FORCES IN ENGINEERING (1)

A) <u>Look at the picture in Fig.1. Why doesn´t the ship sink?</u>

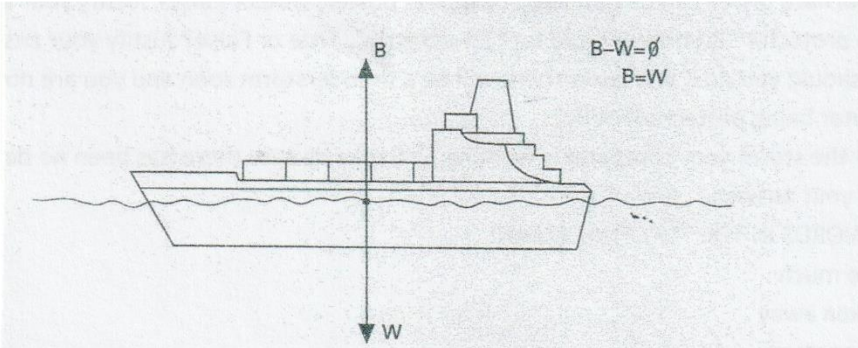

Fig. 1

To answer this problem we must look at the **forces** on the ship (Fig.1). The **weight**, W, acts downwards: that (a) is the **gravity** force. The **buoyancy**, B, acts upwards. Since the ship is in **equilibrium**, the **resultant force** is zero, so the **magnitudes** of B and W must be the same.

B) Another important force in engineering is the one (b) caused by **elasticity**. A good example of this (c) is a spring. Springs exert more force the more they (d) are stretched. This property provides a way of measuring force. A spring balance can be calibrated in **newtons**, the unit of force.

<u>What makes the spring stretch and what keeps the weight up?</u>

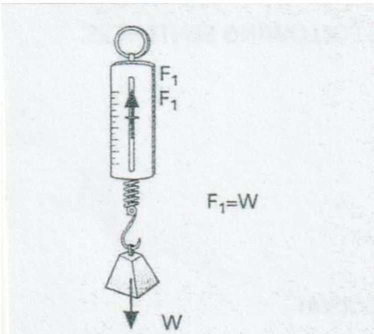

Fig. 2

The block in Fig. 2 has a weight of 10 newtons. The weight on the balance pulls the spring down. To give equilibrium, the spring pulls up to oppose that weight (e). This upward force, F1, equals the weight of the block, W.

C) It is important to get the distinction between **mass** and **weight** absolutely clear. Mass is the quantity of **matter** in an object. Weight is the force on that object due to gravity. Mass is measured in **kilograms**, whereas weight, being a force, is measured in **newtons**.

We have looked at **buoyancy**, **elasticity** and **gravity**. There is a fourth force important in engineering, and that (f) is **friction**. Friction is a help in some circumstances but a hindrance in others. Let us examine the forces on the box (Fig. 3).

Why doesn´t the box slide down the slope?

Firstly, there is its (g) weight, W, the gravity force, then there is the reaction, R, normal to the plane. R and W have a resultant force trying to pull the box down the slope. It is the friction force, F, acting up the slope, that stops it (h) sliding down.

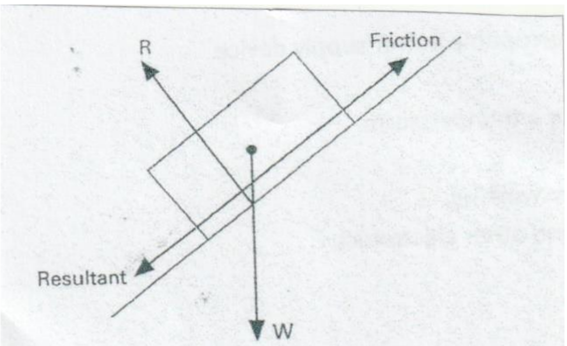

Fig. 3