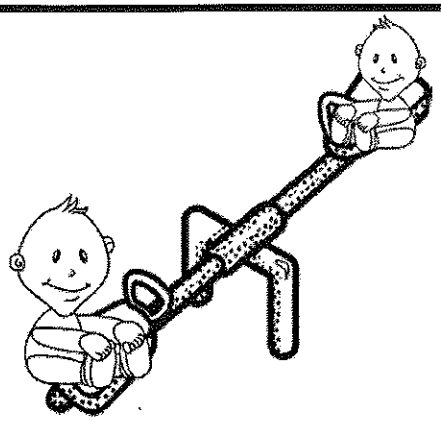


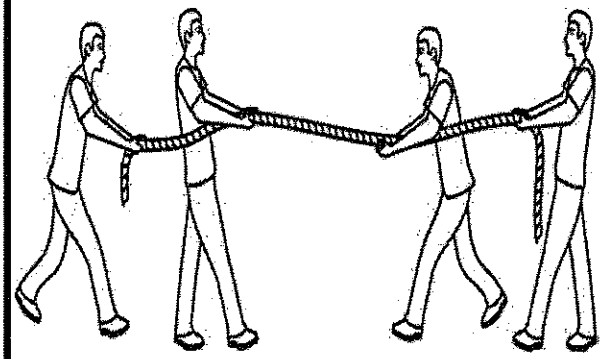
17) You rocking on a rocking chair.
18) Leaves falling to the ground.
19) Unable to lift the barbell weight.
20) Pinecones falling from the trees.

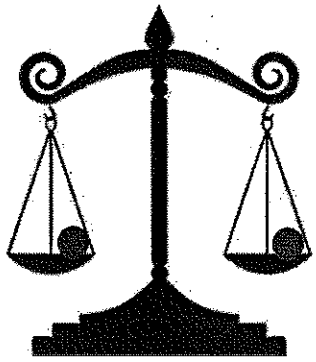
Name:

Balanced Or Unbalanced?

Look at each picture and determine if there is a balanced or unbalanced force and explain why.





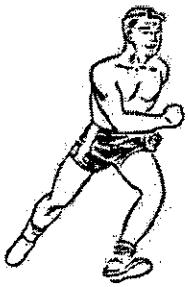


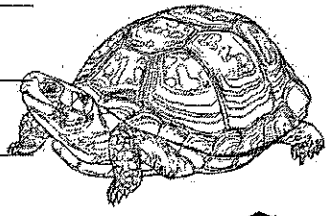
Name:

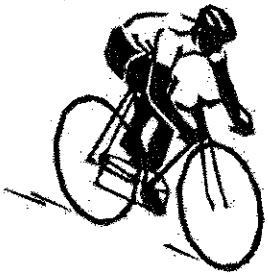
Measuring Speed

Speed is the rate of change of distance over time. Speed is measured in a variety of units. If speed couldn't be measured, we would not know how fast planes, cars, runners, boats, bikes etc. were going. Look at each of the units below and determine which units would fit each of the pictures below to measure their speed. Explain your choices.

1. Miles or Kilometers per hour
2. Yards or Meters per minute
3. Inches or Centimeters per minute
4. Yards or Meters per hour
5. Miles or Kilometers per second







Background Information:

Air Resistance Lab

As the crumpled paper and the sheet of paper fall, there is more air under the flat paper which creates friction as the there is more air. The crumpled paper takes up less space, therefore there is less air under it.

**Galileo was reported to have wanted to prove that regardless of weight, both objects will fall at the same acceleration. He went to the Tower of Pisa to prove this concept. He dropped two objects of <u>different</u> weights and they both landed at the same time.*

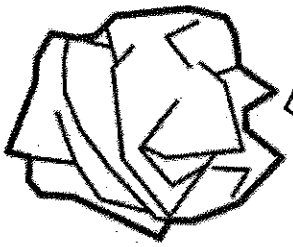
***However** this is **only true**, if there is no air resistance!!!!*

Background Information

Colliding Objects Lab

Newton's Third Law states that for every action, there is a reaction. This lab helps students to understand what happens when two objects collide. An extension to this lab would be to design or discuss solutions to address the impact from the motion of two colliding objects (as per NGSS) Ask students what engineers have done to help make collisions in cars less dangerous. *(airbags, bumpers, alerts on newer models.)*

Name:



Air Resistance

Air resistance is a type of friction. Friction is a force that slows down or stops the motion of two surfaces contacting each other.

What You Need:

Sheets of paper that are the same in size and weight. A timer or watch the second hand on a clock.

What To Do:

Predict which paper will reach the floor first. Provide reasons for your predictions.

Work in pairs. One student drops a full sheet of paper on the flat side, one student drops the same paper but crumples it up first. The paper must be dropped at the same time from the same position above your head. Time the paper to reach the floor.

Record and report your findings.

Name:

Colliding Objects Lab

For every action, there is always a reaction. A force is created that acts on both of the colliding objects. (Newton's third law.)

What You Need:

A variety of miniature toy cars.

A wall and a ruler.

What To Do:

Predict what will happen to each car upon colliding and explain why.

1. Apply a gentle force on one car as you push it into a wall from a 2-3 yard/meter distance. Measure the movement after the car collides. Repeat with a greater force.
2. Work in pairs. Apply a gentle force and push the cars at the same time so that they collide. Measure the movement after each car collides. Repeat with a greater force.

Record and report your findings.

Name:

Friction Lab

Friction is a force that slows down or stops the motion of two surfaces contacting each other.

What You Need:

Small type balls.

A large piece of cardboard.

A small sand or grass hill outdoors.
(If outdoors isn't available, use a towel on a slanted surface –try with and without the towel)

What To Do:

Predict whether the object will travel faster down the hill with or without the cardboard.

