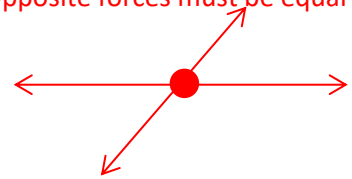
5.1 Forces

Draw a velocity vector and explain what it means.

Direction of the arrow shows the direction of the vector and the length of the line indicates the magnitude.

Draw a free-body diagram showing 4 different forces acting on a stationary object.

Opposite forces must be equal



5.2 Work done and energy transfer

What is the equation for work done and what is it measured in? What do the letters stand for?

W= F s measured in joules, J

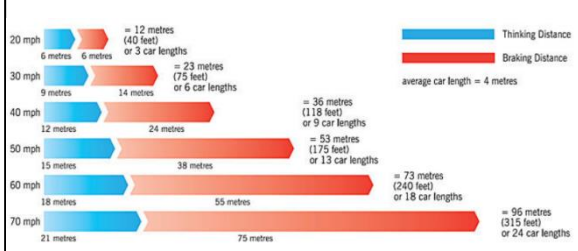
W is work done; F is force; s is distance (or displacement)

1 newton-metre is also known as what?

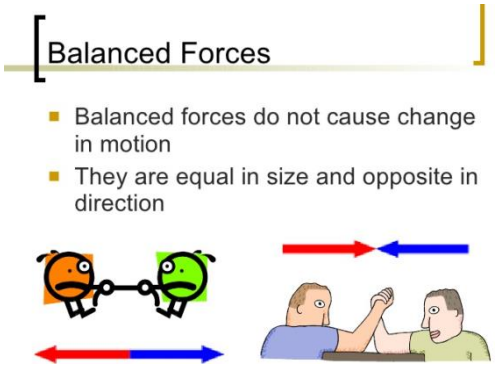
1 joule, J

20 Quick questions: Answer these in your books

1. Name 3 non-contact forces
2. What is mass measured in and what is weight measured in?
3. Is mass a force? Is force a vector?
4. What would the mass of a 90kg man be if he was on the moon?
5. Give two examples of contact forces.
6. What is the acceleration of a car when it increases velocity from 13 m/s to 31 m/s in 5 seconds?
7. If g=9.8 N/kg on the Earth, what is the weight of an 80kg man?
8. What does a horizontal line on a velocity-time graph mean?
9. On a distance-time graph, what is represented by a straight line sloping upwards?
10. What is the equation linking force, work done and distance?
11. What factors could increase thinking distance.
12. What factors could increase braking distance.
13. What does speed affect more out of thinking distance and braking distance?
14. How can a car be accelerating but travelling at a steady speed?
15. If you double your speed, what happens to the braking distance and why?
16. What equation links force and acceleration?
17. If there is a force of 145N pushing an object to the right but 75N of friction resisting the force, what is the resultant force on the object and in which direction does it move?
18. What is acceleration measured in?
19. If a car of mass 750kg needs to accelerate at 3 m/s^2, how much force must the engine provide?
20. What is terminal velocity and when does it occur?



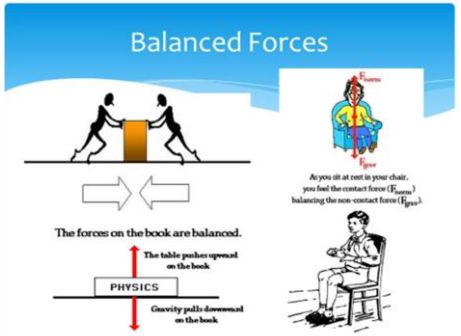
IT TAKES NEARLY TWICE AS FAR TO STOP at 70mph AS IT DOES TO STOP at 50mph



Module 5 FORCES

HIGHER

Knowledge Organiser



"May the force be with you"

(...and easy to recall during the exams).

KEY WORDS/IDEAS TO REMEMBER

contact force
displacement
newtons (N)
non-contact force
scalar
vector
velocity
average speed
distance–time graph
gradient
speed
tangent
acceleration
air resistance (or drag)
deceleration
displacement
gradient
balanced forces
equilibrium
Newton's first law
resultant force
Gravitational mass
Inertia
Inertial mass
rate of change
sketch graph
velocity–time graph
uniform motion
gravitational field strength
mass
newtonmeter
weight

5.3 Elasticity

With an elastic spring, the extension is directly proportional to what?

The force applied.

What do the letters stand for in

F = ke?

F= force; k = spring constant; e = extension

What is the equation for elastic potential energy?

$E_e = 0.5 \times k \times e^2$

What measurements would you need to make to find the spring constant of a spring?

The **extension** as different **forces** are applied.

If you plotted the extension against the force for a piece of elastic that obeys Hooke's Law, what shape would it be?

A diagonal straight line that passes through the origin.

5.4.1 Motion

How could you find the speed at any particular time of an object accelerating using a distance-time graph?

Draw a tangent at that point and measure the gradient.

How can an object be travelling in a circle but still accelerating?

The direction is constantly changing therefore velocity is constantly changing and changing velocity is acceleration.

How would you calculate the speed of an object from a distance time graph?

The gradient of the line.

How do you calculate distance travelled using a velocity-time graph?

It is the area under the graph. Counting the squares is a valid technique to find this.

$v^2 - u^2 = 2as$ If an apple falls out of a tree and falls 3m, how fast will it be going when it hits the ground?

$v = \sqrt{2 \times 9.81 \times 3} = 7.67\ m/s$

5.4.2 Newton's Laws

Newton's first law of motion

An object will remain stationary or travelling at a steady speed unless what? What is this tendency called?

A resultant (unbalanced) force acts on it. This is inertia.

What is inertial mass?

This is a measure of how difficult it is to change the velocity of an object. It is defined as the ratio of the force over acceleration.

What is the equation that summarises **Newton's second** law of motion?

F=ma

Newton's Third law of motion

If I try to push a car and it doesn't move, what does this tell you about the forces involved?

The car pushes you back with an equal force. The forces are equal and opposite.

5.4.3 Stopping distance

Define braking distance and thinking distance.

Braking distance is the distance a vehicle travels under braking force.

Thinking distance is the distance travelled during the driver's reaction time.

5.5 Momentum

What is the equation for momentum? What are the units for each of the quantities?

p=mv

p is momentum measured in kgm/s

m is mass in kg

v is velocity in m/s

What is the law of conservation of momentum?

The law of conservation of momentum states that the momentum after a collision must be equal to the momentum before the collision.