JEFFERSON COUNTY EDUCATIONAL SERVICE CENTER

VIRTUAL LEARNING ACADEMY

STUDENT WORKSHEET

SCIPHYSICS\_APU22 SCIENCE PHYSICS AP

Unit 22: Fluid Pressure Lab

Pre-Lab Questions: Answer the following questions before doing the lab activity.

1. What is the equation for density? Perform the following problems:
   1. A metal sphere with a radius of .05 m has a mass of 1.43 kg. What is the density of the metal?
   2. The density of an unknown liquid is 324 kg/m3 and it has a mass of 432 grams, what is the volume of the liquid?
2. What are the two equations for pressure that we learned in the last unit?
3. Use the equations from number 2 to answer the following:
   1. Calculate the blood pressure (in mm-Hg) that a 5 foot, 7 inch person experiences on their feet?
   2. A man with a mass of 70 kg is kneeling down, taking up an area of .87 m2 How much pressure is he exerting on the ground?
4. What is atmospheric pressure at sea level? Name two things that have an affect on atmospheric pressure that allows it to change from location to location.

PART I – Pressure

Directions: Go to <http://phet.colorado.edu/en/simulation/under-pressure> and follow the steps and answer the questions below

Procedure

1. Fill the entire basin with water
2. Select the ruler and grid options
3. Move the pressure gauge to the locations indicated on the chart below to fill in the rest of the information.

|  |  |  |
| --- | --- | --- |
| Location of Gauge | Metric Pressure Reading | Atmospheric Pressure Reading |
| In the air at the very top of the screen |  |  |
| In the air in between the top of the screen and the ground |  |  |
| At sea level |  |  |
| 1 meter below sea level |  |  |
| 2 meters below sea level |  |  |
| 3 meters below sea level |  |  |

1. Describe your findings and include specific data from your explorations. Why do you think pressure changed the way it did?

1. How would your values compare if this pool of water was at a higher elevation in Denver? To answer this question, try dropping gravity a bit and notice what happens. Can you explain your results?
2. Restore g to 9.8. Turn the atmosphere off and compare the pressure at sea level to the bottom of the pool. Are the values consistent with your data in part 2? If not, explain why they have changed.
3. How does the shape of the pool affect pressure at the bottom? Try the “slanty” pools. Explain your findings.
4. How does the density of the fluid affect the pressure at the bottom? Explain what you did to answer this question.
5. Now try a quick 3 part experiment. Fill the pool and shut off the atmosphere.
   1. Measure the pressure of the water at a depth of 1 meter, 2 meters and 3 meters. Explain any patterns.
   2. Put the gauge at a depth of exactly 1 meter (it should read 9.8 kPa). Now change gravity to 4.9 m/s/s and then 19.6. Explain any patterns.
   3. Put the gauge at a depth of 1 meter and set gravity back to 9.8. Change the fluid density to 700 kg/m3 and 1400 kg/m3. Explain any patterns.
6. Summarize experiment 6 part a,b and c by stating what factors affect pressure and whether the effects are direct or indirect.
7. Convert your written answer in 7 into an equation ( i.e. P = …..). Test your equation to predict the pressure at the bottom of the rectangular tank of seawater of density 1030. Show all of your work including units.
8. Turn air pressure back on. Pick the crazy looking tank with a narrow tube and wide pool unit the gauge reads 101.5 kPa. Make sure the water is plain water, on the earth. Put a pressure marker on the bottom of the tank. Drop a 250 kg mass in the hole.
   1. Does the water exert a force on the mass? How do you know?
   2. Did the pressure change? By how much?
   3. Remove the mass. Put a second pressure gauge on the water line on the wide pool. Drop the mass in again. Did the pressure change? By how much? Compare this to b.
   4. What happens to the gauges if you use the 500kg mass instead?
   5. Try dropping the 250 mass again but now observe the water carefully (ruler!) to compare the movement of water in the small tube to the movement of water in the wider pool. Why do you think these amounts are different?
   6. Turn off atmospheric pressure. What happened? Explain your results using past observations.

PART II – Density

Part two is more of an inquiry based lab using the Phet simulation below. You will be given a task and you will have to use the simulation to figure it out and write the procedure for how you did so.

Go to <http://phet.colorado.edu/en/simulation/density>

Inquiry Task:

1. Play around with the different types of blocks by placing them in the pool of water. Answer the questions below.
   1. Explain how to determine the amount of volume and block displaced in the water
   2. What is similar or different from the volume that the blocks displace naturally? How might a scientist explain the behavior?
   3. Explain why you think the blue block on the “Same Mass” setting can be placed anywhere in the water.
2. Design experiments to demonstrate the following learning goals. Provide tables for evidence and use specific examples from your data to provide the reasoning.
   1. Learning goal 1 - Provide evidence and reasoning for how objects of similar mass can have differing volumes
   2. Learning Goal 2 - Provide evidence and reasoning for how objects of similar volume can have differing mass.
3. Design an experiment to identify the 5 Mystery blocks using the Table in the simulation.
   1. Write your procedure in paragraph form.
   2. Identify each block using specific evidence to support your conclusions – show your calculations by providing a data table.