


# 38 - PRESSURE

3A4



factors affecting pressure; pressure in fluids  
air has mass and occupies space  
atmospheric pressure and its relationship to weather  
measuring pressure, everyday applications of pressure

**How did we show air has mass and takes up space?**

# 38 - PRESSURE

Which would hurt more if it stood on you?



Why do you think this is?



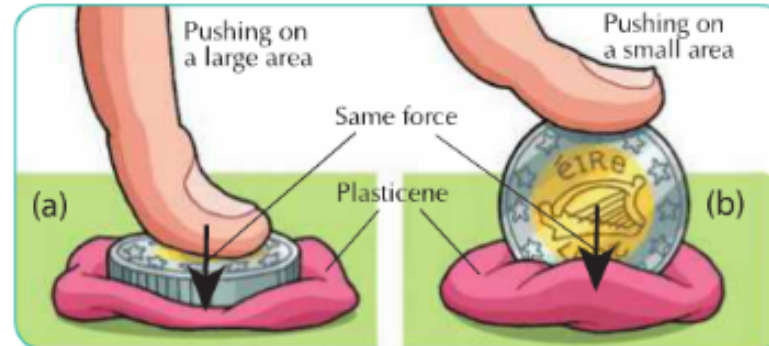
**Snow-shoes** will spread your force over a greater area. This means you won't sink down into the snow as much.

## Size and Area

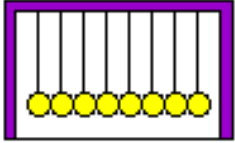
The pressure on an object can be increased in two ways...

1. Increase the Force (Heavier)
2. Decrease the Area

In this picture the force stays the same but the area decreases. This makes a deeper mark in the plasticene.





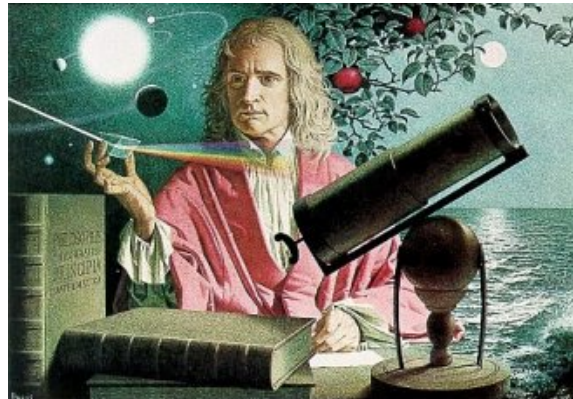
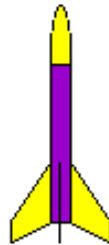


## What is Pressure?

So we say that - **Pressure is force per unit area.**

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

Newtons  
m<sup>2</sup>

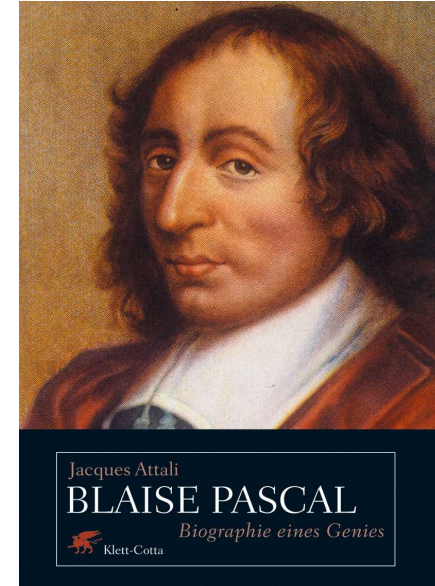


1643 - English  
Laws of motion - planets  
Calculus  
Diffraction of light

# Unit of Pressure

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} \quad \frac{\text{N}}{\text{m}^2}$$

The unit for pressure is  $\text{N/m}^2$   
or sometimes called Pascal - **Pa**



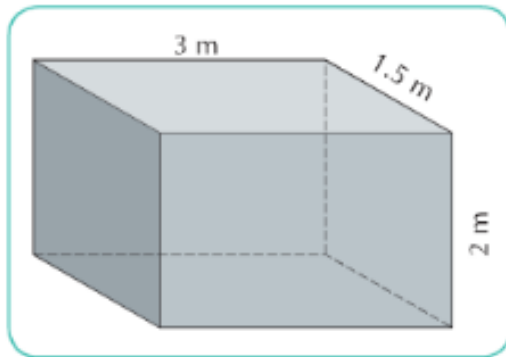
1623 - French  
First calculator - pressure in  
liquids, vacuums, etc

# Calculations

## Example 1

A stone block of weight  $225\,000\text{ N}$  is to be used as a base for a sculpture. The block has dimensions  $3\text{ m} \times 2\text{ m} \times 1.5\text{ m}$  as shown in Fig. 38.3. Any face of the block can be placed on the ground.

