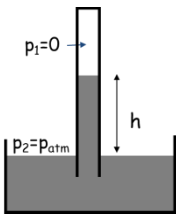
Name: ______________________ DISC: ________

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
5	5	5	5

1. A barometer can be used to measure atomspheric pressure (P_{ATM}). In a barometer an evacuated tube is inserted into a pool of liquid, in this case alcohol. Let's investigate what happens:



ρ **Alcohol**	P_1	P_{ATM}
$789 \frac{kg}{m^3}$	$0\ Pa$	$101335\ Pa$

Explanation (2pts):

a. Why is the height of the alcohol in the tube related to the atmospheric pressure?

Pressure (3 pts):

b. How long must the tube be to measure the atmospheric pressure using alcohol? (hint: $P_{ATM} = P_1 + \rho g h$)

2. Remarkably aircraft carriers don't sink in the ocean. Employ Archimedes' Principle to explain why. (Hint: You may approximate the carrier as a rectangle of area $A_{carrier}$.)

ARCHIMEDES' PRINCIPLE	ρ_{sea}	ρ_{steel}
$F_B = \rho_{fluid} V_{displaced} g$	$1.025\ g/ml$	$7.9\ g/ml$

Floating Carriers (5 pts):

3. Hook's Law, $F_{spring} = -kx$, describes the force exerted on an object by a spring.

Answer:

a. An object is attached to a horizontal spring and rests on a frictionless surface. The spring is displaced from the equilibrium position. Does the object experience *constant* acceleration (**yes/no**)?

b. Draw a free-body diagram describing the situation in part (a). Remember to include a coordinate system and all force labels.

Free-body Diagram (2pts):

c. Using $U_{spring} = \frac{1}{2}kx^2$ and *energy conservation* explain why the *speed* of the object depends on its *position* (x). Let the initial displacement of the spring be $x_{initial}$.

Explanation (2 pts):

4. Foucault's Pendulum is a simple harmonic oscillator. It was used to demonstrate the rotation of the earth.

Answer:

a. Does Foucault's Pendulum experience constant acceleration (**yes/no**)?

b. If the pendulum length is $20\ m$, use $T = 2\pi\sqrt{\frac{L}{g}}$ to find the period of the pendulum's swing.

Period (2 pts):

c. Now take your Foucault's Pendulum to another planet. You want to measure the acceleration of gravity. You set up your pendulum and notice that $T = 3T_{Earth}$. What is the acceleration of gravity on the new planet, g_{new}?

g_{new} (2 pts):