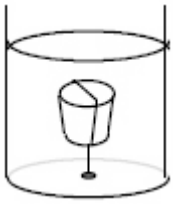
Name: _____

Part I Multiple Choice

AP Physics Multiple Choice Practice – Fluid Mechanics

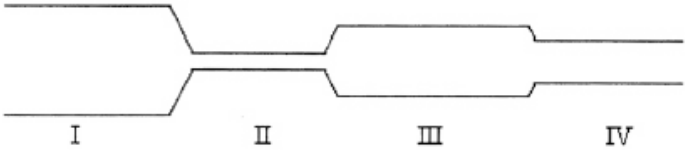
1. A cork has weight *mg* and density 25% of water's density. A string is tied around the cork and attached to the bottom of a water-filled container. The cork is totally immersed. Express the tension in the string in terms of the cork weight *mg*.



   A) 0
   B) mg
   C) 2mg
   D) 3mg

2. An ideal fluid flows through a long horizontal circular pipe. In one region of the pipe, it has radius R. The pipe then widens to radius 2R. What is the ratio of the fluid's speed in the region of radius R to the speed of the fluid in region with radius 2R?
   A) 4 B) 2 C) ½ D) ¼

3. A fluid is forced through a pipe of changing cross section as shown. In which section would the pressure of the fluid be a minimum?



   A) I B) II C) III D) IV

4. Three objects all float on top of water. They have the following relationships:
   - A and B have the same mass and same density but different shapes
   - B and C have the same volume and same shape
   - mass & density of C < mass & density of B

   Three identical weights are tied to each object, and each is pulled completely beneath the water. Which object will displace the greatest amount of water?
   A) A
   B) B
   C) C
   D) All displace the same amount of water.

5. As a rock sinks deeper and deeper into water of constant density, what happens to the buoyant force on it?
   A) It increases.
   B) It remains constant.
   C) It decreases.
   D) It may increase or decrease, depending on the shape of the rock.

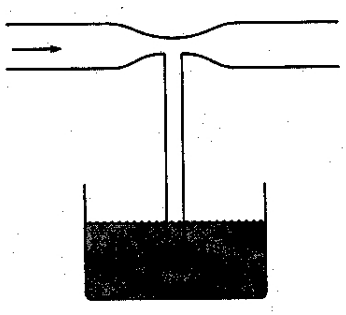
6. A piece of wood with a volume of 50 cm^3 is floating on water, and a piece of iron with a volume of 50 cm^3 is totally submerged. Which has the greater buoyant force on it?
   A) The wood.
   B) The iron.
   C) Both have the same buoyant force.
   D) Cannot be determined without knowing their densities.

7. Salt water is more dense than fresh water. A ship floats in both fresh water and salt water. Compared to the fresh water, the amount of water displaced by the ship when it i in the salt water is
   A) more.
   B) less.
   C) the same.
   D) Cannot be determined from the information given.

8. Water flows through a horizontal pipe. The diameter of the pipe at point B is larger than at point A. Where is the water pressure greater?
   A) Point A
   B) Point B
   C) Same at both A and B
   D) Cannot be determined from the information given.

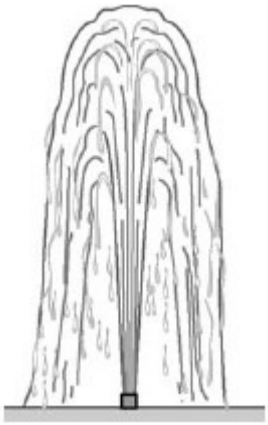
9. Liquid flows through a 4 cm diameter pipe at 1.0 m/s. There is a 2 cm diameter constriction in the line. What is the velocity in this constriction?
   A) 0.25 m/s B) 0.50 m/s C) 2 m/s D) 4 m/s

10. **Multiple Correct:** A T-shaped tube with a constriction is inserted in a vessel containing a liquid, as shown. What happens if air is blown through the tube from the left, as shown by the arrow in the diagram? **Select two answers**.



   (A) The liquid level in the tube rises to a level above the surface of the liquid in the surrounding tube
   (B) The liquid level in the tube falls below the level of the surrounding liquid
   (C) The pressure in the liquid in the constricted section increases.
   (D) The pressure in the liquid in the constricted section decreases.

Part II- Free Response



A fountain with an opening of radius 0.015 m shoots a stream of water vertically from ground level at 6.0 m/s. The density of water is 1000 kg/m^3.

(a) Calculate the volume rate of flow of water.

(b) The fountain is fed by a pipe that at one point has a radius of 0.025 m and is 2.5 m below the fountain's opening. Calculate the absolute pressure in the pipe at this point.

(c) The fountain owner wants to launch the water 4.0 m into the air with the same volume flow rate. A nozzle can be attached to change the size of the opening. Calculate the radius needed on this new nozzle.