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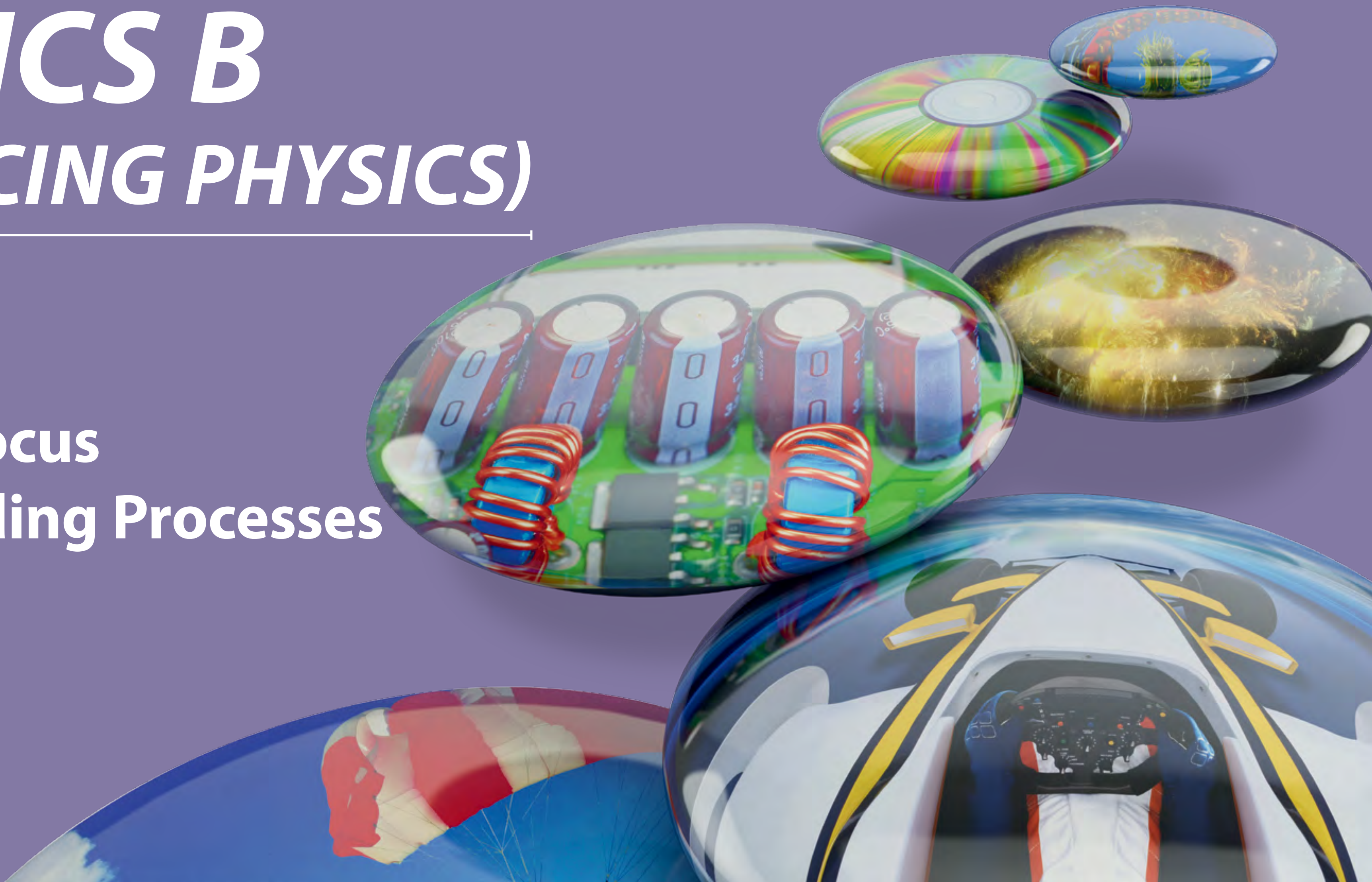
A LEVEL
Transition Guide

PHYSICS B (ADVANCING PHYSICS)

H557
For first teaching in 2015

KS4–KS5 Focus
Understanding Processes

Version 1



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Introduction

A LEVEL

PHYSICS B (ADVANCING PHYSICS)

Key Stage 4 to 5 Transition guides focus on how a particular topic is covered at the different key stages and provide information on:

- Differences in the demand and approach at the different levels;
- Useful ways to think about the content at Key Stage 4 which will help prepare students for progression to Key Stage 5;
- Common student misconceptions in this topic.

