IGCSE

Physics

Specification

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Edexcel IGCSE in Physics (4PH0)

First examination 2011

Issue 3

A PEARSON COMPANY

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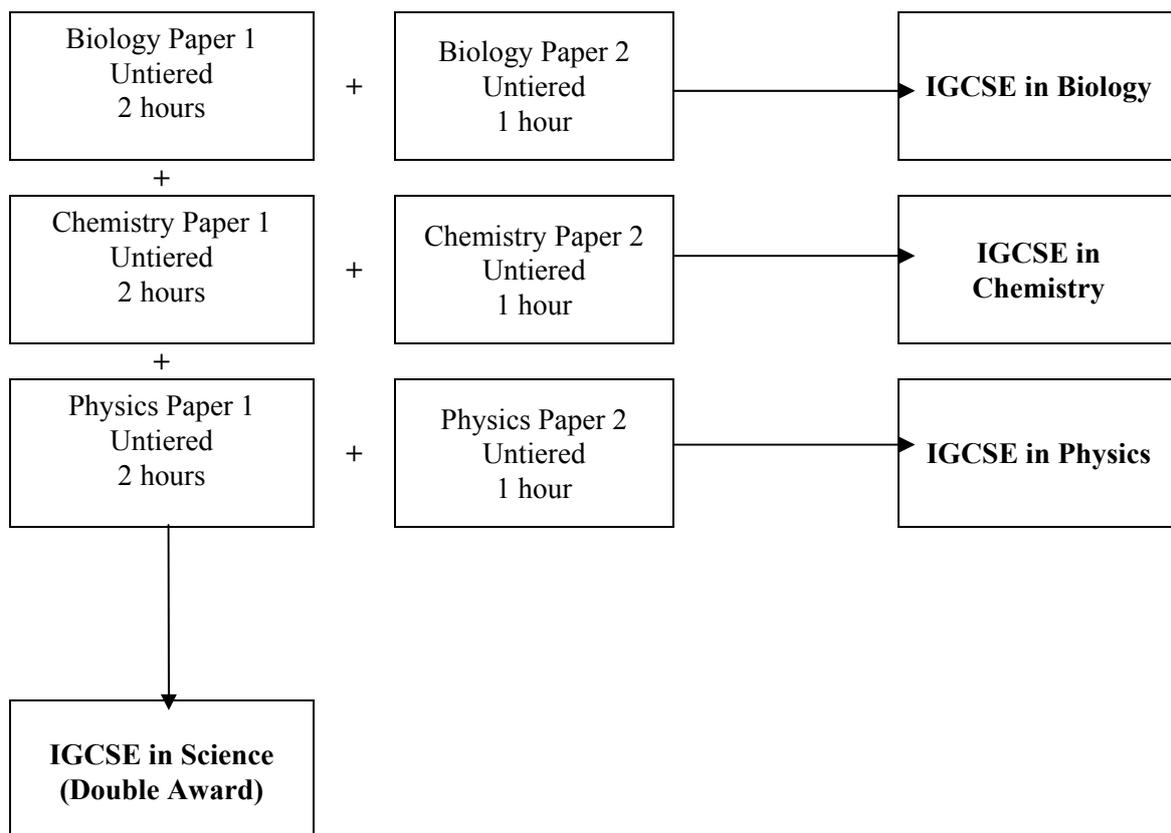
Introduction

The Edexcel International General Certificate of Secondary Education (IGCSE) in Physics is designed for use in schools and colleges. It is part of a suite of the IGCSE suite of Science qualifications offered by Edexcel. The course offers opportunity for students to experience Physics within the context of their general education. In terms of progression, the design of the course provides a basis of progression to further study in GCE Advanced Subsidiary and Advanced Level Physics.

The relationship of assessment to the qualifications available is shown below.

Biology Paper 1 Untiered 2 hours	+	Biology Paper 2 Untiered 1 hour	→	**IGCSE in Biology**
+				
Chemistry Paper 1 Untiered 2 hours	+	Chemistry Paper 2 Untiered 1 hour	→	**IGCSE in Chemistry**
+				
Physics Paper 1 Untiered 2 hours	+	Physics Paper 2 Untiered 1 hour	→	**IGCSE in Physics**

IGCSE in Science (Double Award)

About this specification

Key features and benefits of the specification

Key features and benefits are:

- the specification includes aspects of science appropriate for the 21st century

- a straightforward linear assessment

- single tier assessment

- assessment of investigative skills through an examination paper

- provides a sound foundation for progression to Edexcel GCE Advanced Subsidiary (AS) and Advanced Level in Physics, and other comparable post-16 qualifications.