- (i) What is the greatest possible pressure the block could exert on the ground?
- (ii) What is the least possible pressure the block could exert on the ground?



Greatest pressure = smallest area

Pressure =

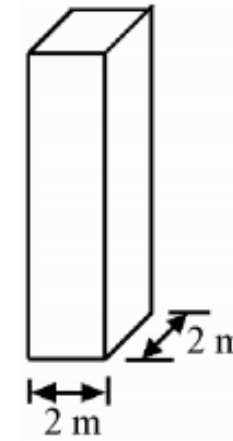
Smallest pressure = greatest area

## You try this one - from 2010...

The diagram shows a tank full of water. The mass of the water in the tank is 48 000 kg. Calculate the *approximate pressure* that it exerts on the base of the tank. Give the *units* of pressure with your answer.

Calculate \_\_\_\_\_

\_\_\_\_\_



**Important - 1Kg X 10 = 1N**  
**If they give you Kg in a question,**  
**you must multiply by 10 to get N.**

## Pressure in Liquids

As you go further down in the sea there is **more water** on top of you.

This increases the pressure on your body.

We have to wear thicker suits if we want to dive very deep.



As you go down 10 meters the pressure increases by 100,000 Pa.

That's roughly 2 elephants standing on 1 leg on top of you every 10 metres you go down!



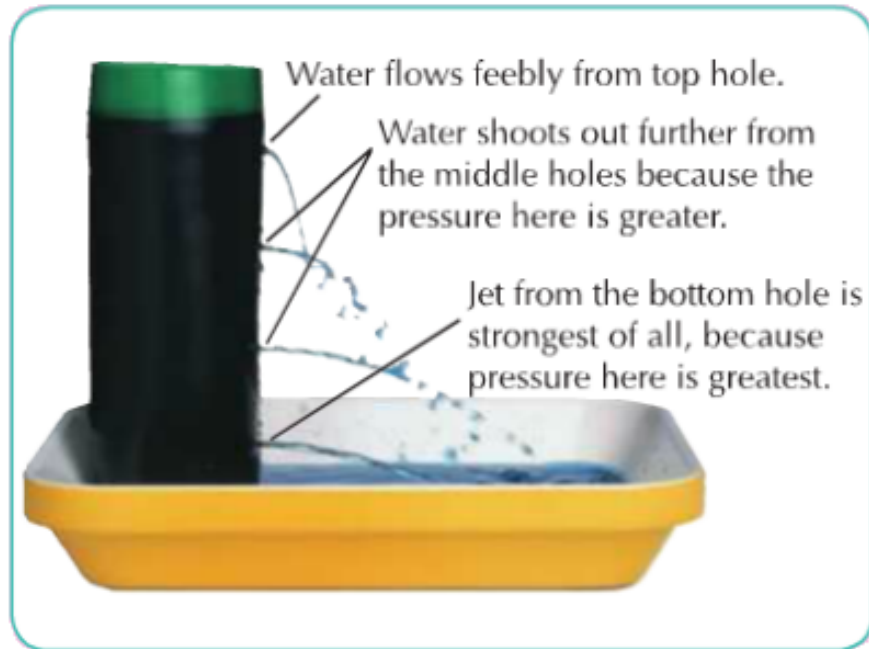
## Experiment to show pressure in liquids

We can show that there is **greater pressure at the bottom** of a bottle of water by filling the bottle and putting holes in the side.

**What would you expect to happen as the water comes out?**



# Results



Here's what happened!

The weight of the water causes more pressure at the bottom of the bottle.

With more pressure the water is pushed out more quickly than near the top.

**How would this affect fish in the sea?**

# Atmospheric Pressure

We learnt before that air does have weight.  
The more air above you the more weight is on you.  
Your body has **1000kg** of air pushing down on you right now!



## Atmospheric Pressure at Sea level

At sea level means the level of the sea around the world. Sea level has the most air above it.

As you go up higher there is less air above you and so there is less pressure.



