Name _____ Date _____

Tuesday, February 5

Balanced and Unbalanced Forces

By Cindy Grigg

A **force** is a push or a pull on an object. Forces are at work all around you all the time. More than one force can-and usually does- act on an object at the same time. Sometimes two forces act in the same direction. An example is when two people work together to push a heavy object. Sometimes the forces act in different directions.

Imagine a tug-of-war between you and one friend. If you are stronger, you apply more force to the rope. You pull your friend across the line, and you are the winner! If your friend is stronger, he might pull you across the line. Sometimes the forces are equal. Neither you nor your friend moves across the line. The two forces are balanced.

We say that the **net force** on an object is the combination of all the forces acting on it. To find the net force of forces that are acting in the same direction, add them together. For example, if you pull on a box with a force of 25 newtons (N) while your friend pushes the box (in the same direction you are pulling) with a force of 30 N, the net force applied to the box in that direction is 55 newtons.

To find the net force of forces that are acting in opposite directions, subtract the smaller force from the larger one. If you are pulling on a tug-of-war rope with a force of 40 N, and your friend is pulling with a force of 35 N in the opposite direction, the net force on the rope is 5 newtons in your direction. You win!

When the net force on an object is zero, the two forces are balanced. **Balanced forces** don't cause any change in the motion of an object. Balanced forces are equal and in opposite directions. If the object is not moving and two forces are applied to it that equal zero when combined, then the object will not move. If the object is already moving and two balanced forces are applied to it, the object will continue moving at the same speed and in the same direction that it was before the forces were applied.

That doesn't mean that balanced forces have no effect on an object, however. Think about what would happen to an empty soda can if you pushed against it in one direction, and a friend pushed against it in the opposite direction with an equal amount of force. If the amount of force was equal, the can wouldn't move. But the two opposing forces would probably crush the can.

When the net force on an object is greater than zero, the forces are unbalanced. **Unbalanced forces** cause the object to move. An object that is not already moving will begin to move in the direction of the larger force. An object that is already moving will change its speed and/or its direction.

Remember that two forces applied to an object in the same direction will combine by adding the two together. Two forces applied to an object in opposite directions will be subtracted. The net force is the combination of the two forces, whether by addition or subtraction. If the net force is zero, no change will happen to the object's motion. If the forces are unbalanced, meaning there is some amount of net force, then the object will move in the direction of the force.

Name _____ Date _____

Tuesday, February 5

Balanced and Unbalanced Forces

Questions

1. What is a force?

_____

_____

_____ 2. A combination of all the forces acting on an object is called:

A. unbalanced force
B. balanced force
C. gross force
D. net force

_____ 3. To find the net force on an object:

A. divide the larger force by the smaller one
B. multiply the forces together
C. always subtract the amounts of the forces
D. combine the amounts of the forces acting on the object

_____ 4. When the net force on an object is zero, we say that the two forces are:

A. balanced
B. unbalanced
C. gross
D. cancelled out

_____ 5. When the net force on an object is zero, the object's motion will:

A. change
B. stop
C. not change

_____ 6. When forces are balanced, they:

A. have no effect on the object
B. don't cause any change in the motion of an object
C. might crush the object
D. both b and c are correct

_____ 7. If you are pushing a box toward your friend with a force of 20 N, and your friend is pushing the box toward you with a force of 30 N, what will happen to the box?

A. The box will move toward your friend with a force of 10 N.
B. The box will move toward you with a force of 10 N.
C. The box will move toward your friend with a force of 50 N.
D. The box will move toward you with a force of 50 N.

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_____ 8. If you are pulling on a box with a force of 30 N, and your friend is pushing the box in the same direction with a force of 30 N, what will happen to the box?

A. The box will move in the direction of your pull with a force of 30 N.
B. The box will move in the direction of the push and pull with a force of 60 N.
C. The box will move in the direction of your friend's push with a force of 30 N.
D. The box will not move because the forces are balanced.

