Spaghetti Bridges

Lesson Goal: discuss compression, tension, and strong shapes

 Compression: the act of pressing something together

 Tension: the act of stretching or straining

REMIND THE KIDS THAT SPAGHETTI IS VERY BRITTLE AND WILL BREAK UNDER STRESS

Link below shows what happens to spaghetti under stress

<http://tedkinsman.photoshelter.com/image/I000004tCIYB0.1M>

Discuss forces acting on bridge with kids

ASK: What are the forces acting on your bridge?

 Gravity

 weight

 weight of other materials

Explain that you want to distribute the force so too much pressure isn’t on one section of spaghetti

This can be done by using the strongest shape

Have kids take guesses about the strongest shape but don’t tell them if they are correct

Link demos how different shapes deal with various forces

 go to link and do demo <http://www.pbs.org/wgbh/buildingbig/lab/shapes.html>

More details can be found in Spaghetti Bridge Power point as well as the project pages and Helpful photo page

Foil Boats

Lesson Goal: Understand Buoyancy and density, Archimedes’ Principle, and water surface tension

(Below is a link I found most of my information in for the instruction of this lesson. All the stuff in bold was found in the text book)

<http://hdurnin.pbworks.com/w/file/fetch/67747092/Copy%20of%20sci8_ch08lr.pdf>

 Buoyancy is the tendency of an object in a fluid to rise or sink due to density differences with its surroundings.

What is the connection between the object’s density and the forces that act on it in a fluid? Earth’s gravitational force attracts matter downward toward Earth’s centre. A fluid, however, exerts an opposite force that pushes matter upward. The upward force exerted by a fluid is called the **buoyant force** (Figure 8.12).

Explain the impact of density on an object’s ability to float.

**• An object will rise in a fluid when: – the density of the object is less than the density of the fluid – the buoyant force on the object is greater than the force of gravity on the object**

**• An object will sink in a fluid when: – the density of the object is greater than the density of the fluid – the buoyant force on the object is less than the force of gravity on the object**

**• An object will float in a fluid when: – the density of the object is equal to the density of the fluid – the buoyant force on the object is equal to the force of gravity on the object**

**Explain Archimedes’ Principle**

**Archimedes’ Principle More than two thousand years ago, a Greek mathematician and inventor named Archimedes discovered an important principle about buoyancy (Figure 8.14). Archimedes’ principle states that the buoyant force on an object is equal to the weight of the fluid displaced by the object.**

**(This happened to be in the text book and it fit perfectly with the activity)**

**Imagine two identical pieces of aluminum foil. If you take one piece of aluminum foil and crumple it up tightly, it will sink in water. But if you fold the second piece into the shape of a boat, it will float. It will even support a “cargo” of some pennies or paper clips. Even though both pieces of aluminum foil have the same mass, the piece shaped like a boat takes up a much greater volume and displaces more fluid. Therefore, the buoyant force acting on the boat and its cargo is greater, so it floats.**

Water high surface tension: due to polarity between water molecules water experiences a strong cohesive force between molecules giving it high surface tension

Discuss how we want to utilize water’s high surface tension as well as displace as much water as possible to increase our buoyant force. Explain to the girls that they should be thinking about keeping the boat as light as possible so as much of the buoyancy force can be used up by the additional weight of the pennies.

Also explain that typically boats have a triangular base because the shape of a triangle equally distributes the buoyancy force applied to the boat making the boat more stable and able to float more easily

Lesson Plan Crumple Zone

Lesson goal: understand the different compression of materials when forces are applied in different ways, Understand Newton’s third law of motion, Understand potential and Kinetic energy

 Definition of a Crumple Zone

*noun*

1. a part of a motor vehicle, especially the extreme front and rear, designed to crumple easily in a crash and absorb the main force of an impact.

 Review compression FROM LESSON 1

 Discuss how certain materials will buckle or survive under pressure

 **Potential Energy** is stored energy. Examples of potential energy are oil sitting in a barrel, or water in a lake in the mountains. This energy is referred to as potential energy, because if it were released, it would do a lot of work.

