December 5, 2017

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 **Law of Inertia**
* **Acceleration**: a change in velocity
  + *Positive acceleration* = speeds up
  + *Negative acceleration* = slows down
  + *Zero acceleration* = constant velocity (can be moving, just not changing speed!)
  + Change in *direction* is also a type of acceleration!
* **Velocity**: the speed of something in a given *direction*
  + Direction is *key*, and distinguishes velocity from speed
  + Velocity = displacement divided by time (v = d/t)
* **Frictional force**: the force that prevents two objects from easily moving against one another
* **ΣF = ma**: the sum of forces are equal to mass multiplied by acceleration
* **Normal reaction force**: the *support* force exerted upon an object in contact with a stable object
  + Pushes up as forcefully as an object pushes down
  + 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**): shows the relationship between the force of friction between two objects and the normal reaction between the objects that are involved
  + Relates to the properties of the two surfaces in contact with each other
  + *Ff = µFn*
    - Ff is frictional force, µ is the coefficient of friction, and Fn is normal force
    - Frictional force = coefficient of friction x normal force
  + A higher frictional force means a higher coefficient of friction
  + *Higher coefficient of friction means MORE force is needed to move an object*
    - Ex. rough surfaces have a high µ, while smooth surface have a low µ

***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.

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

* A change in velocity occurs when an object in motion either changes speed or changes direction. Acceleration denotes a change in velocity in a period of time.

*How does frictional force affect motion?*

* Frictional force decreases the velocity of an object. That is, it decreases speed 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 increased, the frictional force between the load and the surface it moves on increased.

*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 increased, the frictional force between the load and the surface remained constant.

*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 less smooth 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 generated as molecules speed up
  + Hard floor 🡪 less energy transfer
    - Ex. Bounce a ball on sand, ball doesn’t really bounce – all the KE is transferred in the first bounce or two to the sand
* 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 ball bounces on the floor, keeps transferring energy 🡪 loses KE and eventually stops 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.

*Bonus:*

Plumes of water vapor on Enceladus are caused by friction

* Saturn’s gravitational pull tugs on the icy crust of Enceladus and causes the crust pieces to move against each other, creating heat through friction
* This heat vaporizes the ice and water, leading to plumes