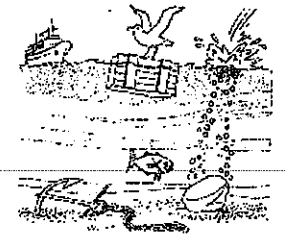
4-11
How and Why Do Things Float?

Name: Date;

Vocabulary: positive buoyancy, neutral buoyancy, negative buoyancy	**Student Notes**
Big Ideas: ▪ Objects float when they have positive buoyancy & sink when they have negative buoyancy	
Key Question: How and why do things float? Forces Acting on a floating object: - Archimedes' principle can be applied to objects floating on a liquid. - The weight of a floating object, such as a ship, is the same as the weight of the water it displaces. - A ship's total weight, including cargo, must be less than the weight of the fluid it displaces. - By including large pockets of air within ships, steel (which would not normally float), can be used in their construction. - The pockets of air in a ship alter its volume, and thus its overall density is less. - A hot-air balloon stays afloat in the cooler air surrounding it due to a buoyant force acting upward on the balloon. - If the density of the balloon (including the hot air inside it) is less than the density of the surrounding cooler air, then the buoyant force acting upward on the balloon will be greater than the downward force of gravity, and the balloon will float up. - As the air in the balloon is heated, its density decreases (due to the increasing movement of its particles). - Therefore, air floats in air! **In Summary: When the upward buoyant force is greater than the weight of the object, the object will float.**	

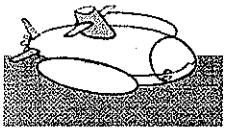
- When you place an object inside a liquid the object does not always stay on the surface like the ball or the ship.

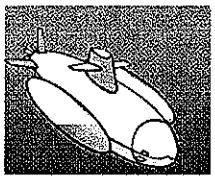


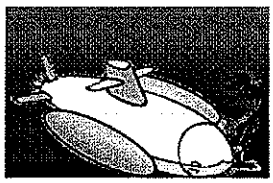
- Some objects are neither at the bottom nor at the surface but in the middle such as a submarine.

- A submarine can change its state.

It can be on the surface, on the middle, or the bottom of the sea







- The buoyancy of the submarine is determined by its density (mass/volume):

- An object that is less dense than its surrounding medium will float, or have _____ _____.
- An object that is denser than its surrounding medium will sink, or have _____ _____.
- An object that floats in the middle is said to have _____ _____.

- A submarine resting on the surface has _____ _____, which means it is less dense than the water around it and will float. At this time, the ballast tanks are mainly full of air.

- To submerge, the submarine must have _____ _____. Vents on top of the ballast tanks are opened. Seawater coming in through the flood ports

forces air out the vents, and the submarine begins to sink.

- The submarine ballast tanks now filled with seawater is denser than the surrounding water. The exact depth can be controlled by adjusting the water to air ratio in the ballast tanks. Submerged, the submarine can obtain _____ _____. That means the weight of the submarine equals the amount of water it displaces. The submarine will neither rise nor sink in this state.

- To make the submarine rise again, compressed air is simply blown into the tanks forcing the seawater out. The submarine gains _____ _____, becomes less dense than the water and rises.

Other examples of positive, neutral or negative buoyancy:

Positive buoyancy	Neutral buoyancy	Negative buoyancy
a balloon rising	a fish swimming in a lake	a rock sinking to the bottom of a lake
a person snorkelling in a wet suit at the surface of an ocean	a scuba diver maintaining a position underwater	a submarine diving to a greater depth in an ocean
two people paddling a canoe	a submarine hovering at a desired depth in an ocean	the *Titanic* taking on water after hitting an iceberg