Key subject aims

The Edexcel IGCSE in Physics enables students to:

- acquire a systematic body of scientific knowledge and the skills needed to apply this in new and changing situations in many domestic, industrial and environmental contexts

- appreciate the practical nature of physics, acquiring experimental and investigative skills based on correct and safe laboratory techniques

- appreciate the importance of accurate experimental work and reporting to scientific method

- form hypotheses and design experiments to test them

- evaluate, in terms of their scientific knowledge and understanding, the benefits and drawbacks (including social, environmental and economic) of scientific and technological developments

- select, organise and present information clearly and logically, using appropriate scientific terms and conventions.

Contents

Specification at a glance

The Edexcel IGCSE in Physics qualification comprises **two** externally assessed papers.

- Physics Paper 1

- Physics Paper 2

Physics Paper 1	Paper code: 4PH0/1P
• Externally assessed • Availability: January and June series • First assessment: June 2011	**66.6% of the total IGCSE marks**
Overview of content: Assesses only the content **not** in bold • Section 1: Forces and motion • Section 2: Electricity • Section 3: Waves • Section 4: Energy resources and energy transfer • Section 5: Solids, liquids and gases • Section 6: Magnetism and electromagnetism • Section 7: Radioactivity and particles	
Overview of assessment: • The paper is assessed through a 2 hour examination paper set and marked by Edexcel. • The total number of marks is 120.	

Physics Paper 2	Paper code: 4PH0/2P
• Externally assessed • Availability: January and June series • First assessment: June 2011	**33.3% of the total IGCSE marks**
Overview of content: • Assesses all content including content in **bold** • Section 1: Forces and motion • Section 2: Electricity • Section 3: Waves • Section 4: Energy resources and energy transfer • Section 5: Solids, liquids and gases • Section 6: Magnetism and electromagnetism • Section 7: Radioactivity and particles	
Overview of assessment: • The paper is assessed through a 1 hour examination paper set and marked by Edexcel. • The total number of marks is 60.	

Qualification content

Paper 1 will assess only the content which is **not** in bold.

Paper 2 will assess all content including content in **bold**.

Section 1: Forces and motion

a) Units

b) Movement and position

c) Forces, movement, shape and momentum

d) Astronomy

a)   Units

Students will be assessed on their ability to:

1.1 use the following units: kilogram (kg), metre (m), metre/second (m/s), metre/second^2 (m/s^2), newton (N), second (s)**,** newton per kilogram (N/kg), **kilogram metre/second (kg m/s)**.

b) Movement and position

Students will be assessed on their ability to:

1.2 understand and use distance-time graphs

1.3 recall and use the relationship between average speed, distance moved and time:

$$\text{average speed} = \frac{\text{distance moved}}{\text{time taken}}$$

1.4 recall and use the relationship between acceleration, velocity and time:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$a = \frac{(v - u)}{t}$$

1.5 interpret velocity-time graphs

1.6 determine acceleration from the gradient of a velocity-time graph

1.7 determine the distance travelled from the area between a velocity-time graph and the time axis.

c) Forces, movement, shape and momentum

Students will be assessed on their ability to:

1.8   express a force as a push or pull of one body on another

1.9   identify various types of force (for example gravitational, electrostatic etc)

1.10   distinguish between vector and scalar quantities

1.11   appreciate the vector nature of a force

1.12   add forces that act along a line

1.13   understand that friction is a force that opposes motion

1.14   recall and use the relationship between unbalanced force, mass and acceleration:

force = mass × acceleration

$F = m \times a$

1.15   recall and use the relationship between weight, mass and *g*:

weight = mass × g

$W = m \times g$

1.16   describe the forces acting on falling objects and explain why falling objects reach a terminal velocity

1.17   describe the factors affecting vehicle stopping distance including speed, mass, road condition and reaction time

1.18   recall and use the relationship between momentum, mass and velocity:

momentum = mass × velocity

$p = m \times v$

1.19   use the ideas of momentum to explain safety features

1.20   use the conservation of momentum to calculate the mass, velocity or momentum of objects

1.21   use the relationship between force, change in momentum and time taken:

force = $\dfrac{\text{change in momentum}}{\text{time taken}}$

1.22   understand Newton's third law

1.23 recall and use the relationship between the moment of a force and its distance from the pivot:

moment = force × perpendicular distance from the pivot

1.24 recall that the weight of a body acts through its centre of gravity

1.25 recall and use the principle of moments for a simple system of parallel forces acting in one plane

1.26 understand that the upward forces on a light beam, supported at its ends, vary with the position of a heavy object placed on the beam

1.27 describe how extension varies with applied force for helical springs, metal wires and rubber bands

1.28 recall that the initial linear region of a force-extension graph is associated with Hooke's law

1.29 associate elastic behaviour with the ability of a material to recover its original shape after the forces causing deformation have been removed.

d) Astronomy

Students will be assessed on their ability to:

1.30 recall that the moon orbits the Earth and that some planets also have moons.

1.31 understand gravitational field strength, *g*, and recall that it is different on other planets and the moon from that on the Earth.

