

PHYSICS 1

Test #3

20 November 1997

Student's name _____ S.N. _____

Givens:

fluid pressure = density $\times g \times$ depth

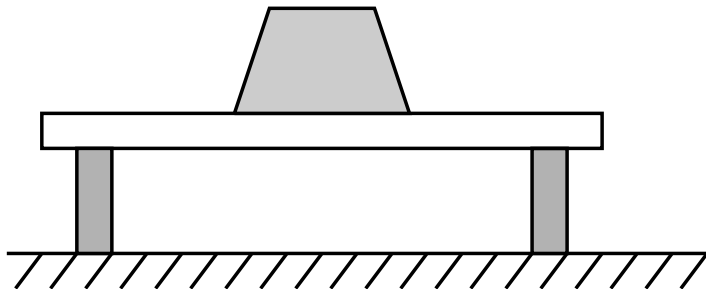
$$f/a = F/A$$

$$fD = Fd$$

Unless noted otherwise, assume friction and air resistance are zero.

A. Short answer. Fill-in the blank. 2 points each.

1. A weight is sitting on a beam. The top of the beam is in _____



2. A loaf of bread, crushed by groceries stacked on top of it, will have (larger/smaller) _____ density than a normal loaf.
3. 10 meters under water, the pressure due the water alone is almost 15 pounds per square inch. What is the water pressure 20 meters under water? _____
4. Paschal's principle says that changing the pressure at any point in an enclosed fluid will change the _____ at every point in the fluid.
5. Unlike water, where increasing depth leads only to increasing pressure, increasing depth in the atmosphere leads to an increase in both pressure and _____.

B. True or false (correct if false). 2 points each.

- _____ 1) Density is a property that tell how much mass of the material is present in a given volume.
- _____ 2) If you increase the linear size of any object by 10, its area increases by a factor of 1000.
- _____ 3) As a building material, stone is stronger under tension than under compression.
- _____ 4) There is a buoyant force on any object submerged in a liquid because the pressure always points towards the surface.
- _____ 5) In order to sink under water, it is useful to empty your lungs of air.
- _____ 6) A dam forms one wall of a shallow (5 meter deep), and it is holding back 40,000,000,000 gallons of water. A 5 meter tall water tank is filled, and it contains 25,000 gallons of water. The pressure on the bottom of the dam is much larger than the pressure on the bottom of the water tank wall.
- _____ 7) On an alien planet with half of earth's atmospheric pressure, a water pump can only pump water up about 16.5 feet.
- _____ 8) The buoyant force, due to the atmosphere, on a small helium balloon is much smaller than the buoyant force on an elephant.
- _____ 9) You can't suck soda out of a can, using a straw, if the can is in a vacuum.
- _____ 10) Water flows more slowly in narrow, constricted sections of a river.

C. Multiple choice. Check the box of the correct answer. 2 points each.

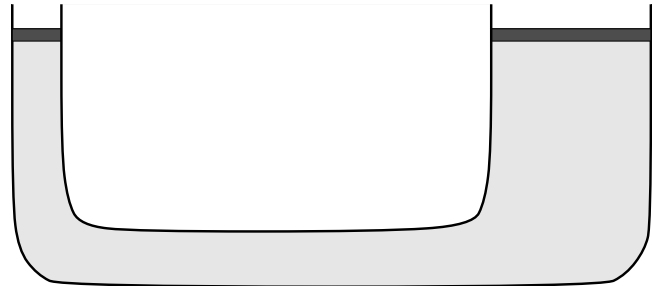
1. If the mass of an object were reduced to half while its volume remains the same, its density would
 - a) double.
 - b) halve.
 - c) remain the same.
2. A strong spring is stretched 20 cm by a suspended weight. If the weight is halved, the spring will stretch
 - a) less than 10 cm.
 - b) 10 cm.
 - c) 20 cm.
 - d) 40 cm.
 - e) more than 40 cm.
3. Consider the fictional case of the incredible shrinking woman. If her height shrinks to $1/10$ normal, then her total skin area shrinks to
 - a) $1/10$.
 - b) $1/100$.
 - c) $1/1000$.
 - d) $1/10000$.
 - e) none of these.
4. Penn has a mass of 100 kg, while his friend Teller has a mass of only 50 kg. They are wearing identical (except for size) suits. Penn's suit requires
 - a) more than twice as much material.
 - b) the same amount of material.
 - c) more material, but less than twice as much material.
5. A candymaker is making taffy apples. If she buys 100 kg of large apples rather than 100 kg of small apples, she will need
 - a) more taffy.
 - b) less taffy.
 - c) the same amount of taffy.
6. The pressure in a liquid depends on liquid
 - a) density.
 - b) depth.
 - c) both of these.
 - d) neither of these.

7. Ice cubes submerged at the bottom of a liquid mixture indicate that the mixture

- a) fails to produce a buoyant force on the ice.
- b) has dissolved air in a liquid state.
- c) is composed of open-structured crystals.
- d) is not displaced by the submerged ice.
- e) is less dense than ice.

8. A hydraulic arrangement consists of a water filled U-tube that is wider at one end than the other. Pistons are fitted at both ends. In order that the output force be larger than the input force, the input end should be the one having the

- a) larger diameter piston.
- b) smaller diameter piston.
- c) relative piston size doesn't matter.



9. Water pressure is the smallest against the

- a) top of a submerged object.
- b) bottom of a submerged object.
- c) sides of a submerged object.
- d) is the same against all surfaces.
- e) none of these.