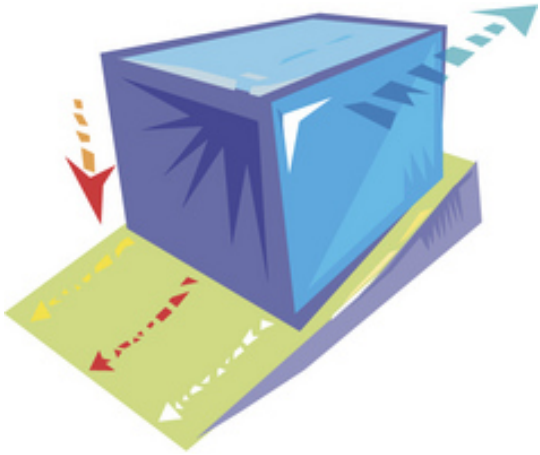
Describe a situation where two unbalanced forces are acting on a box. Be sure to tell the amount of each force and what will happen to the box.

Name _____ Date _____

Wednesday, February 6

Forces Around Us

By Cindy Grigg



Look around you, and chances are you'll see things moving. Cars move. People move. Elevators move up and down in tall buildings. Shopping carts move around in supermarkets. Balls fly through the air when they are thrown. You might not think about **why** these things move. Cars, elevators, and balls don't just move by themselves. Something is making them move. Forces make things move.

A force is a push or a pull. If you had a heavy box to move across your room, you might push it or pull it. The force would be working on the box in the same direction. It wouldn't matter to the box if you pushed it or pulled it. The amount of force needed to move the box would be the same. The direction of the force would also be the same.

When you push or pull a box, it is easy to see where the force is coming from. But it's harder to see forces at work when we think about a person or an animal moving. When you walk across the room, what force is making you move?

When you take a step, your foot is pushing down on the floor. That push is the force that makes your body move. When your foot pushes down on the floor, the floor pushes back. If the floor didn't push back, your foot wouldn't stop pushing down. You wouldn't go anywhere. You might end up standing in a hole.

Have you ever tried to walk in deep snow? It's much harder to walk in snow than it is on solid ground. The snow is too soft; it can't push back as hard as the ground does.

Forces always occur in pairs. A push in one direction means something is pulling in the other direction. When you push a box across the floor in your room, what other forces are pulling on it?

One is friction. Rub your hands together very fast. Do you feel heat? That heat is coming from the friction between your two hands. Whenever two things are rubbing against each other, friction is the force that slows them down. Tiny bits of matter on both surfaces rub against each other. As one surface rubs in one direction, the other surface rubs in the other direction. The two opposite forces create friction. Friction slows down the motion of both surfaces. Friction also makes heat. Some of the energy of motion changes into the energy of heat.

Gravity is another force that pulls on the box when you push it across your room. You may already know that gravity is the force that pulls a ball to the ground when you throw it. Gravity is the force that pulls all things down toward the earth. If you jump up, gravity pulls you down. If you throw a ball, gravity pulls it to the ground. When you stand on a scale, the force of gravity is pushing down on you.

As you push on the box, gravity is pulling on the box toward the ground. The two forces are not pushing and pulling in exactly opposite directions. Gravity is pulling straight down, and you are pushing sideways. The two forces are working against each other even though they are not directly opposite.

Why do cars have wheels? Have you ever thought about that? A wheel rolls much easier than a box would. There is less friction between a rolling wheel and the ground than there would be between a flat surface like a box and the ground. That's why wheels were invented-they make things easier to move.

Forces can be applied in different directions. Forces can be large or small. The direction a force is applied is the direction in which the object will move. Gravity is probably the most important force on earth. Forces are all around us!

