edexcel

INTERNATIONAL GCSE Physics

Specification and Sample Assessment Material

Edexcel International GCSE in Physics (4PH0)

First examination June 2013

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International GCSE

Physics (4PH0)

Specification

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An internationally recognised option within Edexcel's learning pathways for students

Depending on the learning approach that suits them, and the progression route that they wish to follow, different learning pathways can suit different students. For many, especially those capable of progression to further academic study in science-related subjects, this International GCSE qualification forms an ideal grounding in scientific theory.

Used by many UK independent schools as well as renowned international schools, the content of the Certificate is:

- examined terminally to ensure secure acquisition of knowledge
- examined externally – controlled assessment is not required
- focused on the key theory that all students need to consider further study in Science.

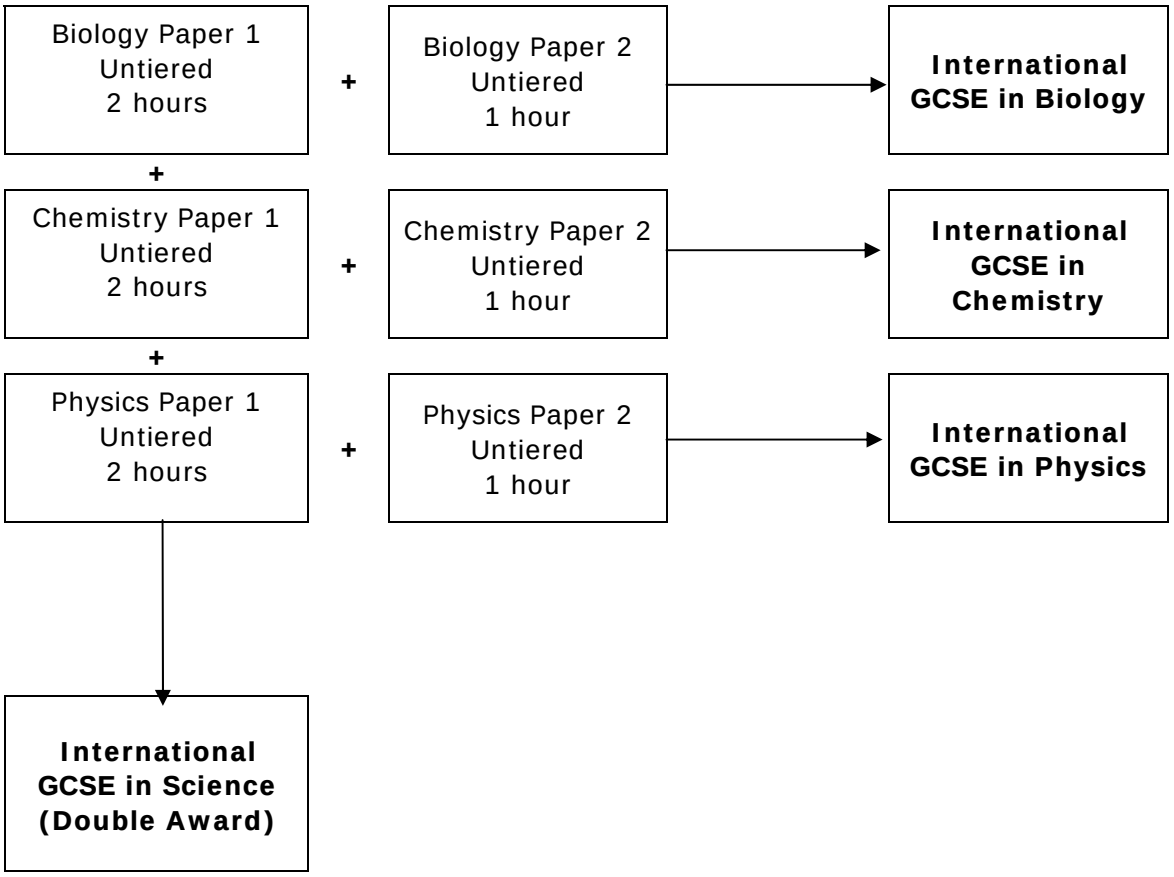
Introduction

The Edexcel International GCSE in Physics is designed for use in schools and colleges. It is part of a suite of International GCSEs offered by Edexcel.

The course offers students the opportunity to experience physics within the context of their general education. The course design provides a basis for progression to further study in GCE Advanced Subsidiary and Advanced Level Physics.

How assessment relates to the qualifications available is shown below.

The assessment for this qualification is linear and both papers need to be completed in the same series.



National Qualifications Framework (NQF) criteria

This specification complies with the requirements of the common criteria which are prescribed by the regulatory authorities.

About this specification

Key subject aims

The Edexcel International GCSE in Physics enables students to:

- learn about the unifying patterns and themes of physics
- acquire knowledge and understanding of physical facts, concepts and principles
- appreciate the practical nature of physics, developing experimental and investigative skills based on correct and safe laboratory techniques
- appreciate the importance of accurate experimental work and reporting as scientific methods
- develop a logical approach to problem solving in a wider context
- evaluate, in terms of their scientific knowledge and understanding, the benefits and drawbacks of real-life applications of science, including their everyday, industrial and environmental aspects
- select, organise and present information clearly and logically, using appropriate scientific terms and conventions
- prepare for more advanced courses in physics and for other courses which require them to have a knowledge of physics.

Key features and benefits of the specification

Key features and benefits of the specification are:

- it includes aspects of science appropriate for the 21st century
- straightforward linear assessment
- untiered assessment
- assessment of experimental skills through an examination paper
- it provides a sound foundation for progression to Edexcel GCE Advanced Subsidiary (AS) and Advanced Level in Physics, and other comparable post-16 qualifications.

Contents

Specification at a glance

The Edexcel International GCSE in Physics 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 2013	**66.7% of the total qualification 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. • Grades A*–G are available.	

Physics Paper 2	**Paper code: 4PH0/2P**
• Externally assessed • Availability: January and June series • First assessment: June 2013	**33.3% of the total qualification 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. • Grades A*–G are available.	

Practicals

The best way to develop practical and investigative skills is to embed practical activities in your teaching of theory. The development of knowledge and skills can then happen together, leading to secure acquisition of knowledge and skills.

There are some practicals in the specification content, which students need to describe. Knowledge of these practicals, and the ability to interpret the resulting data, is required for the examinations.

The teachers' guide materials contain additional suggested practicals.

Appendix 4 also contains some suggestions for practical activities.

Qualification content

Paper 1 assesses only the content that is **not** in bold.

Paper 2 assesses all content including content in **bold**.

This Edexcel International GCSE in Physics requires students to demonstrate an understanding of:

- forces and motion
- electricity
- waves
- energy resources and energy transfer
- solids, liquids and gases
- magnetism and electromagnetism
- radioactivity and particles.

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 plot and interpret distance-time graphs

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

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

1.4 describe experiments to investigate the motion of everyday objects such as toy cars or tennis balls

1.5 know and use the relationship between acceleration, velocity and time:

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

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

1.6 plot and interpret velocity-time graphs

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

1.8 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:

1.9 describe the effects of forces between bodies such as changes in speed, shape or direction

1.10 identify different types of force such as gravitational or electrostatic

1.11 distinguish between vector and scalar quantities

1.12 understand that force is a vector quantity

1.13 find the resultant force of forces that act along a line

1.14 understand that friction is a force that opposes motion

1.15 know and use the relationship between unbalanced force, mass and acceleration:

force = mass × acceleration

$F = m \times a$

1.16 know and use the relationship between weight, mass and g:

weight = mass × g

$W = m \times g$

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

1.18 describe experiments to investigate the forces acting on falling objects, such as sycamore seeds or parachutes

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

1.20 know and use the relationship between momentum, mass and velocity:

momentum = mass × velocity

$\boldsymbol{p = m \times v}$

1.21 use the idea of momentum to explain safety features

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

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

$$\textbf{force} = \frac{\textbf{change in momentum}}{\textbf{time taken}}$$

1.24 demonstrate an understanding of Newton's third law

1.25 know and use the relationship between the moment of a force and its distance from the pivot:

moment = force × perpendicular distance from the pivot

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

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

1.28 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

1.29 describe experiments to investigate how extension varies with applied force for helical springs, metal wires and rubber bands

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

1.31 describe elastic behaviour as 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:

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

1.33 explain that gravitational force:

- causes moons to orbit planets
- causes the planets to orbit the sun
- causes artificial satellites to orbit the Earth
- causes comets to orbit the sun

1.34 describe the differences in the orbits of comets, moons and planets

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

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

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

1.36 understand that:

- the universe is a large collection of billions of galaxies
- a galaxy is a large collection of billions of stars
- our solar system is in the Milky Way galaxy.

