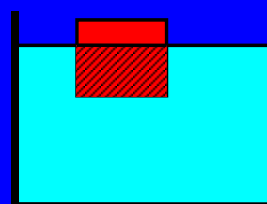


### ConcepTest 13.12a Archimedes I



An object floats in water with  $\frac{3}{4}$  of its volume submerged. What is the ratio of the density of the object to that of water?

- A)  $\frac{1}{4}$
- B)  $\frac{1}{3}$
- C)  $\frac{4}{3}$
- D)  $\frac{3}{4}$
- AB)  $\frac{2}{1}$



### ConcepTest 13.12a Archimedes I

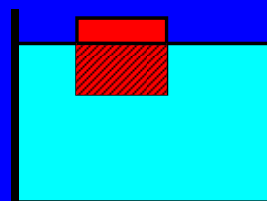
An object floats in water with  $\frac{3}{4}$  of its volume submerged. What is the ratio of the density of the object to that of water?

- 1)  $\frac{1}{4}$
- 2)  $\frac{1}{3}$
- 3)  $\frac{4}{3}$
- D)  $\frac{3}{4}$
- 5)  $\frac{2}{1}$

Remember that we have:

$$\frac{V_{\text{fluid}}}{V_{\text{object}}} = \frac{\rho_{\text{object}}}{\rho_{\text{fluid}}}$$

so if the ratio of the volume of the displaced water to the volume of the object is  $\frac{3}{4}$ , the object has  $\frac{3}{4}$  the density of water.

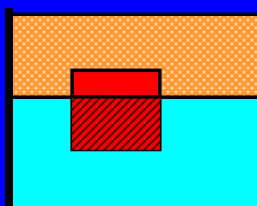
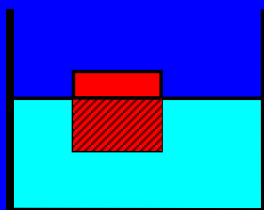


### ConcepTest 13.12d Archimedes IV



An object floats in **water** with  $\frac{3}{4}$  of its volume submerged. When **oil** is poured on top of the water, the object will:

- A) move up slightly
- B) stay at the same place
- C) move down slightly
- D) sink to the bottom
- AB) float to the top

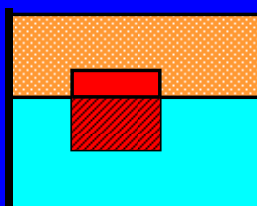
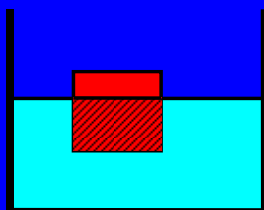


Assumption: the density of oil is  $\frac{1}{2}$  of the density of water.

### ConcepTest 13.12d Archimedes IV

An object floats in **water** with  $\frac{3}{4}$  of its volume submerged. When **oil** is poured on top of the water, the object will:

- A) move up slightly
- 2) stay at the same place
- 3) move down slightly
- 4) sink to the bottom
- 5) float to the top

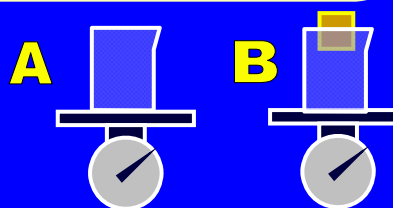


With the oil on top of the water, there is an additional buoyant force on the object equal to the weight of the displaced oil. The effect of this extra force is to **move the object upward** slightly, although it is not enough to make the object float up to the top.

### ConcepTest 13.14a Wood in Water I



Two beakers are filled to the brim with water. A wooden block is placed in the beaker 2 so it floats. (Some of the water will overflow the beaker). Both beakers are then weighed. Which scale reads a **larger weight**?

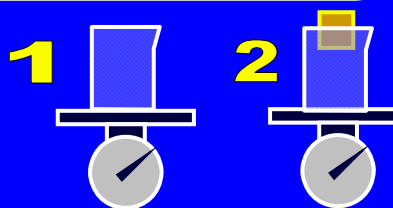


**C** same for both

### ConcepTest 13.14a Wood in Water I

Two beakers are filled to the brim with water. A wooden block is placed in the beaker 2 so it floats. (Some of the water will overflow the beaker). Both beakers are then weighed. Which scale reads a **larger weight**?