## We can feel Atmospheric Pressure



As we go up a hill we feel our **ears clicking**. This is the air equalising inside and outside of our heads.

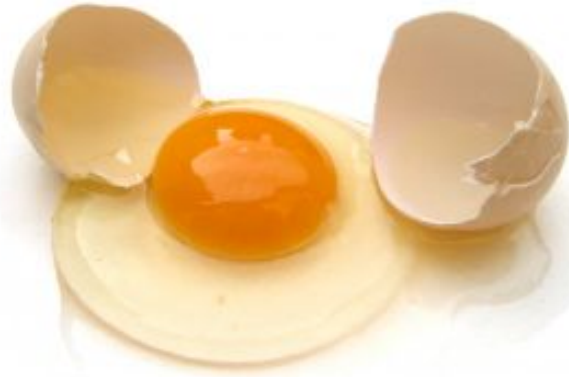
Airplanes have to **pressurise** their cabins so we can survive. The pressure outside would be far less than we could live in.





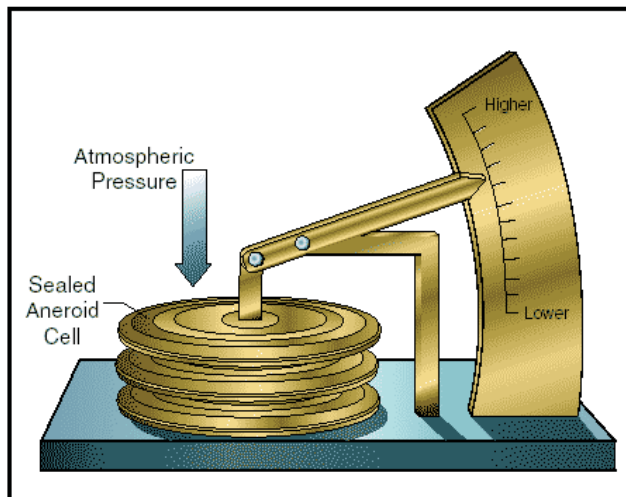
We can see Atmospheric Pressure

What have these got in common?

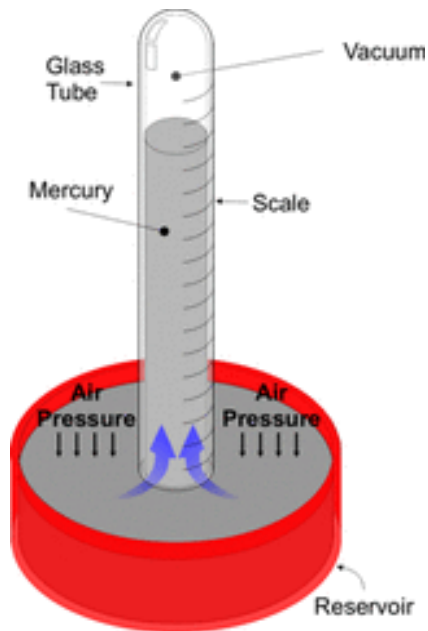


## We can measure Atmospheric Pressure

We use an **aneroid barometer** to measure atmospheric pressure. It is a box with a vacuum inside it. The air pressure squashes the box. The box has a dial that shows how much pressure it's under. They can be used to show weather also.



We can use a **Mercury barometer** to measure atmospheric pressure. The air pressure pushes down on the mercury and pushes it up into the tube. We can then measure the height of mercury in the tube.