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

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

2.4 understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature, and how this can be used in a variety of domestic contexts

2.5 know and use the relationship:

power = current × voltage

$P = I \times V$

and apply the relationship to the selection of appropriate fuses

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

energy transferred = current × voltage × time

$E = I \times V \times t$

2.7 understand the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) being supplied by a cell or battery.

c) Energy and potential difference in circuits

Students will be assessed on their ability to:

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

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

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

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

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

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

2.14 know and use the relationship between voltage, current and resistance:

voltage = current × resistance

$V = I \times R$

2.15 understand that current is the rate of flow of charge

2.16 know and use the relationship between charge, current and time:

charge = current × time

$Q = I \times t$

2.17 know that electric current in solid metallic conductors is a flow of negatively charged electrons

2.18 understand 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:

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

2.20 describe experiments to investigate how insulating materials can be charged by friction

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

2.22 understand that there are forces of attraction between unlike charges and forces of repulsion between like charges

2.23 explain electrostatic phenomena in terms of the movement of electrons

2.24 explain the potential dangers of electrostatic charges, eg when fuelling aircraft and tankers

2.25 explain 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 understand the difference between longitudinal and transverse waves and describe experiments to show longitudinal and transverse waves in, for example, ropes, springs and water

3.3 define amplitude, frequency, wavelength and period of a wave

3.4 understand that waves transfer energy and information without transferring matter

3.5 know 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 identify the order of the electromagnetic spectrum in terms of decreasing wavelength and increasing frequency, including the colours of the visible spectrum

3.12 explain 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 understand the detrimental effects of excessive exposure of the human body to electromagnetic waves, including:

- microwaves: internal heating of body tissue
- infrared: skin burns
- ultraviolet: damage to surface cells and blindness
- gamma rays: cancer, mutation

and describe simple protective measures against the risks.

d) Light and sound

Students will be assessed on their ability to:

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

3.15 use the law of reflection (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 know 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 explain the meaning of critical angle *c*

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

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

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 understand that sound waves are longitudinal waves and how they can be reflected, refracted **and diffracted**

3.27 understand that the frequency range for human hearing is

20 Hz – 20,000 Hz

3.28 describe an experiment 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 describe an experiment using an oscilloscope to determine the frequency of a sound wave

3.31 relate the pitch of a sound to the frequency of vibration of the source

3.32 relate the loudness of a sound to 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 know and use the relationship:

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

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 describe how energy transfer may take place by conduction, convection and radiation

4.7 explain the role of convection in everyday phenomena

4.8 explain 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 know 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 know and use the relationship:

gravitational potential energy = mass × g × height

GPE = $m \times g \times h$

4.12 know and use the relationship:

kinetic energy = $\frac{1}{2}$ × 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 describe 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 (^{o}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 know and use the relationship between density, mass and volume:

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

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

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

5.4 know 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 know and use the relationship for pressure difference:

pressure difference = height × density × g

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

c) Change of state

Students will be assessed on their ability to:

5.7 understand the changes that occur when a solid melts to form a liquid, and when a liquid evaporates or boils to form a gas

5.8 describe the arrangement and motion of particles in solids, liquids and gases

d) Ideal gas molecules

Students will be assessed on their ability to:

5.9 understand the significance of Brownian motion, as supporting evidence for particle theory

5.10 understand 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

5.11 understand why there is an absolute zero of temperature which is –273°C

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

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

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

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

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

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

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

$$p_1V_1 = p_2V_2$$

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 understand that magnets repel and attract other magnets and attract magnetic substances

6.3 describe 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 describe experiments to investigate the magnetic field pattern for a permanent bar magnet and that between two bar magnets

6.7 describe 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 understand 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 understand 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 understand 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 describe how 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 understand 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 and describe 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 and describe the factors which affect the size of the induced voltage

6.17 describe 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 know 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 know 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 $^{14}_{6}\mathrm{C}$ 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 explain 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 understand 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

and describe how the associated risks can be reduced.

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 understand 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

Paper 1 is externally assessed through an examination paper lasting 2 hours.

Paper 2 is externally assessed through an examination paper lasting 1 hour.

The assessment for this qualification is linear and both papers must be taken in the same series.

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 situations. Questions targeted at grades A*–B will include questions designed to test knowledge, understanding and skills at a higher level, including some 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 2013 • Assesses all Assessment Objectives • Maximum mark 120 • 2-hour examination • Assesses specification content **not** in bold	
Physics Paper 2	**Paper code: 4PH0/2P**
• Externally assessed • Availability: January and June series • First assessment: June 2013 • Assesses all Assessment Objectives • Maximum mark 60 • 1-hour examination • Assesses **all** specification content, including that in **bold**	

Assessment Objectives and weightings

In the examination, students will be tested on the following areas:

AO1 Knowledge and understanding

AO2 Application of knowledge and understanding, analysis and evaluation

AO3 Experimental skills, analysis and evaluation of data and methods

Assessment Objectives weightings

	% in International GCSE
AO1: Knowledge and understanding*	45–50%
AO2: Application of knowledge and understanding, analysis and evaluation	27.5–32.5%
AO3: Experimental skills, analysis and evaluation of data and methods	20–25%
TOTAL	**100%**

Relationship of Assessment Objectives to Papers for Certificate

Paper number	Assessment Objectives			
	AO1*	AO2	AO3	Total marks for AO1, AO2 and AO3
Physics Paper 1	54–60 marks	33–39 marks	24–30 marks	120 marks
Physics Paper 2	27–30 marks	16–20 marks	12–15 marks	60 marks
Percentage of Certificate	45–50%	27.5–32.5%	20–25%	100%

* No more than 50% of the AO1 marks **for the International GCSE** will be for recall of knowledge

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 are sent to all active Edexcel centres. The information can also be found on the Edexcel website.

Forbidden combinations

It is forbidden for students to take this qualification at the same time as the following:

- Edexcel Level 1/Level 2 Certificate in Physics (KPH0)
- Edexcel Level 1/Level 2 Certificate in Science (Double Award) (KSC0)
- Edexcel International GCSE in Science (Double Award) (4SC0).

Classification code

Centres should be aware that students who enter for more than one qualification with the same classification code will have only one grade (the highest) counted for the purpose of the school and college performance tables.

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, International GCSE 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, Reasonable Adjustments and Special Considerations 2010–2011*
- 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

Equality Act 2010

Please see the Edexcel website (www.edexcel.com) for information on the Equality Act 2010

Health and safety

Students must follow the health and safety rules which normally operate in their laboratories.

Responsibility for safety during practical activities rests with the centre.

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 in this qualification will take place in the June 2013 series and in each January and June series thereafter for the lifetime of the specification.

Your student assessment opportunities

	June 2012	Jan 2013	June 2013	Jan 2014
Physics			✓	✓

Awarding and reporting

The grading, awarding and certification of this qualification will comply with the requirements of the current GCSE/GCE Code of Practice, which is published by the Office of Qualifications and Examinations Regulation (Ofqual). The International GCSE 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 International GCSE in Physics will be June 2013.

Students whose level of achievement is below the minimum judged by Edexcel to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Language of assessment

Assessment of this qualification 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 and Assessments: 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.

Guided learning hours

The number of guided learning hours required for this qualification is 120–140.

This reflects how centres will use time for practical activities differently.

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 many different areas relating to scientific systems or phenomena. For example, they can use many different relationships between physical quantities to carry out calculations effectively
- 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 describe an appropriate method for a practical task, identifying the key factors to be considered. They can recall or describe a range of apparatus required for the task. They can select a method of presenting data which is appropriate to the task; they can select information from a range of sources where it is appropriate to do so. They can 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 can 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, they can 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 a range of contexts
- use scientific knowledge and understanding to identify an approach to a practical scenario. For example, they can identify key factors to vary and control; they can recall or describe a range of apparatus required for the task; they can present data systematically, in graphs where appropriate, and use lines of best fit; they can identify and explain patterns within data and draw conclusions consistent with the evidence. They can explain these conclusions on the basis of their 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 they suggest ways in which insulation is used in domestic contexts
- use and apply knowledge and understanding in some specific everyday contexts, for example they 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 describe simple apparatus appropriate for the task. They can obtain information from simple tables, charts and graphs and identify simple patterns in information and observations. They can 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 with 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 – to make it easier for you to raise a query with us online, we have merged our **Ask Edexcel** and **Ask the Expert** services.

There is now one easy-to-use web query form that will allow you to ask any question about the delivery or teaching of Edexcel qualifications. You will receive a personal response, from one of our administrative or teaching experts, sent to the email address you provide.

We will also be doing lots of work to improve the quantity and quality of information in our FAQ database where you will be able to find answers to many questions.

Examzone – the Examzone site is aimed at students sitting external examinations and gives information on revision, advice from examiners and guidance on results, including remarking, resitting 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 students either in the form given or in rearranged form.

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

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

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

force = mass × acceleration

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

(iii) **momentum = mass × velocity**

momentum = $m \times v$

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

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

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

work done = force × distance moved

(vi) the energy relationships:

energy transferred = work done

kinetic energy = $\frac{1}{2}$ × mass × speed^2

gravitational potential energy = mass × g × height

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

weight = mass × gravitational field strength

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

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

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

moment = force × perpendicular distance from the pivot

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

charge = current × time

voltage = current × resistance

electrical power = voltage × current

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

wave speed = frequency × wavelength

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

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

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

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

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

(xv) $$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy output}}$$

(xvi) the relationship for pressure difference:

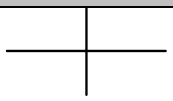
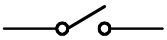
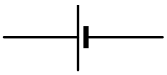
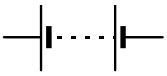
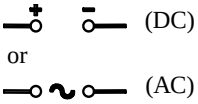
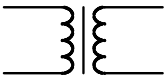
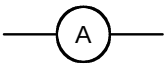
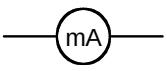
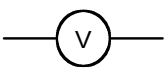
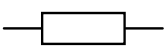
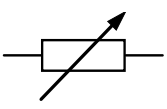
pressure difference = height × density × g

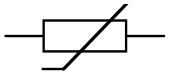
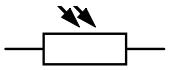
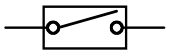
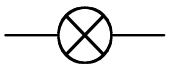
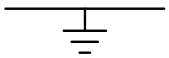
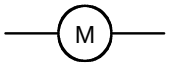
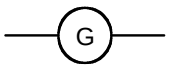
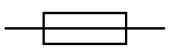
$$p = h \times \rho \times g$$

