Name: _____

Class: _____

Due Date: _____

Physics Topic 21 – Fluids

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: Define *fluid.*

2. C: State the equation for *density* ρ, define each variable, and give the units for each variable. Is density a scalar or a vector?

3. E: Determine the volume of 1.00 kg of gold. The density of gold is approximately $19{,}300\ \frac{\text{kg}}{\text{m}^3}$.

4. C: What is the density of pure water? Include units!

5. C: What is the average density of salt water? Include units!

6. C: What is the average density of a human body? Include units!

7. C: Will it be easier or more difficult to swim (or stay afloat) if the density of a human is greater than salt water? Why?

8. C: Do dead bodies in the ocean salt water float or sink? Why?

9. C: Does oil in the ocean float or sink? Why?

10. C: Does metal (like gold) in the ocean float or sink? Why?

11. C: A dead fish is floating in the middle of the polluted radioactive ocean. Label the forces on the fish.

12. C: State the equation for *pressure P*, define each variable, and give the units for each variable. Is *pressure* a scalar or a vector?

13. C: Is it a good idea to wear high heels on grass? Why?

14. E: The surface area of one foot of a 65.0 kg man is $0.0200\ \text{m}^2$. Calculate the average pressure each foot is applied to the ground.

15. E: A heavy chair has a mass of 12.0 kg. Each of the four legs has a surface area of $4.50\ \text{cm}^2$. Calculate the average pressure each leg applies to the ground.

16.C: State the meaning and equation of the *buoyant force* (*force of buoyancy*).

17.E: 60.0% of a cube with a side length of 1.25 cm is under fresh water. The cube does not move.

a. Calculate the upwards buoyant force acting on the cube.

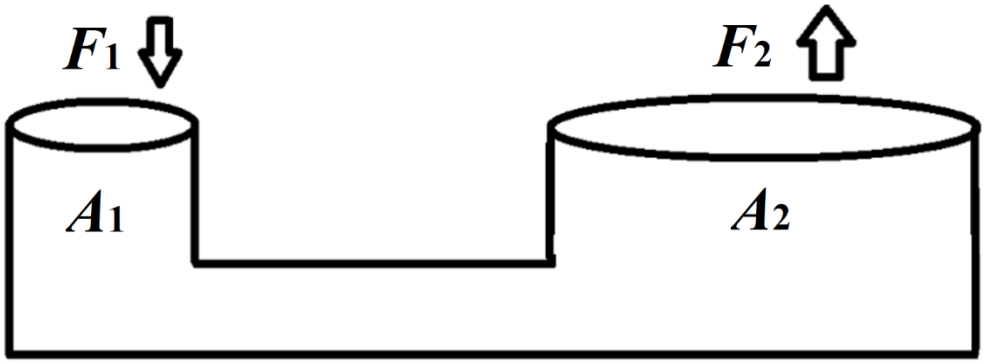
b. Calculate the downward force of gravity acting on the cube.

c. Calculate the mass of the cube.

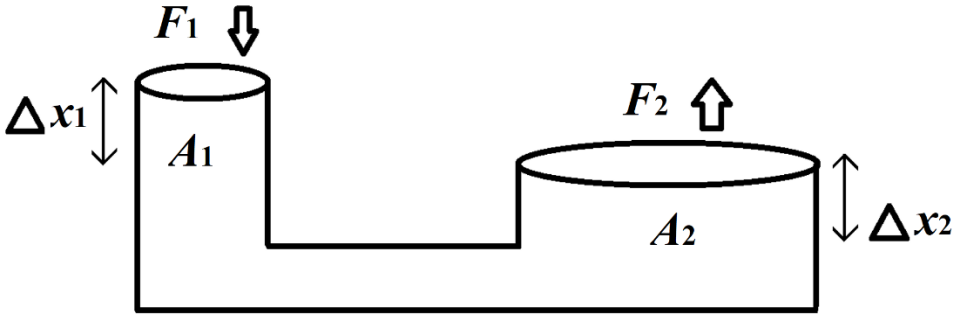
18.C: State *Archimedes Principle*

19.C: State the meaning and equation for *Pascal's Principle.*

20.E: According to *Pascal's Principle* in a hydraulic press a downward force on an area will result in an upwards force on another area. Suppose a downwards force of 135 N on an area of $1.25\ \text{m}^2$ results in an upwards force of 325 N. The surface areas are at the same height. What is the surface area A_2 which rises?