The block in 2 displaces an amount of water equal to its weight, because it is floating. That means that the weight of the overflowed water is equal to the weight of the block, and so the beaker in 2 has the same weight as that in 1.



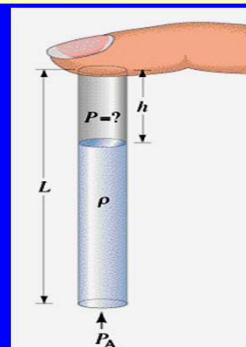
**C** same for both

### ConcepTest 13.7b The Straw II



You put a straw into a glass of water, place your finger over the top so no air can get in or out, and then lift the straw from the liquid. You find that the straw retains some liquid. How does the air pressure  $P$  in the upper part compare to atmospheric pressure  $P_A$ ?

- A) greater than  $P_A$
- B) equal to  $P_A$
- C) less than  $P_A$



### ConcepTest 13.7b The Straw II

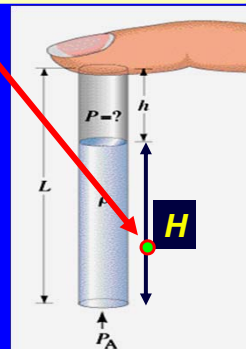
You put a straw into a glass of water, place your finger over the top so no air can get in or out, and then lift the straw from the liquid. You find that the straw retains some liquid. How does the air pressure  $P$  in the upper part compare to atmospheric pressure  $P_A$ ?

- 1) greater than  $P_A$
- 2) equal to  $P_A$
- 3) less than  $P_A$

Consider the forces acting at the bottom of the straw:  $P_A - P - \rho g H = 0$

This point is in equilibrium, so net force is zero.

Thus,  $P = P_A - \rho g H$  and so we see that the pressure  $P$  inside the straw must be less than the outside pressure  $P_A$ .

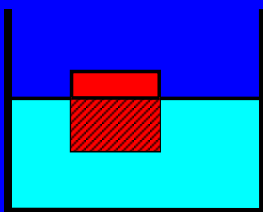


### ConcepTest 13.12c Archimedes III



An object floats in water with  $\frac{3}{4}$  of its volume submerged. When more water is poured on top of the water, the object will:

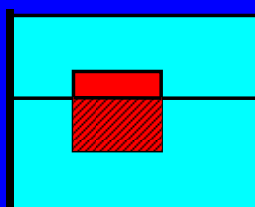
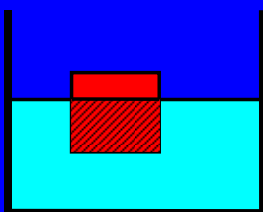
- A) move up slightly
- B) stay at the same place
- C) move down slightly
- D) sink to the bottom
- E) float to the top




### ConcepTest 13.12c Archimedes III

An object floats in water with  $\frac{3}{4}$  of its volume submerged. When more water is poured on top of the water, the object will:


- 1) move up slightly
- 2) stay at the same place
- 3) move down slightly
- 4) sink to the bottom
- E) float to the top

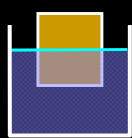



We already know that density of the object is  $\frac{3}{4}$  of the density of water, so it floats in water (i.e., the buoyant force is greater than its weight). When covered by more water, it must therefore float to the top.

**ConcepTest 13.14b Wood in Water II** 

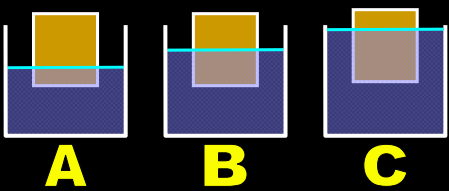
A block of wood floats in a container of water as shown on the right. On the Moon, how would the same block of wood float in the container of water?

 **Earth**




 **Moon**

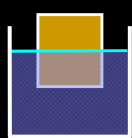
**A** **B** **C**




**ConcepTest 13.14b Wood in Water II**

A block of wood floats in a container of water as shown on the right. On the Moon, how would the same block of wood float in the container of water?

 **Earth**



 **Moon**

**1** **B** **3**

**A floating object displaces a weight of water equal to the object's weight. On the Moon, the wooden block has less weight, but the water itself also has less weight.**