
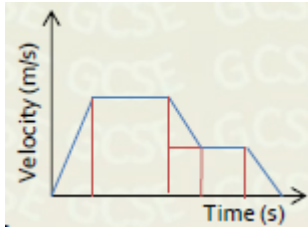


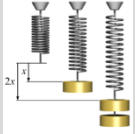
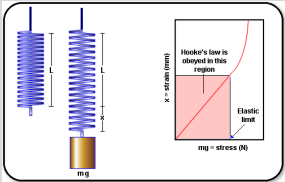
P2 Knowledge Organiser: Forces I

Speed (m/s) =	Distance (m) / time (s)	What is the resultant force if there are 10N → and 8N ← ?	2N →
In a distance-time graph: positive gradient =	Object moves away from starting point	What is the resultant force if there are 10N & 3N ⇨, 8N ← ?	5N →
In a distance-time graph: negative gradient =	Object moves towards starting point	The object is moving and the resultant force is 8N ←. What happens?	The object decelerates.
In a distance-time graph: if the gradient is zero:	Object is stationary (does not move)		
What is velocity?	Speed in a direction	The object is moving and the resultant force is 8N→. What happens?	The object accelerates.
In a velocity-time graph: positive gradient =	Object speeds up		
In a velocity-time graph: negative gradient =	Object slows down	Which formula links force, mass and acceleration?	Force = mass x acceleration
In a velocity-time graph: gradient is zero =	Object travels at steady speed	What is drag?	Air resistance or friction
Area underneath the velocity-time graph represents the...	Distance travelled	What happens to drag as a car accelerates?	It increases until driving force = drag (resistive forces)
Area of a rectangular =	Base x Height	How do you calculate acceleration?	Change in speed/ time
How do calculate the area of a triangle?	(Base x Height) / 2		
What is a resultant force?	The force acting on an object	Unit for acceleration?	m/s ²
The object is stationary and the resultant for is 0N. What happens to the object?	It remains stationary.	 	
The object is moving and the resultant force is zero. What happens to the object?	The object continues to move at steady speed.		

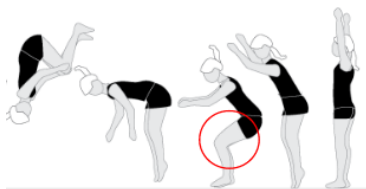

P2 Knowledge Organiser: Forces II

What force is the driving force from the motor of a car?	Thrust	Why do the brakes become hot when used?	Work is done by friction force between brakes and the wheel. Kinetic energy is reduced and transferred to thermal energy.
Which forces are resistive forces?	Air resistance and friction	What is a regenerative braking system?	Braking system fitted into hybrid cars. Motor is put in reverse. This slows car down as the wheels are slowed. The battery is recharged in the process. Work is done to convert kinetic energy to electrical and chemical energy.
Why do cars reach a top speed that does stay constant?	When a car accelerates, the resultant force is forward. As speed increases, resistive forces also increase, reducing the resultant force. Eventually thrust and drag are equal and the resultant force is zero.		
Why does a streamlined car reach higher speed than a lorry?	Streamlined means drag is smaller. It will take a higher speed before driving force = resistive force.	What is terminal velocity?	Top speed
What is thinking distance?	Distance a car travels between the driver spotting the obstacle and hitting the brakes.	How does a sky diver reach terminal velocity?	Jump: only weight/gravity acting on diver. Diver accelerates downwards. Speed increases, so air resistance increases until weight = air resistance. Terminal velocity is reached.
What is braking distance?	Distance car travels between driver hitting the brakes and car stopping.		
What is stopping distance?	Thinking distance + braking distance.	What happens when the parachute opens during a sky dive?	Surface area increase, so air resistance increases. Air resistance is greater than weight, so speed decreases. As speed decreases, air resistance decreases until both are equal and a new terminal velocity has been reached.
What affects thinking distance?	Tiredness, drugs, visibility, distractions, alcohol		
What affects braking distance?	Mass of car, condition of road, condition of brakes and tyres.		

