Year 9 Physics: Forces, Movement and Energy Knowledge Organiser

1. Forces

FORCES

Forces change the speed, shape or direction of an object.

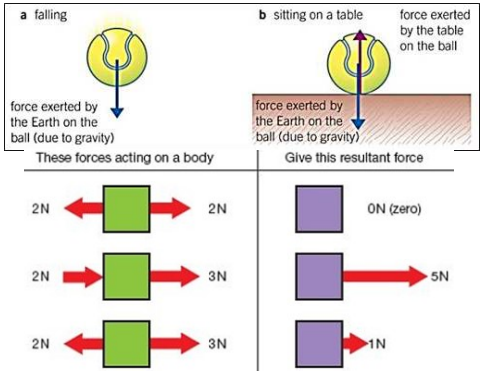
Force arrows show the direction AND size of the force.

Forces always come in pairs; interaction pairs.

Forces can be measured with a newton-meter (force meter).

Forces are measured in newtons (N).

The size and direction of a resultant force determines how (and if) an object will move.



All stationary objects are in equilibrium. The resultant force is zero.

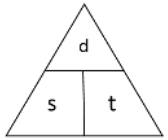
Objects moving at a steady speed have a resultant force of zero.

CONTACT FORCES	NON-CONTACT FORCES
Reaction force	Magnetism
Tension	Electrostatic
Friction & air resistance	Gravity
Applied force	

3. Speed and acceleration

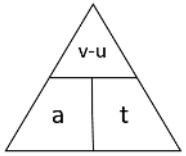
Speed is measured in miles per hour (mph) or kilometres per hour (km/h).
The speed of an object is always relative to the speed of the observer.

S= speed (m/s)
d = distance (m)
t = time (s)

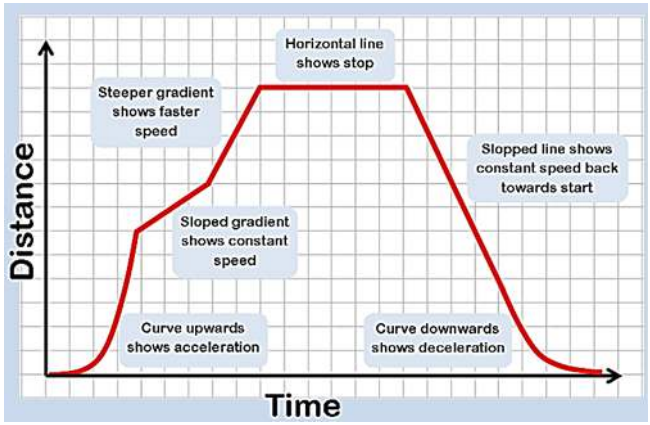


Acceleration is the rate of change in an objects velocity.

v-u = end velocity—start velocity (change in velocity)
a = acceleration (m/s^2)
t = time (s)



2. Distance time graphs



KEYWORD	DEFINITION
Acceleration	How quickly speed increases or decreases.
Air resistance (drag)	The force on an object moving through air that causes it to slow down.
Average speed	The overall distance travelled divided by overall time for a journey.
Balanced	Forces acting on an object that are the same size but act in opposite directions.
Contact forces	Force that acts by direct contact; e.g. friction
Distance-time graph	A graph that shows how far an object moves each second.
Driving force	The force that is pushing or pulling something.
Equilibrium	State of an object when all forces are balanced.
Friction	Force opposing motion which is caused by the interaction of surfaces moving over one another.
Gravitational field strength	The force from gravity on 1kg (N/kg)
Gravitational force/ gravity	A non-contact force that acts between two masses.
Interaction pairs	When two objects interact there is a force on each one that is the same size but in opposing directions.
Mass	The amount of matter 'stuff' in an object (kg).
Newtons (N)	Unit for measuring forces (N)
Non-contact force	Force that acts without direct contact, e.g. magnetism.
Resistive forces	Any force that acts to slow down a moving object.
Resultant force	Single force that can replace all the forces acting on an object and have the same effect.
Speed	How much distance is covered in a given time.
Unbalanced	Opposing forces on an object that are unequal.
Weight	The force of gravity due to the Earth (planet/ moon) on an object. Measured in N.

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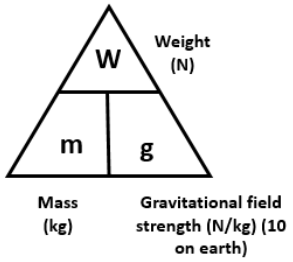
4. Mass and weight



5. Energy Stores and Transfers

ENERGY STORES:
Chemical
Thermal
Elastic
Kinetic
Gravitational potential
Nuclear
Magnetic
Electrostatic
*(**Revision tip:** use the first letter of each store to write a mnemonic to help you remember them).*

Energy is transferred by:
Heating
Mechanically (by movement/ change in position)
Electric current
Waves (sound & light)

KEYWORD	DEFINITION
Chemical energy store	Emptied during chemical reactions when energy its transferred to surroundings; e.g. burning fuel.
Dissipation	Becoming spread out wastefully to the surroundings.
Elastic energy store	Filled when a material is stretched or compressed; e.g. stretching a spring.
Energy	Energy is needed to make things happen.
Energy resources	Something with stored energy that can be released in a useful way.
Fossil fuels	Non-renewable energy resource formed from dead animals and plants, millions of years ago. E.g. coal, oil and natural gas.
Gravitational potential energy store	Filled when an object is raised; e.g. book on a shelf or when climbing a ladder.
Joules	The unit of energy, symbol J 1 kilojoule (kJ) = 1000 J
Kinetic energy store	Filled when an object speeds up/ moves; e.g. when a car accelerates.
Law of conservation of energy	Energy cannot be created or destroyed, only transferred between stores.
Non-renewable	An energy resource that cannot be replaced and will be used up, such as coal, oil or gas, or nuclear.
Renewable	An energy resource that can be replaced and will not run out; e.g. solar, wind, waves, geothermal and biomass.
Thermal energy store	Filled when an object is warmed up; e.g. heating water in a kettle.

REDUCING ENERGY USE
Use fewer appliances, Use appliances with a lower power rating, Use appliances for fewer hours.
Insulate the home; this reduces the rate at which energy is transferred to surroundings; reducing need to heat the house.

6. Energy

Energy can be **dissipated/ wasted** due to **friction** (energy transferred to a thermal store / sound) or when objects get **hot** and transfer energy to anything at a lower temperature.
The efficiency of an appliance can be calculated by:

$$\text{Efficiency} = \frac{\text{Useful Energy Output}}{\text{Energy Input}} \times 100\%$$

7. Energy Transfers

Energy Transfer: The movement of energy from one store to another.

Energy Transfer	How it transfers
Mechanical Working	Physical movement
Electrical Working	Movement of charge in electrical currents
Heating	Via conduction or convection
Radiation	Light, sound or heat

Energy Key points

Theory	Definition
Conservation of energy	Energy cannot be created or destroyed Energy can only change store within a system
Dissipation of energy	Energy if lost from a system, spreads out, often as heat
System	Is an object or group of objects
Wasted energy	Energy that is not usefully transferred