

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

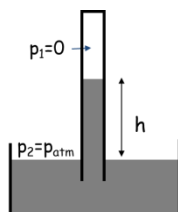
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1. A barometer can be used to measure atmospheric pressure ( $P_{atm}$ ). In a barometer an evacuated tube is inserted into a pool of liquid, in this case alcohol. Let's investigate what happens:



$\rho$ Alcohol	$P_1$	$P_{atm}$
$841 \frac{kg}{m^3}$	$0 Pa$	$101,325 Pa$

- a. Why does the alcohol rise up the tube inside?

Explanation (2 pts):

- b. How high does the alcohol rise up the tube inside relative to the level outside? (hint:  $P_{atm} = P_1 + \rho gh$ )

Pressure (3 pts):

2. Consider an iceberg floating in an ocean as appearing in the movie *Titanic*. The density is  $0.917 g/ml$  for ice and  $1.055 g/ml$  for the surrounding water. What percentage of the iceberg's volume is above water?

ARCHIMEDES' PRINCIPLE	$\rho_{ice}$	$\rho_{sea}$
$F_B = \rho_{fluid} V_{displaced} g$	$0.917 g/ml$	$1.055 g/ml$

Floating  
Iceberg (5 pts):

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

Answer (1 pt):

- a. A rectangular block is attached to a horizontal spring and rests on a frictionless surface. A lab assistant pulls the block displacing it from its equilibrium position and then releases it. Does the block experience *constant* acceleration just after it is released **(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 (2 pts):

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

Explanation (2  
pts):

4. Foucault's Pendulum can be approximated as a simple harmonic oscillator. It was used to demonstrate the rotation of the earth.

Answer (1 pt):

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

- b. If the pendulum length is  $8\text{ m}$ , 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 on that planet. 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):