

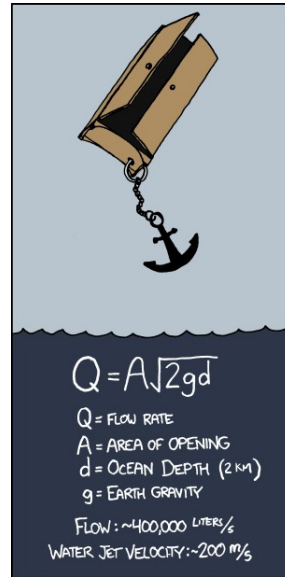
November 4, 2016

Physics 131

Prof. E. F. Redish

■ **Theme Music:**  
**Pearl Jam**  
*Even Flow*

■ **Cartoon:**  
**Randall Munroe**  
*xkcd*

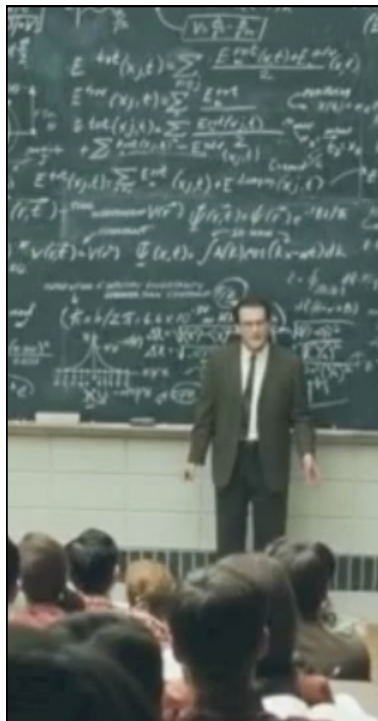


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THE WHITE WITCH DIDN'T  
 KNOW WHAT HIT HER.

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## The Equation of the Day

Incompressible  
 flow

$$A_1 v_1 = A_2 v_2$$

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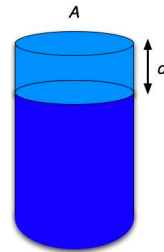
## Foothold ideas: Pressure 2



- A constrained fluid has an internal pressure  
–like an internal force at every point in all directions.  
(Pressure has no direction.)
- At a boundary or wall, the pressure creates a force perpendicular to the wall.  $\vec{F} = p\vec{A}$
- The pressure in a fluid increases with depth.

$$p = p_0 + \rho g d$$

- The pressure in a fluid is the same on any horizontal plane no matter what the shape or openings of the container.



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## Toolbelt



- Mapping physical meaning to math.

$$p = \frac{F}{A}$$

$$p = p_0 + \rho g d$$

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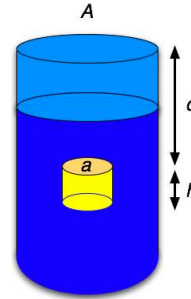
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## Foothold ideas: Buoyancy

- **Archimedes' principle:**

When an object is immersed in a fluid (in gravity), the result of the fluid's pressure variation with depth is an upward force on the object equal to the weight of the water that would have been there if the object were not.



- As a result, an object less dense than the fluid will float, one denser than the fluid will sink.
- An object less dense than the fluid floats with a fraction of its volume under the fluid equal to  $\frac{\rho_{object}}{\rho_{fluid}}$

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 $\rho_{fluid}$ 

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## Toolbelt



- Principle-based reasoning  
“Stakes in the ground”

- **Archimedes' principle:**

When an object is immersed in a fluid (in gravity), the result of the fluid's pressure variation with depth is an upward force on the object equal to the weight of the fluid that would have been there if the object were not there.

Or

Buoyant force = weight of displaced fluid.

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