Answer on Question 59299, Physics, Solid State Physics

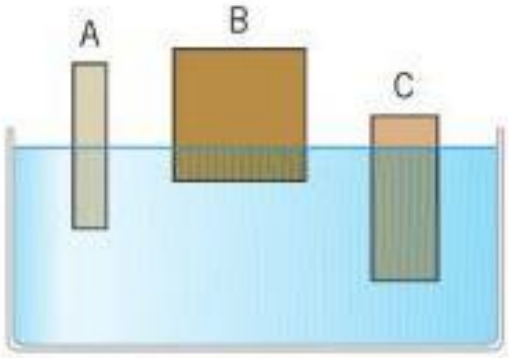
Question:

Three solid objects are floating in a liquid, as in the drawing. They have different weights and volumes, but have the same thickness (the dimension perpendicular to the page).

a) Rank the objects according to their density, largest first

b) Which principle of physics regarding fluid pressure explains your answer? Explain.

Answer:



a) As we know, the density of an object determines whether it will float or sink in a liquid. For instance, the object will float if it is less dense than the liquid it is placed in. And if the object is more dense than the liquid, it will sink. Therefore, from the picture above we can see that the object C has the largest density (the most part of the object submerged in the liquid, so it has the largest density), then we must place the object A and, finally, - the object B (only little part of the object submerged in the liquid). So, the correct answer will be C, A, B.

b) The answer on the part (a) of the question can be explained using the Archimede's principle. It states, that the buoyant force that acts on the object wholly or partially submerged in the liquid is equal to the weight of the liquid displaced by that object:

$$F_B = \rho_f V_f g,$$

here, F_B is the buoyant force, ρ_f is the density of displaced fluid, V_f is the volume of displaced fluid and g is the acceleration due to gravity.

Also, when the object submerged in the liquid, the downward force of gravity acts on it. The buoyant force is directed upward. So, to float the weight of the object (W) must be equal to the buoyant force (it follows from the Archimede's principle):

$$W = F_B$$

And if the weight of the object is greater than the buoyant force it will sink. If the density will be greater, then the weight of the object also will be greater and the most part of that object will be submerged in the liquid (case C). If the density of the object will be the smallest (case B), than the buoyant force will be greater compare to the weight of the object and only the little part of it will be submerged in the liquid.