October 23, 2019

8th Grade Friction Review

***Vocab***

* **Force:** a push or pull on an object
  + Force has two qualities: *direction* and *magnitude* (strength)
* **Newton’s First Law of Motion**: an object in motion will stay in motion and an object at rest will stay at rest unless acted upon by an external force
  + Also known as the **Law of Inertia**
* **ΣF = ma**: the sum of forces is equal to mass multiplied by acceleration
  + F=ma is *Newton’s Second Law of Motion*
* **Velocity**: the speed of something in a certain *direction*
  + Direction is *key*, and distinguishes velocity from speed
  + Velocity = displacement divided by time (v = d/t)
* **Acceleration**: a change in velocity
  + ***This can be either a change in speed or a change in direction!***
  + *Positive acceleration* = speeds up
  + *Negative acceleration* = slows down
  + *Zero acceleration* = constant velocity (can be moving, just not changing speed or direction!)
* **Frictional force**: the force that prevents two objects from easily moving against one another
  + **Friction opposes kinetic energy, or acts against motion**
    - Friction transfers kinetic energy of a moving body to the surface it is in contact with
  + Frictional force is influenced by the normal reaction force and by the properties of the surfaces in contact
* **Normal reaction force**: the *support* force exerted upon an object in contact with a stable object
  + The normal reaction force pushes up as forcefully as an object pushes down
  + Works against gravity
  + Keeps an object from falling, for example the surface of a desk exerts a normal force against a book on top of the desk
* **Coefficient of friction (µ**): describes the force of friction between two objects based on the surfaces of the objects
  + The higher the frictional force, the higher the coefficient of friction
    - Ex. rough surfaces have a high µ, while smooth surface have a low µ
  + *A higher coefficient of friction means MORE force is needed to move an object*

***Focus Questions***

*Why does friction cause heat?*

* Surfaces on small scales are very rough. These rough surfaces sliding against each other cause millions of little collisions, speeding up molecular movement and causing heat.
  + Because friction acts against motion, the kinetic energy that would have resulted in unrestrained motion is converted into heat energy

*What is the relationship between speed, velocity, and acceleration?*

* Velocity is speed in a certain direction. Acceleration is a change in velocity. A change in velocity occurs when an object in motion either changes speed or changes direction.

*How does frictional force affect motion?*

* Frictional force decreases the velocity of an object. Friction *opposes* kinetic energy, meaning it slows motion.

*How does velocity of an object affect the frictional force between it and the surface with which is comes in contact?*

* Frictional force is independent of velocity.

*What is the relationship between weight and frictional force?*

* As the weight of a load increases, the frictional force between the load and the surface it moves on increases.

*What is the relationship between the surface area of an object in contact with another surface and the frictional force between two surfaces?*

* As the surface area of a load increases, the frictional force between the load and the surface remains constant. Frictional force is independent of surface area.

*How does the smoothness of the two surfaces in contact affect the frictional force between the two surfaces?*

* The smoother the two surfaces, the less frictional force. The rougher the two surfaces, the more frictional force.

*Why doesn’t a basketball bounce forever?*

* The friction of the ball hitting the floor causes a loss of kinetic energy with each bounce
* Ball hits floor 🡪 KE transferred to floor
  + Small amount of heat is generated as molecules in the basketball and the floor speed up
  + Hard floor 🡪 less energy transfer
    - Ex. If you bounce a ball on sand, the ball doesn’t really bounce – all the kinetic energy in the ball is transferred to the sand in the first bounce or two
* Ball hits floor 🡪 KE transferred to air
  + We hear a sound because the ball transfers energy to the air molecules, causing them to vibrate and produce sound waves
* As the ball bounces on the floor, it keeps transferring energy until the ball loses all its kinetic energy and eventually stops bouncing
* **All of the vibrations, sound, and heat come directly from the kinetic energy of motion of the bouncing ball as it hits the floor. This transformed energy is thus no longer available for the movement of the ball, so the ball must eventually stop bouncing.**

*What does displacement mean?*

* Displacement essentially means movement, or change in location.

*How can a change in direction be considered a type of acceleration?*

* Acceleration is a change in velocity, and because *velocity is dependent on direction*, a change in direction would by definition cause a change in velocity.

*Why do space shuttles look like they’re on fire when they reenter Earth’s atmosphere?*

* What I mean is, why do they get so hot?
  + Because of the intense friction between the space shuttle and the atmosphere!
* Why can shuttles float around space at similar speeds without causing excessive heat production?
  + There are no molecules in the atmosphere to cause friction.