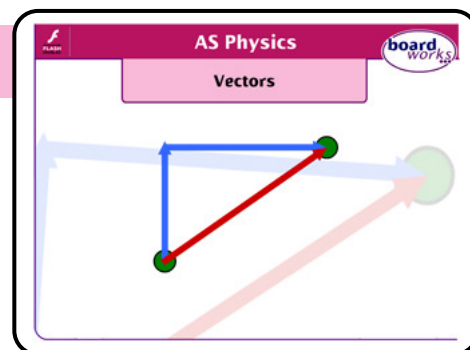


Boardworks AS Physics





Vectors

24 slides


 11 Flash activities






Prefixes, scalars and vectors

-  Guide to the SI unit prefixes of orders of magnitude
-  Matching powers of ten to their SI unit prefixes
-  Guide to example scalar and vector measurements
 - Overview of vector equations
-  Identifying measurements as being either scalar or vector




Displacement vectors

- Overview of displacement vectors
- Vector notation and vector addition
- How to calculate a resultant vector
-  Create-your-own vector activity, including calculations involving the resultant

Velocity vectors

- Overview of vector components and how to calculate them
-  Create-your-own vector activity, including calculations involving the components
-  Calculations relating to velocity vectors, including full working out
-  Identifying missing words relating to vectors

Summary activities





-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz

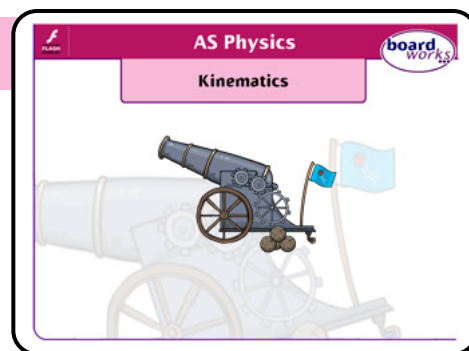
Kinematics

21 slides





 11 Flash activities

suvat equations




-  Animation illustrating how a displacement–time graph can be interpreted
-  Animation illustrating how a velocity–time graph can be interpreted
 - Overview of the *suvat* equations
-  Calculations relating to the *suvat* equations, including full working out
-  Animation illustrating how the *suvat* equations can be derived from a velocity–time graph



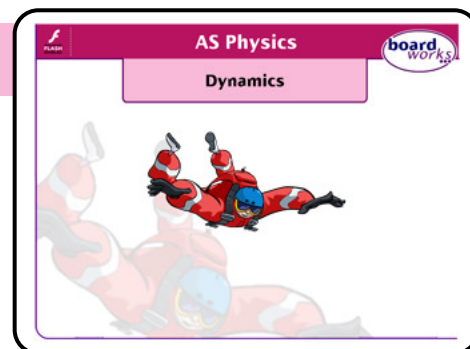
Freefall and projectile motion

-  Guide to key milestones in the understanding of gravity
 - Acceleration of freefall
-  Animation illustrating how a camera and stroboscope can be used to record projectile motion
 - Overview of the equations of projectile motion
-  Animation illustrating an example calculation using the equations of projectile motion
 - Example calculation relating to the equations of projectile motion
-  Simulation in which the trajectory of a cannonball needs to be calculated

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz





Dynamics





28 slides

 10 Flash activities


Newton's first law

- Overview of balanced forces and Newton's first law
-  Animation illustrating the concept of relativity
-  Identifying true-or-false statements about Newton's first law
-  Animation illustrating the concept of free body diagrams
-  Calculations relating to equilibrium on a slope, including full working out




Newton's second law

- Overview of unbalanced forces and Newton's second law
- Example calculation involving $F = ma$
-  Animation illustrating terminal velocity, by the example of skydiving on the Earth and the Moon
-  Calculations relating to Newton's second law, including full working out

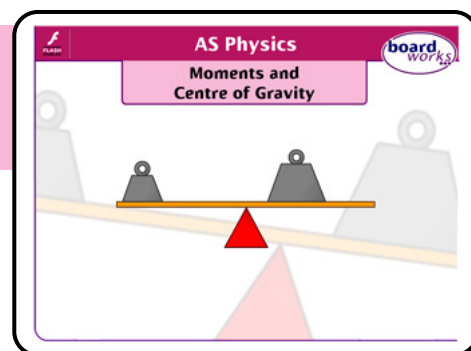
Newton's third law

- Overview of action and reaction pairs, and Newton's third law
-  Identifying true-or-false statements about Newton's third law