1.32 explain that gravitational force:

– causes the planets to orbit the sun

– causes the moon and artificial satellites to orbit the Earth

– causes comets to orbit the sun

1.33 use the relationship between orbital speed, orbital radius and time period:

$$\text{orbital speed} = \frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$$

$$v = \frac{2 \times \pi \times r}{T}$$

1.34 describe how the orbit of a comet differs from that of a planet

1.35 recall that the solar system is part of the Milky Way galaxy:

– describe a galaxy as a large collection of billions of stars

– state that the universe is a large collection of billions of galaxies.

Section 2: Electricity

a) Units

b) Mains electricity

c) Energy and potential difference in circuits

d) Electric charge

a) Units

Students will be assessed on their ability to:

2.1 use the following units: ampere (A), coulomb (C), joule (J), ohm (Ω), second (s), volt (V), watt (W).

b) Mains electricity

Students will be assessed on their ability to:

2.2 recall the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets, and pushing metal objects into sockets

2.3 describe the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances

2.4 know some of the different ways in which electrical heating is used in a variety of domestic contexts

2.5 understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature

2.6 recall and use the relationship:

power = current × voltage

$P = I \times V$

and apply the relationship to the selection of appropriate fuses

2.7 use the relationship between energy transferred, current, voltage and time:

energy transferred = current × voltage × time

$E = I \times V \times t$

2.8 recall that mains electricity is alternating current (a.c.) and understand the difference between this and the direct current (d.c.) supplied by a cell or battery.

c) Energy and potential difference in circuits

Students will be assessed on their ability to:

2.9   explain why a series or parallel circuit is more appropriate for particular applications, including domestic lighting

2.10 understand that the current in a series circuit depends on the applied voltage and the number and nature of other components

2.11 describe how current varies with voltage in wires, resistors, metal filament lamps and diodes, and how this can be investigated experimentally

2.12 describe the qualitative effect of changing resistance on the current in a circuit

2.13 describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature

2.14 know that lamps and LEDs can be used to indicate the presence of a current in a circuit

2.15 recall and use the relationship between voltage, current and resistance:

voltage = current × resistance

$V = I \times R$

2.16 understand that current is the rate of flow of charge

2.17 recall and use the relationship between charge, current and time:

charge = current × time

$Q = I \times t$

2.18 recall that electric current in solid metallic conductors is a flow of negatively charged electrons

2.19 recall that:

- **voltage is the energy transferred per unit charge passed**
- **the volt is a joule per coulomb.**

d) Electric charge

Students will be assessed on their ability to:

2.20 identify common materials which are electrical conductors or insulators, including metals and plastics

2.21 recall that insulating materials can be charged by friction

2.22 explain that positive and negative electrostatic charges are produced on materials by the loss and gain of electrons

2.23 recall that there are forces of attraction between unlike charges and forces of repulsion between like charges

2.24 explain electrostatic phenomena in terms of the movement of electrons

2.25 recall the potential dangers of electrostatic charges, eg when fuelling aircraft and tankers

2.26 recall some uses of electrostatic charges, eg in photocopiers and inkjet printers.

Section 3: Waves

a) Units

b) Properties of waves

c) The electromagnetic spectrum

d) Light and sound

a) Units

Students will be assessed on their ability to:

3.1 use the following units: degree (°), hertz (Hz), metre (m), metre/second (m/s), second (s).

b) Properties of waves

Students will be assessed on their ability to:

3.2 describe longitudinal and transverse waves in ropes, springs and water where appropriate

3.3 state the meaning of amplitude, frequency, wavelength and period of a wave

3.4 recall that waves transfer energy and information without transferring matter

3.5 recall and use the relationship between the speed, frequency and wavelength of a wave:

wave speed = frequency × wavelength

$$v = f \times \lambda$$

3.6 use the relationship between frequency and time period:

$$\text{frequency} = \frac{1}{\text{time period}}$$

$$f = \frac{1}{T}$$

3.7 use the above relationships in different contexts including sound waves and electromagnetic waves

3.8 understand that waves can be diffracted when they pass an edge

3.9 understand that waves can be diffracted through gaps, and that the extent of diffraction depends on the wavelength and the physical dimension of the gap.

c) The electromagnetic spectrum

Students will be assessed on their ability to:

3.10   understand that light is part of a continuous electromagnetic spectrum which includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations and that all these waves travel at the same speed in free space

3.11   recall the order of the electromagnetic spectrum in decreasing wavelength and increasing frequency, including the colours of the visible spectrum

3.12   recall some of the uses of electromagnetic radiations, including:

- radio waves: broadcasting and communications

- microwaves: cooking and satellite transmissions

- infrared: heaters and night vision equipment

- visible light: optical fibres and photography

- ultraviolet: fluorescent lamps

- x-rays: observing the internal structure of objects and materials and medical applications

- gamma rays: sterilising food and medical equipment

3.13   recall the detrimental effects of excessive exposure of the human body to electromagnetic waves, including:

