

AP Physics 2 – Density and Fluids

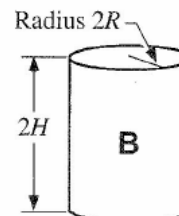
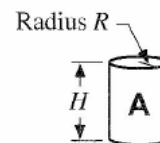
C1-QRT04: CYLINDERS WITH THE SAME MASS I—VOLUME, AREA, AND DENSITY

Two solid cylinders are shown. Cylinder A has a height H and a radius R , and cylinder B has a height $2H$ and a radius $2R$. Both cylinders have uniform densities and the same mass. Cylinder A has a density ρ_A and volume V_A .

If r is the radius of a cylinder and h is the height, then the volume of the cylinder is $V = \pi r^2 h$, and the surface area is $SA = 2\pi r^2 + 2\pi r h$.

(a) What is the volume of cylinder B in terms of the volume of cylinder A? (Your answer should look like $V_B = n V_A$, where n is some number.)

Explain your reasoning.



(b) What is the surface area of cylinder B in terms of the surface area of cylinder A? (Your answer should look like $SA_B = n SA_A$, where n is some number.)

Explain your reasoning.

(c) What is the density of cylinder B in terms of the density of cylinder A? (Your answer should look like $\rho_B = n \rho_A$, where n is some number.)

Explain your reasoning.

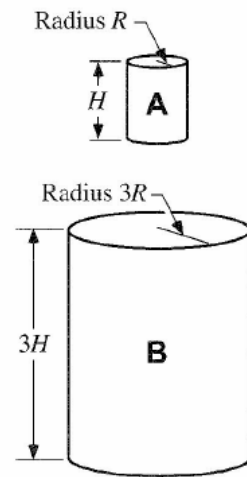
C1-QRT05: CYLINDERS WITH THE SAME MASS II—VOLUME, AREA, AND DENSITY

Two solid cylinders are shown. Cylinder A has a height H and a radius R and cylinder B has a height $3H$ and a radius $3R$. Both cylinders have uniform densities and the same mass. Cylinder A has a density ρ_A and volume V_A .

If r is the radius of a cylinder and h is the height, then the volume of the cylinder is $V = \pi r^2 h$, and the surface area is $SA = 2\pi r^2 + 2\pi r h$.

(a) What is the volume of cylinder B in terms of the volume of cylinder A? (Your answer should look like $V_B = n V_A$, where n is some number.)

Explain your reasoning.



(b) What is the surface area of cylinder B in terms of the surface area of cylinder A? (Your answer should look like $SA_B = n SA_A$, where n is some number.)

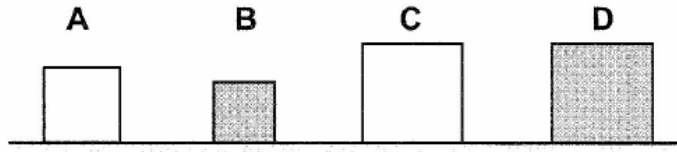
Explain your reasoning.

(c) What is the density of cylinder B in terms of the density of cylinder A? (Your answer should look like $\rho_B = n \rho_A$, where n is some number.)

Explain your reasoning.

C1-QRT09: FOUR CUBES—MASS

Of the four cubes shown below, white cubes A and C are made of the same material, and gray cubes B and D are made of the same material. Each cube has a uniform density. The ranking of cube size is $C = D > A > B$. Cubes A and B have the same mass.

