

Chapter 3: Forces in Fluids

Pressure

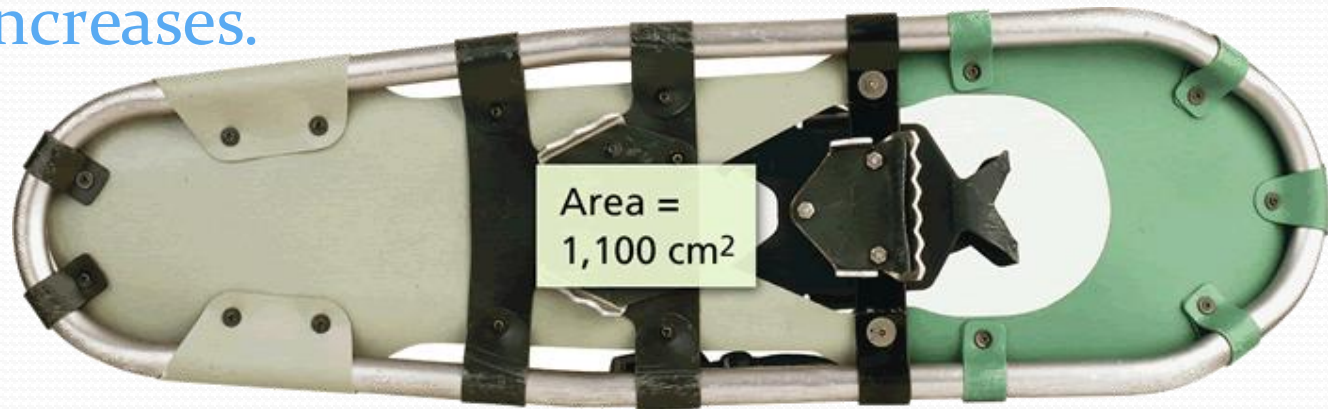
Section 3.1 Notes

Key Concepts

- What does pressure depend on?
- How do fluids exert pressure?
- How does fluid pressure change with elevation and depth?

What Is Pressure?

- Pressure decreases as the area over which a force is distributed increases.



Area = 250 cm²



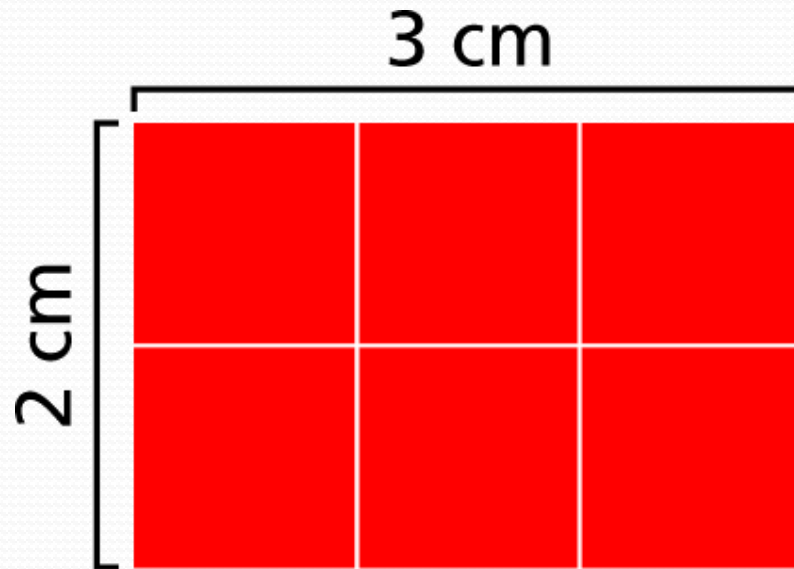
Pressure

- A force exerted over an area on the surface of an object
- Pressure decreases when spread over a larger area (snowshoes)
 - Regular shoes – sink in snow
 - Snow shoes – distribute same pressure over larger area – allow you to walk on snow!
- Why it's easier to water ski on 2 skis instead of 1...(or on your bare feet!)



Area

- The area of a surface is the number of square units that it covers. To find the area of a rectangle, multiply its length by its width. The area of the rectangle below is 2 cm X 3 cm, or 6 cm².