Transition guides also contain links to a range of teaching activities that can be used to deliver the content at Key Stage 4 and 5 and are designed to be of use to teachers of both key stages. Central to the transition guide is a Checkpoint task which is specifically designed to help teachers determine whether students have developed deep conceptual understanding of the topic at Key Stage 4 and assess their 'readiness for progression' to Key Stage 5 content on this topic. This checkpoint task can be used as a summative assessment at the end of Key Stage 4 teaching of the topic or by Key Stage 5 teachers to establish their students' conceptual starting point.

Key Stage 4 to 5 Transition Guides are written by experts with experience of teaching at both key stages.

Key Stage 4 Content

Explain, with examples, that electromagnetic radiation transfers energy from source to absorber.

Recall that different substances may absorb, transmit, or reflect electromagnetic radiation in ways that depend on wavelength.

Recall that in each atom its electrons are arranged at different distances from the nucleus, that such arrangements may change with absorption or emission of electromagnetic radiation, and that atoms can become ions by loss of outer electrons.

Recall that changes in molecules, atoms and nuclei can generate and absorb radiations over a wide frequency range, including:

a) gamma rays are emitted from the nuclei of atoms
b) X-rays, ultraviolet and visible light are generated when electrons in atoms lose energy
c) high energy ultraviolet, gamma rays and X-rays have enough energy to cause ionisation when absorbed by some atoms
d) ultraviolet is absorbed by oxygen to produce ozone, which also absorbs ultraviolet, protecting life on Earth
e) infrared is emitted and absorbed by molecules.

Recall and apply the relationship between speed, frequency and wavelength to waves, including waves on water, sound waves and across the electromagnetic spectrum: wave speed (m/s) = frequency (Hz) × wavelength (m)

a) describe the effects of reflection and refraction of waves at material interfaces
b) describe how to measure the refraction of light through a prism
c) describe how to investigate the reflection of light off a plane mirror.

Recall that waves travel in different substances at different speeds and that these speeds may vary with wavelength.

Explain how refraction is related to differences in the speed of the waves in different substances.

Key Stage 5 Content

This module provides progression from the application-oriented work in Physics in Action. Understanding Processes is organised around different ways of describing and understanding processes of change: motion in space and time, wave motion, quantum behaviour. It provides a sound foundation in the classical physics of mechanics and waves and takes the story further, touching on the quantum probabilistic view.

Physical variables are extended from scalars to quantities that add like vectors. Either section may be covered first. Some teachers may wish to introduce work on vector addition from **4.2** before embarking on work on combining phasors. The first section of the module is mainly about superposition phenomena of waves with a brief account of the quantum behaviour of photons. This is a rich field for practical physics and learners will have many opportunities to extend their experimental and analytical skills. In addition, the topics provide a picture of the development of theories and understanding over time (HSW1, HSW2, HSW7). Quantum behaviour is discussed through considering possible photon paths, avoiding the wave/particle dichotomy.

4.1 Waves and quantum behaviour

(a) Describe and explain:

(i) production of standing waves by waves travelling in opposite directions
(ii) interference of waves from two slits
(iii) refraction of light at a plane boundary in terms of the changes in the speed of light and explanation in terms of the wave model of light
(iv) diffraction of waves passing through a narrow aperture
(v) diffraction by a grating
(vi) evidence that photons exchange energy in quanta $E = hf$ (for example, one of light-emitting diodes, photoelectric effect and line spectra)
(vii) quantum behaviour: quanta have a certain probability of arrival; the probability is obtained by combining amplitude and phase for all possible paths
(viii) evidence from electron diffraction that electrons show quantum behaviour.

Key Stage 4 Content

Recall that electromagnetic waves are transverse construct and interpret two-dimensional ray diagrams to illustrate refraction at a plane surface and dispersion by a prism.

Show how changes, in speed, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related.

Describe, with examples, where there are energy transfers in a system, that there is no net change to the total energy of a closed system describe, with examples, system changes, where energy is dissipated, so that it is stored in less useful ways.

Recall and apply Newton's third law.

