

FORCES & MOTION STUDY GUIDE

SPEED AND ACCELERATION

What is the difference between speed and acceleration?

Speed is the change in position in relation to time (distance divided by time). Acceleration is the change in velocity to increase or decrease speed.

How is speed calculated?

Distance divided by time

In a time distance graph, what does a straight and horizontal line mean? Straight and vertical line? Straight and diagonal?

Straight and Horizontal: object is at rest

Straight and Vertical: IMPOSSIBLE

Straight and Diagonal: object moving at a constant speed (not accelerating or decelerating)

MASS VS. WEIGHT

Compare mass versus weight. How are they different? How are they alike?

Mass is the amount of molecules in an object and weight is the pull of gravity on those molecules. Mass times the pull of gravity equals weight. Mass can't change, however weight can!

FRICTION

Name three examples of things that increase friction and 3 examples of things that reduce friction.

INCREASE FRICTION	REDUCE FRICTION
1. Rough surfaces	1. Smooth surfaces
2. Rubber and carpet	2. Soap and oil
3. Gravel and grass	3. Water and grease

If an item is lubricated or greased, how will friction be affected?

Lubrication (grease) decreases friction and makes things easier to move.

GRAVITY AND AIR RESISTANCE

If you drop a book and a flat piece of paper at the same time, which will hit the ground first? Why?

The book will hit first because the piece of paper is more affected by air resistance (drag), which slows down the paper more than the book. The paper and book most likely have the same surface area, but because of the difference in mass, air resistance can keep the paper in the air longer.

If you crumple up the paper from the above question (take away its surface area), will you get different results? Why?

The paper will fall through the air molecules faster because there is less surface area to be slowed down by the air resistance.

BALANCED AND UNBALANCED FORCES

If a car's speed is constant, the forces are **BALANCED. In order to accelerate, the object must have **UNBALANCED** forces.**

If the same force was applied to a bike, a car, and a bus, which would have the easiest time accelerating? Why?

The bike will accelerate quicker because it has less mass, which means it has less inertia and will be easier to move.

If the same force was applied to a bike, a car, and a bus, which would roll the furthest? Why?

Because the bus has the most mass and the most inertia, it will roll the furthest because it does not want to change what it is already doing and takes more force to stop/slow down.

Is inertia a force or a property of an object? Explain how you know!

Inertia is a property because forces are pushes or pulls. Inertia is the tendency of an object to do what it is already doing, not a push or pull.

What are the different types of forces occurring when you hit a golf ball to the hole?

Forward force when the club hits the ball. Gravity pulling the ball down, air resistance slowing the ball down, friction between the ball and the grass slowing it down, and finally gravity as the ball falls into the hole. The bottom of the cup stops the motion completely.

How do potential and kinetic energy differ? Name one example of each.

Potential energy is energy that is stored up and ready to use. Kinetic energy is energy in motion. A rock sitting on top of a hill has potential energy. A rock rolling down the hill has kinetic energy.

NEWTON'S 1ST LAW

Your friend kicks a soccer ball and it stops a few feet in front of you. What needs to happen to the ball in order for it to return to your friend? BE SPECIFIC!

I would have to use an outside force (unbalanced) to move it back to my friend. I would kick it using the muscle force in my leg to move it back to my friend.

In relation to velocity, imagine you are riding in a car with your grandfather and he turns left. Why do you shift to the right?

Because of inertia, my body wants to continue in a straight line. When my grandfather turns left, my body continues to go straight. This makes me lean to the right until my body is forced back straight by my muscles or the car door.

NEWTON'S 2ND LAW

What is acceleration?

Acceleration is a change in velocity to increase or decrease speed.

Your neighbor is riding her bike around the block. When she slows down and turns a corner, what changes about her? Speed, velocity, friction, or balance? Explain your answer.

Her velocity changes because her direction and speed change. Velocity deals with speed and direction.

What can cause a moving object to change direction?

To change the direction of an object you need an outside unbalanced force. Mass, force, and speed

NEWTON'S 3RD LAW

What happens when 2 objects, such as a baseball and a bat collide?

They hit each other with an equal and opposite force. Because the baseball has less mass, it will fly in the opposite direction.

When 2 objects with unequal mass collide, what will they do?

They hit each other with the same force. The object with the least mass will move further in the opposite direction than the object with the greater mass.

What does an object do when it accelerates?

An object changes its distance in relationship to time when it accelerates. It can either speed up or slow down.

If the first force is the action force, what do we call the second force? **Reaction**

NEWTON'S LAW OF GRAVITY

If a basketball player shoots a three point shot, what keeps the ball from floating in the air for forever and ever and ever?

Gravity!

What is gravitational force?

Gravitational force is an invisible force that pulls objects to the center of other objects. Gravity depends on the mass of the objects and their distance from one another.

Is the pull of gravity stronger between the Earth and the Sun OR the Earth and the Moon? Explain your answer.

Gravitational pull is stronger between the Sun and Earth than it is between the Earth and the Moon because the Sun is so massive. This counteracts the extreme distance between the Sun and Earth.

TRUE OR FALSE? IF FALSE, MAKE THE STATEMENT TRUE.

T or F An object's center of gravity is at the center of its mass.
TRUE

T or F The force of gravity between a pencil and a heavy science book on your desk is unequal.
TRUE

T or F The Earth's gravity is stronger than the Moon's gravity.
TRUE