

## Section 1: Forces and motion

- a) Units
- b) Movement and position
- c) Forces, movement, shape and momentum
- d) Astronomy

### a) Units

*Students will be assessed on their ability to:*

- 1.1 use the following units: kilogram (kg), metre (m), metre/second (m/s), metre/second<sup>2</sup> (m/s<sup>2</sup>), newton (N), second (s), newton per kilogram (N/kg), **kilogram metre/second (kg m/s)**.

### b) Movement and position

*Students will be assessed on their ability to:*

- 1.2 plot and interpret distance-time graphs
- 1.3 know and use the relationship between average speed, distance moved and time:

$$\text{average speed} = \frac{\text{distance moved}}{\text{time taken}}$$

- 1.4 describe experiments to investigate the motion of everyday objects such as toy cars or tennis balls
- 1.5 know and use the relationship between acceleration, velocity and time:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$a = \frac{(v-u)}{t}$$

- 1.6 plot and interpret velocity-time graphs
- 1.7 determine acceleration from the gradient of a velocity-time graph
- 1.8 determine the distance travelled from the area between a velocity-time graph and the time axis.

## c) Forces, movement, shape and momentum

Students will be assessed on their ability to:

1.9 describe the effects of forces between bodies such as changes in speed, shape or direction

1.10 identify different types of force such as gravitational or electrostatic

**1.11 distinguish between vector and scalar quantities**

**1.12 understand that force is a vector quantity**

**1.13 find the resultant force of forces that act along a line**

1.14 understand that friction is a force that opposes motion

1.15 know and use the relationship between unbalanced force, mass and acceleration:

force = mass  $\times$  acceleration

$$F = m \times a$$

1.16 know and use the relationship between weight, mass and  $g$ :

weight = mass  $\times$   $g$

$$W = m \times g$$

1.17 describe the forces acting on falling objects and explain why falling objects reach a terminal velocity

1.18 describe experiments to investigate the forces acting on falling objects, such as sycamore seeds or parachutes

1.19 describe the factors affecting vehicle stopping distance including speed, mass, road condition and reaction time

**1.20 know and use the relationship between momentum, mass and velocity:**

**momentum = mass  $\times$  velocity**

$$p = m \times v$$

**1.21 use the idea of momentum to explain safety features**

**1.22 use the conservation of momentum to calculate the mass, velocity or momentum of objects**

**1.23 use the relationship between force, change in momentum and time taken:**

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}}$$

**1.24 demonstrate an understanding of Newton's third law**

1.25 know and use the relationship between the moment of a force and its distance from the pivot:

**moment = force  $\times$  perpendicular distance from the pivot**

1.26 recall that the weight of a body acts through its centre of gravity

**1.27 know and use the principle of moments for a simple system of parallel forces acting in one plane**

**1.28 understand that the upward forces on a light beam, supported at its ends, vary with the position of a heavy object placed on the beam**

1.29 describe experiments to investigate how extension varies with applied force for helical springs, metal wires and rubber bands

1.30 understand that the initial linear region of a force-extension graph is associated with Hooke's law

1.31 describe elastic behaviour as the ability of a material to recover its original shape after the forces causing deformation have been removed.

#### **d) Astronomy**

*Students will be assessed on their ability to:*

1.32 understand gravitational field strength,  $g$ , and recall that it is different on other planets and the moon from that on the Earth

1.33 explain that gravitational force:

- causes moons to orbit planets
- causes the planets to orbit the sun
- causes artificial satellites to orbit the Earth
- causes comets to orbit the sun

1.34 describe the differences in the orbits of comets, moons and planets

1.35 use the relationship between orbital speed, orbital radius and time period:

$$\text{orbital speed} = \frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$$

$$v = \frac{2 \times \pi \times r}{T}$$

1.36 understand that:

- the universe is a large collection of billions of galaxies
- a galaxy is a large collection of billions of stars
- our solar system is in the Milky Way galaxy.