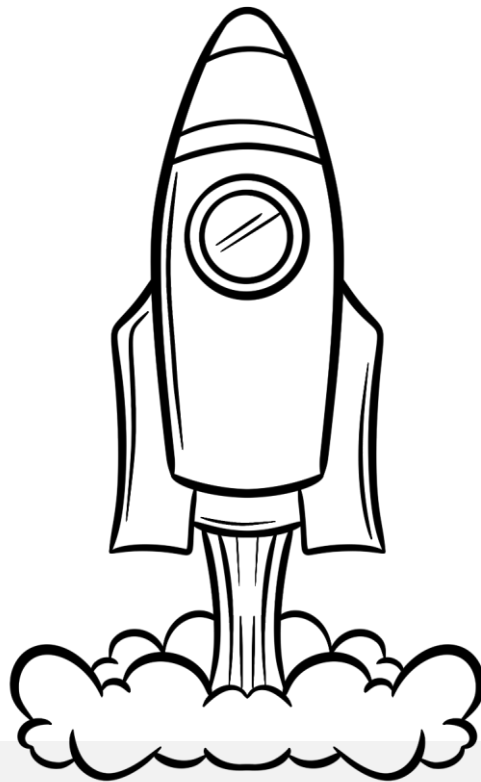


Force and Motion



Rockets rely on Newton's third law of motion to propel them into space. When the rocket engines push hot gases down, the gases push back on the rocket, making it go up.

Read the passage to answer the questions on the next page..

Force and Motion

In the world around us, everything we see, feel, and experience involves force and motion. Force is simply a push or a pull exerted on an object. It can cause an object to start moving, stop moving, or change direction. Forces can be large or small, and they can act over short or long distances. For example, when we kick a soccer ball, we apply force to it, causing it to move. Motion refers to the change in position of an object over time. It can be described in terms of speed, direction, and acceleration.

Friction

Friction is the force that slows down objects when they rub against each other. Friction works against motion and acts in the opposite direction. For example, if you are running outside and you suddenly need to stop, you can stop because of the friction between your shoes and the cement or grass.



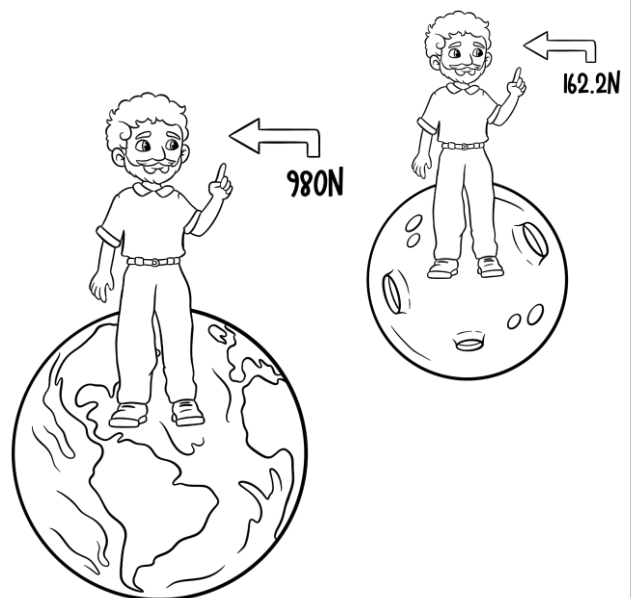
Gravity

Gravity are forces of attraction. Gravity makes everything fall down toward Earth. The more mass an object has and the closer you are to the object, the stronger the gravity. Since earth is huge, gravity is strong. Without earth's gravity we would fly right out of it; Earth would not be livable. If you kick a ball, it would be flying forever.

The Earth's gravitational force causes objects to accelerate, or speed up, as they fall. For example, If you drop a ball from a third story window, the ball will keep falling and gaining speed with each passing moment until it hits the ground. Gravity pulls the ball downward continuously, making it accelerate as it moves closer to the Earth's surface.

Mass and Weight

Mass is how much stuff is inside of something. Objects with more mass contain more matter. The mass of an object will never change. Your mass will be the same on Earth as in outer space. Weight is the force of gravity pulling on an object. Weight is measured in Newtons, and the symbol for Newton is 'N'. Unlike mass, the weight of an object can change depending on where it is. For example, you would weigh less on the Moon than you do on Earth because the Moon has weaker gravity. So, if you weigh 980 Newtons on Earth, you would weigh about 162.2 Newtons on the Moon.



