

Quiz.

1. An egg will sink in pure water but float if enough salt is added to the water. (Circle all that apply.)
 - a) Eggs are more dense than pure water.
 - b) Eggs are less dense than salt water.
 - c) Eggs are less dense than pure water.
 - d) Eggs are more dense than salt water.

2. A sharp knife cuts better than a dull knife because
 - a) a sharp knife exerts its force over a greater area.
 - b) a sharp knife exerts less force than a dull knife.
 - c) a sharp knife exerts more pressure than a dull knife.

3. When an ice cube in a glass of water melts, does the water level in the glass rise, fall, or stay the same?
 - a) The water level falls.
 - b) The water level remains unchanged.
 - c) The water level rises.

4. The buoyant force on a life preserver filled with cement is greater than the buoyant force on an identical floating life preserver.
 - a) False; they have the same buoyant force because they are the same size.
 - b) True; the floating preserver weighs less than the concrete-filled one.
 - c) True; the concrete-filled preserver will not float and therefore displace more fluid.
 - d) False; the floating preserver is less dense and being pushed up more than the concrete-filled one.

5. According to Pascal's principle, how does a hydraulic jack lift a car?
 - a) The side of the jack with the smaller area multiplies the force with which you can lift.
 - b) The side of the jack with the greater area multiplies the force with which you can lift.
 - c) The fluid compresses to impart more pressure on the car.

6. A rock that is sinking into the ocean (Circle all that apply.)
 - a) will experience increasing liquid pressure.
 - b) will experience a constant liquid pressure.
 - c) will not experience an increase in buoyant force.
 - d) will experience an increase in buoyant force.

7. If the gravitational field of Earth were to increase, would a fish float to the surface, sink, or stay at the same depth?
 - a) The fish would sink.
 - b) The fish would float to the surface.
 - c) The fish would remain at the same depth.

8. Rose floats on a wooden door in the middle of the ocean. Jack holds onto the door while floating in the water. If Jack joined Rose on the door
- a) the door would sink some.
 - b) the door would remain level since he was already floating and holding onto the door. #theybothcouldhavefit!!
 - c) the door would rise some.
9. A rock does not change its density when falling to the bottom of a pool, but your density changes when you swim to the bottom. Why?
- a) The buoyant force is greater on you.
 - b) You are compressible, whereas the rock is not.
 - c) You weigh more than the rock.
 - d) You can move your arms and legs.

Answer Key.

1. a) & b)

Archimedes's principle tells us that an immersed body is buoyed up by a force equal to the weight of the fluid it displaces, and the weight of the fluid is dependent on its density. A floating object will displace a weight of fluid equal to its own weight. Less dense objects float.

2. c)

When both knives are exerting the same amount of force the sharp knife applies its force over a smaller area, resulting in greater pressure.

3. b)

Whether the ice cube is solid or melted it displaces the same amount of water, neglecting temperature effects. (Try this at home!)

4. c)

The buoyant force only depends on the density of the liquid, the volume of the liquid displaced, and gravity. Although the two life preservers are identical in size, the concrete-filled one will displace more liquid than the floating one.

5. b)

Since hydraulic fluid is a liquid, it is incompressible. The pressure at every point in the container is the same, so a greater area will result in a greater force. $\text{Area} \times \text{Pressure} = \text{Area} \times \text{Force}/\text{Area} = \text{Force}$.

6. a) & c)

Liquid pressure increases with depth, and the buoyant force is a consequence of this phenomenon. However, the sinking rock displaces the same weight of water at any depth.

7. c)

Gravity pulls on the water as much as it pulls on the fish, so their weights would change by the same factor, therefore the ratio of their densities would remain unchanged.

8. a)

Although the door was floating with Rose on top and while Jack was holding onto it, buoyancy was helping Jack float while he was partially immersed. If he had pulled himself on top of the door he would exert the extra force that buoyancy had been

counteracting, and the door would have sunk a certain amount. They may have both fit, but the door would not remain level.

9. b)

Although the buoyant force may be greater than you, and though you may weigh more than the rock, you are compressible, particularly your lungs, but the rock is solid. (By the way, the rock might be larger and heavier than you, but the answer remains the same.)