Recall examples of ways in which objects interact:
by gravity, electrostatics, magnetism and by contact (including normal contact force and friction).

Describe how examples of gravitational, electrostatic, magnetic and contact forces involve interactions between pairs of objects which produce a force on each object.

Represent interaction forces as vectors.

a) make measurements of distances and times, and calculate speeds
b) describe how to use appropriate apparatus and techniques to investigate the speed of a trolley down a ramp

Explain the vector–scalar distinction as it applies to displacement and distance, velocity and speed.

a) recall and apply the relationship:
   acceleration (m/s^2) = change in speed (m/s) ÷ time taken (s)
b) explain how to use appropriate apparatus and techniques to investigate acceleration

Key Stage 5 Content

(b) Make appropriate use of:

(i) the terms: phase, phasor, amplitude, probability, interference, diffraction, superposition, coherence, path difference, intensity, electronvolt, refractive index, work function, threshold frequency.

(c) Make calculations and estimates involving:

(i) wavelength of standing waves
(ii) Snell's Law,
(iii) path differences for double slits and diffraction grating, for constructive interference
(iv) the energy carried by photons across the spectrum, E = hf
(v) the wavelength of a particle of momentum p, .

(d) Demonstrate and apply knowledge and understanding of the following practical activities(HSW4):

(i) using an oscilloscope to determine frequencies
(ii) determining refractive index for a transparent block
(iii) superposition experiments using vibrating strings, sound waves, light and microwaves
(iv) determining the wavelength of light with a double slit and diffraction grating
(v) determining the speed of sound in air by formation of stationary waves in a resonance tube
(vi) determining the Planck constant using different coloured LEDs.

4.2 Space, time and motion

(a) Describe and explain:

(i) the use of vectors to represent displacement, velocity and acceleration
(ii) the trajectory of a body moving under constant acceleration, in one or two dimensions
(iii) the independent effect of perpendicular components of a force
(iv) calculation of work done, including cases where the force is not parallel to the displacement
(v) the principle of conservation of energy
(vi) power as rate of transfer of energy

Key Stage 4 Content

Select and apply the relationship:
(final speed (m/s))^2 – (initial speed(m/s))^2 = 2 × acceleration (m/s^2) × distance (m)

Draw and use graphs of distances and speeds against time to determine the speeds and accelerations involved.

Interpret distance–time and velocity–time graphs, including relating the lines and slopes in such graphs to the motion represented.

Interpret enclosed areas in velocity – time graphs.

Recall the value of acceleration in free fall and calculate the magnitudes of everyday accelerations using suitable estimates of speeds and times.

Describe, using free body diagrams, examples where several forces lead to a resultant force on an object and the special case of balanced forces (equilibrium) when the resultant force is zero.

Use scale drawings of vector diagrams to illustrate the addition of two or more forces, in situations when there is a net force, or equilibrium.

Limited to parallel and perpendicular vectors only.

Recall and apply the equation for momentum and describe examples of the conservation of momentum in collisions:
momentum (kg m/s) = mass (kg) × velocity (m/s) select and apply Newton's second law in calculations relating force, change in momentum and time:
change of momentum (kg m/s) = resultant force (N) × time for which it acts (s)

Apply Newton's first law to explain the motion of objects moving with uniform velocity and also the motion of objects where the speed and/or direction changes.

Recall and apply Newton's second law relating force, mass and acceleration:
force (N) = mass (kg) × acceleration (m/s^2)

Key Stage 5 Content

(vii) measurement of displacement, velocity and acceleration
(viii) Newton's Laws of Motion
(ix) The principle of conservation of momentum; Newton's Third Law as a consequence.

(b) Make appropriate use of:

(i) the terms: displacement, speed, velocity, acceleration, force, mass, vector, scalar, work, energy, power, momentum, impulse by sketching and interpreting:
(ii) graphs of accelerated motion; slope of displacement–time and velocity–time graphs; area underneath the line of a velocity–time graph
(iii) graphical representation of addition of vectors and changes in vector magnitude and direction.

