AP Physics 2 Summer Assignment

Name: ___________________________

Checklist:

___ Do 5 assigned problems from WileyPlus/eBook. Use Interactive Solutions, Concept Simulations, Student Study Guide, etc. to help if necessary.

___ Do the attached summer packet.

___ Wash dishes and observe the color of water bubbles.

___ Feel the buoyant force inside a pool.

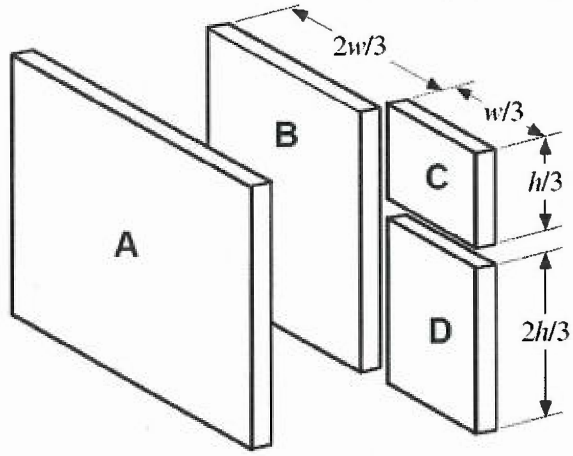
- The due date of your summer work is **Friday August 30, 2019**.

Please send the finished assignment to the main office in person or in mail. If you have any questions, please contact Dr. Shen at yshen@briarcliffschools.org **before** the due date. Thanks.

Enjoy the summer and look forward to having you in September!

Dr. Yiqing Shen

1. A block of material (labeled A in the diagram) with a width w, height h, and thickness t has a mass of M_o distributed uniformly throughout its volume. The block is then cut into three pieces, B, C, and D, as shown.

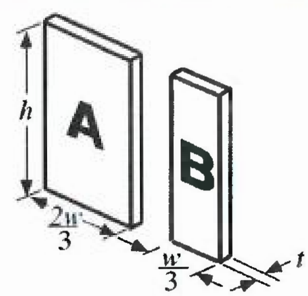


Rank the density of the original block A, piece B, piece C, and piece D.

				OR	☐	☐	☐
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

2. A block of material with a width w, height h, and thickness t has a mass of M_o distributed uniformly throughout its volume. The block is then broken into two pieces, A and B, as shown. Three students make the following statements:



Ajay: *"They both have the same density. It's still the same material."*

Ben: *"The density is the mass divided by the volume, and the volume of B is smaller. Since the mass is uniform and the volume is in the denominator, the density is larger for B."*

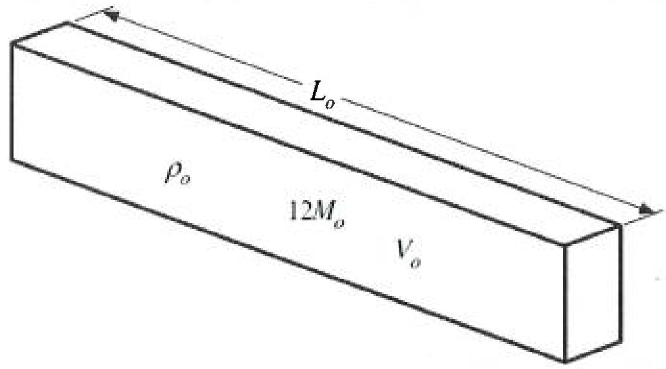
Chithra: *"The density of piece A is larger than the density of piece B since A is larger; thus it has more mass."*

With which, if any, of these students do you agree?

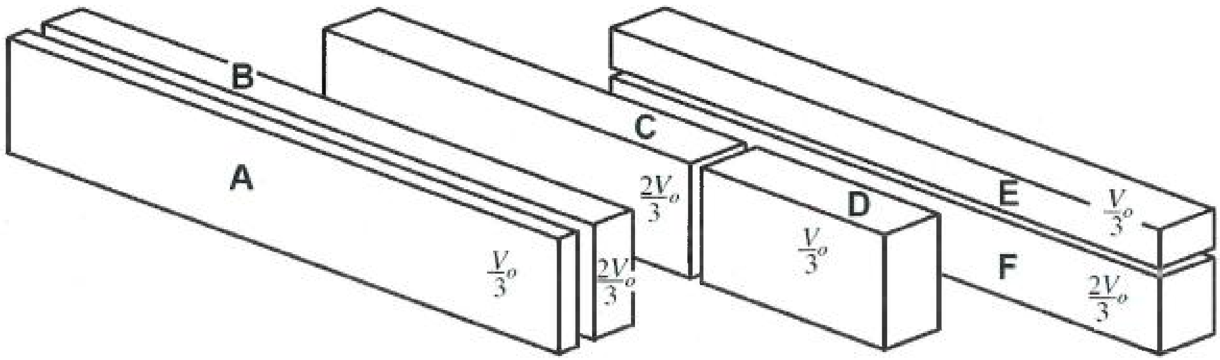
Ajay _____ Ben _____ Chithra _____ None of them_____

Explain your reasoning.