**Typical atmospheric pressure is,**

**76 cm of mercury** or  
**1013 hPa** (hectopascals or 1 millibar)

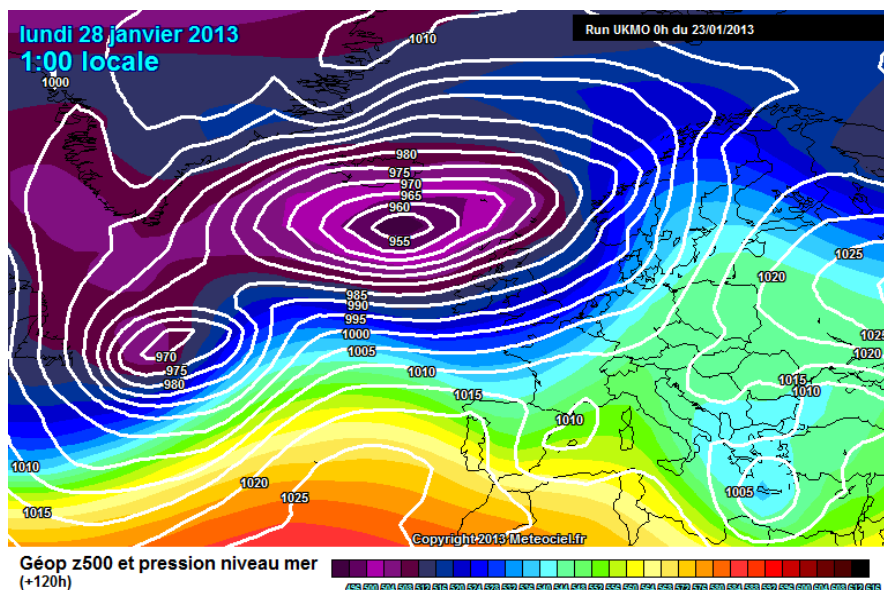
We can use a barometer on a plane to tell us how high we are.  
It's called an **Altimeter**.



## Isobars and the weather

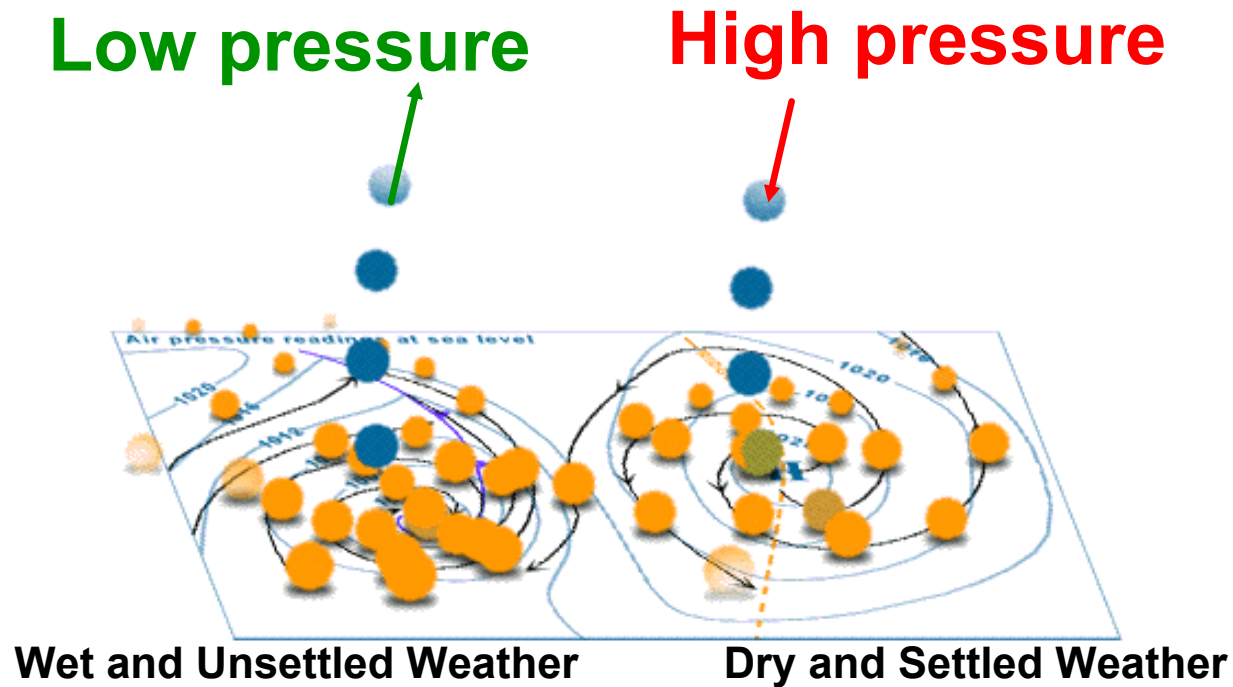
**Isobars are lines that join places of equal pressure.**

On weather maps the closer the isobars then the stronger the winds.



# What is wind?

Wind is the movement of air from one place to another.





# Everyday applications of Pressure

An application is also called a use.

1. **Flight** - Air moves quickly over a wing and slowly under the wing causing 'lift'.



2. **Hydraulics** - Liquids are hard to compress and are used to move pressure from one place to another. In car brakes we push a pedal, this squashes a liquid and this then pushes the brakes against the wheels.



## Attachments

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under-pressure\_en.jar