(c) Make calculations and estimates involving:

(i) the resolution of a vector into two components at right angles to each other
(ii) the addition of two vectors, graphically and algebraically
(iii) the kinematic equations for constant acceleration derivable from:

$a = \frac{v - u}{t}$ and average velocity = $\frac{v + u}{2}$:

$v = u + at$, $s = ut + ½at^2$, $v^2 = u^2 + 2as$

(iv) momentum p = mv
(v) the equation $F = ma = \frac{\Delta(mv)}{\Delta t}$ where the mass is constant
(vi) the principle of conservation of momentum
(vii) work done $\Delta E = F\Delta s$
(viii) kinetic energy = ½mv^2
(ix) gravitational potential energy = mgh
(x) force, energy and power:

power = $\frac{\Delta E}{t}$, power = Fv

(xi) modelling changes of displacement and velocity in small discrete time steps, using a computational model or graphical representation of displacement and velocity vectors.

Key Stage 4 Content

Use and apply equations relating force, mass, velocity, acceleration, and momentum to explain relationships between the quantities.

Describe the energy transfers involved when a system is changed by work done by forces including:

a) to raise an object above ground level

b) to move an object along the line of action of the force

Recall and apply the relationship to calculate the work done (energy transferred) by a force:
work done (Nm or J) = force (N) × distance (m) (along the line of action of the force)

Recall the equation and calculate the amount of energy associated with a moving object:
kinetic energy (J) = 0.5 × mass (kg) × (speed (m/s))^2

Recall the equation and calculate the amount of energy associated with an object raised above ground level gravitational potential energy (J) = mass (kg) × gravitational field strength (N/kg) × height (m)

Make calculations of the energy transfers associated with changes in a system, recalling relevant equations for mechanical processes. Describe all the changes involved in the way energy is stored when a system changes, for common situations: including an object projected upwards or up a slope, a moving object hitting an obstacle, an object being accelerated by a constant force, a vehicle slowing down.

Explain, with reference to examples, the definition of power as the rate at which energy is transferred (work done) in a system recall and apply the relationship:
power (W) = energy transferred (J) ÷ time (s)

Key Stage 5 Content

(d) Demonstrate and apply knowledge and understanding of the following practical activities(HSW4):

(i) investigating the motion and collisions of objects using trolleys, air track gliders etc. with data obtained from ticker timers, light gates, data-loggers and video techniques

(ii) determining the acceleration of free fall, using trapdoor and electromagnet arrangement, lightgates or video technique

(iii) investigating terminal velocity with experiments such as dropping a ball bearing in a viscous liquid or dropping paper cones in air.

Comment

Waves and quantum behaviour

At GCSE, it is vital that the concept of refraction is well understood. In particular, being able to explain it in terms of the change in speed of the wave causing a change in wavelength should be stressed. Students should have plenty of practice at measuring angles of incidence and refraction in glass/Perspex blocks and prisms. Mathematically able students could be exposed to Snell's law, perhaps in the special case where n1=1, in preparation for A Level. This could be related to an investigation where θ1 is varied.

In addition to covering reflection and refraction, it would be good if students could see diffraction, as this is so significant at A Level. This is best introduced when working on ripple tanks as it is frequently present even when not wanted. Relating diffraction to mobile 'phone reception vs. radio reception' is a classic real world application that students find relevant.

Students are expected to know the nuclear model of the atom and how electrons move closer or further from the nucleus as energy is emitted or absorbed. They should also know that atoms are ionised when outer electrons are removed. It would be helpful if the idea of fixed energy levels was used at this stage. The Shark Infested Energy Level Game is great for getting this across. Mentioning how the energy of a photon is related to frequency would be good for brighter students, and could be related to the damage down by different parts of the EM spectrum.

At A Level, refraction is quantified with Snell's Law, and linked to the wavespeed in each medium. Students should practice determining the refractive index of material by experiment. Standing waves also need to be studied, and form a great way to judge students' understanding of wavelength, amplitude and frequency, as well as introducing phase and superposition. Practical opportunities abound, with suggestions in the Superposition Circus activity.

Diffraction is introduced formally in a range of situations. It is best to look first at single slit diffraction, as any experimental result will be convolved with this. Students should experience diffraction of laser light, microwaves, and ripples, and sound should also be discussed. The next step is double slit diffraction. It is vital that this is understood as it will be key in grasping the work on quantum behaviour. The formula nλ=dsinθ should be derived by reference to path differences, and applied to experimental measurements. Finally, diffraction gratins should be introduced, and their benefits highlighted.

