

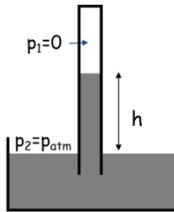
Name: \_\_\_\_\_

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:



$\rho$ 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  $770 \text{ mm}$ . 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  $A_{carrier}$ .)

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

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 20 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  $T = 2T_{Earth}$ . What is the acceleration of gravity on the new planet,  $g_{new}$ ?

$g_{new}$  (2 pts):