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz



Moments and Centre of Gravity





26 slides

 11 Flash activities





Moments

- Overview of moments and torque
-  Animation explaining how to calculate moments when force and distance are not perpendicular
- Overview of couple and the torque of a couple
-  Matching key terms relating to moments to their definitions or equations




Centre of gravity

- Overview of centre of mass and centre of gravity
-  Animation explaining how to find the centre of gravity of an object
-  Identifying missing words relating to centre of gravity

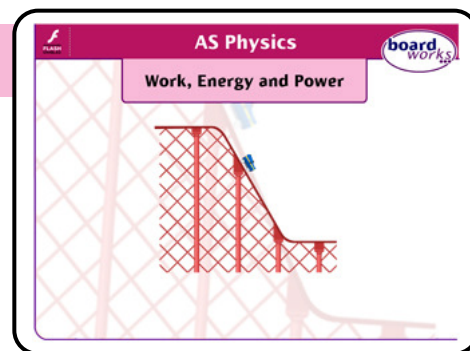
Equilibrium

- Overview of equilibrium, beam balancing and the principle of moments
-  Calculations involving beam balancing and randomly-generated forces
-  Calculations relating to balancing moments, including full working out
- The principle of moments applied to the human forearm carrying a weight
-  Simulation involving the centre of gravity of a block on a slope
- Beam balancing taking into account the centre of gravity of the beam
-  Identifying systems that are in equilibrium and how systems not in equilibrium could be made to balance

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz




Work, Energy and Power






39 slides

 12 Flash activities



Work

- Overview of work done, and example calculations
- Work done at an angle, and example calculations
-  Simulation to investigate work done when a force is applied to a trolley at an angle to the direction of motion
-  Animation illustrating how work done can be calculated from a force–distance graph
-  Identifying true-or-false statements about work done





Kinetic and potential energy

- Types of energy and energy transfer
- Gravitational potential energy and example calculations involving $E_p = mgh$
-  Animation illustrating the effect of a slope on work done and the force needed to raise an object
- Kinetic energy and example calculations involving $E_k = \frac{1}{2}mv^2$
- Conservation of energy, including example questions involving E_p and E_k
-  Simulation of a rollercoaster, including calculations involving E_p , E_k and energy lost to resistive forces
-  Calculations relating to energy, including full working out

Power and efficiency

- Power, motive power and example calculations
- Efficiency and the use of Sankey diagrams
-  Identifying missing values in a Sankey diagram
-  Calculations relating to power and efficiency, including full working out

Summary activities



-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Matching terms relating to work, energy and power with their equations
-  Multiple-choice quiz

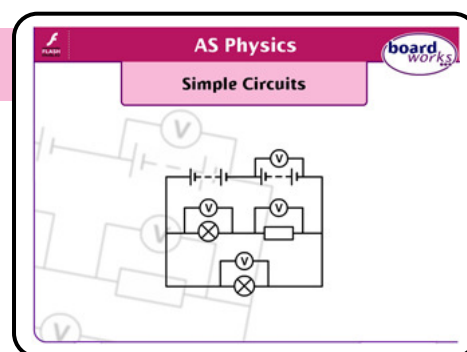
Simple Circuits

27 slides




 12 Flash activities

Circuit symbols





- Overview of the importance of circuit symbols
-  Identifying basic circuit symbols
-  Guide to more specialized electrical components






Current, voltage and resistance

- Overview of current, voltage and resistance
-  Experiment to investigate the relationship between current, voltage and resistance in two simple circuits
- Current–voltage graphs of Ohmic and non-Ohmic devices
-  Animation illustrating how to calculate the resistance of a non-Ohmic device from its current–voltage graph
-  Identifying true-or-false statements about current, voltage and resistance

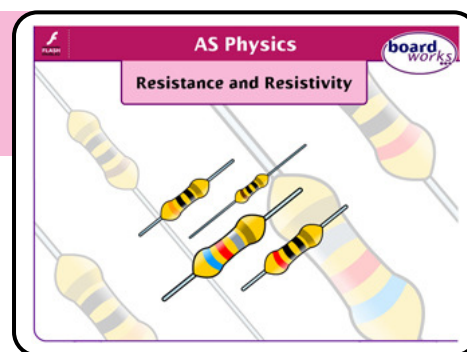
Kirchoff's laws

- Overview of Kirchoff's first law
-  Using Kirchoff's first law to calculate ammeter readings in a circuit
- Conservation of energy in a circuit
- Overview of Kirchoff's second law
-  Using Kirchoff's second law to calculate voltmeter readings in a circuit
- Further uses of Kirchoff's laws
-  Calculations relating to Kirchoff's laws, including full working out
-  Identifying missing words relating to Kirchoff's laws