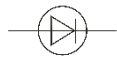



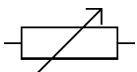

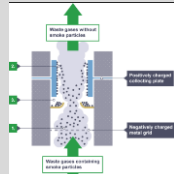

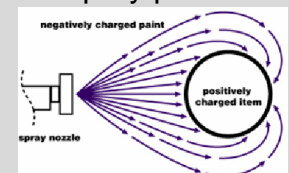
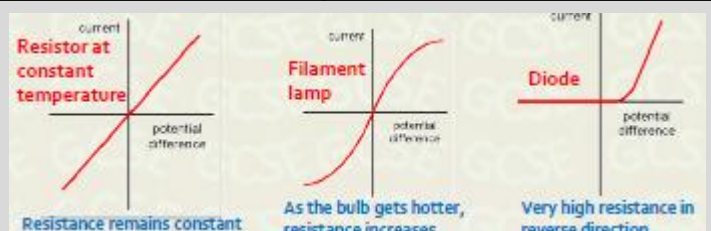
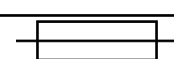
P2 Knowledge Organiser: Forces III

<p>What happens to the shape of an elastic object when a force acts on it?</p>	<p>The shape changes.</p>	<p>What is work?</p>	<p>The force needed to make an object move a distance. Work (J) = Force (N) x distance (m)</p>
<p>When work is done to change the shape of an elastic object, what is the work done stored as?</p>	<p>Elastic potential energy</p>	<p>Why is it easier to drag a box up a ramp rather than lift it up directly?</p>	<p>Dragging increases distance so less force is needed to do the same amount of work.</p>
<p>What is Hooke's law?</p> 	<p>When an object, such as a spring or elastic band is stretched, the extension of the object is directly proportional to the force applied.</p>	<p>What is the formula for Gravitational Potential energy?</p>	<p>GPE (J) = mass (kg) x height (m) x gravitational field strength (10N/kg)</p>
<p>What does directly proportional mean?</p>	<p>Straight line through the origin.</p>	<p>What is the formula for kinetic energy?</p>	<p>KE(J) = ½ mass x velocity²</p>
<p>What is the limit of proportionality?</p> 	<p>The relationship between extension and force applied is no longer directly proportional. Beyond the limit of proportionality the object can no longer return to its original shape.</p>	<p>Rollercoaster ride: what is the speed at which the carriage arrives at the bottom of the slide?</p>	<p>The GPE at the top of the slide is transferred to KE at the bottom so that at the bottom: GPE = KE. Rearrange the KE equation to velocity² = KE x 2/mass and velocity = √(KE x 2/mass)</p>
<p>Hooke's law formula =</p>	<p>Force (N) = extension (m) x spring constant (N/m)</p>	<p>What happens to the KE if the speed doubles?</p>	<p>The KE increases by a factor of 4. This means a car hitting a tree at twice the speed, will experience 4x more force and damage.</p>
<p>Which object does not follow Hooke's law?</p>	<p>A rubber band; a plastic strip</p>		
<p>How do you find the limit of proportionality?</p>	<p>Measure the length of the unstretched spring. Attach the first weight and measure the extension of the spring. Repeat with further weights until the limit has been reached.</p>		

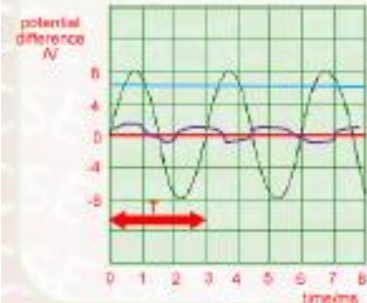
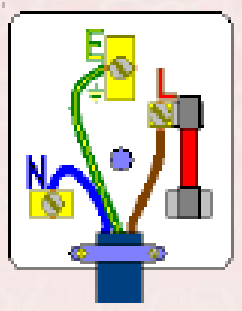
P2 Knowledge Organiser: Forces IV

<p>What do all moving objects have?</p>	<p>Momentum</p>	<p>What is the main safety feature at a playground?</p>	<p>Rubber flooring.</p>
<p>What is the formula for momentum?</p>	<p>Momentum (kg m/s) = mass (kg) x velocity (m/s)</p>	<p>What is the purpose of this safety feature?</p>	<p>The child slows down; this increases the time taken to change momentum to zero. The force exerted by the floor on the child is less. Injury is reduced.</p>
<p>Why does momentum have direction?</p>	<p>Because velocity has direction.</p>		
<p>What happens to momentum when a collision happens in a closed system?</p>	<p>Momentum is conserved. That means the total momentum before the collision = total momentum after the collision.</p>		
<p>How do you calculate the velocity of an object after a collision?</p>	<p>Use Momentum = mass x velocity to find the total momentum before collision (adding momentum of object 1 and object 2). Total Momentum after collision = total momentum before collision = mass of both objects x velocity. Rearrange to velocity = total momentum after / mass of both objects.</p>	<p>Why do gymnasts bend their legs when the jump off the apparatus?</p>	<p>The gymnast slows down; this increases the time taken to change momentum to zero. The force exerted by the floor on the gymnast is less. Injury is reduced.</p> 
<p>What are the main safety features in a car?</p>	<p>Air bag, seat belt, crumple zone, side impact bars</p>	<p>Skater 1 has a mass of 70kg and travels at 2m/s towards skater 2 who has a mass of 48kg and travels at 3m/s. At what velocity do the two skaters move after collision?</p> <p>Momentum skater 1 = $70 \times 2 = 140$. Momentum skater 2 = $48 \times 3 = 144$ Total momentum before = $140 + 144 = 284$. Total momentum after = $284 = (\text{mass of skater 1} + 2) \times \text{velocity}$. Velocity = $284 / (70+48) = 2.4\text{m/s}$.</p>	
<p>What is the purpose of the safety features in a car?</p>	<p>To ensure the time taken to stop the car and bodies increases. This decreases the change in momentum and therefore reduces the forces on the car and bodies reducing injury.</p>		