- microwaves: internal heating of body tissue

- infra-red: skin burns

- ultraviolet: damage to surface cells and blindness

- gamma rays: cancer, mutation.

d) Light and sound

Students will be assessed on their ability to:

3.14   recall that light waves are transverse waves which can be reflected, refracted **and diffracted**

3.15   recall that the angle of incidence equals the angle of reflection

3.16   construct ray diagrams to illustrate the formation of a virtual image in a plane mirror

3.17   describe experiments to investigate the refraction of light, using rectangular blocks, semicircular blocks and triangular prisms

3.18   recall and use the relationship between refractive index, angle of incidence and angle of refraction:

$$n = \frac{\sin\ i}{\sin\ r}$$

3.19   describe an experiment to determine the refractive index of glass, using a glass block

3.20   describe the role of total internal reflection in transmitting information along optical fibres and in prisms

3.21   recall the meaning of critical angle *c*

3.22   recall and use the relationship between critical angle and refractive index:

$$\sin c \quad \frac{1}{n}$$

3.23   understand the difference between analogue and digital signals

3.24   describe the advantages of using digital signals rather than analogue signals

3.25   describe how digital signals can carry more information

3.26   recall that sound waves are longitudinal waves which can be reflected, refracted **and diffracted**

3.27   recall that the frequency range for human hearing is 20 Hz – 20 000 Hz

3.28   describe how to measure the speed of sound in air

3.29   understand how an oscilloscope and microphone can be used to display a sound wave

3.30   use an oscilloscope to determine the frequency of a sound wave

3.31   appreciate that the pitch of a sound depends on the frequency of vibration of the source

3.32   appreciate that the loudness of a sound depends on the amplitude of vibration.

Section 4: Energy resources and energy transfer

a) Units

b) Energy transfer

c) Work and power

d) Energy resources and electricity generation

a) Units

Students will be assessed on their ability to:

4.1 use the following units: kilogram (kg), joule (J), metre (m), metre/second (m/s), metre/second^2 (m/s^2), newton (N), second (s), watt (W).

b) Energy transfer

Students will be assessed on their ability to:

4.2 describe energy transfers involving the following forms of energy: thermal (heat), light, electrical, sound, kinetic, chemical, nuclear and potential (elastic and gravitational)

4.3 understand that energy is conserved

4.4 recall and use the relationship:

$$\text{efficiency} \quad \frac{\text{useful energy output}}{\text{total energy input}}$$

4.5 describe a variety of everyday and scientific devices and situations, explaining the fate of the input energy in terms of the above relationship, including their representation by Sankey diagrams

4.6 recall that energy transfer may take place by conduction, convection and radiation

4.7 describe the role of convection in everyday phenomena

4.8 describe how insulation is used to reduce energy transfers from buildings and the human body.

c) Work and power

Students will be assessed on their ability to:

4.9 recall and use the relationship between work, force and distance moved in the direction of the force:

work done = force × distance moved
$W = F \times d$

4.10 understand that work done is equal to energy transferred

4.11 recall and use the relationship:

gravitational potential energy = mass × g × height

GPE = $m \times g \times h$

4.12 recall and use the relationship:

kinetic energy = ½ × mass × speed^2

KE = $\frac{1}{2} \times m \times v^2$

4.13 understand how conservation of energy produces a link between gravitational potential energy, kinetic energy and work

4.14 describe power as the rate of transfer of energy or the rate of doing work

4.15 use the relationship between power, work done (energy transferred) and time taken:

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

d) Energy resources and electricity generation

Students will be assessed on their ability to:

4.16 understand the energy transfers involved in generating electricity using:

- wind
- water
- geothermal resources
- solar heating systems
- solar cells
- fossil fuels
- nuclear power

4.17 describe the advantages and disadvantages of methods of large-scale electricity production from various renewable and non-renewable resources.

Section 5: Solids, liquids and gases

a) Units

b) Density and pressure

c) Change of state

d) Ideal gas molecules

a) Units

Students will be assessed on their ability to:

5.1   use the following units: degrees Celsius ($^{\circ}$C), kelvin (K), joule (J), kilogram (kg), kilogram/metre^3 (kg/m^3), metre (m), metre^2 (m^2), metre^3 (m^3), metre/second (m/s), metre/second^2 (m/s^2), newton (N), pascal (Pa).

b) Density and pressure

Students will be assessed on their ability to:

5.2   recall and use the relationship between density, mass and volume:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\rho = \frac{m}{V}$$

5.3   describe how to determine density using direct measurements of mass and volume

5.4   recall and use the relationship between pressure, force and area:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

$$p = \frac{F}{A}$$

5.5   understand that the pressure at a point in a gas or liquid which is at rest acts equally in all directions

5.6   recall and use the relationship for pressure difference:

$$\text{pressure difference} = \text{height} \times \text{density} \times g$$

$$p = h \times \rho \times g$$

c) Change of state

Students will be assessed on their ability to:

