

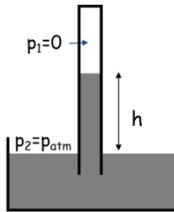
Name: _____

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 atmospheric pressure (P_{ATM}). In a barometer an evacuated tube is inserted into a pool of liquid, usually mercury. Let's investigate what happens:



ρ MERCURY	P_1	P_2
$13,600 \frac{kg}{m^3}$	$0 Pa$	UNKNOWN

Explanation (2pts):

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

b. You observe the height of mercury in the tube is 755 mm. Find the atmospheric pressure (hint: $P_{ATM} = P_1 + \rho gh$)

Pressure (3 pts):

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:

- 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)?
- 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):

- 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:

- Does Foucault's Pendulum experience constant acceleration (yes/no)?
- If the pendulum length is 25 m, use $T = 2\pi \sqrt{\frac{L}{g}}$ to find the period of the pendulum's swing.

Period (2 pts):

- 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 $T = 2.5T_{Earth}$. What is the acceleration of gravity on the new planet, g_{new} ?

g_{new} (2 pts):