Name: _____

Force and Motion

1. Force is:

- a) The amount of matter in an object
- b) The speed of an object
- c) A push or pull on an object
- d) The distance an object travels

2. Which force slows down or stops the motion of an object?

- a) Friction
- b) Magnetism
- c) Gravity
- d) Air resistance

3. What happens when you push a heavy box with more force?

- a) The box becomes lighter
- b) The box moves faster
- c) The box becomes smaller
- d) The box stops moving

4. Which force keeps objects on the ground?

- a) Friction
- b) Magnetism
- c) Gravity
- d) Buoyancy

5. Explain Newton's first law of motion in your own words and provide an example.

6. Describe Newton's second law of motion and how it relates force, mass, and acceleration.

Read the passage and complete the next page.

Newton's Laws of Motion

Isaac Newton is one of the most important scientists in history. Newton was a brilliant English mathematician, physicist, and astronomer who lived in the 17th and 18th centuries. He was best known for defining the three laws of motion and universal gravity.

1st Law of Motion

Newton's first law of motion states an object at rest will remain at rest, and an object in motion will stay in motion with the same speed and direction unless acted on by an unbalanced force. For example, in the picture shown to the right, the soccer ball will not move until the girl kicks it.



2nd Law of Motion

Newton's second law of motion states if you use the same force on two objects of different mass, you will get different accelerations (changes in motion). The more force and the smaller the mass, the greater the acceleration. This relationship can be represented by the equation $F = ma$, where 'F' represents force, 'm' represents mass, and 'a' represents acceleration.

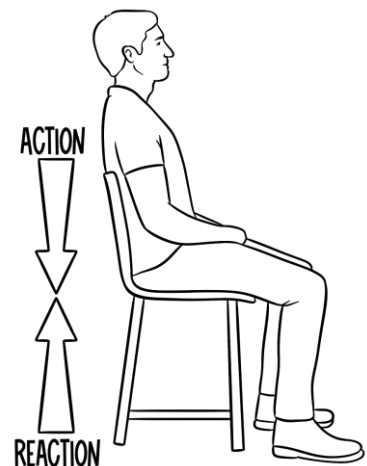
For example, imagine pushing two different shopping carts, one empty and the other filled with groceries, with the same amount of force. According to Newton's second law, the shopping cart with the groceries will experience less acceleration compared to the empty one because it has more mass.



3rd Law of Motion

Newton's third law of motion states For every action (force) there is an equal and opposite reaction (force).

For example, When you sit on a chair, your body exerts a downward force on the chair (action) due to your weight. According to Newton's third law, the chair also exerts an equal and opposite force upward on your body (reaction). This upward force from the chair supports your weight and prevents you from falling through the chair.



Name: _____

Newton's Laws of Motion

Directions: Decide which of Newton's Laws of Motion (First, Second, or Third) best describes each situation below. Write "1st," "2nd," or "3rd" after each scenario to indicate your choice.

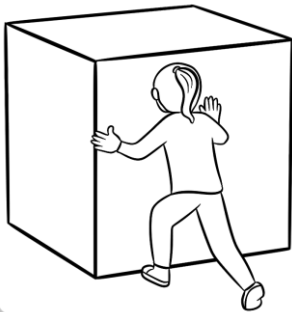
- 1.** When you blow up a balloon and let it go, the air rushes out one way, and the balloon moves in the opposite direction.



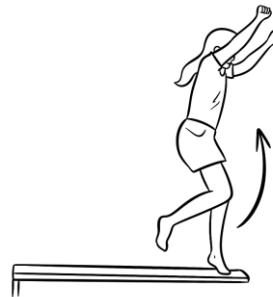
- 2.** A toy car continues rolling on a smooth surface until it hits a wall and stops.



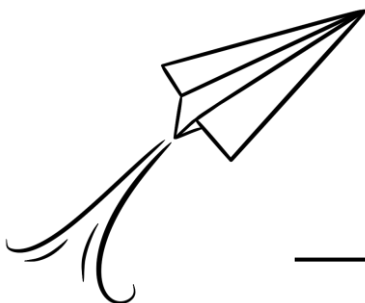
- 3.** A person needs to apply more force to push a heavy box compared to a lighter box..



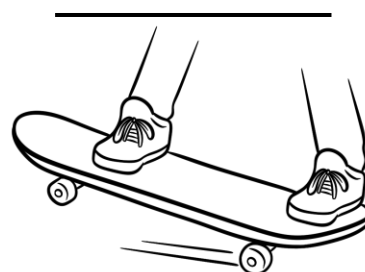
- 4.** When a person jumps off a diving board, the diving board pushes them upward into the air.



- 5.** A paper airplane flies further when you throw it harder.

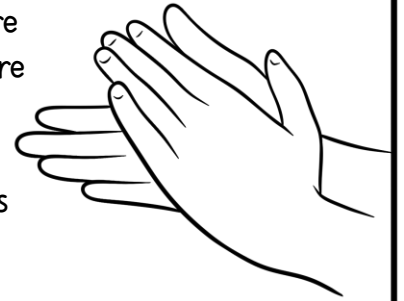


- 6.** A skateboard slows down when you apply the brakes.