(xvii) input power = output power

$V_P I_P = V_S I_S$ for 100% efficiency

Appendix 2: Electrical circuit symbols

Description	Symbol
Conductors crossing with no connection	
Junction of conductors	
Open switch	
Closed switch	
Open push switch	
Closed push switch	
Cell	
Battery of cells	
Power supply	
Transformer	
Ammeter	
Milliammeter	
Voltmeter	
Fixed resistor	
Variable resistor	

Description	Symbol
Heater	
Thermistor	
Light-dependent resistor (LDR)	
Relay	
Diode	
Light-emitting diode (LED)	
Lamp	
Loudspeaker	
Microphone	
Electric bell	
Earth or ground	
Motor	
Generator	
Fuse/circuit breaker	

Appendix 3: Wider curriculum

Signposting and development suggestions

Issue	Paper	Opportunities for development
Spiritual	None	
Moral	All	3c
Ethical	All	3c, 4.16, 4.17
Social	All	2.2, 2.25, 3c, 3.24, 7.14
Legislative	All	2.2, 3c
Economic	All	3c, 3.24, 4.16, 4.17
Cultural	All	3c, 3.24
Sustainable	All	3c, 3.24, 4.8, 4.16, 4.17, 7.14
Health and safety	All	1.19, 1.21, practical work, 2.2, 2.24, 7.14
European initiatives	All	1.19, 1.21, 7.14

Appendix 4: Suggested practicals

The following suggestions for practical investigations exemplify the scientific process and can support students' understanding of the subject.

- Investigate the power consumption of low-voltage electrical items
- Investigate factors affecting the generation of electric current by induction
- Investigate how the nature of a surface affects the amount of energy radiated or absorbed
- Investigate models to show refraction, such as toy cars travelling into a region of sand
- Investigate the areas beyond the visible spectrum, such as those found by Herschel and Ritter who discovered infrared and ultraviolet (UV) respectively
- Investigate the relationship between potential difference (voltage), current and resistance
- Investigate the relationship between force, mass and acceleration
- Investigate the forces required to slide blocks along different surfaces, with differing amounts of friction
- Investigate how crumple zones can be used to reduce the forces in collisions
- Investigate forces between charges
- Conduct experiments to show the relationship between potential difference (voltage), current and resistance, for a component whose resistance varies with a given factor, such as temperature, light intensity and pressure
- Investigate the motion of falling
- Investigate momentum during collisions
- Investigate power by running up the stairs or lifting objects of different weights
- Investigate the critical angle for perspex/air or glass/air or water/air boundaries
- Investigate factors affecting the height of rebound of bouncing balls
- Investigate the temperature and volume relationship for a gas
- Investigate the volume and pressure relationship for a gas
- Investigate the absorption of light by translucent materials in order to simulate rays' absorption

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edexcel

International GCSE

Physics (4PH0)

Sample Assessment Material

First examination June 2013

ALWAYS LEARNING

PEARSON

Contents

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, ie if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Codes:

ecf = error carried forward

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Paper: 1P

Sample Assessment Material
Time: 2 hours

Paper Reference
4PH0/1P

You must have:
Ruler, protractor, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is **120**.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 4 1 6 4 8 A 0 1 3 0

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{kelvin temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

Answer ALL questions.

1 The Solar System contains planets, comets and satellites.

(a) Answer the following questions by placing a cross (☒) in the appropriate box.

(i) When one object goes around another in space, it follows a path called

(1)

☒ **A** a circle

☒ **B** an equator

☒ **C** an orbit

☒ **D** an oval

(ii) Which force is responsible for planets following their paths around the Sun?

(1)

☒ **A** friction

☒ **B** gravity

☒ **C** magnetism

☒ **D** upthrust

(iii) Which force is responsible for artificial satellites following their paths around the Earth?

(1)

☒ **A** friction

☒ **B** gravity

☒ **C** magnetism

☒ **D** upthrust

(iv) Moons are natural satellites of

(1)

☒ **A** asteroids

☒ **B** comets

☒ **C** planets

☒ **D** stars

(b) State **one** similarity in the movement of planets and comets.

(1)

.....

.....

(c) State **one** difference between the movement of planets and comets.

(1)

.....

.....

(d) Explain how the speed of a comet changes as it moves.

(2)

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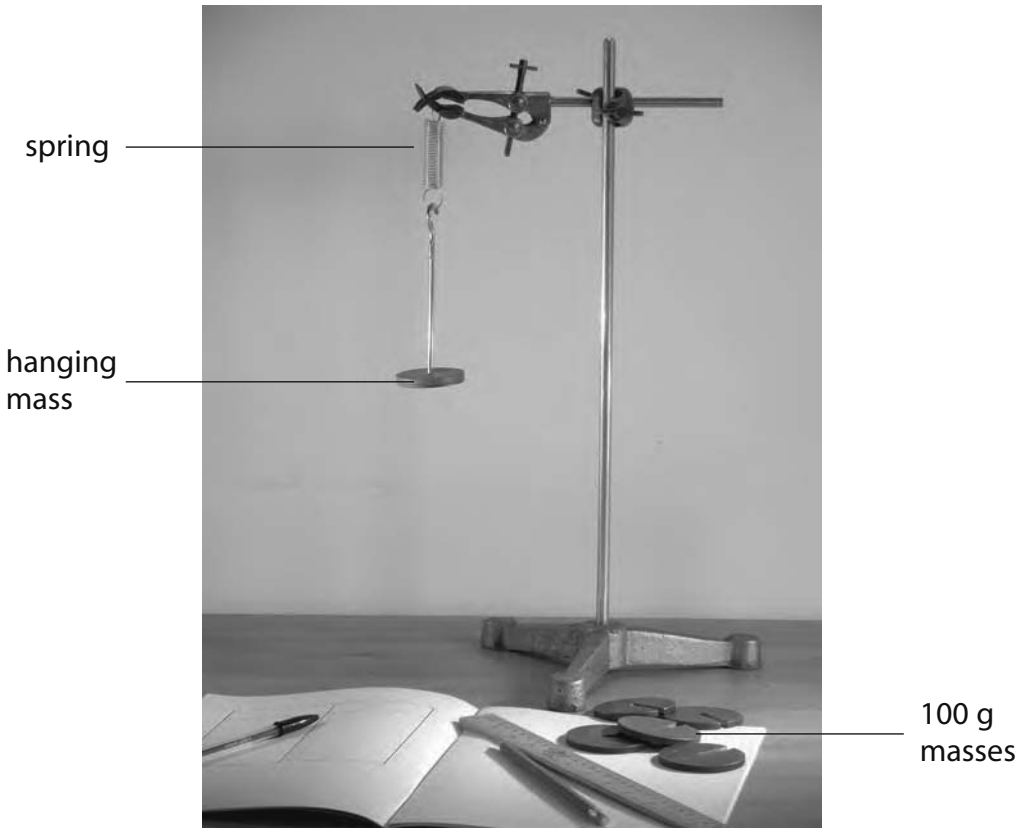
(Total for Question 1 = 8 marks)

2 A student is investigating how the extension of a spring varies when she changes the force stretching it.

The photograph shows how she sets up her experiment.



The student has a ruler marked in centimetres.

Each mass is marked '100 g'.

The student writes the following plan:

- I will hang 100 g on the spring.
- I will hold the ruler next to the spring and measure the length of the spring.
- I will add another mass and measure the length again.
- I will repeat this process until I have enough measurements.

(a) Explain how the student could improve her plan to make her measurements more accurate.

(5)

(b) State, with a reason, a suitable safety precaution the student should take when carrying out her experiment.

(1)

(c) Describe how the student should convert her measurements of mass into forces.

(2)

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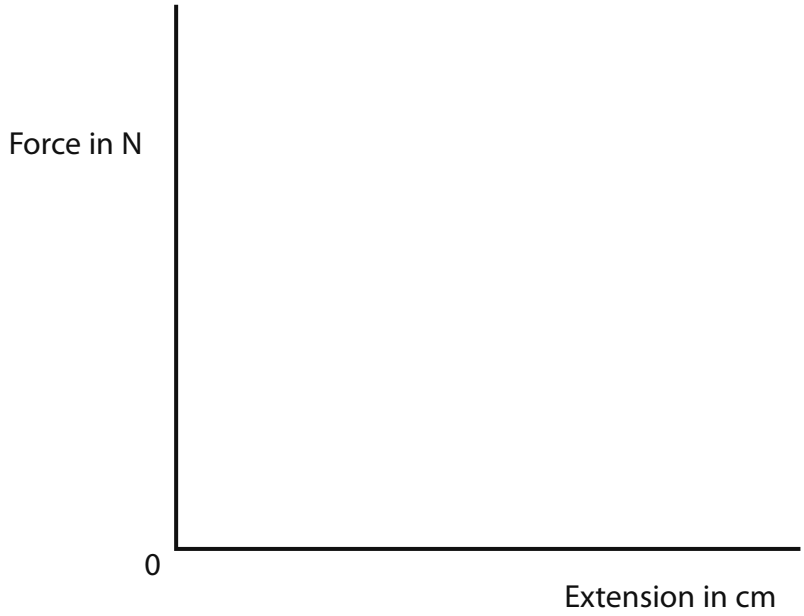
(d) The student plots a graph of force against extension.

She finds that the spring obeys Hooke's law.

On the axes below, sketch the line she gets.