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz





Resistance and Resistivity




31 slides

 17 Flash activities






Ohm's law

- Overview of resistance and Ohm's law
- Finding the resistance from a current–voltage graph
-  Animation describing the use of a test circuit to obtain current–voltage graphs for various components
-  Identifying the correct descriptions of various current–voltage graphs
-  Identifying circuit symbols and current–voltage graphs of various components
-  Identifying missing words relating to Ohm's law





Resistors in series and parallel

- Overview of equivalent resistance
- Resistance equations for resistors in series and parallel
-  Calculations relating to resistors in series and parallel, including full working out




Resistivity

- Overview of, and equation for, resistivity
-  Example worked calculations relating to the resistivity equation
-  Calculations relating to the resistivity equation, including full working out
-  Sorting materials according to whether their resistivity increases or decreases with temperature
-  Experiment investigating the effect of temperature on resistance of a resistor and a thermistor
-  Arranging various substances in order of resistivity

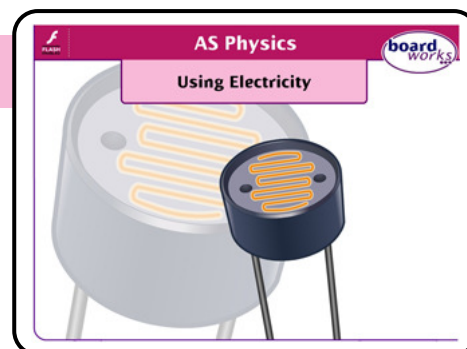
E.m.f. and internal resistance

-  Animation explaining e.m.f., internal resistance and terminal p.d.
-  Calculations relating to the e.m.f. equations, including full working out
-  Animation explaining how to find e.m.f. and internal resistance from a current–voltage graph
-  Matching phrases relating to e.m.f.

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz

Using Electricity



32 slides

16 Flash activities

Sensors

- Matching sensing components to their symbols and descriptions
- Explanation of the properties of LDRs and thermistors
- Identifying missing words relating to sensors

Potential dividers

- Experiment illustrating how voltage varies through a simple nichrome wire
- Overview of potential dividers and the potential divider equation
- Example worked calculations relating to the potential divider equation
- Experiment illustrating how a potential divider's V_{OUT} is affected by the addition of an LDR, thermistor or variable resistor, under varied conditions
- Calculations relating to the potential divider equation, including full working out
- Identifying missing words relating to potential dividers and their use in sensor circuits

Power and energy in circuits

- Overview of electrical power and the different forms of the power equation
- Example worked calculations relating to the electrical energy equation
- Overview of efficiency, and example calculations
- Multiple-choice quiz involving calculations of domestic energy consumption

Alternating currents

- Overview of drift velocity
- Guide to the terms of the equation $I = nAve$
- Demonstration of the differences between AC and DC when viewed on an oscilloscope
- Overview of root mean squared (RMS) measures of AC signals
- Calculations of V_{RMS} linked to oscilloscope data
- Identifying true-or-false statements relating to AC and DC signals

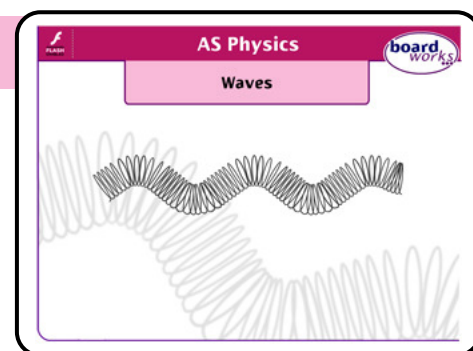
Summary activities

- Glossary of keywords in the presentation
- Identifying the correct definition of selected keywords in the presentation
- Multiple-choice quiz