21.E: According to *Pascal's Principle* in a hydraulic press a downward force on an area will result in an upwards force on another area. Suppose a downwards force of 135 N on an area of $1.25\ \text{m}^2$ results in an upwards force of 325 N. The vertical distance between the two surface areas are $\Delta x_1 = 2.25\ \text{m}$. What is the surface area A_2 which rises? The density of the fluid is $\rho_\text{f} = 0.800\ \frac{\text{kg}}{\text{m}^3}$



22.C: Define a fluid in *hydrostatic equilibrium*.

23.C: Define *laminar flow.*

24.C: What do *streamlines* tell us?

25.C: What are the characteristics/conditions for an *ideal fluid*?

26.C: State the *continuity equation*. This is also called the *volumetric flow rate Q*. Define each variable and draw and label an image.

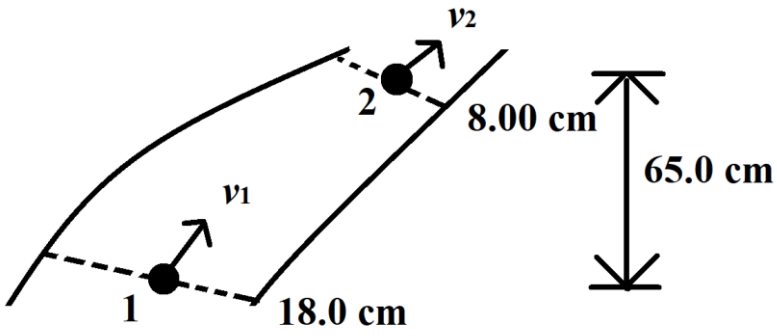
27.E: A liquid with a density of $1{,}050\ \frac{\text{kg}}{\text{m}^3}$ moves to the right with a speed of 3.25 cm/s through a tube with a cross section area of $4.75\ \text{cm}^2$. What is the volumetric flow rate of this liquid in $\frac{\text{m}^3}{\text{s}}$?

28.E: A liquid with a density of $1{,}050\ \frac{\text{kg}}{\text{m}^3}$ moves to the right with a speed of 3.25 cm/s through a tube with a cross sectional area of $4.75\ \text{cm}^2$. The cross sectional area of the tube then increases to $6.25\ \text{cm}^2$. What is the speed of the liquid as it flows through the larger tube in $\frac{\text{m}}{\text{s}}$?

29.E: A liquid with a density of $975\ \frac{\text{kg}}{\text{m}^3}$ moves to the right with a speed of 4.25 cm/s through a tube with a cross sectional area of $2.75\ \text{cm}^2$. The cross sectional area of the tube then decreases to $2.25\ \text{cm}^2$. What is the speed of the liquid as it flows through the smaller tube in $\frac{\text{m}}{\text{s}}$?

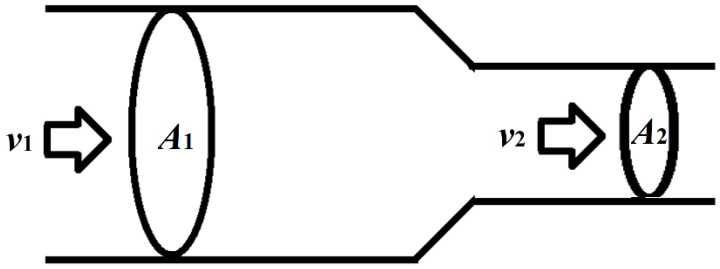
30.C: State *Bernoulli's equation* and define each variable.

31.E: A circular pipe with a varying diameter is shown below. The diameter of the circular pipe at point 1 is 18.0 cm and the diameter of the circular pipe at point 2 is 8.00 cm. The pressure at point 1 is measured to be 225,000 Pa. Point 2 is a vertical distance 65.0 cm above point 1. A liquid of density $975\ \frac{\text{kg}}{\text{m}^3}$ flows up the pipe with a flow rate of $0.555\ \frac{\text{m}^3}{\text{s}}$. Calculate the pressure at point 2.