3. The plastic block shown below has a volume V_o and a mass $12M_o$ distributed evenly to give a uniform density ρ_o.



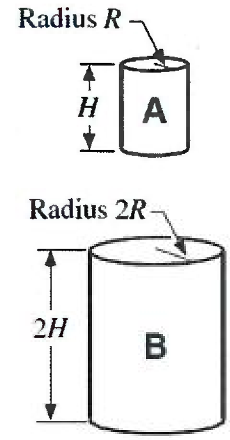
Three possible ways to slice the plastic block into unequal pieces are shown below. In each case, the larger piece has a volume $2V_o/3$ and the smaller piece has a volume $V_o/3$.



Fill in the table for the mass (in terms of M_o) and density (in terms of ρ_o) of the pieces of the block labeled A– F.

	Mass	Density
Original block		
Piece A		
Piece B		
Piece C		
Piece D		
Piece E		
Piece F		

4. 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 $SA = 2\pi r^2 + 2\pi rh$.

(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.

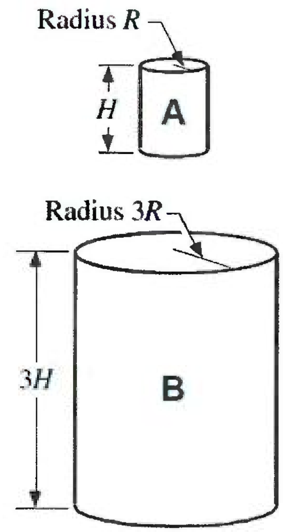
(b) What is the surface area of cylinder B in terms of the surface area of cylinder A? (Your answer should look like $SA_B = n\ SA_A$, where n is some number.)

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.

5. 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.

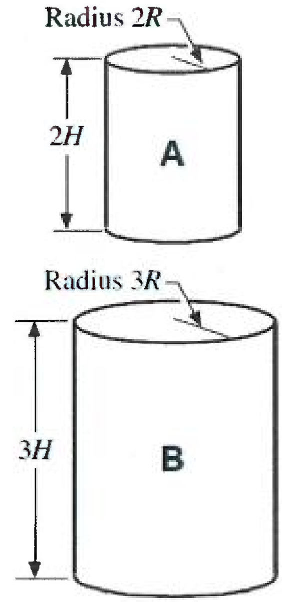
(b) What is the surface area of cylinder B in terms of the surface area of cylinder A? (Your answer should look like $SA_B = n\ SA_A$, where n is some number.)

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.

6. Two solid cylinders are shown. Cylinder A has a height $2H$ and a radius $2R$ 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 $SA = 2\pi r^2 + 2\pi rh$.

(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.

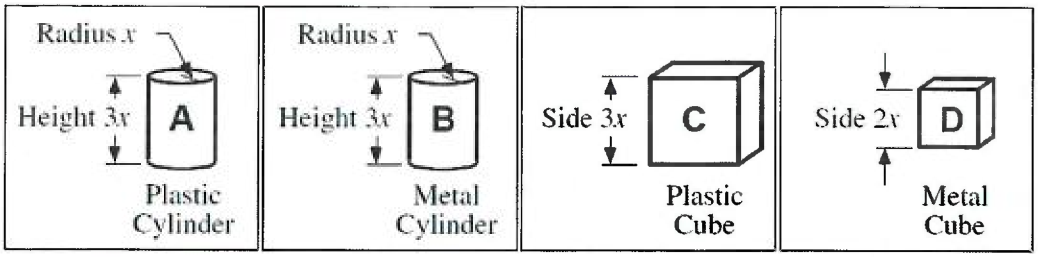
(b) What is the surface area of cylinder B in terms of the surface area of cylinder A? (Your answer should look like $SA_B = n\ SA_A$, where n is some number.)

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.

7. A cylinder and a cube are carved out of a piece of plastic with uniform density, and a second cylinder and cube are carved out of a piece of metal with uniform density. Dimensions are given for the cylinders and cubes. The mass of the cylinder in Case B is twice the mass of the cylinder in Case A.

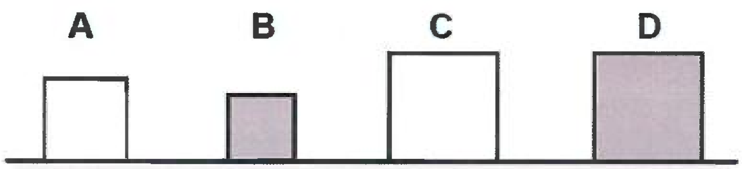


Rank the densities of the objects.

____	____	____	____	OR	☐	☐	☐
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

8. 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?