(2)



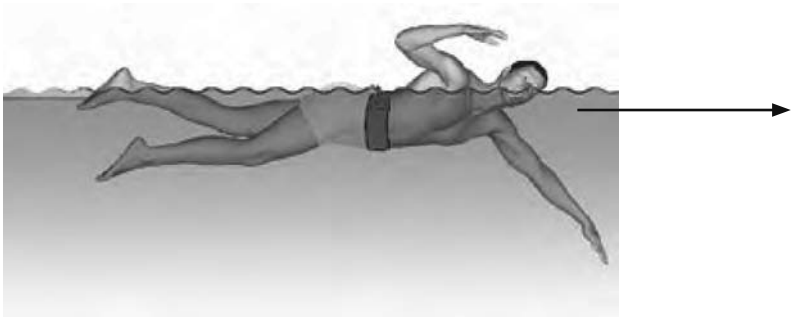
(Total for Question 2 = 10 marks)

3 A triathlon race has three parts: swimming, riding a bicycle and running.

(a) The diagram shows the force responsible for the forward movement of an athlete in the swimming part of the race.

Label the diagram to show **two** other forces acting on the athlete.

(2)



(b) The table shows the distance of each part of a triathlon race and the time an athlete takes for each part.

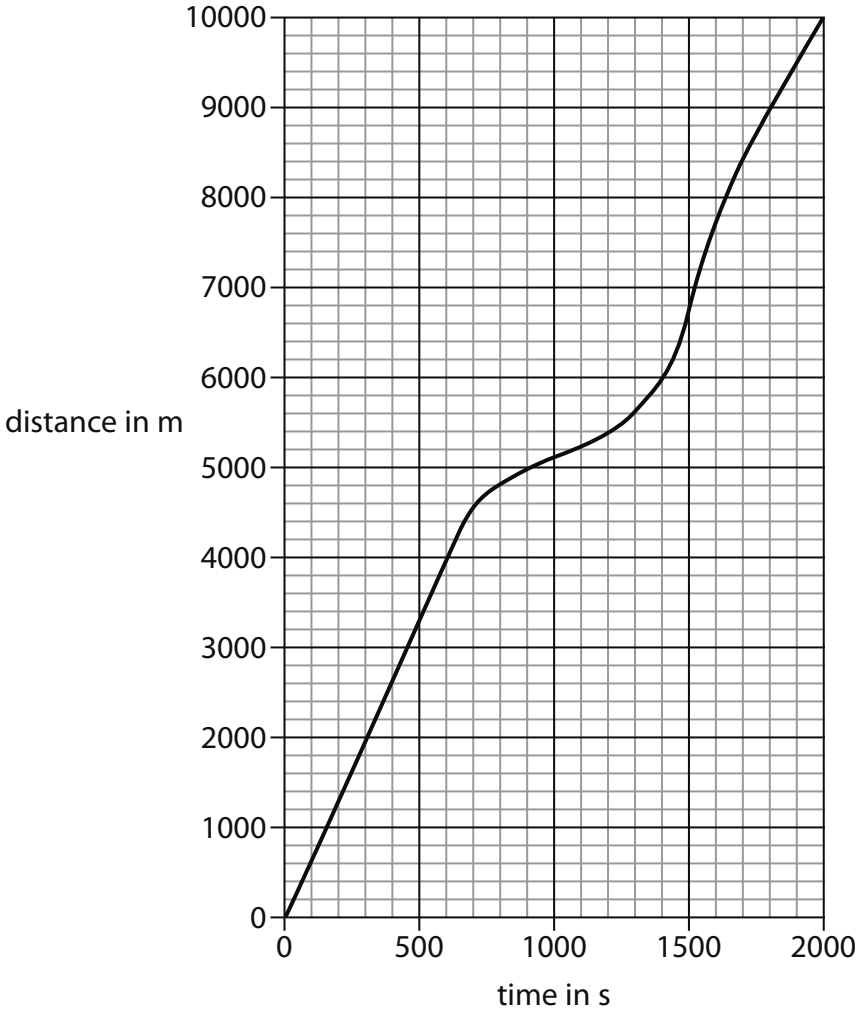
Part of race	Distance in m	Time in s
swimming	1 500	1 200
riding a bicycle	40 000	3 600
running	10 000	2 000

(i) Calculate the athlete's average speed for the whole race.

(2)

Average speed = ... m/s

(ii) The graph shows how the distance varied with time for the running part of the race.



Describe how the athlete's speed changed during this part of the race.

(3)

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(Total for Question 3 = 7 marks)

4 Using mains electricity can be dangerous.

(a) Suggest **two** safety precautions you should take when putting a plug into a mains socket.

(2)

1 .....

.....

.....

2 .....

.....

.....

(b) Mains electricity provides an alternating current (a.c.)

A battery provides direct current (d.c.)

Describe the difference between a.c. and d.c.

(2)

.....

.....

.....

.....

(c) The photograph shows two mains plugs.

Mains plug A has a connection for an earth wire.
Mains plug B does not have an earth connection.

(i) Describe how the earth wire can act together with a fuse as a safety device.

(2)

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.....

(ii) Explain why mains plug B can be safe to use even though it has no earth connection.

(2)

.....

.....

.....

.....

(d) A fuse is rated at 13 A.

The mains voltage is 230 V.

Calculate the maximum power that can be supplied using this fuse.

State the correct unit in your answer.

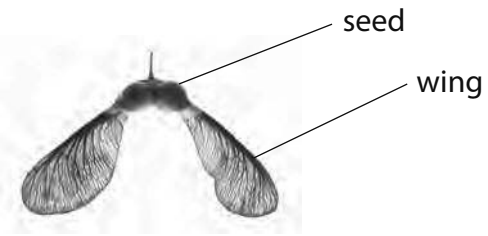
(3)

Maximum power = ... Unit .....

(Total for Question 4 = 11 marks)

5 Two students notice some small objects falling from a tree.

The objects have wings that make them spin around and fall slowly.



The students find out that this is the way that the tree spreads its seeds.

They decide to use these 'winged seeds' for an investigation.

They drop several seeds from a window and collect the data shown in the table.

Average mass of a winged seed	0.25 g
Vertical distance fallen	5 m
Average time taken for a winged seed to fall	12 s

(a) Explain why it is a good idea to use a distance of 5 m in this experiment.

(2)

(b) Describe how the students should find the average mass of a winged seed.

(2)

.....

.....

.....

.....

(c) (i) State the equation linking gravitational potential energy, mass, *g* and height.

(1)

(ii) Calculate the average gravitational potential energy lost by one winged seed as it falls a vertical distance of 5 m.

(2)

Gravitational potential energy = ... J

(iii) Describe what happens to this energy.

(2)

.....

.....

.....

.....

(Total for Question 5 = 9 marks)

6 Electromagnetic waves called T-rays (short for tera-rays) are used in some airport security scanners.

T-rays:

- pass through clothes
- bounce off the human body
- do not pass through or bounce off metal.

(a) Put a cross (✖) in the appropriate box to indicate the correct ending for each sentence.

(i) T-rays are absorbed by

(1)

clothes	
the human body	
metal	

(ii) T-rays are reflected by

(1)

clothes	
the human body	
metal	

(b) (i) State the equation linking wave speed, frequency and wavelength.

(1)

(ii) T-rays have a wavelength of 3×10^{-4} m and travel at a speed of 3×10^{8} m/s.

Calculate the frequency of T-rays.

State the correct unit in your answer.

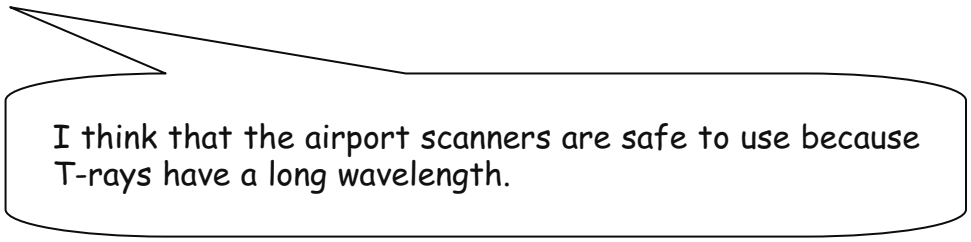
(3)

Frequency = ... Unit .....

(iii) The table shows data for some waves in the electromagnetic spectrum.

Type of wave	Radio waves	Microwaves	T-rays	Infrared waves
Typical wavelength	30 m	3×10^{-2} m	3×10^{-4} m	3×10^{-6} m

A student concludes:



Evaluate the student's conclusion.

(2)

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.....

(Total for Question 6 = 8 marks)

7 Radioactive materials emit different types of ionising radiation.

(a) Complete this table for ionising radiations.

(3)

Type of radiation	Nature of radiation	Charge
alpha	two neutrons and two protons	
beta		negative
	an electromagnetic wave	zero

(b) A nucleus decays and emits an alpha particle.

State the result of this decay on the atomic (proton) number and mass (nucleon) number of the nucleus.

(2)

atomic (proton) number

.....

.....

mass (nucleon) number

.....

.....

(c) Describe how radioactivity can be used to estimate the age of archaeological discoveries such as wooden boats and animal bones.

