

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

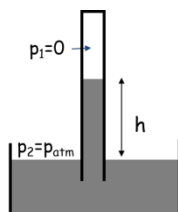
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1. A barometer can be used to measure atmospheric pressure (P_{ATM}). In a barometer an evacuated tube is inserted into a pool of liquid, usually mercury. Let's investigate what happens:



Explanation
(2pts):

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

- 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 $765 mm$. 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 $A_{carrier}$.)

Floating Carriers
(5 pts):

ARCHIMEDES' PRINCIPLE	ρ_{sea}	ρ_{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:

- 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 30 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):