The idea of light being emitted when electrons change energy level is built upon. The quantised nature of the energy is stressed, and it is quantified as E=hf. A good introduction to the topic is to view discharge lamps through diffraction gratings. This can then be linked to transitions and photon emission. Explaining why different coloured LEDs have different activation potentials is a good challenge for able students.

The photoelectric effect should be examined in detail. This is a great opportunity to examine how scientific ideas change, and the importance of Einstein's 1905 paper should be discussed. In addition to seeing the photoelectric effect on a sheet of zinc, students should carry out stopping potential experiments to determine h using different coloured LEDs. Using different coloured filters over a photocell is another way of doing this that they may find more intuitive. Young's Double Slit experiment should be revisited before electron diffraction is demonstrated and the de broglie relationship introduced. The probabalistic nature of quanta will need some time for students to accept; examining the result of electron diffraction experiments at low emission rates can help to prove that it is a real effect.

The most common confusion is whether an electron could absorb the energy from two photons and thus overcome the work function even if their individual energies were insufficient. Close behind this is difficulty accepting the change from the classical model to quantum model.

Space, time and motion

Vectors should be introduced at GCSE. The arrows used on free body force diagrams can be used as an example, stressing the length and direction represent the magnitude and direction. Scale drawings should be used for vector addition. Whilst only parallel and perpendicular forces are needed for GCSE, it would not be a stretch to throw in some forces at other angles in preparation for meeting it at A Level.

The fundamental principle of conservation of energy must be firmly grasped. Students are expected to describe how energy is transferred and stored in different forms. The three formulae WD=Fd, KE=½mv^2, GPE=mgh, and P=E/t need to be thoroughly practised. It would be helpful if it were stressed that the force must be parallel to the movement in the first one, and possibly hint at how a non-parallel force would affect the work done. The more mathematically able could be introduced to the use of Δ to mean 'change in'.

Newton's Laws of Motion will be studied, and it would be helpful for students to meet the original wording (translated of course) and then see how the modern phrasing is simpler and yet more general. Newton's Second Law of Motion should be covered in terms of both acceleration and rate of change of momentum. This is another example of where the Δ notation could be introduced. The Third Law of Motion should be related to the conservation of momentum; for instance consider a person jumping, the Earth must be pushed the other way to conserve momentum.

It is vital that students are able to plot and interpret motion graphs by the end of GCSE. In particular, they should be able to say at a glance whether an object is stationary, moving at constant speed, accelerating or decelerating. Being able to determine values such as distance travelled, velocity and acceleration from the appropriate area and gradients is important, and should be practised on both ideal and experimental data. Introducing the area under a simple force-distance graph could be done whilst studying work done; a constant force would recover WD=Fd, and finding the work done stretching a spring would also be a worthwhile experiment.

Plenty of practice should be given using v=s/t, a=(v-u)/t and v^2-u^2=2as. It is up to the teacher to judge whether the students would be able to cope, but the A Level abbreviations (s, u, v, a, t) could be used for the quantities to avoid confusion later on. The acceleration due to gravity could be experimentally determined in several ways. Using a light gate to find v would allow v^2-u^2=2as to be used, or a simple timing experiment could use s=ut+½at2 (which isn't on the GCSE specification but could readily be handled by students).

At the start of the A Level coverage of this topic, the concept of vectors should be consolidated. The graphical addition of vectors should be extended to cover vectors with any angle between them. Students need to be able to resolve vectors into perpendicular components, most commonly horizontal and vertical. This mathematical trick takes some a long time to grasp; when in doubt, students should draw out the triangle and use the definitions of sine and cosine with which they will be familiar. Once resolving is sorted, algebraic addition of vector can be addressed, using Pythagoras and the definition of tangent to revise the resolving process. Finding resultants and balancing forces to satisfy newton's First Law of Motion are good practice.

The principle of conservation of energy is key to so much of physics. They should already be very familiar with it, and should practice calculations involving KE, GPE and power. The formula P=Fv should be derived and used. The formulae for work done should be built upon by introducing situations here the force is not parallel to the displacement. This is a good opportunity to consolidate work on resolving vectors. Those doing further maths may have encountered dot products and can be shown how this applies to calculating work done.