(4)

(Total for Question 7 = 9 marks)

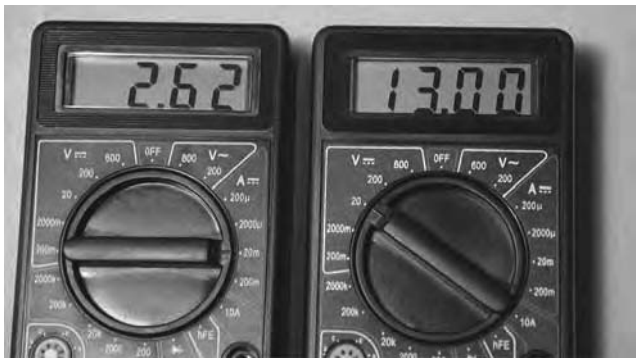
8 A student is investigating the relationship between voltage and current.

(a) State the equation linking voltage, current and resistance.

(1)

(b) The meters show the current in a resistor and the voltage across it.

Current in mA Voltage in V



(i) Complete this table by recording the readings shown on the meters.

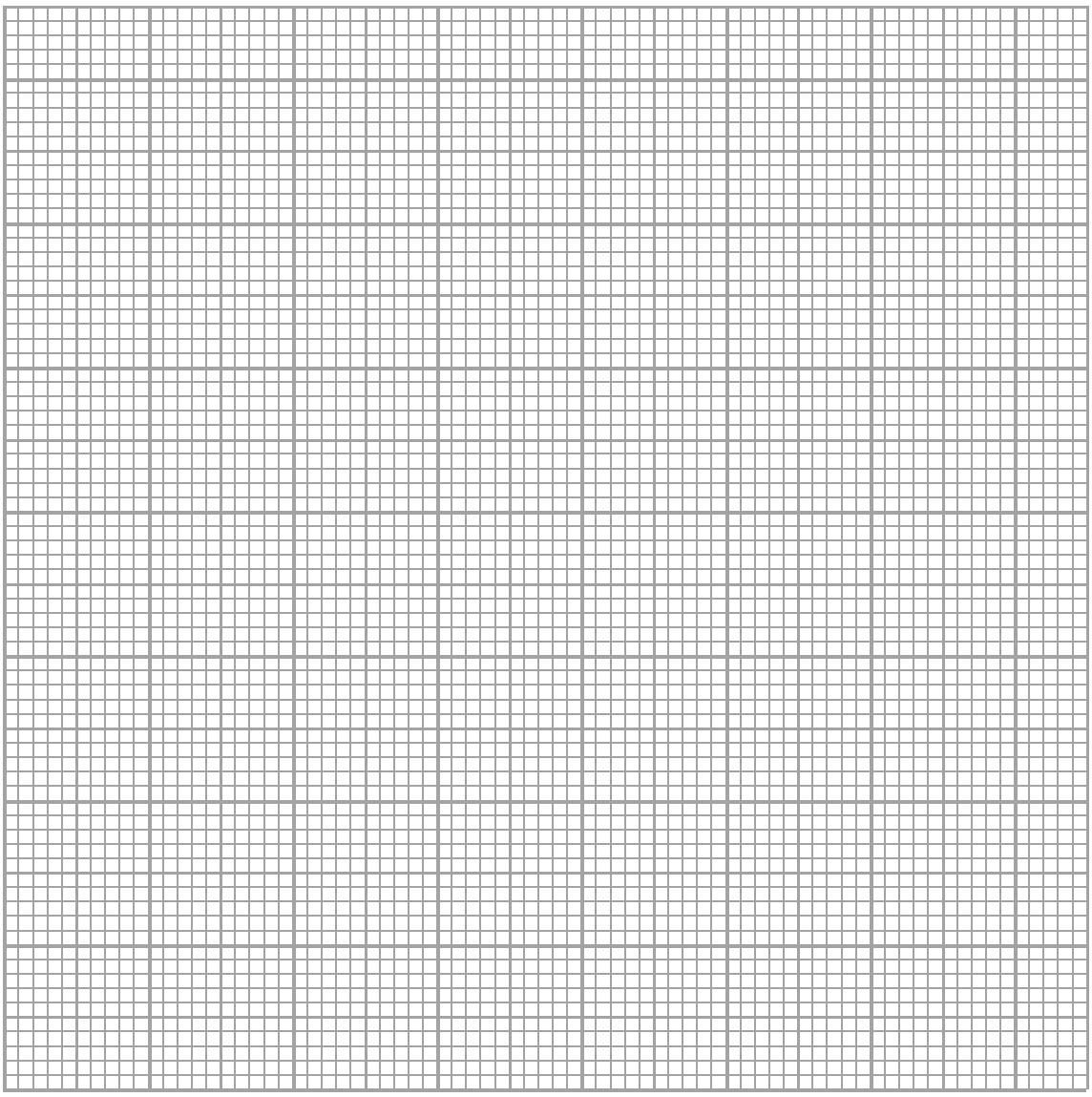
Give your values to an appropriate precision.

(1)

Current in mA	0.20	0.60	1.01	1.14	1.81	2.22	
Voltage in V	1.0	3.0	5.0	7.0	9.0	11.0	

(ii) Use the data in the table to draw a graph of current against voltage.

(5)



(iii) Circle the anomalous point on the graph.

(1)

(iv) How did you decide that this point was anomalous?

(1)

.....

.....

.....

(v) Use your graph, or the table, to find the resistance of the resistor that the student used.

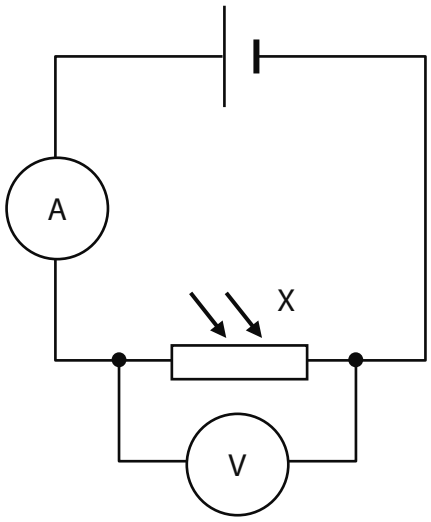
(2)

Resistance = ... Ω

(c) The student wants to investigate the effect of changing light intensity on a circuit.

The student sets up equipment outside in a garden for an experiment lasting 24 hours.

The student uses the circuit shown below.



(i) Give the name of the component labelled X.

(1)

.....

(ii) List the variables that the student should measure.

(2)

.....

.....

.....

(iii) Explain why the student might need help to take all the readings for this investigation.

(2)

.....

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.....

.....

(iv) The graph below shows some results of the student's investigation.

Label both axes with appropriate quantities and units.

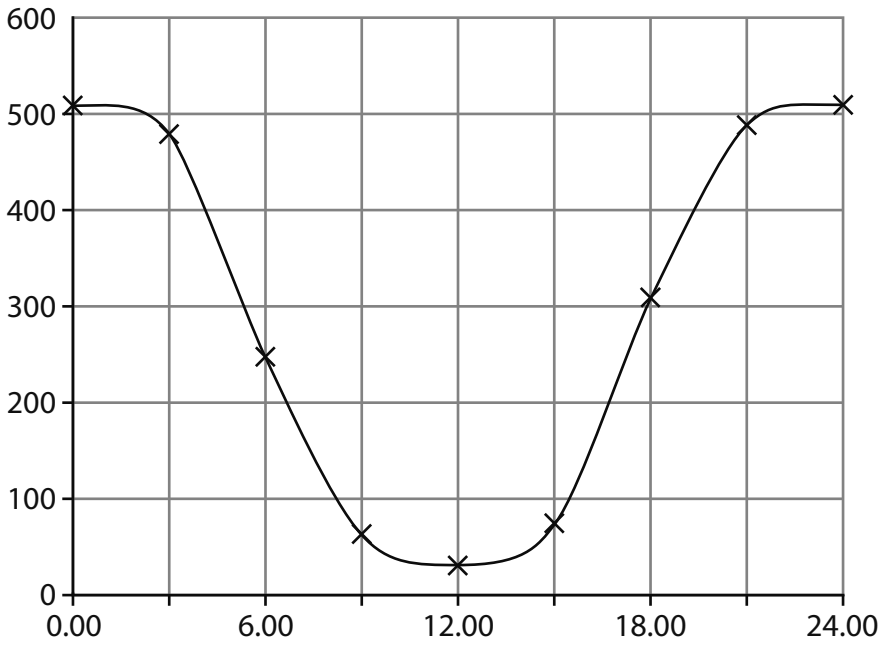
(2)

.....

.....

.....

.....



.....

(Total for Question 8 = 18 marks)

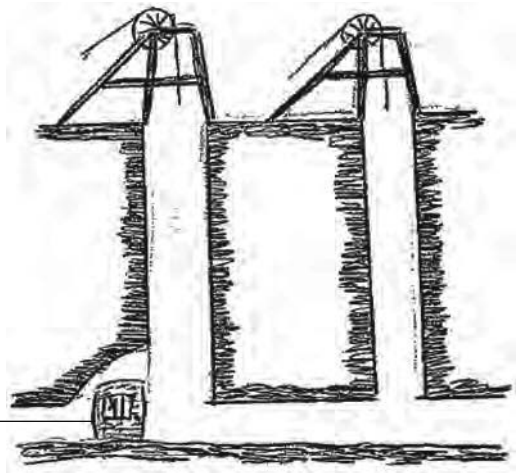
9 Energy can be transferred by radiation, conduction or convection.

(a) Compare the processes of transferring energy by conduction and transferring energy by convection.

(3)

(b) Convection was used in the past to ensure that miners who worked underground had a fresh air supply to breathe.

The diagram shows a mine. A fire has been lit in a furnace at the bottom of one shaft.