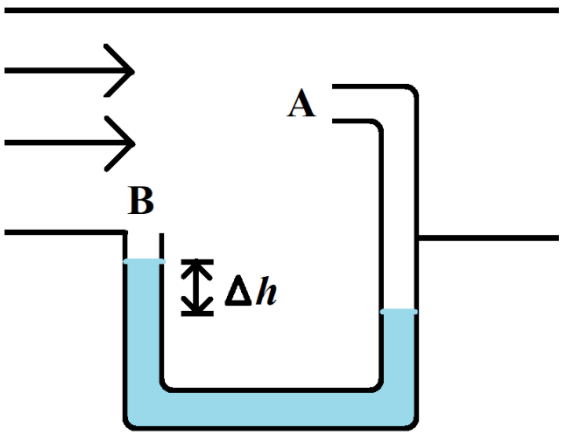


32.C: State the *Bernoulli effect*.

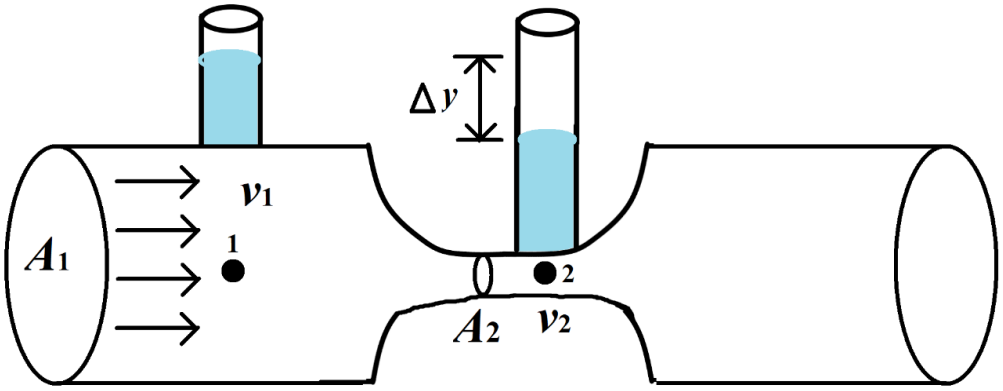
33.E: A liquid with a density of $975\ \frac{\text{kg}}{\text{m}^3}$ moves to the right with a speed of 4.25 cm/s through a tube with a cross sectional area of $2.75\ \text{cm}^2$ and pressure of 195,000 Pa. The cross sectional area of the tube then decreases to $2.25\ \text{cm}^2$. What is the speed of the liquid as it flows through the smaller tube in $\frac{\text{m}}{\text{s}}$ and the pressure in Pa?



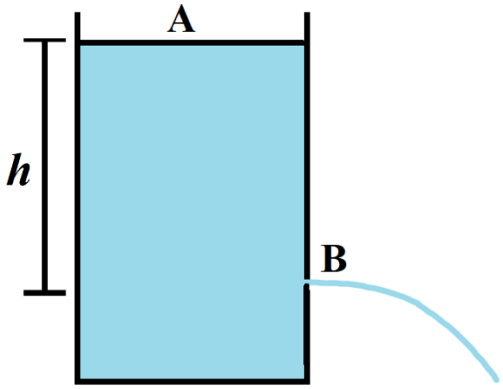
34.C: Describe how the *Bernoulli Effect* relates to the Pitot tube to determine the speed of an airplane.



35.C: Use the Bernoulli equation and the continuity equation to determine the difference in pressure of a fluid in the throat of a cylinder if we are given the radius r_1 and r_2 and the speed v_1.



36.C: Determine the initial horizontal speed of a liquid pouring out of a hole from a container as shown in the figure below:



37.C: Define *viscosity*.

38.C: State the meaning of and give the equation to *Stoke's law*.

39.C: Define *turbulent flow*

40.C: State the meaning, equation, and define each variable for the *Reynold's number R*.