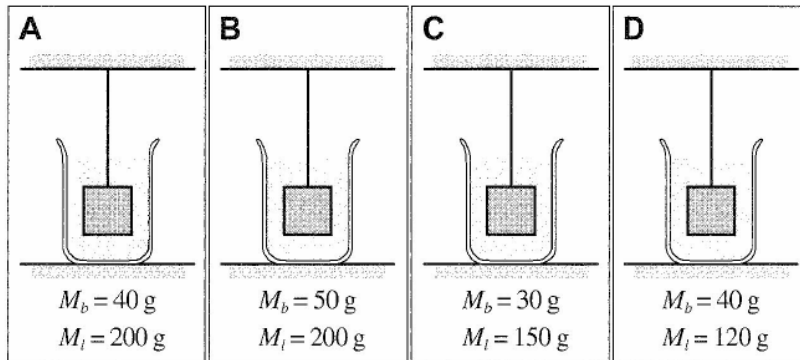


Is the mass of cube C (i) *greater than*, (ii) *less than*, or (iii) *equal to* the mass of cube D?

Explain your reasoning.

C2-RT01: BLOCKS SUSPENDED IN LIQUIDS—BUOYANT FORCE

In each case, a block hanging from a string is suspended in a liquid. All of the blocks are the same size, but they have different masses (labeled M_b) because they are made of different materials. All of the containers have the same volume of liquid, but the masses of these liquids vary (labeled M_l) since the liquids are different. The volume of the blocks is one-sixth the volume of the liquids.



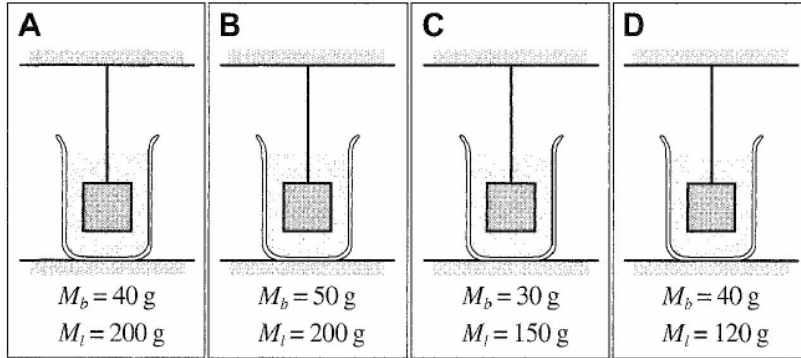
Rank the buoyant forces on the blocks.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

C2-RT02: BLOCKS SUSPENDED IN LIQUIDS—VOLUME OF LIQUID DISPLACED

In each case, a block hanging from a string is suspended in a liquid. All of the blocks are the same size, but they have different masses (labeled M_b) because they are made of different materials. All of the containers have the same volume of liquid, but the masses of these liquids vary (labeled M_l) since the liquids are different. The volume of the blocks is one-sixth the volume of the liquids.



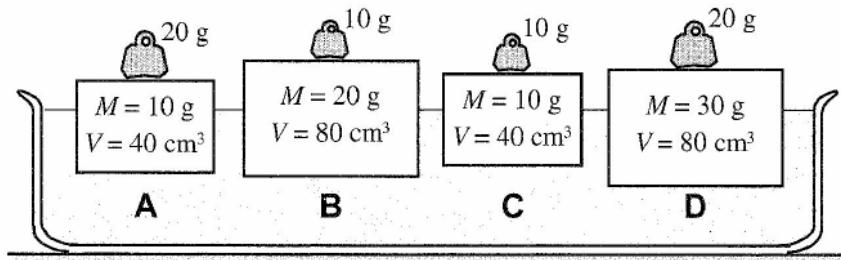
Rank the volume of the liquid displaced by the blocks.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

C2-RT04: FLOATING BLOCKS WITH DIFFERENT LOADS—BUOYANT FORCE

Wood blocks that have different masses and different volumes are floating in water. On top of these blocks are additional masses as shown.