Momentum would be a good concept to address next. In particular, rate of change of momentum should be linked to Newton's Second law of Motion and the principle of conservation of momentum linked to the Third Law of Motion. Plenty of practice of calculating the outcomes of collisions should be done, as should determining force from momentum changes and time. Application to crash safety systems would be useful.

Motion graphs continue to be important, though the complexity of the situations will be higher. Students should consider things such as objects thrown vertically upwards, bouncing balls, and objects falling with drag. This will hammer home the importance of deciding on a positive direction and measuring all motion relative to it. Plotting the trajectory of a horizontally-projected object would be a good opportunity to discuss the independence of horizontal and vertical motion. Terminal velocity should also be examined. Modelling situations using a spreadsheet is a valuable activity, using formulae to calculate the changes on incremental steps.

Finally, the kinematic equations need to be introduced and practised. Students may be more familiar with the terms 'equations of uniformly accelerated motion' or 'suvat equations'. The latter gives a great way to help them lay out their answers; write out s u v a t, then under each quantity write in the value from the question or, if it is what the question asks for, then cross out the quantity that is not used and write down the equation that doesn't involve that quantity. Experiments should include finding the acceleration due to gravity using light gates and using an electromagnet and trapdoor, studying the motion of a trolley down a ramp using ticker timers, and analysing video footage or strobe photographs.

A very common mistake is to neglect or confuse the sign in motion calculations. A strict adherence to a convention, like upwards and right are always positive, will help address this. Another misconception is that a Newton's Third Law Pair will always balance each other and leave no resultant. It should be stressed that these forces always act on different bodies. Some students confuse the principle of conservation of energy with energy conservation.

Activities

Shark Infested Energy Level Game

Mark energy levels on the ground using chalk or string. These could be in a line as seen in energy level diagrams, or in concentric circles like shells. A number of students are placed on the levels to represent electrons; two at the bottom, perhaps three in the next. The teacher, or another trustworthy student, throws tennis balls to the 'electrons'. If tennis ball is caught, the 'electron' jumps up a level. They cannot touch the shark infested custard of the floor. In order to move back down they have to throw a tennis ball away.

If a ball isn't caught, they cannot jump up. If they drop one of their existing balls they have to jump down.

Common Refraction Examples

BBOP: School Physics Resources

Resources: http://www.archaeoroutes.co.uk/edphys/worksheets/Waves/Common%20Refraction%20Examples.pdf

Some examples of refraction in the real world. The coin trick would be a good starter or plenary activity.

Ticker Timer Motion Graphs

Get students to conduct an experiment with a ticker timer. Dropping a tennis ball is a good one, as they can find out a value for g. Make sure it falls a couple of metres whilst being recorded.

Cut the tape up into ten dot strips, making sure they are numbered in case they get muddled up. Line them up to get a rough graph to see if it worked.

Measure the length of each strip, and record it in a table. Note that time goes up in 0.2s intervals. In a third column, calculate speed (strip length / 0.2). Plot a graph of speed against time. Add a straight line of best fit and calculate the gradient.

Collision Lab

PhET

https://phet.colorado.edu/en/simulation/collision-lab

A simulation for 1D collisions, great for conservation of momentum work.

Newtons Laws of Motion Quiz

Softschools.com

http://www.softschools.com/quizzes/science/newtons_laws/quiz384.html

A quick quiz on the statements and applications of Newton's Laws of Motion.

Overview

The task has two sections, one relating to waves and quantum behaviour, the other to space, time and motion. They could either be done together at the end of GCSE or individually after the appropriate topics have been covered. They would also make good activities before starting each topic at A Level, to judge students' existing knowledge and understanding.

1.1 Students often get confused about absorption and emission. In particular, some are unable to separate that process from diffuse reflection. A fluorescent jacket and a UV source are used to examine the difference. Student responses are likely to range from those unable to match the process to what they have been taught, through those who can name the processes going on, to the top students who can explain in terms of changes to electron energy levels why it is happening.

1.2 Examining a fluorescent tube will assess whether students are able to apply what they learnt about a fluorescent jacket to a different situation. The more able students will swiftly identify the similarity and be able to transfer the explanation, whilst weaker one may not have acquired a generalised understanding of the processes.

2.1 A conservation of momentum task will assess students' mathematical abilities. Close attention should be paid to their working and the units provided for their answer.

