

Y11 Forces in Action

1.8 Centre of mass

a) The centre of mass of an object is the point at which the mass of the object may be thought to be concentrated.

You will be expected to be able to describe how to find the centre of mass of a thin, irregular sheet of a material.

b) If freely suspended, an object will come to rest with its centre of mass directly below the point of suspension.

c) The centre of mass of a symmetrical object is along the axis of symmetry.

d) The relationship between time period **T**, and frequency **f** is:

$$\mathbf{T = 1/f}$$

The time period of a pendulum depends on its length.

Applications of the pendulum should include simple fairground and playground rides.

The equation for the time period of a pendulum is not required.

1.9 Moments

a) The turning effect of a force is called the moment.

b) The relationship between the moment **M**, turning force **F** and perpendicular distance **d** from the force to the pivot is:

$$\mathbf{M = F \times d}$$

c) If an object is not turning, the total clockwise moment must be exactly balanced by the total anticlockwise moment about any pivot.

You should be able to calculate the size of a force, or its distance from a pivot, acting on an object that is balanced.

d) Simple levers can be used as force multipliers.

e) If the line of action of the weight of an object lies outside the base of the object there will be a resultant moment and the body will topple.

Examples should include vehicles and simple balancing toys.

1.10 Circular motion

a) When an object moves in a circle it continuously accelerates towards the centre of the circle. This acceleration changes the direction of motion of the body, not its speed.

b) The resultant force causing this acceleration is called the centripetal force and is always directed towards the centre of the circle.

You should be able to identify which force provides the centripetal force in a given situation.

c) The centripetal force needed to make an object perform circular motion increases as:

- the mass of the object increases
- the speed of the object increases
- the radius of the circle decreases.

The equation for calculating centripetal force is not required.

1.11 Hydraulics

a) Liquids are virtually incompressible, and the pressure in a liquid is transmitted equally in all directions.

You should understand that this means that a force exerted at one point on a liquid will be transmitted to other points in the liquid.

b) The relationship between pressure **P**, force **F** and cross-sectional area **A** is:

$$\mathbf{P = F/A}$$

c) The use of different cross-sectional areas on the effort and load side of a hydraulic system enables the system to be used as a force multiplier.