**Kinetic Energy** is energy that is in motion. Moving water and wind are good examples of kinetic energy.

Explain that objects with more mass have more potential and kinetic energy meaning a heavier object has more energy than a lighter one… apply concept with Newton’s Third law of motion

The heavier the car/ crumple zone the more energy it will have when traveling down the ramp. Thus, the greater the weight of the car the greater the crash with the wall causing more stress on the crumple zone.

Talk about Newton’s Third Law of Motion

 for every action there is an equal and opposite reaction

Talk about why crumple zones/airbags are important on cars

Fun fact: mention Bela Barenyi engineer for Mercedes Benz was the first person to invent the crumple zone and they are now mandated on all cars

Also discuss how certain will give in different ways depending on their construction

 I.e. a popsicle stick will snap easier in one direction than the other because it is thicker one way

Egg Drop

Lesson Goals: quick overview of last crumple zone because activity will build, Discuss drag, gravity 9.8 meters per squared second, talk about landing top heavy loads and smart landing systems, discuss aerodynamics

Drag definition

 In [fluid dynamics](https://en.wikipedia.org/wiki/Fluid_dynamics), **drag** (sometimes called **air resistance**, a type of friction, or **fluid resistance**, another type of [friction](https://en.wikipedia.org/wiki/Friction) or fluid friction) refers to [forces](https://en.wikipedia.org/wiki/Force) acting opposite to the relative motion of any object moving with respect to a surrounding fluid.[[](https://en.wikipedia.org/wiki/Drag_%28physics%29#cite_note-1)

Air Flow

 noun

1.

the air flowing past or through a moving body, as an airplane or automobile.

 discuss why we want cars to and planes to have good airflow and low drag

 Friction requires them to do more work because opposing more force burning more fuel and taking more energy

Less friction/ drag on object faster it travels

 Discuss what kind of airflow and drag we want the egg drops to have to insure egg safety keeping in mind Newton’s third law and crumple zones

Explain to students that when something free falls it increases speed at 9.8 meters per squared second meaning the longer their egg protector falls the faster it’s traveling. Remind them they can create drag with their contraptions to slow the impact of the contraption with the ground

Also explain that since the students’ goal is to protect their egg they are going to want to have a consistent landing of their protector so it falls on the desired spot. Explain how wide bases make for effective landing gear because of their large areas. Additionally, talk about how unequal weight distribution can cause the protector to land on an unexpected area.

Rube Goldberg Contraption

Lesson goals: talk about friction, velocity

Discuss slopes and speed, and effective ways to control speed

Friction: *noun*

1. the resistance that one surface or object encounters when moving over another.
2. Friction always works in the opposite way that the object is moving causing the object to slow down

The more rough a surface the more friction

Ask students for examples of that in real life

 (ice skating vs trying to slide on carpet)

Explain that in this activity we will be looking to increase friction and decrease velocity of the ball so we are able to keep the ball moving off the ground for 10-15 seconds

Explain that the ball can’t move too fast (have too little friction) because it will go through the contraption too fast

The ball can’t have too much friction because it will stop moving

 What shapes/ forms are good for reducing friction?

sticky or rough surfaces ( speed bumps)

upward slopes because gravity must be opposed

Also changing the direction of the ball will slow it down because it has to direct it’s energy in another direction which takes time

Filtration Activity

Lesson Plan: Talk about effective filtration systems, as well as impact on environment of treatment methods, and why filtration systems are important

Talk about how Earth is 70% Water yet only 2.5% is fresh and 1% easily accessible which is why filtration systems are extremely important

Where are filtration systems common?

 Pools, houses drinking water, sewer systems, hot tubs

Popular methods of filtration is using desalination

What do most water filtration systems have?

Layers !!! The More layers a system has the more dirt and bacteria can be cleaned out to make the water cleaner

Think about possibilities of being able to drink out of puddle and discuss the lifestraw which allows the user to drink clean water out of a puddle