

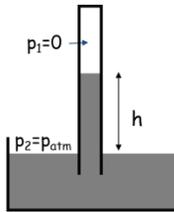
Name: _____

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, in this case alcohol. Let's investigate what happens:



| | | |
|----------------------|--------|--------------|
| ρ Alcohol | P_1 | P_{atm} |
| $736 \frac{kg}{m^3}$ | $0 Pa$ | $101,325 Pa$ |

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 $1.035 g/ml$ for the surrounding water. What percentage of the iceberg's volume is above water?

| | | |
|--------------------------------------|--------------|--------------|
| ARCHIMEDES' PRINCIPLE | ρ_{ice} | ρ_{sea} |
| $F_B = \rho_{fluid} V_{displaced} g$ | $0.917 g/ml$ | $1.035 g/ml$ |

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 6 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):