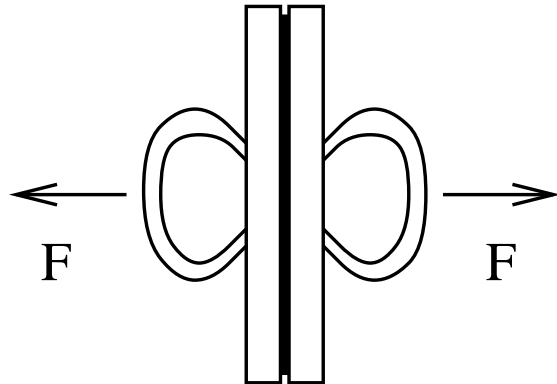
10. A hydraulic jack multiplies force by 50. This multiplication is done at the expense of

- a) energy, which decreases by a factor of 50.
- b) the distance through which the force acts.
- c) the time through which the force acts, which is extended by a factor of 50.
- d) the mechanism providing the force.
- e) none of these.

11. A suction cup sticks to a wall. It is

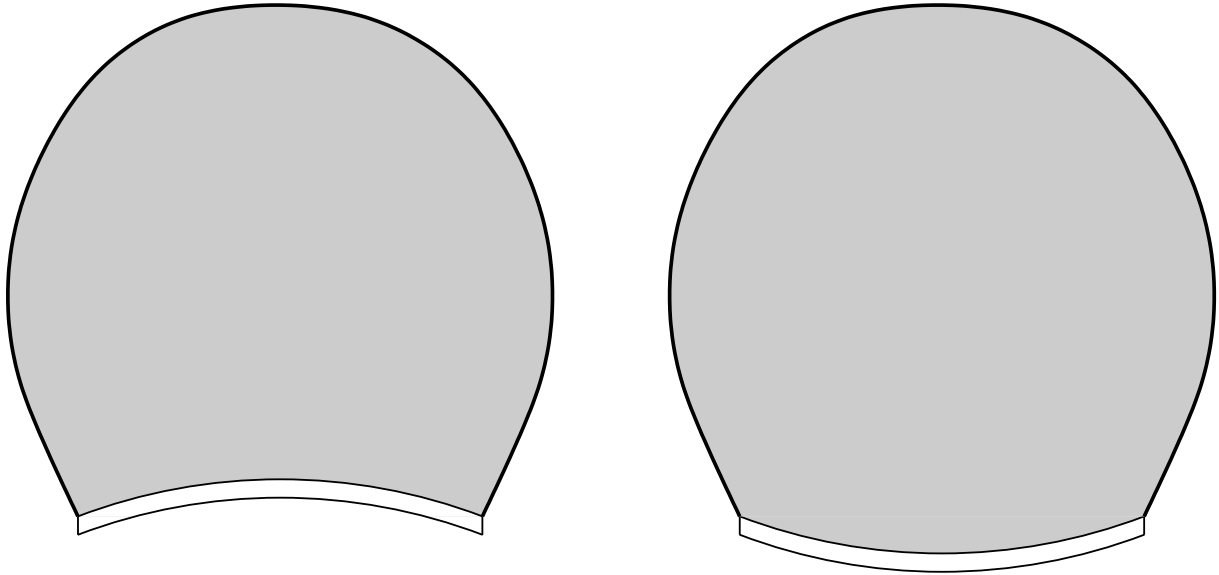
- a) pulled to the wall by the vacuum.
- b) pushed to the wall by the atmosphere.
- c) both of these.
- d) neither of these.

12. Compared to the buoyant force of the atmosphere on a 1-liter balloon, the buoyant force of the atmosphere on a 1-liter solid iron block is
- a) considerably more.
 - b) considerably less.
 - c) the same.
13. The Bernoulli effect causes passing ships to be drawn together when the ships are close and moving in
- a) the same direction.
 - b) opposite directions.
 - c) either the same or opposite directions.
14. When water is turned on in a shower, the shower curtain moves towards the water. This has to do with
- a) capillary action.
 - b) surface tension.
 - c) heat capacity.
 - d) pressure of a moving fluid.
 - e) none of these.
15. In lecture, we saw the effect of air pressure holding together two metal plates with a small evacuated region in between them. It would be harder to pull the plates apart when they are
- a) held upside down.
 - b) at sea level.
 - c) 20 km beneath the ocean surface.
 - d) 20 km above the ocean surface.
 - e) none of these.

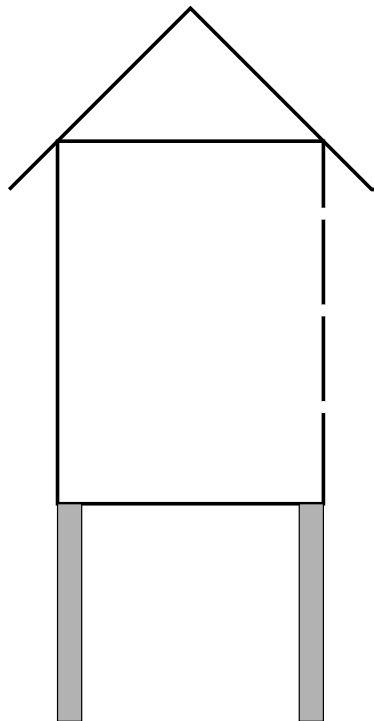


D. Complete the pictures as requested. 10 points each.

1. On the 2 dams, indicate whether the outer face if the dam is under tension or under compression. If the dams are made of stone, which design is better?



2. The tank is filled with water, but has 3 holes in it. Sketch the flow of water from each hole.



E. You'd think that a large, fast truck is pushing air out of the way, and the air would tend to push things away from the truck. When I'm out cycling, and a large, fast truck passes too close, I am pulled **towards** the truck! How would you explain this situation in terms of some physics concept we've recently discussed in lecture? 20 points.