Name _____ Date _____

Wednesday, February 6

Forces Around Us

Questions

1. What makes things move?

_____

_____

_____ 2. A force is a _____.

A. push
B. pull
C. both A and B
D. none of the above

3. Forces always occur in _____.

_____

_____

4. Complete this sentence: Whenever two things are rubbing against each other, friction _____.

_____

_____

_____ 5. Where there is friction, there is _____.

A. heat
B. noise
C. smoke
D. fire

_____ 6. What is the name of the force that pulls all things down toward the earth?

A. friction
B. magnetic force
C. atomic force
D. gravity

_____ 7. Which of these would have less friction?

A. a toy car with wheels rolling across the floor
B. a rock being pushed across the sidewalk

_____ 8. An object will move _____.

A. opposite the direction the force is applied
B. in the direction the force is applied
C. both A and B

Name _____ Date _____

Thursday, February 7

Forces

By Cindy Grigg

What is a force? A **force** is a push or a pull. Forces are acting all around you. Forces are even acting on you! Objects (and you) are being pushed and pulled in different directions. Sometimes the force can be seen, like when you push a toy car or throw a ball. Sometimes you don't see forces at all. Even objects that are not moving have forces acting on them. Forces have the ability to cause change.

Forces always come in pairs. Objects exert forces on each other. When you run into something, let's say another person, you exert a force on that person. He may fall down if the force is strong enough. But that other person also exerts a force on you. You might also fall down. You can see movement caused by the force. If you run into a wall, you might not see any movement. The wall doesn't move. You probably wouldn't fall down. But it might hurt. You pushed on the wall, or exerted a force on the wall. The wall exerted a force back on you. It hurts the part of your body that hit the wall because the wall exerted a force on your body.

The strength of the force is called the **magnitude** of the force. Forces also have a certain direction. For example, when you are standing, you exert a force on the ground that is equal to your weight. Your body is exerting a force on the ground in a downward direction.

Forces are measured in units called **newtons.** Newtons were named for the English scientist Isaac Newton who came up with the set of laws that describes forces and motion. It takes about forty newtons to lift a small dog.

Forces can affect objects in several ways. Forces that act on an object that is not moving can cause the object to move. Forces can act on an object that is already moving to cause a change in the object's speed or direction of movement. A force can act on an object and not make it move. Forces acting on a still object can change the object's shape. For example, if you sit on a bean bag chair, you can see how the force of your body pushing down on the chair changes the shape of the chair.

Acceleration means a change in the speed or direction of an object. When something speeds up, we say that is a positive acceleration. When it slows down, we say that is a negative acceleration. But remember that acceleration can also be a change in the direction of an object that is moving. An object that is moving along a curved path is always accelerating. That is to say, its line of motion is always changing.

The force you are probably most familiar with is the force of gravity. **Gravity** is the force of attraction between objects that have mass. Two objects that have mass are attracted toward each other. They exert force on each other. They pull on each other. Hold a book out from your side and let go. What happens to the book? It falls until it hits the floor. What force pulled on the book? The force of gravity. The book and the earth are attracted to each other. Earth pulled the book toward its center.

Mass is a measure of the amount of "stuff" in an object. Since all objects have mass, gravity acts on all objects. You know that the earth pulls all objects toward its center. But what you might not know is that all objects, including you, pull the earth toward their centers. Since the earth is a lot bigger than you, it pulls a lot harder on you than you pull on it.

The greater the mass of either of two objects, the stronger the force of gravity is between them. The force of gravity between the earth and the book you let go of is stronger than the force of gravity between your hand and the book. The earth, because it has so much more mass, pulls more on the book than your hand does. That explains why the book falls when you let go of it, and it doesn't stick to your hand.

The strength of the force of gravity depends on two things. One is the mass of the two objects. The other is the distance between the two things. The closer the two objects are, the stronger the force. The farther apart the

objects, the weaker the force exerted by the objects on each other.

For example, the sun and the moon both exert gravity on the earth's oceans. This is what causes ocean tides to rise and fall. The sun is about 400 times bigger than the moon. But the moon is much closer to the earth. So the moon exerts more force on tides than the sun does.

Forces are all around you. Understanding forces helps us understand how many things happen. Physics is the branch of science that studies forces, energy, and motion. Every motion you make and every job you do uses forces.