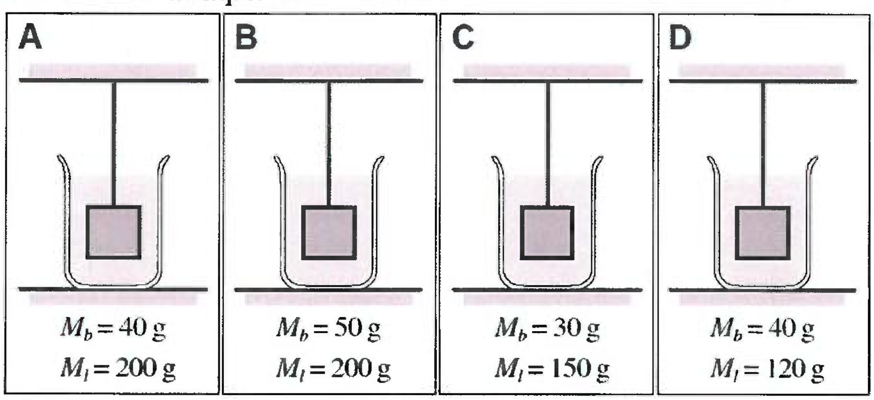
Explain your reasoning.

9 A liquid in a tall, narrow cylindrical beaker is poured into a wider cylindrical beaker. The liquid only fills the wider beaker to one-fourth its height in the tall beaker. A student makes the following statement:

"When the liquid was poured from the narrow beaker into the wider one, the volume changed. Since no liquid was spilled, all of the liquid is still in the wider beaker, so the density of the liquid must have changed."

What, if anything, is wrong with this statement? If something is wrong, explain the error and how to correct it. If the statement is valid, explain why.

10. 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.

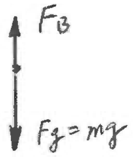


Rank the volume of the liquid displaced by the blocks.

☐	☐	☐	☐	OR	☐	☐	☐
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

Buoyant force is a force acting on an object if the object is either partially or totally submerged in a liquid. The force is always vertically upward. For example, if you jump into a pool, your downward acceleration is reduced. It is because the water acting on you with the buoyant force. With the help of the Free-Body-Diagram, the net force acting on you is less than the weight. Therefore, the downward acceleration is less.

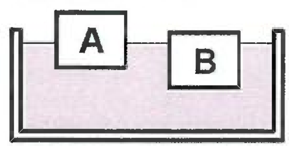


$$\Sigma F = F_g - F_B = ma \quad \Rightarrow \quad a < g$$

More you are submerged into the water, more buoyant force you get.

For the following problems, you are not expected to explain your answers with equations. **You are expected to explain your reasoning with the help of FBD.**

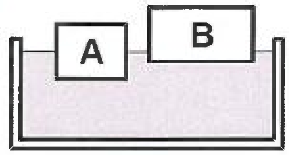
11. Two equal-sized cubes are floating in water at different levels.



Is the buoyant force exerted by the water on block A (i) *greater than*, (ii) *less than*, or (iii) *equal to* the buoyant force on block B? ____

Explain your reasoning with FBD.

12. Two blocks with the same weight but different dimensions are floating in water at different levels. Block A is as tall as block B but is smaller in both other dimensions.

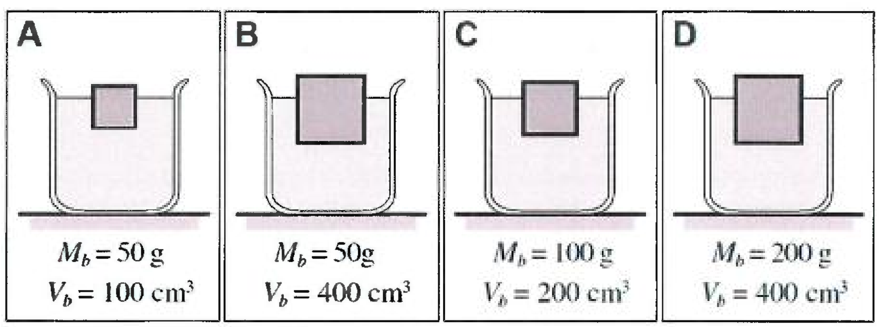


Is the buoyant force exerted by the water on block A (i) *greater than*, (ii) *less than*, or (iii) *equal to* the buoyant force on block B? _____

Explain your reasoning.

Show FBD first:

13. 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.



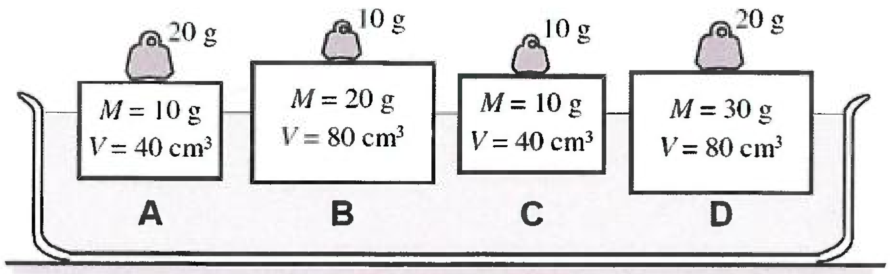
Rank the buoyant force exerted by the liquid on the blocks.

☐	☐	☐	☐	OR	☐	☐	☐
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

Show FBD:

14. 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.

				OR	☐	☐	☐
1 Greatest	2	3	4 Least		All the same	All zero	Cannot determine

Explain your reasoning.

Show FBD: