**a**

Describe the difference between scalar and vector quantities.

**b**

Give an example of a scalar and vector quantity.

scalar: _____

vector: _____

**c**

What do the length and direction of arrows represent for forces? _____

**d**

List the different types of forces, e.g. friction.

Annotate your list of forces above by writing an N for non-contact forces and a C for contact forces.

**e**

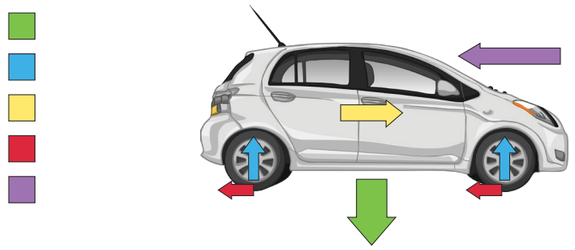
Describe the difference between a contact and non-contact force.

**f**

What is the equation linking weight, mass and gravitational field strength?

**g**

Complete the diagram to show the forces acting on a car that is decelerating.



**h**

Write the units and symbols for the following:

weight: _____

mass: _____

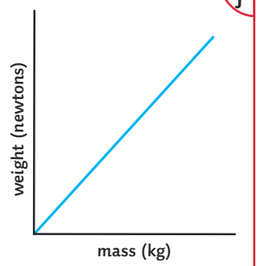
gravitational field strength: _____

**i**

Where does the weight act for an object?

**j**

Describe the relationship between mass and weight.




**k**

How is weight measured?

**l**

Write a definition for resultant force.

**m**

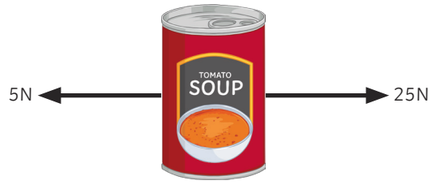
Give some examples of balanced and unbalanced forces.

**balanced:** _____

**unbalanced:** _____

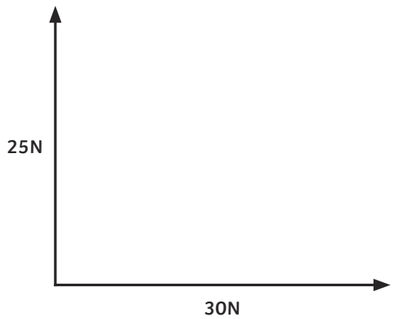
**n**

Calculate the resultant force on this object and draw an arrow on the diagram to represent this.




**o**

For the vector diagram below, add an arrow to show the resultant force and calculate it.




**p**

What is the difference between displacement and distance?

**q**

What is the equation linking work done, distance and force?

**r**

Write the units and symbols for the following:

work done: _____

force: _____

distance: _____

**s**

How much work is done on a stationary box that is moved across a carpet by a person? The box weighs 5N and it is moved 50cm.

What is the energy transfer for this box?

**t**

How many forces are required to stretch an elastic band and why?

**u**

Describe the difference between elastic deformation and inelastic deformation.

**v**

Describe the relationship between extension of an elastic object and force applied.

**a**

What is the equation that links force, spring constant and extension?

_____

**b**

Write the units and symbols for the following:

force: _____

spring constant: _____

extension: _____

**c**

What is spring constant?

_____

_____

**d**

Fill in the gaps.

When a spring is _____ or compressed by a _____, work is done on it and _____ _____ _____ is stored in the spring.

The _____ _____on the spring is equal to the elastic potential energy stored.

**e**

Describe the difference between a linear and non-linear relationship for force and extension.

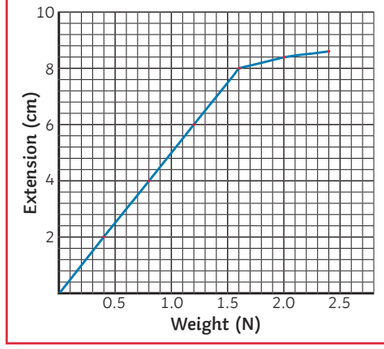
_____

_____

_____

**f**

Mark on the graph where there is a linear relationship and where there is a non-linear relationship.




**g**

What is the equation linking moment of a force, force and distance?

_____

**h**

Write the units and symbols for the following:

moment of a force: _____

distance:_____

**i**

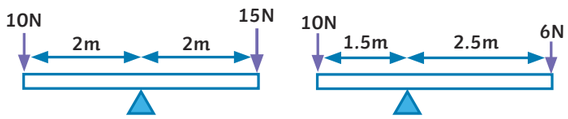
When an object is balanced, what is the relationship between the clockwise and anticlockwise moments?

_____

_____

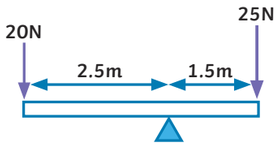
**j**

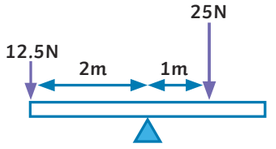
For the following situations, are the moments balanced or unbalanced? If they are unbalanced, what is the size and direction of the moment?










**k**

Explain which spanner (A, B or C) would be better to use to loosen a nut.

_____

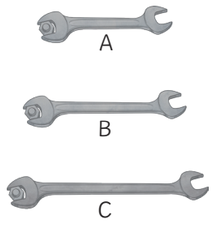
_____

_____

_____

_____

_____




**l**

What is the equation that links pressure, force normal to a surface and area of that surface?

_____

**m**

Write the units and symbols for the following:

pressure: _____

area: _____

**n**

What is a fluid?

_____

**o**

What is the cause of pressure in fluids?

_____

**p**

What is the equation linking pressure, height of the column, density of the liquid and gravitational field strength?

_____

**q**

Write the units and symbols for the following:

height of the column: _____

density: _____

gravitational field strength: _____

_____

**r**

What factors affect pressure in a column at a particular point?

_____

**s**

Explain why these factors affect the pressure.

_____

_____

_____

_____

**t**

Describe upthrust.

_____

_____

**u**

Explain which factors influence whether an object floats or sinks.

_____

_____

_____

_____

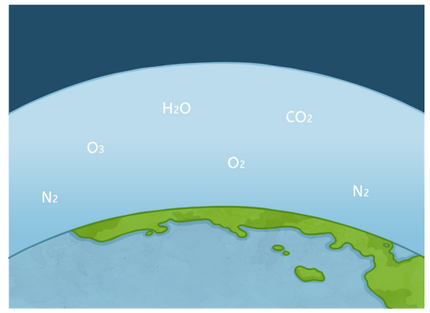
_____

**v**

What is atmospheric pressure?

_____

_____




**w**

Explain why atmospheric pressure varies with height above a surface.

_____

_____

_____

_____

_____

_____

_____

_____

**a** What factors will affect the speed a person can walk?

**b** State some typical speeds for the following in m/s:

walking: running:

cycling: city driving:

motorway driving: high speed train:

aircraft: sound:

**c** What is the equation linking distance travelled, speed and time?

**d** Write the units and symbols for the following:

distance travelled: _____

speed: _____

time: _____

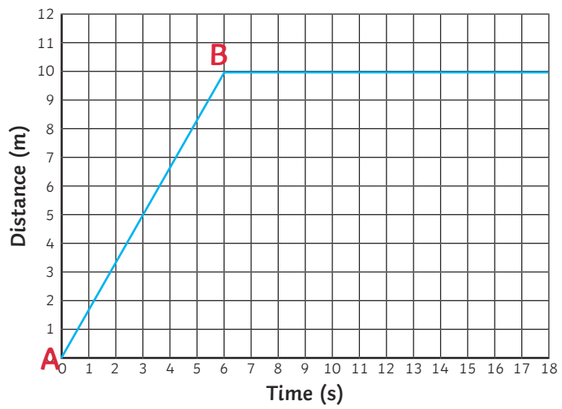
**e** What is the difference between velocity and speed?

**f** Describe what happens to the velocity of an object moving in a circle at constant speed.

**g** What does a distance-time graph represent?

**h** How can you find the speed from a distance time graph?

**i** Calculate the speed of the object in the distance/time graph from points A-B.




**j** How can you tell that an object is moving at a faster speed in a distance-time graph?

**k** What is the equation linking acceleration, change in velocity and time taken?

**l** Write the symbols and units for the following:

acceleration: _____

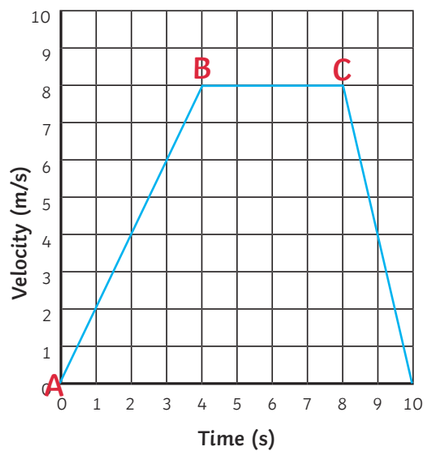
change in velocity: _____

**m** How are acceleration and deceleration shown in a distance-time graph?

**n** For a velocity-time graph, what does the gradient show?

**o** How can you find the distance travelled or displacement of an object in a velocity-time graph?

**p** Calculate the distance travelled by the object in the velocity-time graph from points A-C.




**q** Calculate the acceleration of the object between points A-B.

**r** What is the equation for uniform acceleration?

**s** Write the units for the following:

final velocity: _____

initial velocity: _____

**t** What is the acceleration due to the gravity of an object falling near the Earth's surface?

**u** Describe and explain the changes that occur to an object as it falls through a fluid.

**v** What is the term given to an object which is moving at a constant velocity in a fluid?

**w** How is constant velocity shown on a velocity-time graph?

**x** On the velocity-time graph, between which points is the object travelling at constant velocity?

**a**

State Newton's first law.

If the resultant force is zero and...

the object is stationary, _____

_____

the object is moving, _____

_____

**b**

Define the term inertia.

_____

_____

**c**

Describe the forces acting on a vehicle that has a steady speed.

_____

_____

**d**

State Newton's second law.

_____

_____

_____

_____

**e**

Define the following terms:

proportional: _____

_____

inversely proportional: _____

_____

**f**

What is the equation linking resultant force, mass and acceleration?

_____

**g**

Write the symbols and units for the following:

force: _____

mass: _____

acceleration: _____

**h**

Define inertial mass.

_____

_____

**i**

What do these symbols represent?

$\sim$ _____

$\propto$ _____

**j**

State Newton's third law.

_____

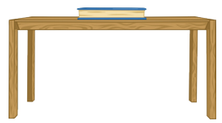
_____

_____

**k**

Show the forces acting in the following situations:

A book on a table:



A car travelling at a constant velocity:

**l**

List the factors that affect stopping distance.

_____

_____

_____

_____

_____

_____

_____

Put a T next to the factors that will affect thinking distance and a B next to those that will affect braking distance.

**m**

How can stopping distance be calculated?

_____

**n**

What is the average reaction time for an individual?

_____

**o**

If a person's reaction time is 0.7 seconds and a car is travelling at 30m/s, how far will the thinking distance be?

**p**

List the factors that affect reaction time.

_____

_____

**q**

Explain the factors affecting braking distance.

_____

_____

_____

_____

_____

**r**

Describe what happens when a force is applied to the brakes of a vehicle.

_____

_____

_____

**s**

Explain the dangers caused by large decelerations.

_____

_____

_____

**t**

What is the equation linking momentum, mass and velocity?

_____

**u**

Write the units and symbols for the following:

Momentum: _____

Veolocity: _____

**v**

Define conservation of momentum.

_____

_____

**w**

A gun with a mass of 0.16kg fires a bullet of mass 0.02kg. The bullet travels at a velocity of 180m/s.

Calculate the recoil velocity once it has been fired.

**x**

What is the change in momentum equation?

**y**

What is change in momentum?

**z**

Explain how a crumple zone reduces the injury to a person involved in a collision with a car.

_____

_____

**a**

Describe the difference between scalar and vector quantities.

**Scalar quantities only have a magnitude (size). Vector quantities have a magnitude and direction.**

**b**

Give an example of a scalar and vector quantity.

scalar: **speed and distance**

vector: **velocity, force and displacement**

**c**

What do the length and direction of arrows represent for forces? **Length represents magnitude and direction represents the direction that the force is acting in.**

**d**

List the different types of forces, e.g. friction.

| | |
|---|---|
| **friction** | **C** |
| **air resistance** | **C** |
| **tension** | **C** |
| **gravitational** | **N** |
| **electrostatic** | **N** |
| **reaction** | **C** |
| **magnetic** | **N** |
| **upthrust** | **C** |

Annotate your list of forces above by writing an N for non-contact forces and a C for contact forces.

**e**

Describe the difference between a contact and non-contact force.

**In contact forces, the objects are touching. In non-contact forces, the objects are not physically touching.**

**f**

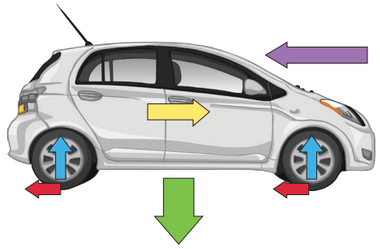
What is the equation linking weight, mass and gravitational field strength?

**weight = mass × gravitational field strength**

**g**

Complete the diagram to show the forces acting on a car that is decelerating.

- **weight**
- **reaction force**
- **driving force**
- **friction**
- **air resistance**



**h**

Write the units and symbols for the following:

weight: **W, newtons, N**

mass: **m, kilograms, kg**

gravitational field strength: **g, newtons per kilogram, N/kg**

**i**

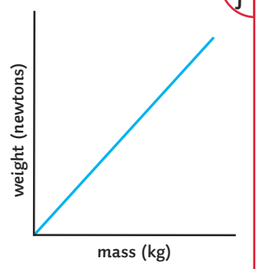
Where does the weight act for an object?

**At its centre of mass.**

**j**

Describe the relationship between mass and weight.

**Weight and mass are directly proportional.**




**k**

How is weight measured?

**Weight is measured using a newton meter.**

**l**

Write a definition for resultant force.

**Resultant force is a single force that has the same effect as the original forces all acting together.**

**m**

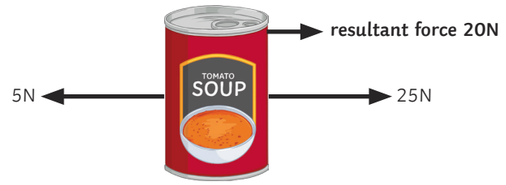
Give some examples of balanced and unbalanced forces.

**balanced: a car travelling at a steady speed, a book on a table, a stationary duck on a pond.**

**unbalanced: an aeroplane accelerating, a person standing in quicksand.**

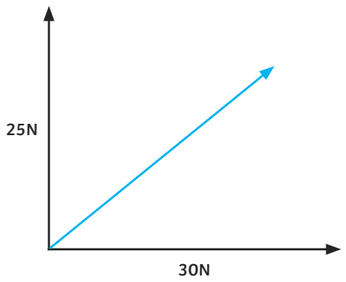
**n**

Calculate the resultant force on this object and draw an arrow on the diagram to represent this.




**o**

For the vector diagram below, add an arrow to show the resultant force and calculate it.




$AC^2 = AB^2 + BC^2$

$AC^2 = 30^2 + 25^2$

$AC^2 = 900 + 625$

$AC^2 = 1525$

$AC = 39.05$

**p**

What is the difference between displacement and distance?

**Distance is a scalar quantity and only describes how far an object has moved. Displacement is a vector quantity. It has a direction (in a straight line from the origin) and a magnitude (how far it has travelled).**

**q**

What is the equation linking work done, distance and force?

**work done = force × distance**

**r**

Write the units and symbols for the following:

work done: **W, joules, J**

force: **F, newtons, N**

distance: **s, metres, m**

**s**

How much work is done on a stationary box that is moved across a carpet by a person? The box weighs 5N and it is moved 50cm.

**work done = 5N x 0.5m**

**work done = 2.5J**

What is the energy transfer for this box?

**Chemical energy store in the person's muscles is transferred to kinetic energy store and thermal energy store of the object and the surroundings.**

**t**

How many forces are required to stretch an elastic band and why?

**Two forces pulling in opposite directions. Otherwise, it would only move in the direction that it was being pulled.**

**u**

Describe the difference between elastic deformation and inelastic deformation.

**Elastic deformation is when an object is pulled out of shape but returns to its original shape once the forces are removed. Inelastic deformation is when an object is pulled out of shape but does not return to its original shape once the forces are removed.**

**v**

Describe the relationship between extension of an elastic object and forces applied.

**The extension of an elastic object is directly proportional to the force applied as long as the limit of proportionality is not exceeded.**

**a**

What is the equation that links force, spring constant and extension?

**force = spring constant × extension**

**b**

Write the units and symbols for the following:

force: **F, newtons, N**

spring constant: **k, newtons per metre, N/m**

extension: **e, metres, m**

**c**

What is spring constant?

**Spring constant is how easy it is to stretch or compress a spring.**

**d**

Fill in the gaps.

When a spring is **stretched** or compressed by a **force**, work is done on it and **elastic potential energy** is stored in the spring. The **work done** on the spring is equal to the elastic potential energy stored.

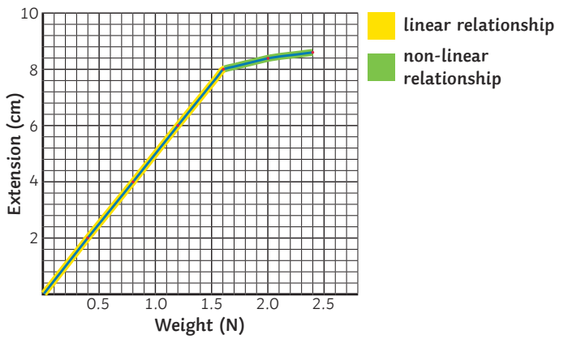
**e**

Describe the difference between a linear and non-linear relationship for force and extension.

**Extension is directly proportional to force until the limit of proportionality is exceeded. After this, force and extension are no longer proportional.**

**f**

Mark on the graph where there is a linear relationship and where there is a non-linear relationship.




**g**

What is the equation linking moment of a force, force and distance?

**moment of a force = force × distance**

**h**

Write the units and symbols for the following:

moment of a force: **M, newton-metres, Nm**

distance: **d, metres, m**

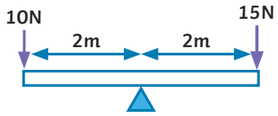
**i**

When an object is balanced, what is the relationship between the clockwise and anticlockwise moments?

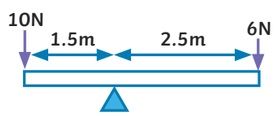
**The clockwise and anticlockwise moments are the same/equal.**

**j**

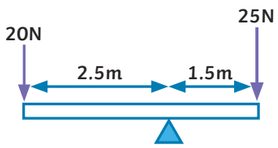
For the following situations, are the moments balanced or unbalanced? If they are unbalanced, what is the size and direction of the moment?



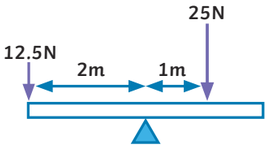

**unbalanced, turns clockwise,10Nm**




**balanced**




**unbalanced, turns anticlockwise,12.5Nm**

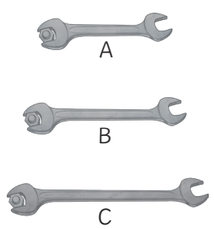



**balanced**

**k**

Explain which spanner (A, B or C) would be better to use to loosen a nut.

**The longer spanner (C) would be better as the bigger the distance from the pivot, the smaller the force needed to loosen the nut.**




**l**

What is the equation that links pressure, force normal to a surface and area of that surface?

**pressure = force normal to a surface ÷ area of that surface**

**m**

Write the units and symbols for the following:

pressure: **p, pascals, Pa**

area: **metres squared, $m^2$**

**n**

What is a fluid?

**A fluid is a gas or liquid.**

**o**

What is the cause of pressure in fluids?

**Particles collide with the surface, causing pressure.**

**p**

What is the equation linking pressure, height of the column, density of the liquid and gravitational field strength?

**pressure = height of the column × density of the liquid × gravitational field strength**

**q**

Write the units and symbols for the following:

height of the column: **h, metres, m**

density: **p, kilograms per metre cubed, $kg/m^3$**

gravitational field strength: **g, newtons per kilogram, N/kg**

**r**

What factors affect pressure in a column at a particular point?

**Height of the column above the point and density of the liquid.**

**s**

Explain why these factors affect the pressure.

**The higher the column above the point, the greater the weight, so the greater the force over a certain area. The greater the density, the greater the weight of the liquid and therefore a greater force.**

**t**

Describe upthrust.

**This is the force that a fluid exerts on an object which is partially or totally submerged.**

**u**

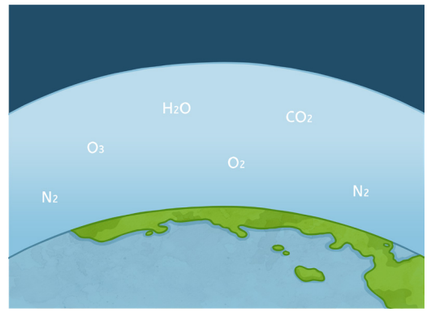
Explain which factors influence whether an object floats or sinks.

**If an object's weight is equal to upthrust, it will float. If its weight is greater than its upthrust, then it will sink. If an object is less dense than water, it will float. If it is more dense, it will sink.**

**v**

What is atmospheric pressure?

**It is a layer of air around the Earth.**




**w**

Explain why atmospheric pressure varies with height above a surface.

**As height above a surface increases, the number of air molecules decreases and therefore the density of the atmosphere decreases. An object at a lower altitude will experience greater atmospheric pressure. This is because there are more air particles above it, so there will be a greater weight acting on it.**

**a**

What factors will affect the speed a person can walk?

**age, terrain, fitness, distance travelled**

**b**

State some typical speeds for the following in m/s:

walking: **1.5m/s**

running: **3m/s**

cycling: **6m/s**

city driving: **12m/s**

motorway driving: **30m/s**

high speed train: **75m/s**

aircraft: **250m/s**

sound: **330m/s**

**c**

What is the equation linking distance travelled, speed and time?

**distance travelled = speed × time**

**d**

Write the units and symbols for the following:

distance travelled: **s, metres, m**

speed: **v, metres per second, m/s**

time: **t, seconds, s**

**e**

What is the difference between velocity and speed?

**Velocity is speed in a given direction (vector quantity), whereas speed is how fast something is moving (scalar quantity).**

**f**

Describe what happens to the velocity of an object moving in a circle at constant speed.

**The object is constantly changing direction, therefore its velocity changes.**

**g**

What does a distance-time graph represent?

**It represents the motion of an object travelling along a straight line.**

**h**

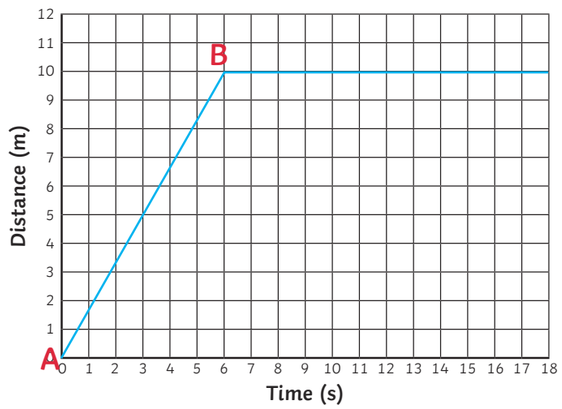
How can you find the speed from a distance time graph?

**From the gradient.**

**i**

Calculate the speed of the object in the distance/time graph from points A-B.

**speed = $\frac{\text{distance}}{\text{time}}$ = 10m ÷ 6s = 1.67m/s**




**j**

How can you tell that an object is moving at a faster speed in a distance-time graph?

**There will be a steeper gradient.**

**k**

What is the equation linking acceleration, change in velocity and time taken?

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

**l**

Write the symbols and units for the following:

acceleration: **a, metres per second squared, m/s²**

change in velocity: **Δv, metres per second, m/s**

**m**

How are acceleration and deceleration shown in a distance-time graph?

**Acceleration is shown as an upward curve, while deceleration is shown as a downward curve.**

**n**

For a velocity-time graph, what does the gradient show?

**The gradient shows acceleration.**

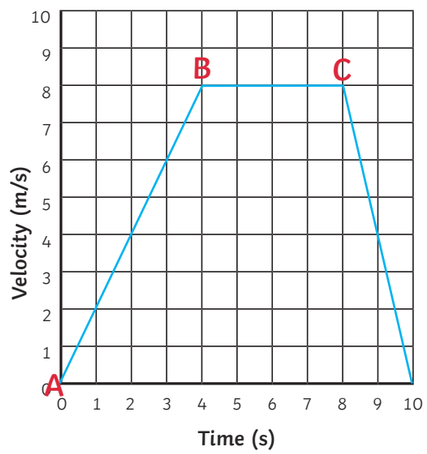
**o**

How can you find the distance travelled or displacement of an object in a velocity-time graph?

**This can be calculated by calculating the area under the graph.**

**p**

Calculate the distance travelled by the object in the velocity-time graph from points A-C.




**points A-B = $\frac{1}{2}$ × 8 × 4 = 16m**

**points B-C = 8 × 4 = 32m**

**total distance = 16m + 32m = 48m**

**q**

Calculate the acceleration of the object between points A-B.

**acceleration = $\frac{(8 - 0)\text{m/s}}{4\text{s}}$ = 2m/s²**

**r**

What is the equation for uniform acceleration?

**(final velocity)² - (initial velocity)² = 2 × acceleration × distance**

**s**

Write the units for the following:

final velocity: **v, metres per second, m/s**

initial velocity: **u, metres per second, m/s**

**t**

What is the acceleration due to the gravity of an object falling near the Earth's surface?

**9.8m/s²**

**u**

Describe and explain the changes that occur to an object as it falls through a fluid.

**The object initially accelerates due to gravity, but it accelerates less as the force upwards starts to equal the force down, until resultant force is zero. When resultant force is zero, it will fall at a constant velocity.**

**v**

What is the term given to an object which is moving at a constant velocity in a fluid?

**terminal velocity**

**w**

How is constant velocity shown on a velocity-time graph?

**Constant velocity is shown by a horizontal line.**

**x**

On the velocity-time graph, between which points is the object travelling at constant velocity?

**points B-C**

**a**

State Newton's first law.

If the resultant force is zero and...

the object is stationary, **it will remain stationary.**

the object is moving, **the object will continue to move at the same velocity.**

**b**

Define the term inertia.

**The tendency of objects to continue in their same state of rest or motion.**

**c**

Describe the forces acting on a vehicle that has a steady speed.

**The driving force is the same as the resistive forces (friction and air resistance).**

**d**

State Newton's second law.

**The acceleration of an object is proportional to the resultant force of the object and is inversely proportional to its mass.**

**e**

Define the following terms:

proportional: **as one value doubles, the other value doubles.**

inversely proportional: **as one value doubles, the other value halves.**

**f**

What is the equation linking resultant force, mass and acceleration?

**resultant force = mass × acceleration**

**g**

Write the symbols and units for the following:

force: **F, newtons, N**

mass: **m, kilograms, kg**

acceleration: **a, metres per second squared, m/s²**

**h**

Define inertial mass.

**How difficult it is to change the velocity of an object.**

**i**

What do these symbols represent?

~ **approximately**

∝ **proportional**

**j**

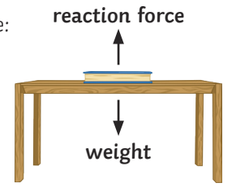
State Newton's third law.

**Whenever two objects interact, the forces they exert on each other are equal and opposite.**

**k**

Show the forces acting in the following situations:

A book on a table:




A car travelling at a constant velocity:


**l**

List the factors that affect stopping distance.

**fatigue - T**

**drugs - T**

**alcohol - T**

**distraction - T**

**weather - B**

**brakes - B**

**tyres - B**

**speed - B and T**

Put a T next to the factors that will affect thinking distance and a B next to those that will affect braking distance.

**m**

How can stopping distance be calculated?

**stopping distance = thinking distance + braking distance**

**n**

What is the average reaction time for an individual?

**0.2-0.9 seconds**

**o**

If a person's reaction time is 0.7 seconds and a car is travelling at 30m/s, how far will the thinking distance be?

**distance =30m/s × 0.7s = 21m**

**p**

List the factors that affect reaction time.

**alcohol, drugs, tiredness, distractions**

**q**

Explain the factors affecting braking distance.

**Weather – if the road is icy/snowy then there will be less friction between the tyres and the road, so the braking distance will be greater.**

**Brakes – efficient brakes will reduce the braking distance. Tyres – if tyre tread is good, then the braking distance will be reduced.**

**r**

Describe what happens when a force is applied to the brakes of a vehicle.

**Work is done by frictional forces acting between the brakes and the wheel. Kinetic energy is transferred to thermal energy in the brakes and to the surroundings.**

**s**

Explain the dangers caused by large decelerations.

**Large braking forces may lead to brakes overheating, which will increase the braking distance. The car may also lose grip with the road, causing it to skid.**

**t**

What is the equation linking momentum, mass and velocity?

**momentum = mass × velocity**

**u**

Write the units and symbols for the following:

Momentum: **p, kilogram metres per second, kg m/s**

Veolocity: **v, metres per second, m/s**

**v**

Define conservation of momentum.

**total momentum at the beginning = total momentum at the end**

**w**

A gun with a mass of 0.16kg fires a bullet of mass 0.02kg. The bullet travels at a velocity of 180m/s.

Calculate the recoil velocity once it has been fired.

**momentum of the bullet = 180m/s × 0.02kg = 3.6kg m/s**

**momentum of the bullet = momentum of the gun**

$\frac{\text{3.6kg m/s}}{\text{0.16kg}}$ **= recoil velocity = 22.5m/s**

**x**

What is the change in momentum equation?

$\textbf{force} = \frac{\textbf{change in momentum}}{\textbf{time}}$

**y**

What is change in momentum?

**mass × change in velocity**

**z**

Explain how a crumple zone reduces the injury to a person involved in a collision with a car.

**The crumple zone increases the time for the change in momentum and so reduces the force exerted on an individual.**