Waves

41 slides





 21 Flash activities







Types of wave

- Key distinguishing features of transverse and longitudinal waves
-  Simulations of transverse and longitudinal waves
- Mechanical and electromagnetic waves
-  Guide to examples of transverse and longitudinal waves
-  Identifying types of wave as being either transverse or longitudinal
-  Guide to features of a transverse wave
-  Animation illustrating how light can be plane-polarized by a polarizing filter
-  Identifying missing words relating to waves





Measuring waves

- Introducing period and frequency
-  Example worked calculations relating to wave speed, wavelength and frequency
-  Calculations relating to wave speed, wavelength and frequency, including full working out
-  Animation illustrating phase difference
-  Identifying the phase difference of two points on a series of wave diagrams




Superposition and interference

- The principle of superposition
-  Simulation illustrating constructive and destructive interference
- Interference patterns, path difference and lines of maxima and minima
-  Simulation of two point interference
-  Animation illustrating the derivation of $w = \lambda D / s$ from a double slit set-up
-  Simulation of the double slit interference experiment using monochromatic light

Stationary waves

- Progressive vs. stationary waves, and the concept of nodes and antinodes
-  Simulation to produce stationary waves by varying the wave characteristics of two waves travelling in opposite directions
-  Experiment to investigate the fundamental frequency and harmonics of a vibrating string
-  Guide to how stationary waves can be used to determine the speed of sound
-  Identifying true-or-false statements about stationary waves

Summary activities



-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz

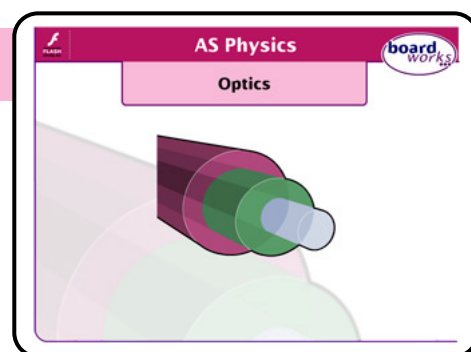
Optics

34 slides



 **15 Flash activities**

The EM spectrum






- Overview of optics and the electromagnetic spectrum
-  Guide to the main components of the electromagnetic spectrum
- Lasers as light sources
-  Completing sentences about the electromagnetic spectrum






Refraction

- Refraction and optical density
-  Simulation of refraction between different media
- Refractive index and the law of refraction
-  Calculations relating to refraction, including full working out




Total internal reflection

-  Simulation of total internal reflection between air and water
-  Guide to finding the critical angle for the interface between two media
-  Animation illustrating how optical fibres make use of total internal reflection
-  Guide to the structure of optical fibres in relation to the critical angle
-  Multiple-choice quiz about total internal reflection and the critical angle

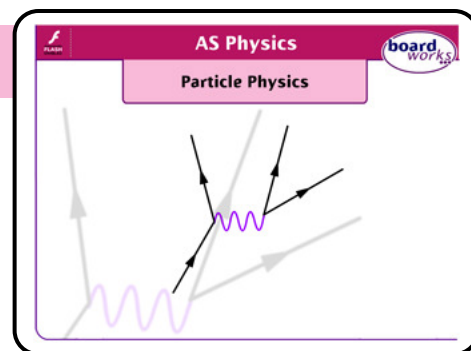
Diffraction

- Overview of single slit diffraction: pattern and intensity
- Diffraction gratings and their use in spectrometers
-  Animation illustrating the derivation of the diffraction grating equation $n\lambda = d\sin\theta$
-  Simulation of the use of a diffraction grating and the diffraction grating equation
-  Calculations relating to diffraction gratings, including full working out

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz

Particle Physics



41 slides

21 Flash activities

Structure of the atom

- Milestones in the understanding of atomic structure
- Guide to protons, neutrons and electrons
 - Specific charge, atomic number, proton number and isotopes
- Animation illustrating the action of the strong nuclear and electrostatic forces
- Guide to radioactive decay
- Identifying true-or-false statements about atomic structure

Particles and interactions

- Photons, rest mass and minimum energy
- Overview of antimatter and the neutrino
- Identifying properties of particles and antiparticles
- Animation illustrating annihilation and pair production
- The four fundamental forces, exchange particles and the W boson
- Animation explaining Feynman diagrams
- Guide to Feynman diagrams for some important interactions
- Guide to particle classification
 - Mesons and strangeness
 - Overview of particle interactions through the strong, weak and electrostatic forces
 - Decay of other baryons into protons
- Identifying correct particle classifications
- Identifying the correct Feynman diagram
- Identifying missing words relating to particles, antiparticles and interactions