5.7   **understand that a substance can change state from solid to liquid by the process of melting**

5.8   **understand that a substance can change state from liquid to gas by the process of evaporation or boiling**

5.9   **recall that particles in a liquid have a random motion within a close-packed irregular structure**

5.10 **recall that particles in a solid vibrate about fixed positions within a close-packed regular structure.**

d) Ideal gas molecules

Students will be assessed on their ability to:

5.11   understand the significance of Brownian motion

5.12   recall that molecules in a gas have a random motion and that they exert a force and hence a pressure on the walls of the container

5.13   understand that there is an absolute zero of temperature which is – 273$^{\text{o}}$C

5.14   describe the Kelvin scale of temperature and be able to convert between the Kelvin and Celsius scales

5.15   understand that an increase in temperature results in an increase in the speed of gas molecules

5.16 **understand that the Kelvin temperature of the gas is proportional to the average kinetic energy of its molecules**

5.17   describe the qualitative relationship between pressure and Kelvin temperature for a gas in a sealed container

5.18 **use the relationship between the pressure and Kelvin temperature of a fixed mass of gas at constant volume:**

$$\frac{p_1}{T_1} \quad \frac{p_2}{T_2}$$

5.19   use the relationship between the pressure and volume of a fixed mass of gas at constant temperature:

$$p_1 V_1 = p_2 V_2$$

Section 6: Magnetism and electromagnetism

a) Units

b) Magnetism

c) Electromagnetism

e) Electromagnetic induction

a) Units

Students will be assessed on their ability to:

6.1   use the following units: ampere (A), volt (V), watt (W).

b) Magnetism

Students will be assessed on their ability to:

6.2   recall that magnets repel and attract other magnets, and attract magnetic substances

6.3   recall the properties of magnetically hard and soft materials

6.4   understand the term 'magnetic field line'

6.5   understand that magnetism is induced in some materials when they are placed in a magnetic field

6.6   sketch and recognise the magnetic field pattern for a permanent bar magnet and that between two bar magnets

6.7   know how to use two permanent magnets to produce a uniform magnetic field pattern.

c) Electromagnetism

Students will be assessed on their ability to:

6.8   recall that an electric current in a conductor produces a magnetic field round it

6.9   describe the construction of electromagnets

6.10 sketch and recognise magnetic field patterns for a straight wire, a flat circular coil and a solenoid when each is carrying a current

6.11 appreciate that there is a force on a charged particle when it moves in a magnetic field as long as its motion is not parallel to the field

6.12 recall that a force is exerted on a current-carrying wire in a magnetic field, and how this effect is applied in simple d.c. electric motors and loudspeakers

6.13 use the left hand rule to predict the direction of the resulting force when a wire carries a current perpendicular to a magnetic field

6.14 recall that the force on a current-carrying conductor in a magnetic field increases with the strength of the field and with the current.

d) Electromagnetic induction

Students will be assessed on their ability to:

6.15 recall that a voltage is induced in a conductor or a coil when it moves through a magnetic field or when a magnetic field changes through it; also recall the factors which affect the size of the induced voltage

6.16 describe the generation of electricity by the rotation of a magnet within a coil of wire and of a coil of wire within a magnetic field; also describe the factors which affect the size of the induced voltage

6.17 recall the structure of a transformer, and understand that a transformer changes the size of an alternating voltage by having different numbers of turns on the input and output sides

6.18 explain the use of step-up and step-down transformers in the large-scale generation and transmission of electrical energy

6.19 recall and use the relationship between input (primary) and output (secondary) voltages and the turns ratio for a transformer:

$$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$$

$$\frac{V_p}{V_s} = \frac{n_p}{n_s}$$

6.20 recall and use the relationship:

input power = output power

$$V_P I_P = V_s I_s$$

for 100% efficiency

Section 7: Radioactivity and particles

a) Units

b) Radioactivity

c) Particles

a) Units

Students will be assessed on their ability to:

7.1   use the following units: becquerel (Bq), centimetre (cm), hour (h), minute (min), second (s).

b) Radioactivity

Students will be assessed on their ability to:

7.2   describe the structure of an atom in terms of protons, neutrons and electrons and use symbols such as $^{14}_{6}\text{C}$ to describe particular nuclei

7.3   understand the terms atomic (proton) number, mass (nucleon) number and isotope

7.4   understand that alpha and beta particles and gamma rays are ionising radiations emitted from unstable nuclei in a random process

7.5   describe the nature of alpha and beta particles and gamma rays and recall that they may be distinguished in terms of penetrating power

7.6   describe the effects on the atomic and mass numbers of a nucleus of the emission of each of the three main types of radiation

7.7   understand how to complete balanced nuclear equations

7.8   understand that ionising radiations can be detected using a photographic film or a Geiger-Muller detector