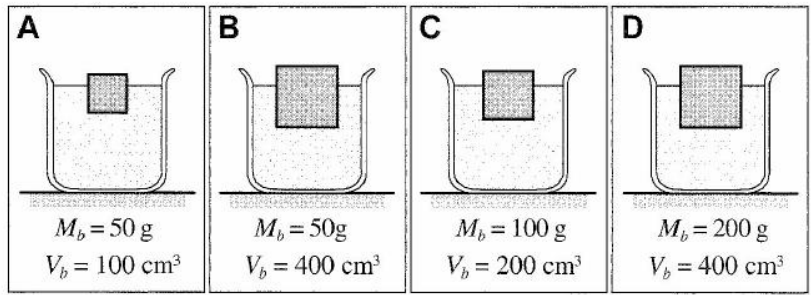
Rank the buoyant force exerted by the water on the wood blocks.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.

C2-RT06: BLOCKS FLOATING IN LIQUIDS—BUOYANT FORCE

In each case, a block floats in a liquid. The blocks are made of different materials and vary in mass and volume as shown. All of the containers have the same volume of an identical liquid.



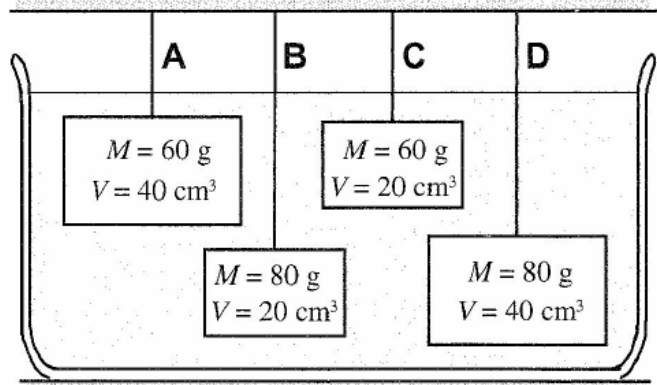
Rank the buoyant force exerted by the liquid on the blocks.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All the same	All zero	Cannot determine
Greatest			Least				

Explain your reasoning.

C2-RT08: FOUR METAL CUBES SUSPENDED IN LIQUIDS—TENSION

Four blocks are suspended from strings in water. Cubes A and C are at the same depth, as are B and D.



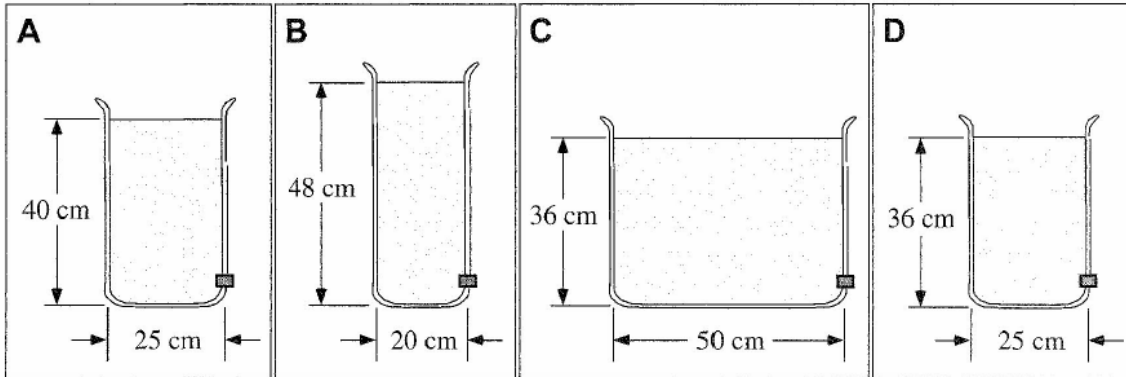
Rank the tensions in the strings.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All the same	All zero	Cannot determine
Greatest			Least				

Explain your reasoning.

C2-RT15: BEAKERS OF WATER—PRESSURE ON THE CORK

In each case a beaker is filled with water to the height shown. The diameters of the beakers are also shown. The cylinders have identical holes in their side at the same height above the base. There are corks in all of the holes.



Rank the pressure exerted on the cork by the water.

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	OR	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4		All	All	Cannot
Greatest			Least		the same	zero	determine

Explain your reasoning.