

CHAPTER 2: NEWTON'S LAWS STUDY GUIDE

I. Newton's First Law

- A. Objects in motion stay in motion, objects at rest stay at rest unless a force acts on it.
- B. Also called the Law of Inertia.
1. Inertia is the tendency of an object to resist changes in motion.
 2. The more mass an object has, the more inertia it has.
 3. Inertia is the reason why you can pull a tablecloth out from beneath objects and the objects still stay on the table.
- C. In space, objects will not need any force to keep moving as there is no friction. So the net force on the object would be zero.
- D. All the forces that are on an object can be added together to get the net force.
1. If the two forces are equal and opposite, the object won't move and the net force is zero.
 2. If the two opposite forces aren't equal, you subtract them and that will tell in what direction and with how much force an object moves.
 3. Write in the following examples.

Ex. 1



net force = 0N

Ex. 2



net force = 75N Left

- E. There are different kinds of forces.
1. Friction—the force that opposes motion.
 - a. There are two types of friction... starting and sliding.
 - i. Starting friction is always more than sliding friction.
 - b. Friction is caused by small bumps on the surfaces of two objects touching which causes the objects to get “hung up” on each other.
 2. Weight—the force of gravity on mass.
 - a. Mass—how much “stuff” is in an object and doesn't change no matter where the object is.
 - b. Weight can change depending on gravity.
 - c. On Earth, the acceleration due to gravity is 10 m/s^2 . Therefore, use this number in your equation of $F = ma$ for the acceleration whenever you are finding or using weight in the problem.

REVIEW OF NEWTONS THREE LAWS

1. Define Newton's First Law: "law of inertia"

2. The reason why objects slow down is because of friction. If there is no friction, then the object would never stop. So when something is fired into space, it will keep going forever because there is no friction.

3. Define Inertia. If you pull a tablecloth off a table quickly, the objects on the table will stay. Why?

Stay the way they are

4. Inertia depends on the mass of an object.

5. What is the difference between mass and weight?

stuff ↓ gravity

6. In order to determine weight on Earth, you have to multiply the mass by 10 (because of gravity). So, if an object has a mass of 20 kg, what would be its weight? 200N If an object has a weight of 30 N, what would be its mass? 3kg

7. Define friction. What is static friction? Kinetic friction? What is stronger, static or kinetic friction?

Opposition to motion

Over come to get object moving
Over come to keep going

Key

Force and Motion Review

Test Format

Modified True/False; Multiple Choice; Fill in the Blank; Problems; Free-Body Diagrams

Key Vocabulary Words

- Force
- Net force
- Balanced forces
- Unbalanced forces
- Friction
- Static friction
- Sliding/kinetic friction
- Rolling friction
- Fluid friction
- Gravity
- Air resistance
- Acceleration due to gravity
- Newton's 1st Law of Motion (aka Law of Inertia)
- Newton's 2nd Law of Motion
- Newton's 3rd Law of Motion

Applied Force

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Forces: Use the word bank to complete the following statements.

acceleration	subtract	balanced
air	gravity	sliding
support	net	friction
Inertia	equal	fluid
reaction	applied	pairs
unbalanced	static	

- a. Objects always feel at least 2 forces because forces always act in pairs.
- b. When two forces are acting in the same direction, we add the forces together. When two forces act in opposite directions, we subtract the forces.
- c. Combining all the forces together gives us the applied net force.
- d. If the net force is 0 (zero) then the forces are balanced.
- e. If the net force is greater than 0, the forces are considered unbalanced. This causes changes in the velocity of the object.
- e. Newton's 1st Law of Motion says that an object in motion wants to stay in motion, while an object at rest wants to stay at rest. This is known as inertia.
- f. Friction is the force that always exists when objects slide against one another.
- g. It is harder to get a still object to start moving. During this time, you are pushing against Static friction. Once the object is moving it is easier to push. During this time you are pushing against Kinetic friction.
- h. Newton's 2nd Law of Motion said that force equals mass multiplied by acceleration.
- i. Newton's 3rd Law states that for every action, there is an action and opposite reaction.

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Newton's Laws

3. What is the mass of a falling rock if it produces a force of 147 N?

Unknown: mass

Formula: $m = F/a$

Plug & Chug: $\frac{147}{9.8} = 15 \text{ kg}$

4. If a plane is moving at 3,000 m/s and has a momentum of 85,000 kg m/s, what is the mass?

Unknown: m

Formula: $m = F/a$

Plug & Chug: $85,000 / 3,000 = 28.3 \text{ Kg}$

Identify the Law: Identify which of Newton's Laws is being described.

- 2 a. I can throw a ping pong twice as fast as a bowling ball.
- 1 b. When I start pulling on a sled, my dogs fall off the back.
- 2 c. I have to use twice the force to pick up an object with twice the mass.
- 3 d. A bird pushes his wings backwards in order to fly forwards.
- 1 e. If my car quickly comes to a stop, I feel pushed towards the windshield.
- 3 f. A rocket pushes gases out the back to move upward.