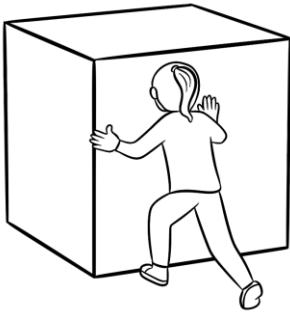


All About Friction

Try rubbing your hands together fast. Do you feel the heat? If not, try increasing the pressure as you rub. By rubbing them together, you are generating heat through friction. The faster and harder you rub, the more friction is produced, resulting in an increase in temperature.



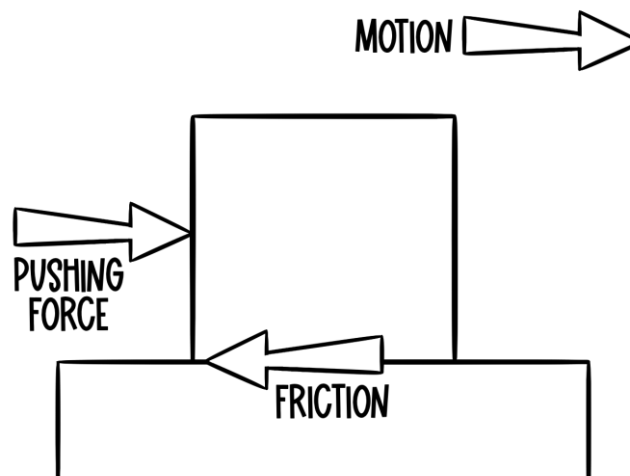
Friction is a force, the resistance of motion when one object rubs against another. Anytime two objects rub against each other, they cause friction. It works against the motion and acts in the opposite direction.



The amount of friction depends on the materials from which the two surfaces are made. For example, rough surfaces like rock and sand create more friction than smooth surfaces like glass and ice. It is harder to move things when there is a lot of friction holding them back. For example, you would have to push a box using more power to get it moving on a carpet than you would on a tile floor. There is more friction between the carpet and the box than there is between the tiles and the box.

Did you know that if friction did not exist, you would slip and slide around wherever you take a step? The friction between your shoes and the floor stops you from slipping. It would also be very tough to stand up without friction.

There are three different types of friction: dry friction, fluid friction, and rolling friction. **Dry friction** occurs when two solid objects touch each other. If they are not moving, it is called static friction. If they are moving it is called kinetic or sliding friction. **Fluid friction** involves a fluid or air. A submarine moving through water is an example of fluid friction. Lastly, **rolling friction** occurs when a round object rolls over a surface. For example, a bowling ball or truck tires have rolling friction.



Name: _____

Recognizing Push, Pull, Friction, and Gravity

Identify whether each example demonstrates a push, a pull, friction, or gravity.

1.

Opening your
car door



2.

Rubbing your
hands together to
generate warmth



3.

Picking a
flower



4.

Falling back to the
ground after
jumping in the air



5.

Moving a shopping cart



6.

An apple
falling off a
tree



7.

Gripping a pencil
tightly to prevent
it from slipping
while writing



8.

Brakes on a car
slowing down
the vehicle



Name: _____

Vocab Match

Match each word with its definition. Write the correct letter in the space provided.

1. Force _____

2. Motion _____

3. Friction _____

4. Gravity _____

5. Mass _____

6. Weight _____

7. Acceleration _____

8. Speed _____

9. Velocity _____

10. Inertia _____

A

The force that pulls objects toward each other

B

A push or a pull on an object

C

The speed and direction of a moving object

D

The rate at which an object changes speed and direction

E

The force that slows down objects when they rub against each other

F

The amount of matter ("stuff") in an object

G

An object's tendency to resist a change in motion

H

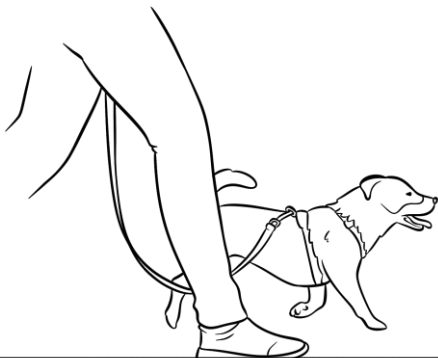
The change in position of an object

I

The distance an object travels in one unit of time

J

The amount of force that gravity has on an object's mass



FORCE AND MOTION

Day 5

Name: _____

How does the type of surface affect the amount of friction experienced by an object? Consider the differences in friction between rough and smooth surfaces and provide examples to illustrate your answer.

[illegible]