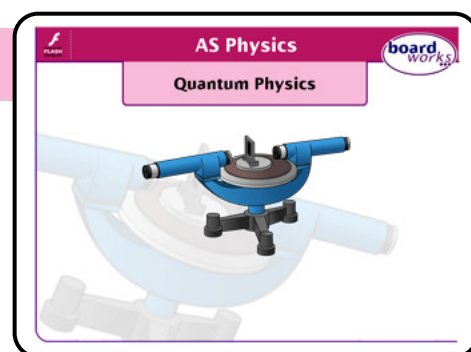
Quarks and antiquarks

- Overview of quarks and their properties
- Identifying quark combinations for mesons
- Identifying quark combinations for baryons
 - Beta decay in terms of quarks
- Guide to conservation of quantities in particle interactions
- Identifying correct quark combinations for mesons and baryons
- Identifying reactions that will or will not take place and why

Summary activities

- Glossary of keywords in the presentation
- Identifying the correct definition of selected keywords in the presentation
- Multiple-choice quiz





Quantum Physics






34 slides

 **16 Flash activities**




Thermal emission

- Overview of thermal radiation
-  Animation explaining why a hot object emits light as well as thermal radiation
- Thermal emission and the incandescent light bulb
-  Experiment to investigate line spectra for various elements
-  Animation explaining why line spectra are produced by hot gases
- Overview of electron energy levels
-  Identifying missing words relating to thermal emission




A closer look at energy levels

- Overview of absorption spectra
-  Multiple-choice quiz to identify which elements are contributing to a star's absorption spectrum
-  Example worked calculations relating to photon energy
- Overview of the electron volt
-  Calculations relating to waves and photon energy, including full working out
- How to calculate the wavelength of emitted radiation




The photoelectric effect

- Overview of photoelectricity
-  Animation illustrating photoelectricity using a gold leaf electroscope
-  Guide to Einstein's photoelectric equation and the work function
-  Calculations relating to Einstein's photoelectric equation, including full working out

De Broglie waves

-  Identifying properties of light corresponding to either its wave-like or particle-like behaviour
- Overview of the De Broglie wavelength
-  Calculations relating to De Broglie wavelength, including full working out
-  Identifying true-or-false statements relating to waves and particles

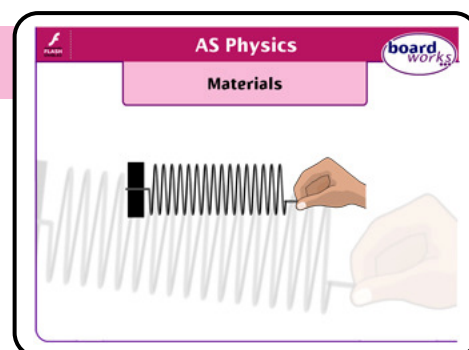
Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz



Materials

34 slides





 **17 Flash activities**





Density

- Overview of density and the uses of materials
-  Guide to finding the density of regular solids, irregular solids and liquids
-  Calculations relating to density, including full working out







Behaviour of springs

-  Overview of tensile and compressive forces
-  Overview of restoring forces
- Overview of Hooke's law and the force constant
-  Animation illustrating how to find the spring constant from a force–extension graph
-  Calculations relating to the force constant, including full working out
- Definitions of the limit of proportionality and elastic limit




Elastic potential energy

- Overview of elastic potential energy and work done
-  Animation illustrating the derivation of the equation for elastic potential energy for a spring from its force–extension graph
-  Matching variables to their equations

The Young modulus

-  Animation defining stress and strain, and the equation for the Young modulus
-  Guide to calculating the Young modulus
-  Guide to the terms ultimate tensile stress, elastic deformation, plastic deformation, Young modulus, elastic limit, yield point and breaking
- Comparing the Young modulus by comparing stress–strain graphs
- Stiffness, strength and toughness
-  Simulation of a tensile tester with ductile, brittle and polymeric materials
-  Guide to stress–strain graphs for ductile, brittle and polymeric materials
- Measuring the Young modulus in the classroom
-  Calculations relating to the Young modulus, including full working out

Summary activities

-  Glossary of keywords in the presentation
-  Identifying the correct definition of selected keywords in the presentation
-  Multiple-choice quiz