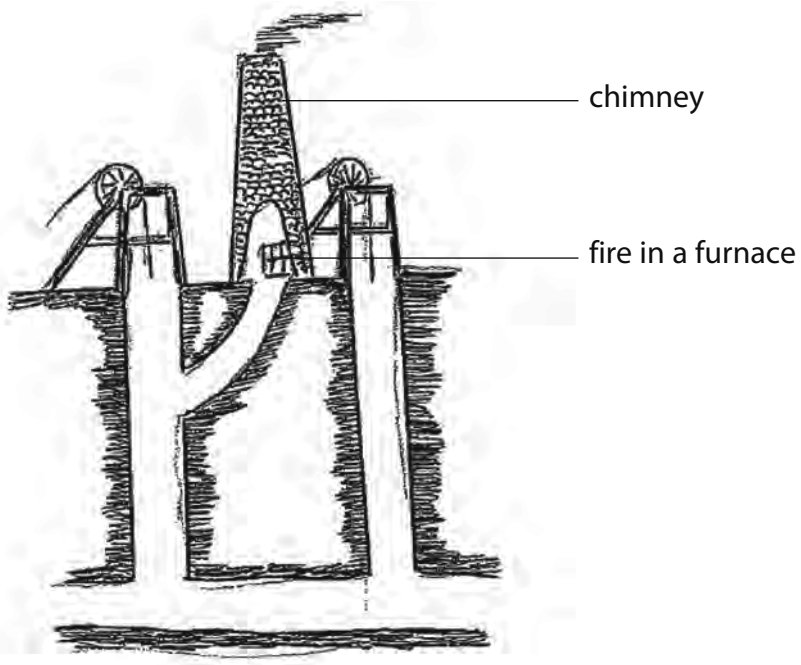


(i) Explain how lighting a fire in this way helped to keep a supply of fresh air moving through the mine.

You may draw on the diagram above to help illustrate your answer.

(3)

(ii) In an earlier system, the fire was lit at the surface of the mine.



This system was less effective at keeping fresh air moving through the mine.

Suggest why.

(2)

.....

.....

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.....

(Total for Question 9 = 8 marks)

10 A student compares two electric lamps.

The lamps have the same brightness.

Type of lamp	filament lamp 	energy-saving lamp 
Electrical energy transferred in J/s	100	20
Useful light energy emitted in J/s	5	5

(a) Both lamps waste energy.

(i) How much energy does the filament lamp waste each second?

(1)

..... J

(ii) Describe what happens to the energy wasted by the filament lamp.

(2)

.....

.....

.....

.....

.....

(b) (i) Calculate the efficiency of the energy-saving lamp.

(2)

Efficiency = ...

(ii) Sketch a labelled Sankey diagram to show the energy transfers in the energy-saving lamp.

(3)

(c) The lamps in the student's house are connected in parallel.

State **two** benefits of connecting lamps in parallel.

(2)

1 .....

.....

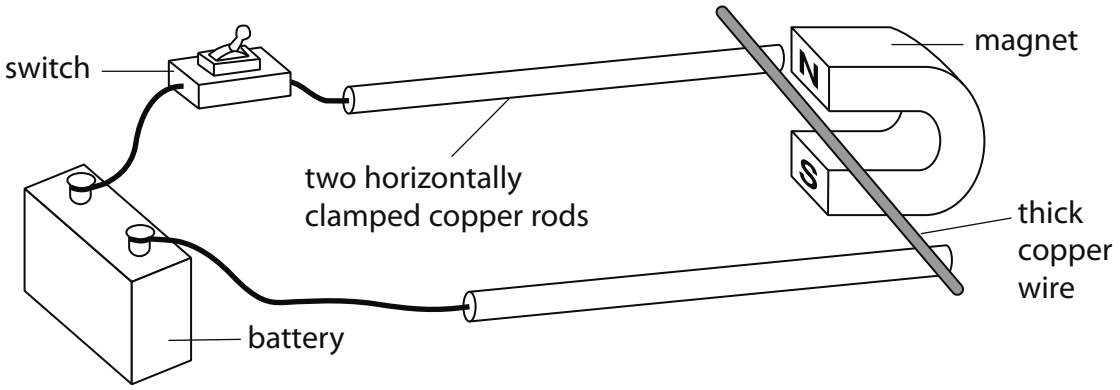
2 .....

.....

(Total for Question 10 = 10 marks)

11 A student investigates electromagnetic effects.

(a) Firstly, he tests this circuit.



When he presses the switch, the thick copper wire rolls along the clamped copper rods, away from the magnet.

(i) Explain why this happens.

(3)

.....

.....

.....

.....

.....

.....

(ii) On the diagram, draw an arrow to show the direction of the current in the circuit when the switch is pressed.

(1)

(iii) State **two** changes the student could make so that the copper wire moved away more quickly when he pressed the switch.

(2)

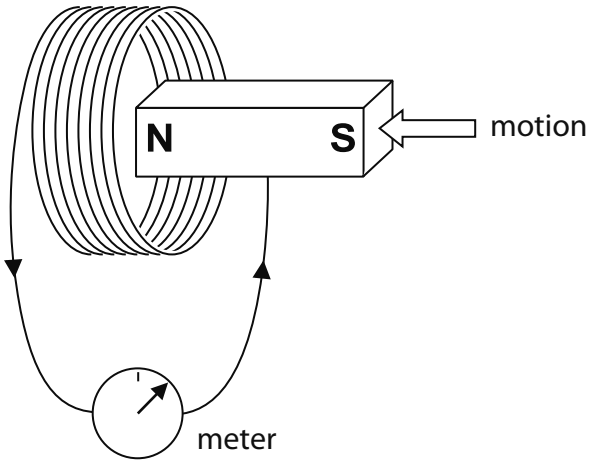
1 .....

.....

2 .....

.....

(b) The student investigates another effect using a coil of wire, a sensitive meter and a magnet.



When he moves the magnet towards the coil, the meter gives a reading to the right.

(i) What is the name of this effect?

(1)

.....

(ii) State **two** changes the student could make so that the meter gives a larger reading to the right.

(2)

1 .....

.....

2 .....

.....

(iii) How could the student make the meter give a reading to the left?

(1)

.....

.....

(Total for Question 11 = 10 marks)

12 The human eye contains liquid.

The liquid exerts a pressure on the inside of the eye.

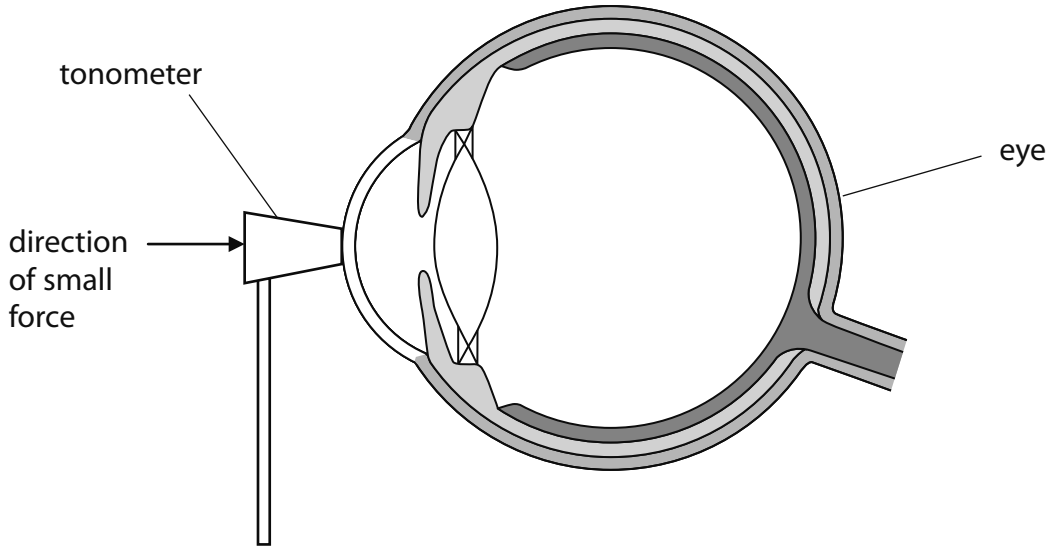
This pressure is higher than atmospheric pressure from the air on the outside of the eye.

(a) Explain, in terms of molecular motion, how the air exerts a pressure on the outside of the eye.

(4)

(b) A doctor uses a tonometer to measure the excess pressure (how much higher the pressure is than atmospheric pressure) of the liquid in the eye.

The tonometer pushes on the person's eye with a very small force.



The tonometer pushes on the eye with a force of 0.015 N.

The tonometer touches an area of 7.35×10^{-6} m^2.

Show that the pressure that the tonometer exerts is about 2 kPa.

(3)

(c) Doctors think that a healthy excess pressure in the eye is 'about 15 mm Hg'.

This equals the pressure difference produced by a 0.015 m column of mercury.

The density of mercury is 13 600 kg/m^3.

Explain whether or not the excess pressure of 2 kPa in part (b) is healthy for the eye.

Use a suitable calculation to support your answer.