Calculating pressure

- Pressure – $\frac{\text{force}}{\text{area}}$
- Unit: N/m^2
- 1 Pascal (Pa) = 1 N/m^2

Fluid Pressure

- What is a fluid?
- Material that can easily flow (liquids and gasses)
- In fluids, the particles are constantly moving
- Each particle exerts pressure –
- Pressure of all particles together make up the pressure of the fluid



Air Pressure

- The weight of the 100km of fluid air that makes up our atmosphere
- Why aren't we crushed? (Weight supported by the surface area of your hand is 1,000 N, or the weight of a large washing machine!!)



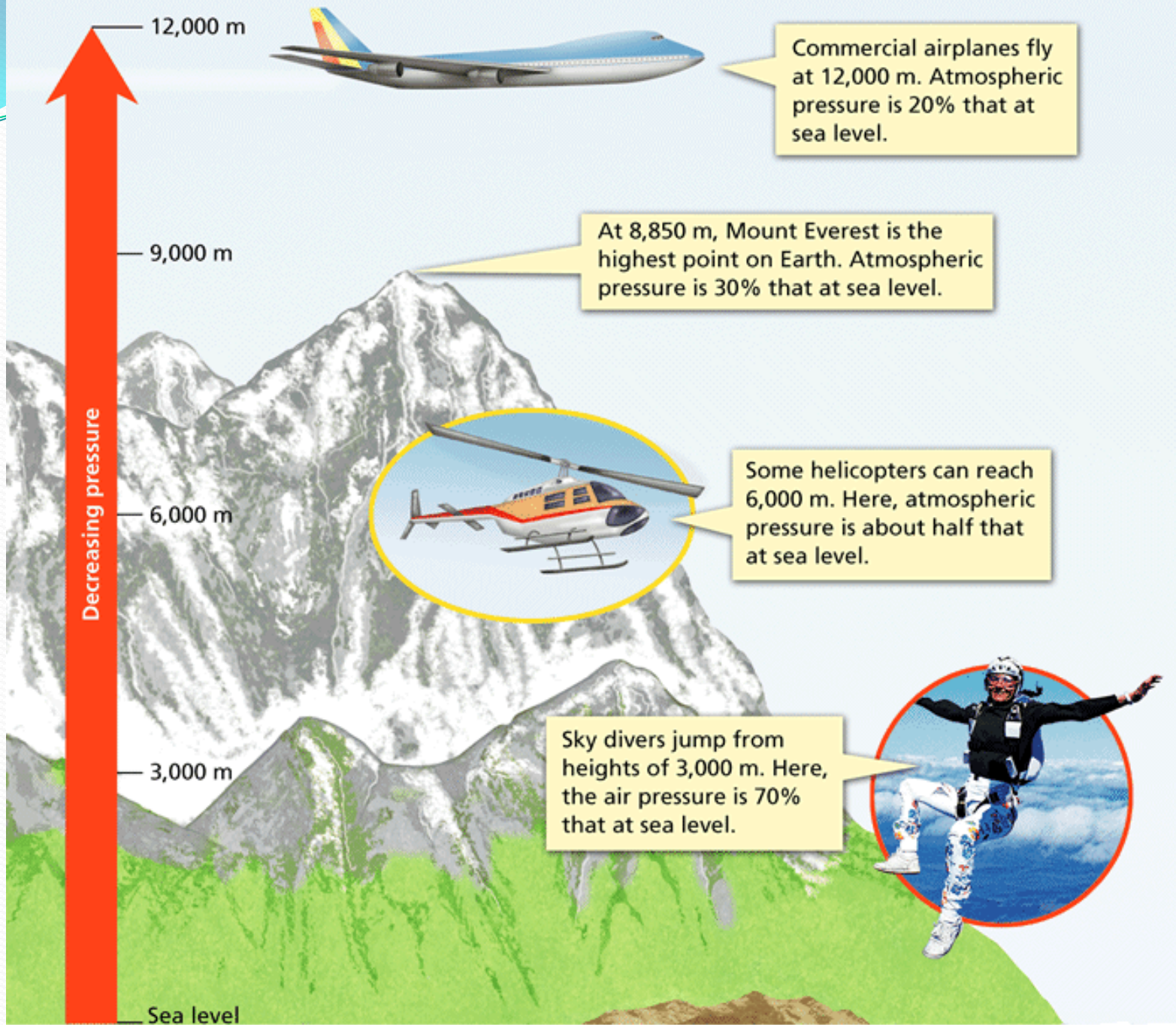
Balanced Pressure

- Air pressure exerted equally on an object from different directions
- Your body contains fluids that exert outward pressure – air in lungs, liquid blood, etc.
- Bodily fluids balance our air pressure
- What happens when we leave the Earth's atmosphere?
- http://imagine.gsfc.nasa.gov/docs/ask_astro/answers/970603.html

Air Pressure and elevation

- What happens to air pressure when you go high on a mountain, or fly in an airplane?
- Decreases
- As elevation increases, air pressure decreases
- The higher you go, the less air is above you pressing down on your body!
- How do you know air pressure is changing?