Forces

Questions

_____ 1. A force is a:

A. push or a pull
B. field of energy around something
C. strange, unknown power

_____ 2. Forces have the ability to:

A. be seen
B. be invisible
C. cause change
D. all of the above
E. none of the above

_____ 3. Forces can act on an object and:

A. cause the object to move
B. cause a change in the speed of the object
C. cause a change in the direction the object is moving
D. cause a change in the shape of the object
E. all of the above

_____ 4. What is magnitude?

A. the strength or amount of the force
B. the height of the object
C. the attitude of a force

_____ 5. Forces are measured in units called:

A. kilograms
B. magnitude
C. newtons
D. pounds

_____ 6. Acceleration is:

A. speeding up of an object
B. slowing down of an object
C. change in the direction of a moving object
D. all of the above
E. none of the above

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Thursday, February 7

_____ 7. The force of attraction between two objects that have mass is:

A. magnitude
B. force
C. gravity
D. acceleration

_____ 8. The strength of the force of gravity depends on:

A. the mass of the two objects
B. the distance between the two objects
C. both of these
D. neither of these

Explain why it hurts when you fall down. Use details from the reading to support your answer.

Name _____ Date _____

Friday, February 8

Force and Motion

By Sharon Fabian

Force and motion describe everyday things that are happening all the time. Hundreds of times every day, you use force and motion. Did you just pick up a pencil? -- force and motion. Did you turn a page? -- force and motion. Raise your hand? Kick the desk in front of you? Pack your backpack? All of these are examples of force and motion.

Out on the playground you can see even bigger and better examples of force and motion. Climbing, jumping, running, chasing, throwing, and sliding all use force and motion.

Force and motion are also parts of a complicated branch of science, called physics. Now that you know what force and motion are, the next thing that you should know are some definitions.

The scientific definition of **force** is a push or a pull. When you throw a baseball, you are pushing it through the air. When you pick up a baseball bat you are pulling it up from the ground. When you hit the ball, you use both pushing and pulling motions.

Motion is another word with a scientific meaning. **Motion** means moving something from one place to another. When you used force to swing the bat and hit the baseball, they both moved from one place to another. That's what motion is. In fact, the word motion is a form of the word move.

Let's stick with our baseball example for a little bit longer. Some kids can hit a baseball harder than others can. You could say that their baseball travels at a faster rate. **Speed** is a scientific term that means the rate of motion, or how fast something travels.

OK, enough about baseball. Now think about rocks. Why can you throw a little pebble farther than you can throw a huge boulder? The boulder is heavier; it has more weight.

The Earth's gravity causes everything on Earth to have weight. **Gravity** is a force that pulls everything toward the center of the Earth. Gravity is holding both the pebble and the boulder down, at the same time that you are trying to throw them. Gravity is a force acting against your force. Gravity's force is stronger on heavier objects. That's why it is not too hard to throw the pebble, but very hard to throw the boulder. **Weight** is the measure of gravity's force. Since gravity is holding the boulder with more force than the pebble, the boulder has more weight.

Force, motion, speed, gravity, and weight -- everyday words with special meanings in the science called physics.

Force and Motion

Questions

_____ 1. Force and motion are parts of a branch of science called

A. geology
B. physics
C. earth science
D. biology

Name _____ Date _____

Friday, February 8

_____ 2. _____ is the measure of gravity's force.

A. weight
B. speed
C. force
D. gravity

_____ 3. _____ is the force that pulls everything toward the center of the earth.

A. force
B. speed
C. weight
D. gravity

_____ 4. _____ means rate of motion, or how fast something is moving.

A. gravity
B. speed
C. weight
D. force

_____ 5. Climbing a hill is an example of force and motion.

A. False
B. True

_____ 6. Throwing a Frisbee is an example of force and motion.

A. True
B. False

_____ 7. Ice-skating is another example of force and motion.

A. True
B. False

8. List four more examples of force and motion that are not mentioned in this article.

_____

_____