(5)

(Total for Question 12 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

Sample Mark Scheme

Paper 1P

Question number	Answer	Notes	Marks
1 (a) (i)	**C**		1
(ii)	**B**		1
(iii)	**B**		1
(iv)	**C**		1
(b)	both orbit Sun		1
(c)	shape of orbit	ACCEPT period of orbit	1
(d)	An explanation linking the following: • the comet travels faster when it is nearer the Sun / the comet is travelling at $2\pi r/T$ • (because) the gravitation attraction from the Sun is stronger when the comet is close / the force of gravity from the Sun is stronger when the comet is closer	ACCEPT a reasonable alternative	2
			Total: 8

Question number	Answer	Notes	Marks
2 (a)	An explanation linking **five** of the following: • check each mass on scales/balance • use a ruler marked in mm / smaller division • fix ruler in clamp (next to the spring), with the zero next to start of the spring • check the ruler is vertical with a suitable device eg set square • attach marker/pin to top/bottom of spring • measure at eye level to avoid parallax		max 5
(b)	wear eye protection (as there is a) risk of spring 'flying back' into face **OR** care against tipping over / clamp the stand (with a G clamp) (as there is a) risk of falling onto feet /sending spring flying **OR** protection on floor/desk / use as low a height as possible (as there is a) risk of damage to feet	Precaution must be relevant to the experiment Reason given must match the precaution	1
(c)	the force she needs is the <u>weight</u> of the masses and $W = mg$ **OR** convert mass to kg multiply by g	 REJECT "multiply by 10" unless it is clear that this is g	2
(d)	straight line through the origin		2
			Total: 10

Question number	Answer	Notes	Marks
3 (a)	Any **two** forces correctly shown on diagram from: • drag • gravity • upthrust	Each force arrow must be in the correct direction	max 2
(b) (i)	total distance (51 500) and total time (6800) seen 51500 ÷ 6800 = 7.57 (m/s)	ACCEPT 7.6 (m/s)	2
(ii)	A description including **three** from: • starts with constant speed • slows down • speeds up again • correct ref to slope • correct ref to coordinates		max 3
			Total: 7

Question number	Answer	Notes	Marks
4 (a)	Any **two** of: • beware of frayed cable • beware of damaged plug • beware of water	ALLOW: turn socket off keep metal objects away from pins	max 2
(b)	d.c. – electrons/current motion only in one direction a.c. – electron/current motion reverses (regularly)		2
(c) (i)	A description including **two** from: • large current in earth wire / charge flows to earth • large current in fuse • fuse melts / blows / breaks circuit • stopping electrocution		max 2
(ii)	An explanation linking **two** of the following: • term <u>double insulation</u> (applied to plug, cable or appliance) • idea that insulation stops current / does not conduct • idea that electric shocks are currents • idea of a second insulation layer in case the first fails		max 2
(d)	statement of P = IV or 13 × 230 seen answer = 2990 unit (W or J/s)	 ACCEPT 2.99 kW / 3000 W / 3 kW Unit mark independent of answer	 3
			Total: 11

Question number	Answer	Notes	Marks
5 (a)	An explanation linking the following: • improves accuracy / reduces % uncertainty • (because) allows longer time measurement / reduces impact of reaction time		2
(b)	A description including: • method of measuring mass e.g. scales / balance • with **EITHER** idea of Σ*n* **OR** idea of repeated readings		2
(c) (i)	GPE = m × g × h	if left blank, can credit correct statement of equation seen in (ii)	1
(ii)	substitution (0.00025 × 10 × 5) answer = 0.0125 (J)	ecf on equation in (i) ALLOW 1 mark if 0.25g used, giving 12.5J	2
(iii)	(transferred to) kinetic energy (of the seed) (transferred to) thermal (heat) energy in the surroundings	 ACCEPT sound	2
			Total: 9

Question number	Answer	Notes	Marks
6 (a) (i)	metal		1
(ii)	the human body		1
(b) (i)	$v = f \lambda$	if left blank, can credit correct statement of equation seen in (ii)	1
(ii)	rearrangement / substitution : $f = 3 \times 10^8 \div 3 \times 10^{-4}$ answer = 1×10^{12} unit = Hz / s^{-1}	ecf for omitted equation in (i) Unit mark independent of answer	3
(iii)	An explanation linking the following: <u>Disagreement with the conclusion:</u> • T-rays have shorter wavelength / higher frequency / more energy (than radio / microwave) or appropriate correct reference to wavelengths • (likely to) cause increase of named detrimental effect (e.g. skin burns) **OR** <u>Agreement with the conclusion:</u> • T-rays do not penetrate the human body • (because) T-rays are reflected / bounce off	NB there is no mark for stating agreement / disagreement with the conclusion	2
			Total: 8

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 (a)</td><td>
<table>
<tr><th>Type of radiation</th><th>Nature of radiation</th><th>Charge</th></tr>
<tr><td></td><td></td><td>positive</td></tr>
<tr><td></td><td>electron / e</td><td></td></tr>
<tr><td>gamma / γ</td><td></td><td></td></tr>
</table>
</td><td>ACCEPT +ve / 2+ / +2</td><td>3</td></tr>
<tr><td>(b)</td><td>atomic number: decreases by two

mass number: decreases by four</td><td></td><td>2</td></tr>
<tr><td>(c)</td><td>A description including any four from:
• (living things contain) carbon (14)
• C^{14} is a radioactive isotope / beta emitter
• (radio)activity decreases (over time)
• (estimate) half-lives (since material was alive)
• compare activity (of sample now with living tissue) / ratio of C^{14} to C^{12} is fixed in living material</td><td></td><td>max 4</td></tr>
<tr><td></td><td></td><td></td><td>Total: 9</td></tr>
</table>

Question number	Answer	Notes	Marks
8 (a)	voltage = current × resistance	ACCEPT V = IR or rearrangement	1
(b) (i)	2.62 and 13.0	NOT 13.00	1
(ii)	suitable scale chosen (>50% of grid used) ; line of best fit acceptable ; axes labelled with scales and units ; plotting to nearest half square (minus one for each error) ;;	 deduct 1 mark for each incorrect plot	1 1 1 2
(iii)	1.14, 7.0 identified / circled		1
(iv)	does not fit with the pattern of the others / well away from the line		1
(v)	conversion of reading from graph from mA to A answer = 4950 ± 50 (Ω)	4.95 (± 0.05) scores 2nd mark only 4.95 (± 0.05) **kΩ** scores both marks	 2

(c) (i)	light dependent resistor	ACCEPT LDR	1
(ii)	time voltage and current	ACCEPT "time of day" for time ACCEPT resistance	2
(iii)	An explanation linking **two** of the following: • difficulty in taking readings over long time • difficulty in taking two or more readings simultaneously • appropriate named simultaneous readings (e.g. time and resistance; voltage and current; time, voltage and current) • idea that second person / datalogger could assist with above		max 2
(iv)	resistance in ohms time in hours / time of day / clock time	both quantities but no units – 1 mark, both units but no quantities – 1 mark	2
			Total: 18

Question number	Answer	Notes	Marks
9 (a)	Any **three** from: CONDUCTION: • from particle to particle • by collision CONVECTION: • particles able to move • transfer the energy by their movement / kinetic energy		max 3
(b) (i)	A explanation linking the following: • heated air expands / becomes less dense • (therefore) rises (up the shaft) • (this) sets up convection current so fresh air moves down other shaft		3
(ii)	heated air only rises from surface air in shaft only 'drawn up', not rising itself **OR** convection currents are not set up as efficiently		2
			Total: 8

Question number	Answer	Notes	Marks
10 (a) (i)	95 (J)		1
(ii)	A description including **two** from: • converted / transformed • into thermal energy • dissipated to surroundings	ALLOW heat for thermal energy	max 2
(b) (i)	equation / substitution of values = 5 ÷ 20 answer = 0.25	ALLOW 25 %	2
(ii)	recognisable Sankey diagram widths of arrows in proportion at least 2 correct labels		3
(c)	independent control failure of one allows others to continue working	Points in either order, and could be explained with a diagram ALLOW reverse arguments based on problems with series connection	2
			Total: 10

Question number	Answer	Notes	Marks
11 (a) (i)	An explanation linking **three** of the following: • current in the (thick) copper wire • sets up a magnetic field (around it) • which interacts (OWTTE) with the field of the magnet • there is a force on the wire		max 3
(ii)	arrow indicating anticlockwise direction somewhere in or near the electric circuit		1
(iii)	Any **two** from: • higher current / higher voltage • lower resistance wires • stronger magnet	NOT bigger magnet	max 2
(b) (i)	electromagnetic induction	ALLOW generator effect	1
(ii)	Any **two** from: • stronger magnet • more turns (on coil) • move faster (towards coil) • lower resistance wire	NOT bigger magnet NOT more coils	max 2
(iii)	move magnet away from coil / turn the magnet round / reverse connections on the meter		1
			Total: 10

Question number	Answer	Notes	Marks
12 (a)	An explanation linking **four** of the following: • random motion (or air molecules) • (create(impact(s) on outside of eye • (particle's) momentum/direction changes • (therefore) force produced • on the area outside (the eye) • reference to pressure = force/area		max 4
(b)	equation (pressure = force ÷ area) / substitution = $0.015 \div 7.35 \times 10^{-6}$ answer = 2041 Pa conversion to 2 kPa		3
(c)	An explanation linking the following: • uses formula : P = hρg • conversion of 15mm into m i.e. 0.015 m • substitution : $0.015 \times 13600 \times 10$ • answer = 2040 Pa • appropriate comment about pressure being healthy	ACCEPT similar reverse argument: • uses formula : P = hρg • substitution : $2000 = h \times 13600 \times 10$ • answer : h = 0.0147 m • conversion of answer to mm i.e. 14.7 mm • appropriate comment about pressure being healthy	5
			Total: 12

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Paper: 2P

Sample Assessment Material
Time: 1 hour

Paper Reference
4PH0/2P

You must have:
Ruler, protractor, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is **60**.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S41643A

S 4 1 6 4 3 A 0 1 1 4

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{kelvin temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

