SmD Physics
F Newton's second law of motion

1. The **weight** of 1kg (=**mass!**) depends on the place where it's measured (see figure).

$$g_E \approx 9.81 \text{m/s}^2$$
$$g_M \approx 1.62 \text{m/s}^2$$
$$g_J \approx 26 \text{m/s}^2$$
$$g_V \approx 8.5 \text{m/s}^2$$
$$g_S \approx 0 \text{m/s}^2$$

Earth   Moon Jupiter   Venus   "Space"
 (E)   (M)   (J)   (V)   (S)

   a) Calculate the **weight** of a mass of 12kg on Earth and on the Moon.
   b) Calculate **your weight** on Earth, on the Moon, on Jupiter, on Venus and in "space".
   c) How much is **your mass** in each of these cases?

2. What is the acceleration of a 40-kg block of cement when pulled sideways with a net force of 200N?

3. What is the acceleration of a 20-kg box that is pulled upward (**not** sideways!) with a force of 300N?

4. How much acceleration does an airplane of mass 30'000kg experience in takeoff when the thrust for each of four engines is 30'000N?

5. A man of mass 80kg slides down a vertical pole with an acceleration of 4m/s^2. What is the friction force that acts on the man?

6. Sprinting near the end of a race, a runner with a mass of 60kg accelerates from a speed of 6m/s to a speed of 7m/s in 2s.
   a) What is the runner's average acceleration during this time?
   b) To gain speed the runner produces a backward force on the ground, so that the ground pushes the runner forward providing the force necessary for acceleration. Calculate this average force.

7. An oil tanker (ship) has a mass of 120'000'000kg. It accelerates to 4m/s in 10m.
   a) Calculate its acceleration.
   b) Calculate the force required to produce this acceleration.

8. A car is driven into a brick wall at 15m/s. The mass of the car is 1'000kg. The car is stopped in 0.5 seconds.
   a) What is the average **deceleration** of the car?
   b) What average force does the wall exert on the car?