2.2 Discussion of how the experimental result compares to their predicted result should allow the teacher to assess which students have a good grasp of data analysis and experimental design.

Teacher preparation

1 A fluorescent jacket and a UV lamp will be needed for the first part. A working fluorescent tube (or CFL) needs to be available to be shown for the second part. This could be one in the ceiling of the lab. Ideally, an old one where some of the powder coating has come away would be useful, but not essential (there is no need to switch this on, but if you do, consider the UV hazard).

2 An air track or low-friction motion track needs to be set up, with light gates to measure speed before and after impact. The mass of the two gliders/trolleys should be measured, as the students will need to be told these, one should be more than the other. The trolleys should be set up to stick together upon collision (e.g. using magnets).

The displays showing the speeds should ideally be arranged so that the students can see the initial speed but not the final speed. If they are both on the same screen, you could hide both and just tell them the initial speed, or prop a bit of card up to hide the latter result.

Learner resource 2:

www.ocr.org.uk/Images/380225-understanding-processes-learner-resource-2.doc

Learner resource 3:

www.ocr.org.uk/Images/380227-understanding-processes-learner-resource-3.doc

Activities

Superposition Circus

Set out the following experiments and have students try them out in turn, seeing what varies and explaining their observations in terms of superposition and interference:

1. Clamped rubber tube and vibrator.
2. Cork dust in a tube with one closed end and a speaker at the other.
3. Two speakers several metres apart pointing at each other and the student moves their head between the two.
4. Two microwave transmitters pointing at each other with a moveable probe between them.
5. A microwave transmitter and receiver, with a moveable metal sheet set up so the receiver get direct and reflected waves.
6. Vibrator with metal hacksaw blades of different lengths attached to it.
7. White light source and bubble mixture (a bubble sword is ideal).

Motion Spreadsheet Models

Students should model freefall by getting a spreadsheet to calculate how much an object would move in each small increment of time, and then plot the graph. An extension would be to add in air resistance and see how different factors affect terminal velocity. An example of a simple spreadsheet is alongside this resource on the OCR website.

Learner resource 1

www.ocr.org.uk/Images/380224-understanding-processes-learner-resource-1.xls

Equations of Motion

See learner resources entitled 'Equations of motion'. Also, Deriving equations of motion (BBOP Physics Resources).

http://www.archaeoroutes.co.uk/edphys/worksheets/Forces%20and%20Motion/Deriving%20the%20Equations%20of%20Motion.pdf

A nice way to understand and remember the formulae.

Freefall Trajectories

There are several demonstrations that show the independence of horizontal and vertical motion. A classic is the Money and Hunter, with the monkey being a steel can held aloft by an electromagnet that cuts out when a ball bearing is fired.

However, a much simpler one involved a ruler and two coins. Place the ruler diagonally with one end overhanging the edge of a table. Place one coin on that end, and another between the other end of the ruler and the edge of the table. A swift tap of the table end of the ruler will project one coin horizontally and simultaneously drop the other vertically. Both should be heard to hit the ground at the same time.

Projectile Motion

BBOP: School Physics Resources

http://www.archaeoroutes.co.uk/edphys/worksheets/Forces%20and%20Motion/Projectile%20Motion.pdf

Practice questions on projectile motion.

Quantum Worksheet

Stowmarket Physics

http://www.archaeoroutes.co.uk/edphys/worksheets/Waves/Snell's%20Law.pdf

A set of differentiated questions on waves and quantum behaviour.

Activities

Wave-Particle Duality

BBOP: School Physics Resources

http://www.archaeoroutes.co.uk/edphys/worksheets/Quantum%20and%20Particles/Wave-Particle%20Duality.pdf

Reading task on the development of ideas about waves and particles.

Motion Challenge Problems

Mr Patterson Science

http://student.pattersonandscience.com/Lesson%20content/2AB%20Physics/Exam%20Revision/Motion%20Challenge%20Question.pdf

A set of motion questions requiring multi-step solutions.

Resources, links and support

Science Spotlight – Our termly update Science Spotlight provides useful information and helps to support our Science teaching community. Science Spotlight is designed to keep you up-to-date with Science here at OCR, as well as to share information, news and resources. Each issue is packed full with a series of exciting articles across the whole range of our Science qualifications: www.ocr.org.uk/qualifications/by-subject/science/science-spotlight/

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