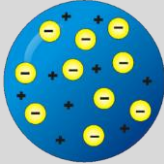
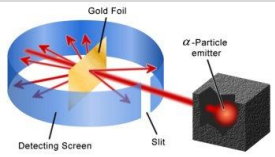
P2 Knowledge Organiser: Electricity I

Like charges	Repel	Symbol for a diode	
Unlike charges	Attract	Symbol for a cell	
How do you create static?	Rub two insulators against each other. Electrons transfer due to friction from one material to the other.	Symbol for a battery	
		Symbol for a resistor	
What causes an electric shock?	Electrons jumping from one object to another.	Symbol for a variable resistor	
How do you prevent accidents due to static electricity?	Earthing objects so electrons flow into the ground instead of building up on an object.	Symbol for a thermistor	
Describe how static is used to remove smoke from chimney gases 	Smoke particles rise up the chimney and brush against a negative grid. Smoke particles become negatively charged and are attracted to positive plates at the sides of the chimney.	Symbol for an LDR	
		What causes resistance?	Electrons colliding with vibrating ions inside conductor
		How does an LDR work?	Resistance decreases as light intensity increases.
Describe how static electricity is used to spray paint cars 	Each droplet is given a negative charge. Droplets all repel each other and produce a fine spray. Car is positively charged. Droplets attracted to car.	How does a thermistor work?	Resistance decreases as temperature increases.
		What is Ohm's law?	The current through a resistor at constant temperature is directly proportional to the voltage across the resistor.
Define current	Flow of charge/ flow of electrons		
What is charge measured in?	Coulombs		
Symbol for a fuse			

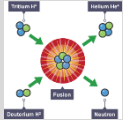
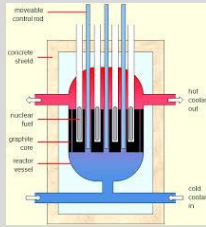
P2 Knowledge Organiser: Electricity II

Current in a series circuit	The same everywhere	Typical mistakes made when wiring a plug?	Select wrong fuse size, connect wires wrong way round, too much bare wire, not securing cable with cable grip.		
Current in a parallel circuit	Current splits				
Voltage in a series circuit	Voltage splits between components				
Voltage in a parallel circuit	Voltage same in each loop but still split between components that are in the same loop	What is direct current, d.c.?	Current that flows in one direction only. Used in cells and batteries.		
Resistance in a series circuit	Total resistance = sum of resistance of each component	What is alternating current, a.c.?	Current that changes direction.		
Which colour is the earth wire?	Green/yellow	What is the UK mains electricity supply?	a.c. current 230V 50Hz (50 direction changes per second)		
Which colour is the neutral wire?	Blue				
Which colour is the live wire?	Brown				
How is a plug double insulated?	Plastic casing and plastic cable around wires	<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;">  </div> <div style="flex: 2; padding-left: 10px;"> <p>An oscilloscope can display d.c. current (blue) or a.c. current (live wire: green; neutral wire: purple). The amplitude of the wave is the maximum voltage supplied. The x axis represents the time T taken for one cycle.</p> <p>Frequency is calculated the following way:</p> <p>Frequency (Hz) = 1/time per cycle (seconds)</p> </div> </div>			
What is the job of a fuse?	To blow when the current is too large. This breaks the circuit.				
An appliance runs on 3A. What size fuse should you use?	Next size up: 5A.				
What is a residual current circuit breaker?	A fuse that detects small changes in current and switches off current faster than a normal fuse. An RCCB can be reset.				
Why should you not touch electrical appliances with wet hands?	Wet skin has a lower resistance than dry skin. This increases risk of shock.				
					

