

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

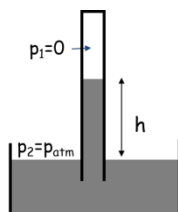
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1. A barometer can be used to measure atmospheric pressure ( $P_{ATM}$ ). In a barometer an evacuated tube is inserted into a pool of liquid, in this case alcohol. Let's investigate what happens:



Explanation  
(2pts):

$\rho$ Alcohol	$P_1$	$P_{ATM}$
$789 \frac{kg}{m^3}$	$0 Pa$	$101330 Pa$

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

- b. How long must the tube be to measure the atmospheric pressure using alcohol? (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  $A_{carrier}$ .)

Floating Carriers  
(5 pts):

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

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 15 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  $T = 3T_{Earth}$ . What is the acceleration of gravity on the new planet,  $g_{new}$ ?

$g_{new}$  (2 pts):