Key words

acceleration
action at a distance
friction
gravity
gravitational field
mass
terminal velocity
viscosity
weight

1 Gravity: action at a distance

- The force of *gravity* acts through space and can cause an object which is not in contact with Earth to fall to the ground.
- Earth is surrounded by a *gravitational field* which exerts a force on any object within that field. The strength of a gravitational field is defined as the force acting on unit *mass* in the field.
- Measurements on Earth's surface show that an object of mass 1 kg experiences a force of 9.8 N due to gravity; i.e. its *weight* is 9.8 N.
- The strength of Earth's field is denoted by g and is 9.8 N kg^{-1}. Since N = kg ms^{-2}, g can also be given as 9.8 m s^{-2}, the *acceleration* due to gravity.

2 Free fall and terminal velocity in air

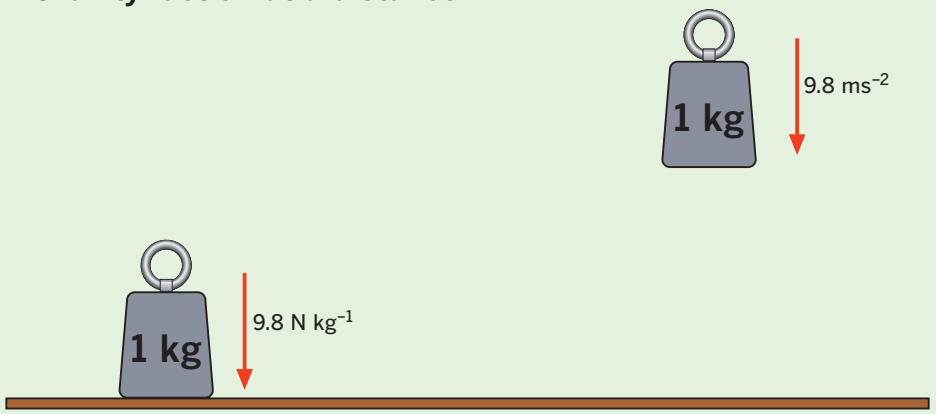
- When an object falls through the air the force of weight acts downwards, pulling it towards the ground while the force of air resistance acts in the opposite opposing this motion.
- Initially, the falling object speeds up however, as it does, air *friction* increases and reduces its acceleration. Eventually, the upward force due to air friction is equal to the weight of the object and the resultant force is zero. The object no longer accelerates but falls at a constant velocity called its *terminal velocity*.

3 Free fall and terminal velocity in a liquid

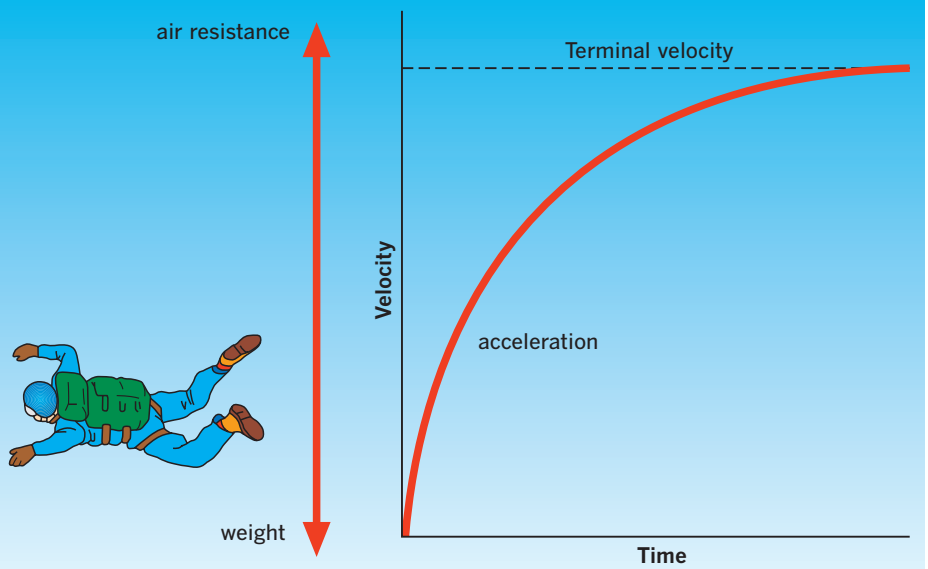
- Objects moving through *viscous* liquids behave in exactly the same way.
- The ball bearing initially accelerates but as it does the friction acting on it from the oil increases. At some point the ball bearing reaches a constant velocity—its terminal velocity.

Free fall and terminal velocity

1 Gravity: action at a distance



2 Free fall and terminal velocity in air



3 Free fall and terminal velocity in a liquid