Put the smaller ball on the hill and give it a gentle push.

Put the cardboard on the hill and the ball on the cardboard. Give it a gentle push. ***(If you have a timer, time how long it takes for the ball to reach the bottom.)***

Record and report your findings.

Background Information:

Pendulum Motion Lab *(Demonstrates Newton's first and third law)*

The swing duration is effected by the length of string—the longer string should be in motion longer. The force of gravity and air resistance will eventually stop the pendulum from swinging.

HOWEVER, the weight should not make a difference to the duration of the swing. The mass has no relevance to the motion.

***Note**—do students discover that the shorter string pendulums actually swing faster?*

Ask students:

Where they see pendulums being used—swings, grandfather clocks, yoyos, amusement park rides.

What direction or path does a pendulum swing? Back and forth along a curved path.

Background Information:

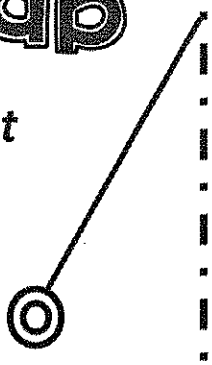
Let it Roll Lab

This lab can be done with a variety of items, replace toy cars with paper towel or toilet paper rolls or do it again with a variety of items—cardboard rolls, tennis balls, marbles...

This lab introduces students to the concept of measuring speed in units.

Name:

Pendulum Motion Lab



A pendulum is an object suspended by a string. What affects how long the pendulum will swing for?

What You Need:

Strings and weights/objects like erasers to tie to the end of the string.

What To Do:

Predict whether the pendulums with heavier or lighter weights will swing longer. Predict whether the pendulums with shorter or longer strings will swing longer. Explain.

1. Make 4 pendulums. Use a longer string and a shorter string with the same weights. Use a longer string and one heavier weight and one lighter weight.
2. Hold the pendulum in one hand at shoulder length. Pull the weight from the pendulum out and even with the top of your head. Release it. Count how many times the pendulum swung before it stopped (or time it). *(Do this 4 times)*

Record and report your findings.

Name:

Pendulum Recording

	Try 1	Try 2	Try 3
Long Pendulum	_____	_____	_____
Short Pendulum	_____	_____	_____
Heavy Pendulum	_____	_____	_____
Light Pendulum	_____	_____	_____

Use number of full swings or time the swing from beginning of swing until it stops.

Name:

Pendulum Recording

Try 1 Try 2 Try 3

Long Pendulum _____ _____ _____

Short Pendulum _____ _____ _____

Heavy Pendulum _____ _____ _____

Light Pendulum _____ _____ _____

Use number of full swings or time the swing from beginning of swing until it stops.

Name:

Let it Roll Lab

Speed is the rate at which the position of the object changes. Calculate the speed of roll in seconds.

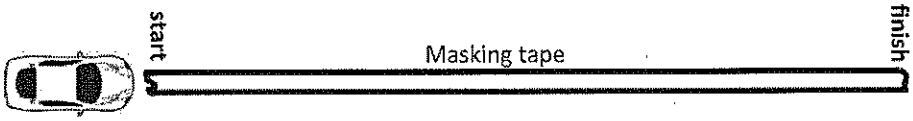
What You Need:

Miniature toy cars and masking tape. *(can substitute marbles for cars.)*

What To Do:

Predict how long in seconds it will take the car to travel from the beginning of the masking tape to the end, stopping on its own.

Put a piece of masking tape on the floor about 1-2 meters or yards long.



Practice a few times by giving the car a gentle push until it stops at the end of the masking tape. When you can push the car just hard enough for it to stop at the finish mark, begin timing it. For seconds, say 1001, 1002, 1003, 1004...

Calculate: $\frac{\text{distance the car traveled (1 or 2 meters or yards)}}{\text{time in seconds}}$

Record and report your findings.

Name:

Scientific Planner

What I Am Trying To Find Out:

What I Think Will Happen:

What I Need:

What I will do:

What I Observed:

Conclusion and why I think it happened:

Name:

Scientific Planner

What I Am Trying To Find Out:

What I Think Will Happen:

What I Need:

What I will do:

What I Observed:

Conclusion and why I think it happened:

Name:

What I Learned

What I like learning most about force and motion was:

I was surprised to learn that:

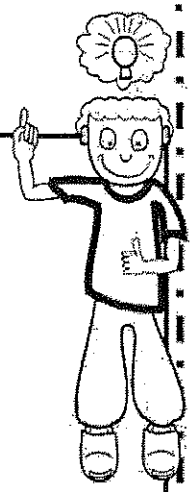
It's good for me to know about force and motion because:

The hardest part was:

I still wonder about:

Name:

What I Learned



What I like learning most about force and motion was:

I was surprised to learn that:

It's good for me to know about force and motion because:

The hardest part was:

I still wonder about:

Discussion Questions

1. What is a force?
2. Make a list of as many things that move as you can think of.
3. Beside the list of everything that moves, describe '*how*' it moves.
4. Beside the list of everything that moves, indicate what is living and what is non living.
5. If you didn't actually see something move, how might you know that it did move?
6. If force is described as something that is pushed or pulled, how many things can you identify that move by being pushed or pulled?
7. Do you think it is easier to push something or to pull something? Explain.
8. Do things slide easier on smooth surfaces or rough surfaces? Why?
9. Why is friction important? (*stopping cars, bikes, rides..)*
10. What are all the ways/units we measure the speed of moving objects? *(cars, running races, planes, walking, baking...)*
11. Do you think it is easier or harder to start or stop an object?
12. What is friction?
13. What does friction do to a moving object?
14. What are magnets?
15. What are magnets useful for?
16. If you can't see gravity, how do you know it is a force?