Water pressure and depth

- What happens to pressure when you dive deep into a pool/lake?
- Increases! What does this feel like?
- Water pressure increase as depth increases.
- The deeper you go, the more water is on top of you pressing down on your body
- Deepest parts of ocean – pressure is more than 1,000 times normal air pressure!!





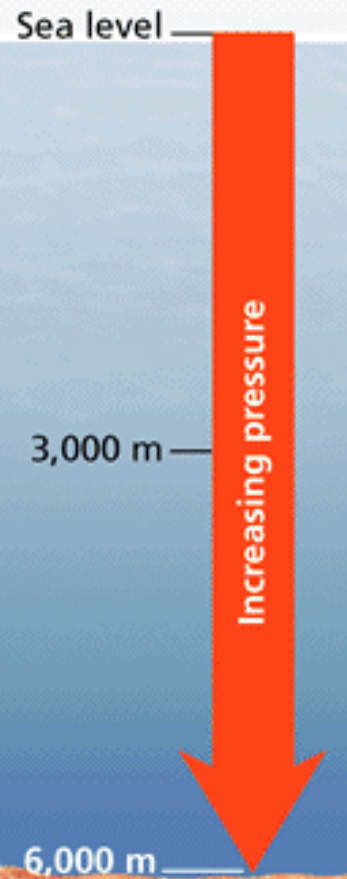
At sea level, standard atmospheric pressure is about $100,000 \text{ N/m}^2$.

Just 10 m below the surface, the water pressure on a scuba diver is double the atmospheric pressure at sea level.



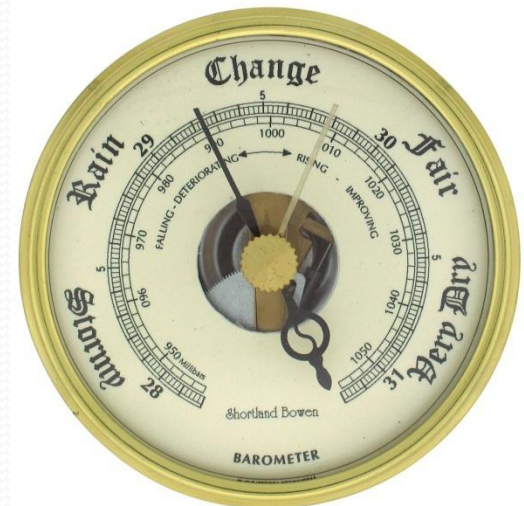
The gulper eel can live 2,500 m below the surface. Pressure here is about 250 times greater than standard atmospheric pressure.

Piloted submersibles can explore as deep as 6,500 m. Here, water pressure is 650 times greater than at sea level.



How do we measure pressure?

- Barometer – measures atmospheric (air) pressure
- Increasing air pressure usually means nice weather
- Rapidly Decreasing air pressure usually indication of storms





Teacher notes/ideas

- Pop can demo – air pressure and temperature (??)
- Garbage bag and vacuum
- Something with air pump – did we already do the balloon things?