7.9   recall the sources of background radiation

7.10 understand that the activity of a radioactive source decreases over a period of time and is measured in becquerels

7.11 recall the term 'half-life' and understand that it is different for different radioactive isotopes

7.12 use the concept of half-life to carry out simple calculations on activity

7.13 describe the uses of radioactivity in medical and non-medical tracers, in radiotherapy and in the radioactive dating of archaeological specimens and rocks

7.14 describe the dangers of ionising radiations, including:

- radiation can cause mutations in living organisms

- radiation can damage cells and tissue

- the problems arising in the disposal of radioactive waste.

c) Particles

Students will be assessed on their ability to:

7.15   describe the results of Geiger and Marsden's experiments with gold foil and alpha particles

7.16   describe Rutherford's nuclear model of the atom and how it accounts for the results of Geiger and Marsden's experiment and understand the factors (charge and speed) which affect the deflection of alpha particles by a nucleus

7.17   understand that a nucleus of U-235 can be split (the process of fission) by collision with a neutron, and that this process releases energy in the form of kinetic energy of the fission products

7.18   recall that the fission of U-235 produces two daughter nuclei and a small number of neutrons

7.19   understand that a chain reaction can be set up if the neutrons produced by one fission strike other U-235 nuclei

7.20   understand the role played by the control rods and moderator when the fission process is used as an energy source to generate electricity.

Assessment

Assessment summary

Physics Paper 1

This paper will assess **physics** across all Assessment Objectives. All the content in this specification which is not in bold will be assessed in this paper. The maximum mark for this paper is 120.

Physics Paper 2

This paper will assess physics across all the assessment objectives. All the content in this specification, whether bold or not, will be assessed in this paper. The maximum mark for this paper is 60.

There will be a range of compulsory, short-answer structured questions in both papers which are ramped to ensure accessibility for less-able students, as well as to stretch more-able students.

Students may be required to perform calculations, draw graphs and describe, explain and interpret physical phenomena. Some of the question content will be unfamiliar to students; these questions are designed to assess data-handling skills and the ability to apply physical principles to unfamiliar information. Questions targeted at grades A* – B will include questions designed to test knowledge, understanding and skills at a higher level, including some questions requiring longer prose answers.

Summary of table of assessment

Physics Paper 1	**Paper code: 4PH0/1P**
• Externally assessed	
• Availability: January and June series	
• First assessment: June 2011.	
Physics Paper 2	**Paper code: 4PH0/2P**
• Externally assessed	
• Availability: January and June series	
• First assessment: June 2011.	

Assessment Objectives and weightings

AO1   Knowledge and understanding

In the examination, students will be tested on their ability to:

- recognise, recall and show understanding of specific physical facts, terminology, principles, concepts and practical techniques including aspects of safety

- draw on existing knowledge to show understanding of the ethical, social, environmental, economic and technological applications and implications of physics

- select, organise and present relevant information clearly and logically, using appropriate vocabulary.

AO2   Application of knowledge and understanding, analysis and evaluation

In the examination, students will be tested on their ability to:

- describe, explain and interpret phenomena, effects and ideas in terms of physical principles and concepts, presenting arguments and ideas clearly and logically

- interpret and translate data presented as continuous prose or in tables, diagrams, drawings and graphs, from one form to another

- carry out relevant calculations

- apply physical principles and concepts in solving problems in unfamiliar situations, including those related to the ethical, social, economic and technological applications and implications of physics

- assess the validity of physical information, experiments, inferences and statements and make informed judgements from them.

AO3   Investigative skills

In the assessment of these practical skills, students will be tested on their ability to:

- devise and plan investigations, drawing on physical knowledge and understanding in selecting appropriate techniques

- demonstrate or describe appropriate experimental and investigative methods, including safe and skilful practical techniques

- make observations and measurements with appropriate precision, record these methodically, and present them in a suitable form

- analyse and interpret data to draw conclusions from experimental activities which are consistent with the evidence, using physical knowledge and understanding, and communicate these findings using appropriate specialist vocabulary, relevant calculations and graphs

- evaluate data and methods.

	% in IGCSE
A01: Knowledge and understanding	45-55%
A02: Application of knowledge and understanding, analysis and evaluation	25-35%
A03: Investigative skills	20%
TOTAL	**100%**

Relationship of Assessment Objectives to Papers for IGCSE

Paper number	Assessment Objective			
	AO1	**AO2**	**AO3**	**Total for AO1, AO2 and AO3**
Paper 1	30-36%	17-23%	$13\frac{1}{3}$ %	$66\frac{2}{3}$ %
Paper 2	15-19%	8-12%	$6\frac{2}{3}$ %	$33\frac{1}{3}$ %
Total for IGCSE	45-55%	25-35%	20%	100%

Entering your students for assessment

Student entry

Details of how to enter students for this qualification can be found in Edexcel's *International Information Manual*, copies of which (in CD format) are sent to all active Edexcel centres. The information can also be found on Edexcel's website.

