

BUOYANCY

The tendency of an object to float when placed in a fluid is called BUOYANCY.

The forces acting on a substance in a fluid are the force of gravity and the force of buoyancy. When the force of buoyancy is greater than the force of gravity an object floats, also referred to as positive buoyancy. When the force of gravity is greater than the force of buoyancy the object will sink, also referred to as negative buoyancy. When the force of gravity and force of buoyancy are equal, neutral buoyancy occurs.

The Plimsoll line is a reference line painted on boats - indicating safe loading levels - depending on saltwater or freshwater concentrations where the ship travels.

COMPRESSION

As particles - within an enclosed space - have force applied, they will fill a smaller volume - this is called compression.

Objects under compression tend to deform in their shape.

Fluids can be compressed - Gases can be compressed much more than liquids, because of the greater space between the particles.

Because there is very little compression in a liquid, they are considered to be incompressible (just as solids are).

PRESSURE and 'Pascal's Law'

Pressure is the amount of force that is applied to a given area.

Pressure is measured in pascals. 1 pascal is equal to the force of 1 Newton over an area of 1 meter².

It is calculated as follows:

$$p = F / A$$

Pascal's Law states that the enclosed fluid transmits pressure equally in all directions throughout the fluid.

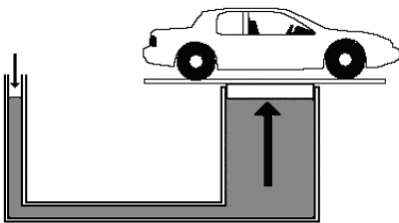
Pascal's Law led to the invention of hydraulic and pneumatic systems

HYDRAULICS

Hydraulic devices use an enclosed liquid to transfer force throughout the device equally in all directions.

This application of Pascal's Law enables us to use these systems to gain very large force advantages.

Hydraulic systems can be used to lift very heavy objects, such as this hydraulic lift.



PNEUMATICS

Pneumatic devices use an enclosed gas which is compressed and transfers force throughout the device equally in all directions.

This application enables us to have a great deal of force when the device releases the pressure.

Pneumatic systems can be used to apply a lot of force in a particular direction, such as this pneumatic nailing gun.



SOLUBILITY TECHNOLOGIES

Different substances have different solubilities. This knowledge enables us to utilize this property of a fluid in different applications, such as



washing machines and



hyperbaric chambers.

In both of these technologies knowing what is soluble and what isn't and how solubility of different substances can be changed helps to make these technologies very useful.

DIVING & DECOMPRESSION

As a diver dives below the surface of the water, increasing pressure is exerted by the water on the body.

Nitrogen gas in the body dissolves at a much higher rate under these pressures.

As the diver resurfaces the nitrogen gas bubbles out of the blood and tissues very quickly causing extreme pain. This condition is often referred to as the 'BENDS'.

To treat this condition, the diver is placed in a decompression chamber, called a hyperbaric chamber.

PUMPS & VALVES

A PUMP is a device that moves a fluid through or into something. Different types of pumps include:

Bicycle pump - has a piston moving up and down inside a cylinder.

Diaphragm pump - has a flexible diaphragm that is pushed and pulled inside a compartment by a piston.

Archimedes screw is a pump used to move water by rotational motion.

Pipeline pig - as the fluid is pushed through a pipeline, the 'pig' cleans and monitors the inside of the pipe.

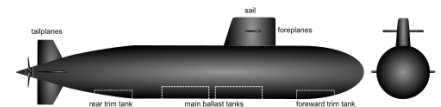
Valves are devices that control or regulate the amount of flow, or the level in a container. A ball valve works by turning in one direction allowing the fluid through, or by stopping the flow. A compression valve is opened by a pin that has a hole to allow the fluid in.

SUBMARINES

A deep ocean submersible is called a bathyscaph. It is designed to withstand extreme pressure on the ocean floor.

A SUBMARINE is a hollow tubelike ship that has tanks between the inner and outer shells, called ballast tanks.

Submarine control surfaces



These tanks can be filled with water or air. When they are filled with water the submarine can dive. To resurface, the water in the tanks is forced out and replaced with air. This action changes the density of the submarine, allowing it to 'sink or float'.