

Exercises for Unit 1: Mechanics

Lesson 1: Forces Exercises

1. Name at least one force that is acting on you right now.
2. Name at least two invisible force fields that are surrounding you right now.
3. What kind of an object can be affected by a gravitational force field?
4. What kind of an object can be affected by an electrical force field?
5. What kind of an object can be affected by a magnetic force field?
6. What happens to the force on an object as it gets closer and closer to a magnet?
7. How does the force of the sun's gravitational pull on Neptune, which is the farthest planet from the sun if you don't count Pluto, compared to the force of the sun's gravitational pull on Mercury, which is the closest planet to the sun.

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Lesson 2: Gravity Exercises

1. Of the following objects, which ones are attracted to one another by gravity? a) An apple and a banana b) A beagle and chihuahua c) The Earth and you d) All of the above
2. Gravity accelerates all things differently, true or false?
3. Gravity pulls on all things differently, true or false??
4. If I drop a golf ball and a golf cart at the same time from the same height, which hits the ground first?
5. There is a monkey hanging on the branch of a tree. A wildlife biologist wants to shoot a tranquilizer dart at the monkey to mark and study him. The biologist very carefully aims directly at the shoulder of the monkey and fires. However, the gun makes a loud enough noise that the monkey gets scared, lets go of the branch, and falls directly downward. Does the dart hit where the biologist was aiming or does it go higher or lower than he aimed? (This, by the way, is an old thought problem.)
6. Why don't a feather and a brick hit the ground at the same time?

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Lesson 3: Friction Exercises

1. What is friction?
2. Walking would be easier without friction, true or false?
3. Why does a feather fall slower than a brick?
4. Put a coin on a piece of paper and quickly pull the paper out from under the coin. What do static friction and kinetic friction have to do with this?
5. What was the experiment with the magnets showing?

Answers to Forces Exercises

1. Gravity is pulling on you. If you're sitting, your chair is pushing up on you as well.
2. Gravity and magnetic fields. To be honest, you are probably also sitting in an electromagnetic field. Can you get a radio or a cell phone to work where you are? If so, you're in an electromagnetic field.
3. Any object can be pulled by a gravitational force field.
4. Any object. An electrically charged object or a neutral object can be pushed or pulled by an electric field.
5. Another magnet or something with a metal in it that can be magnetic.
6. The force the magnet exerts on the object becomes greater and greater as the object gets closer. The inverse-square rule is a way of describing how force increases as objects get closer together.
7. Since Neptune is farther away, the inverse-square rule says that the sun's gravitation pull on it is much smaller.

Answers to Gravity Exercises

1. D. All bodies are attracted to other bodies by gravity, but a body has to be really stinkin' big before it's noticeable.
2. FALSE!!! Gravity accelerates all things at the same rate. All things fall at the same rate of speed no matter what (ignoring air resistance, that is).
3. True. That's why some things weigh more than other things. Gravity pulls more on the big stinky guy sitting next to me on the bus than it does on me.
4. They hit the ground at the same time. Gravity accelerates all things equally.
5. The monkey and the dart fall downward at the same rate of speed. So the dart would hit exactly where the biologist aimed! In fact, if the monkey didn't let go, the dart would have hit lower than the biologist aimed.
6. They do...if you're on the moon! On Earth, the friction between the air and the feather causes the feather to slow down and the brick to win the race.

Answers to Friction Exercises

1. Friction is the force between one object rubbing against another object. Air resistance, by the way, is the friction of one object rubbing against millions and billions of air molecules.
2. FALSE!!! Walking would be impossible without friction. Your feet couldn't push back against the floor to move you forward.
3. Air friction slows the feather down. The feather rubs against many, many, many air molecules as it falls through the air. The feather is light and large enough that the air molecules actually slow it down.
4. If you pull the paper slowly, the static friction between the penny and the paper isn't broken, so the penny rides along with the paper. If you pull it quickly, you can overcome that static friction and the paper will slide along under the penny without moving it. As long as the paper is moving fast enough, the kinetic friction between the paper and the penny isn't enough to move the penny.
5. That objects "stick and slip" as they rub against one another. (Don't forget, that the magnet thing is a good model but it doesn't work quite like that in the real world.)