Combinations of entry

Students entering for this specification may not, in the same series of examinations, enter for the Edexcel IGCSE in Science (Double Award (4SC0).

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, IGCSE, and Entry Level qualifications aims to enhance access to the qualifications for students with disabilities and other difficulties without compromising the assessment of skills, knowledge, understanding or competence.

Please see the Edexcel website (www.edexcel.com) for:

- the Joint Council for Qualifications (JCQ) policy *Access Arrangements and Special Considerations*, *Regulations and Guidance Relating to Students who are Eligible for Adjustments in Examinations*

- the forms to submit for requests for access arrangements and special considerations

- dates for submission of the forms.

Requests for access arrangements and special considerations must be addressed to:

Special Requirements
Edexcel
One90 High Holborn
London WC1V 7BH

Health and safety

Students must follow the Health and Safety rules which normally operate in their laboratories. This will include the following:

- eye protection must always be worn

- laboratory coats must always be worn

- plastic gloves must be worn when supplied for a particular exercise

- all substances should be regarded as being potentially toxic and hazardous

- HazChem labels (eg flammable) should be read and appropriate precautions (eg keep liquid away from flame) taken

- all substances spilled on the skin should be rinsed off immediately

- chemicals must never be tasted

- gases and vapours should never be smelt unless the question instructs the candidates to do so and then only with great care.

With all laboratory practicals it is essential that centres carry out a detailed risk assessment before allowing students to carry out the practical. For further information on risk assessments and chemical hazards please refer to the CLEAPSS website (www.cleapss.org.uk).

Assessing your students

The first assessment opportunity for Physics Paper 1 and Physics Paper 2 of this qualification will take place in the June 2011 series and in each January and June series thereafter for the lifetime of the specification.

Your student assessment opportunities

Paper	June 2011	Jan 2012	June 2012	Jan 2013
Physics Paper 1	✓	✓	✓	✓
Physics Paper 2	✓	✓	✓	✓

Awarding and reporting

The grading, awarding and certification of this qualification will follow the processes outlined in the current GCSE/GCE Code of Practice for courses starting in September 2009, which is published by the Qualifications and Curriculum Authority (QCA). The IGCSE qualification will be graded and certificated on an eight-grade scale from A* to G.

Students whose level of achievement is below the minimum standard for Grade G will receive an unclassified U. Where unclassified is received it will not be recorded on the certificate.

The first certification opportunity for the Edexcel IGCSE in Physics will be June 2011.

Language of assessment

Assessment of this specification will be available in English only. Assessment materials will be published in English only and all work submitted for examination and moderation must be produced in English.

Malpractice and plagiarism

For up-to-date advice on malpractice and plagiarism, please refer to the JCQ's *Suspected Malpractice in Examinations: Policies and Procedures* document on the JCQ website www.jcq.org.uk.

Student recruitment

Edexcel's access policy concerning recruitment to our qualifications is that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Progression

This qualification supports progression to:

- Edexcel GCE Advanced Subsidiary and Advanced Level in Physics
- Edexcel Level 3 BTEC National Award/Certificate/Diploma in Applied Science.

Grade descriptions

Grade A

Candidates can*:*

- recall a wide range of knowledge from all areas of the specification
- use detailed scientific knowledge and understanding in a range of applications relating to scientific systems or phenomena, for example use many different relationships between physical quantities to carry out calculations effectively. Candidates draw together and communicate knowledge from more than one area, routinely use scientific or mathematical conventions in support of arguments and use a wide range of scientific and technical vocabulary throughout their work
- use scientific knowledge and understanding to select an appropriate strategy for a task, identifying the key factors to be considered. They make systematic observations in qualitative work and decide which observations are relevant to the task in hand. When making measurements they decide the level of precision needed and can recall or use different types of apparatus to make appropriately precise measurements. They select a method of presenting data appropriate to the task; they use information from a range of sources where it is appropriate to do. They identify and explain anomalous observations and measurements and the salient features of graphs

- use scientific knowledge and understanding to identify and explain patterns and draw conclusions from the evidence by combining data of more than one kind or from more than one source. They identify shortcomings in evidence, use scientific knowledge and understanding to draw conclusions from their evidence and suggest improvements to methods used that would enable them to collect more reliable evidence.

Grade C

Candidates can:

- recall a range of scientific information from all areas of the specification, including units

- use and apply scientific knowledge and understanding in some general contexts, for example use quantitative relationships between physical quantities to perform calculations

- describe links between related phenomena in different contexts; use diagrams, charts and graphs to support arguments; use appropriate scientific and technical vocabulary in various contexts

- use scientific knowledge and understanding to identify an approach to a question: for example identifying key factors which need to be varied and controlled. Candidates can recall or use various types of apparatus to make careful and precise measurements and systematic observations, and recognise when it is necessary to repeat measurements and observations; they present data systematically, for example in graphs, and use lines of best fit; they identify and explain patterns within data and draw conclusions consistent with the evidence. They explain these conclusions using scientific knowledge and understanding and evaluate how strongly their evidence supports the conclusions.