P2 Knowledge Organiser: Radioactivity

What is a radioactive atom?	An atom that has an unstable nucleus that decays.	Alpha decay general equation	${}^A_Z X \rightarrow {}^{A-4}_{Z-2} Y + {}^4_2 \alpha$
What is an alpha particle?	He nucleus; 2protons+2 neutrons	Beta decay general equation	${}^A_Z X \rightarrow {}^A_{Z+1} Y + {}^0_{-1} \beta$
Properties of alpha particles?	2+ charge, mass of 4, ionising, 5cm range in air; stopped by paper/dust; deflected by magnetic field	What happens during beta decay?	A neutron changes into a proton and electron. The electron is the beta particle which is lost.
What does ionising mean?	Being able to knock electrons off another particle.	Natural sources of background radiation	Radon gas, cosmic rays, soil, building materials, food
What is a beta particle?	A fast moving electron	Man-made sources of background radiation	Nuclear weapons, x-ray machines
Beta particle properties?	1- charge, travels a few m, stopped by 3mm aluminium, deflected by magnetic field in opposite direction to alpha.	What is half life?	Time taken for half the radioactive atoms to decay.
		Gamma radiation uses	Sterilise food and medical equipment; radiotherapy
What is gamma radiation?	Electromagnetic wave	What is the plum pudding model? 	Early scientists thought the atom was like a plum pudding. Positively charged protons making up the pudding with electrons like plums placed inside the pudding base.
Gamma properties?	No charge, no mass; travels several km; stopped by several metres of concrete or thick lead sheets.		
Alpha radiation uses	Smoke detectors	Describe Rutherford's Gold foil experiment 	He shot alpha particles at gold foil. Most alpha particles went through. Some got reflected or deflected. This shows atom is mainly empty space with a tiny positive nucleus.
Beta radiation uses	Tracer for leaky pipes/blood vessels; to monitor thickness of paper or metal sheets		
Describe nuclear fission	Slow moving neutron fired at nucleus. Nucleus absorbs neutron. Nucleus becomes unstable and splits into two. 2-3 neutrons and energy released. Neutrons released go on to split other nuclei and start a chain reaction. Control rods remove excess neutrons.		

P2 Knowledge Organiser: Stars

<p>What is nuclear fusion?</p> 	<p>Two small nuclei join together to form a larger nucleus. Large amounts of energy are released.</p>	<p>Life cycle of a large star – stage 4</p>	<p>Star runs of hydrogen fuel, temperature decreases, star expands to a red super giant.</p>
<p>What are the conditions required for nuclear fusion?</p>	<p>Very high temperature and very high pressure to overcome repulsion between the two positive nuclei.</p>	<p>Life cycle of a large star – stage 5</p>	<p>Red supergiant collapses; the compression reverses suddenly and star explodes as a supernova.</p>
<p>Which nuclei are fused inside our Sun?</p>	<p>Hydrogen nuclei fuse to form helium nuclei.</p>	<p>Life cycle of a large star – stage 6</p>	<p>Heavier elements such as iron form during supernova.</p>
<p>Life cycle of any star– stage 1</p>	<p>Dust and gas are pulled together by gravity</p>	<p>Life cycle of a large star – stage 7</p>	<p>Core left behind forms a neutron star (very dense)</p>
<p>Life cycle of any star– stage 2</p>	<p>Friction produces heat, hydrogen nuclei fuse; star born</p>	<p>Life cycle of a large star – stage 8</p>	<p>Or core left behind forms a black hole if enough mass is left behind.</p>
<p>Life cycle of any star – stage 3</p>	<p>Main sequence stage: force of gravity is balanced by outward force of radiation pressure.</p>	<p>Nuclear fusion reactor pros</p>	<p>Safer and cleaner as no radioactive waste produced. No CO₂ emissions. Releases huge amounts of energy.</p>
<p>Life cycle of a small star (e.g. Sun) – stage 4</p>	<p>Star runs out of hydrogen nuclei. Temperature decreases, star expands to a red giant.</p>		
<p>Life cycle of a small star (e.g. Sun) – stage 5</p>	<p>Helium and other lighter elements fuse to form heavier elements.</p>	<p>Nuclear fusion reactor cons</p>	<p>Expensive and difficult to set up as huge temperatures and pressure needed to start fusion. Material needed to build reactor walls does not yet exist.</p>
<p>Life cycle of a small star (e.g. Sun) – stage 6</p>	<p>Inner core collapses, heats up and forms a white dwarf.</p>		<p>Large magnetic field needed to contain hydrogen nuclei. This field is expensive and difficult to achieve.</p>
<p>Life cycle of a small star (e.g. Sun) – stage 7</p>	<p>Fusion stops, white dwarf fades out, goes cold and becomes a black dwarf.</p>		