Grade F

Candidates can:

- recall a limited range of information, for example suggest ways in which insulation is used in domestic contexts

- use and apply knowledge and understanding in some specific everyday contexts, for example explain that fuels are energy resources

- make some use of scientific and technical vocabulary and make simple generalisations from information

- devise fair tests in contexts which involve only a few factors; they can recall or use simple apparatus to make measurements appropriate to the task, and record observations and measurements in tables and graphs. They can obtain information from simple tables, charts and graphs and identify simple patterns; they offer explanations consistent with the evidence obtained.

Support and training

Edexcel support services

Edexcel has a wide range of support services to help you implement this qualification successfully.

ResultsPlus – ResultsPlus is an application launched by Edexcel to help subject teachers, senior management teams, and students by providing detailed analysis of examination performance. Reports that compare performance between subjects, classes, your centre and similar centres can be generated in 'one-click'. Skills maps that show performance according to the specification topic being tested are available for some subjects. For further information about which subjects will be analysed through ResultsPlus, and for information on how to access and use the service, please visit www.edexcel.com/resultsplus

Ask the Expert – Ask the Expert is a new service, launched in 2007, that provides direct email access to senior subject specialists who will be able to answer any questions you might have about this or any other specification. All of our specialists are senior examiners, moderators or verifiers and they will answer your email personally. You can read a biography for all of them and learn more about this unique service on our website at www.edexcel.com/asktheexpert

Ask Edexcel – Ask Edexcel is Edexcel's online question and answer service. You can access it at www.edexcel.com/ask or by going to the main website and selecting the Ask Edexcel menu item on the left.

The service allows you to search through a database of thousands of questions and answers on everything Edexcel offers. If you don't find an answer to your question, you can choose to submit it straight to us. One of our customer services team will log your query, find an answer and send it to you. They'll also consider adding it to the database if appropriate. This way the volume of helpful information that can be accessed via the service is growing all the time.

Examzone – The Examzone site is aimed at students sitting external examinations and gives information on revision, advice from examiners and guidance on results, including re-marking, re-sitting and progression opportunities. Further services for students – many of which will also be of interest to parents – will be available in the near future. Links to this site can be found on the main homepage at www.examzone.co.uk.

Training

A programme of professional development and training courses, covering various aspects of the specification and examination, will be arranged by Edexcel. Full details can be obtained from our website: www.edexcel.com

Appendices

Appendix 1: Physics formulae for relationships

The relationships listed below will **not** be provided for IGCSE students either in the form given or in re-arranged form.

(i)　　the relationship between average speed, distance and time:

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

(ii)　　the relationship between force, mass and acceleration:

force = mass × acceleration

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

(iii)　　the relationship between density, mass and volume:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(iv)　　the relationship between force, distance and work:

work done = force × distance moved in direction of force

(v)　　the energy relationships:

energy transferred = work done

kinetic energy = ½ × mass × speed^2

gravitational potential energy = mass × g × height

(vi)　　the relationship between mass, weight and gravitational field strength:

weight = mass × gravitational field strength

(vii)　　the relationship between an applied force, the area over which it acts and the resulting pressure:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

(viii)　　the relationship between the moment of a force and its distance from the pivot:

moment = force × perpendicular distance from the pivot

(ix)   the relationships between charge, current, voltage, resistance and electrical power:

charge = current × time

voltage = current × resistance

electrical power = voltage × current

(x)   the relationship between speed, frequency and wavelength:

wave speed = frequency × wavelength

(xi) $$\frac{input\ (primary)\ voltage}{output\ (seconday)\ voltage} = \frac{primary\ turns}{secondary\ turns}$$

(xii)   the relationship between refractive index, angle of incidence and angle of refraction:

$$n \quad \frac{\sin i}{\sin r}$$

(xiii)   the relationship between refractive index and critical angle:

$$\sin c = \frac{1}{n}$$

(xiv)   the relationship for pressure difference:

pressure difference = height × density × g

$p = h\rho\, g$

Appendix 2: Electrical circuit symbols

Description	Symbol	Description	Symbol
Conductors crossing with no connection		Heater	
Junction of conductors		Thermistor	
Open switch		Light-dependent resistor (LDR)	
Closed switch		Relay	
Open push switch		Diode	
Closed push switch		Light-emitting diode (LED)	
Cell		Lamp	
Battery of cells		Loudspeaker	
Power supply	(d.c.) or (a.c.)	Microphone	
Transformer		Electric bell	
Ammeter	A	Earth or ground	
Milliammeter	mA	Motor	M
Voltmeter	V	Generator	G
Fixed resistor		Fuse/circuit breaker	
Variable resistor			