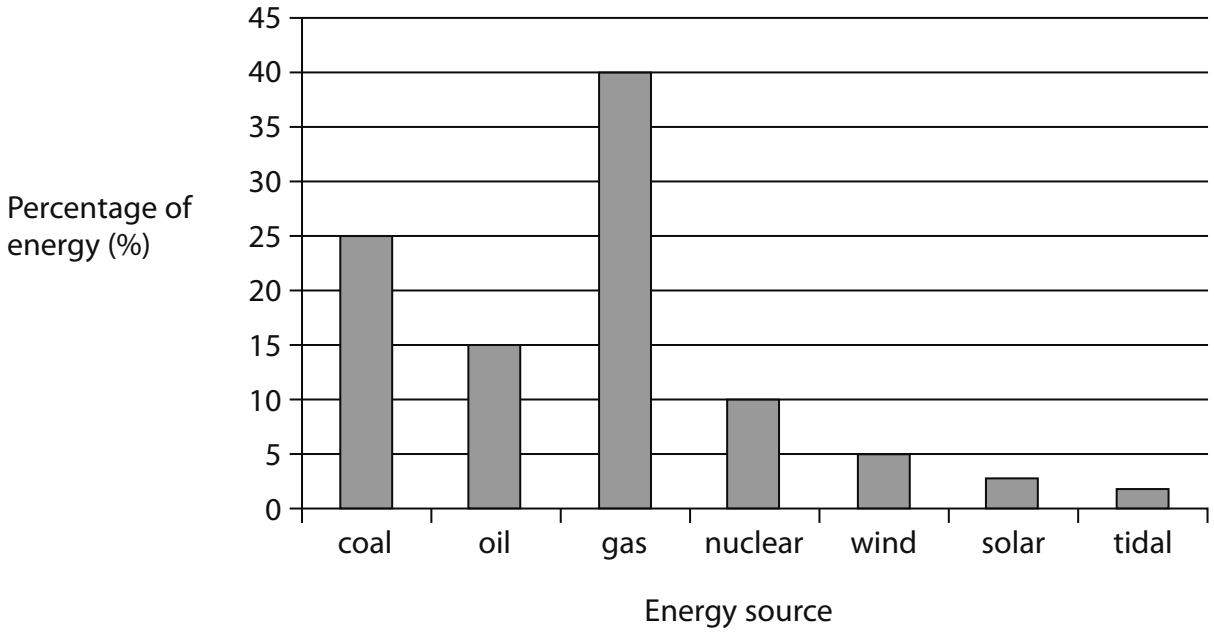
$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

Answer ALL questions.

1 The bar chart shows the energy sources used by a country.



(a) Give the name of one of the renewable energy sources shown in the chart.

(1)

.....

(b) Give the name of one of the fossil fuels shown in the chart.

(1)

.....

(c) Calculate the total percentage of energy supplied by all the fossil fuels shown in the chart.

(1)

Percentage supplied = ... %

(d) Describe the advantages and the disadvantages of using fossil fuels as energy sources.

(5)

(Total for Question 1 = 8 marks)

2 A student investigates how well three different materials conduct heat.

She places some ice on the material she is testing and measures the time taken for the ice to melt.

She carries out the test three times for each material and calculates the average time.

(a) (i) State **two** variables that the student should keep the same throughout her investigation.

(2)

1 .....

2 .....

(ii) Why is it important that she keeps these variables the same?

(1)

.....

.....

(b) The student collects the results shown in the table.

Material	Time for ice to melt in s			Average time for ice to melt in s
	1st test	2nd test	3rd test	
wood	338	325	303	322
plastic	372	770	388	510
metal	93	83	88	88

(i) Give a reason why she tests each material more than once.

(1)

(ii) The time of 770s for plastic is an anomalous result.

Suggest how the student should deal with this.

(2)

(c) Describe how the arrangement and motion of the particles in the ice change as the ice melts.

You may draw diagrams to help your description.

(3)

(Total for Question 2 = 9 marks)

3 In some countries, drivers and passengers in cars are required by law to wear seat belts.

Seat belts are designed to reduce the risk of injury during a collision.

(a) Use ideas about momentum to explain how seat belts reduce the risk of injury during a collision.

(3)

(b) Some people disagree with laws making the wearing of seat belts compulsory.

They agree that wearing seat belts reduces the risk of injury to people in the car. However they say that the risk to other road users might be increased.

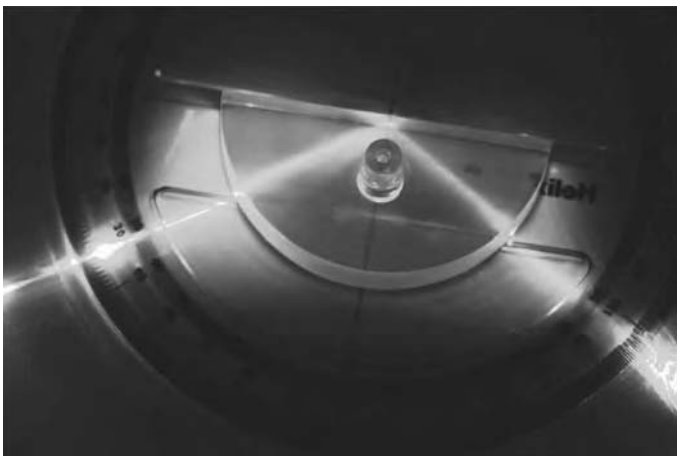
Suggest why it would be difficult to collect evidence to test this idea.

(2)

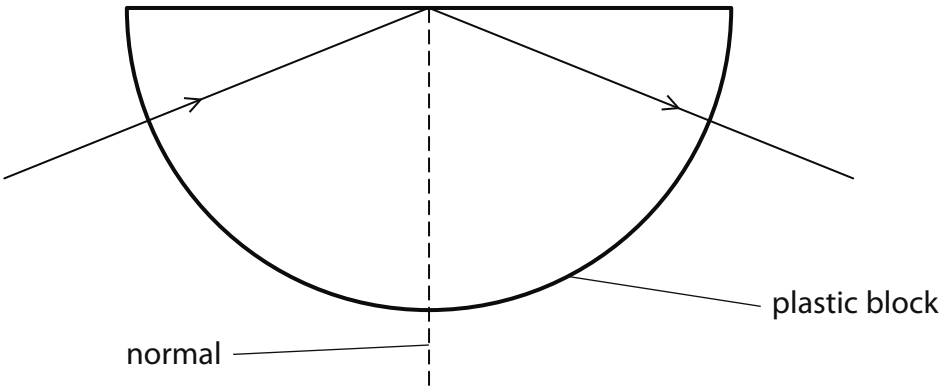
(Total for Question 3 = 5 marks)

4 A student investigates total internal reflection of light inside semicircular blocks.

The photograph shows the path followed by a ray of light in a plastic block.



(a) The student draws this diagram of the apparatus.



(i) On the diagram, mark and name the two angles that the student should measure.

(2)

(ii) Describe how the student should measure and record the angles.

(3)

.....

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.....

.....

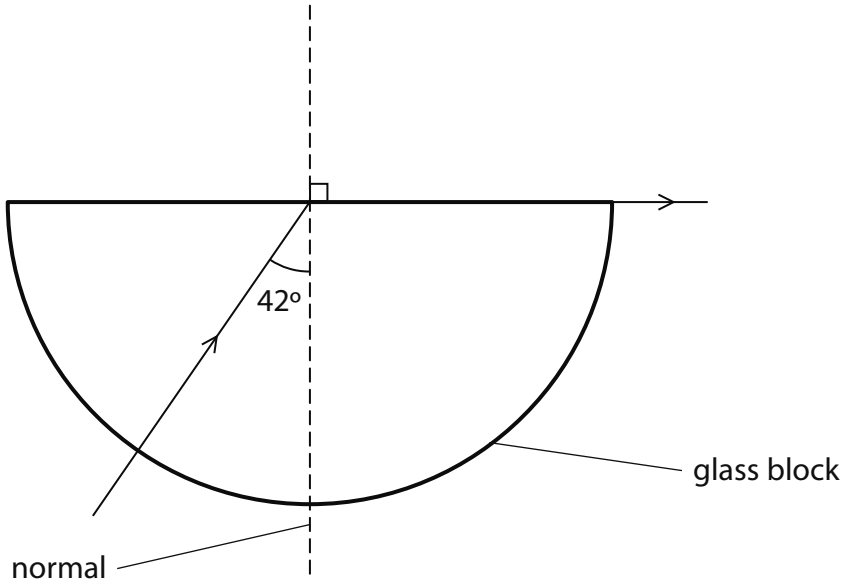
(iii) State how these two angles are related.

(1)

.....

(b) The student repeats the experiment with a glass block instead of the plastic one.

The light emerges from the block in a different place.



(i) What name is given to the angle marked 42° in the diagram?

(1)

.....

(ii) Calculate the refractive index of the glass.

(sin 42° = 0.6691)

(3)

Refractive index = ...

(Total for Question 4 = 10 marks)

5 A student rubs a plastic rod with a cloth.

(a) (i) The plastic rod gains a negative charge.

Explain why.

(2)

(ii) Describe experiments the student could do to show that there are **two types** of electric charge.

(4)

(b) The teacher uses a Van de Graaff generator to give another student a negative charge.

Use ideas about electric charge to explain why the student's hair stands on end.

(3)

(Total for Question 5 = 9 marks)

6 Astra is a communication satellite in orbit around the Earth.

(Courtesy of NASA)

(a) The satellite sends a digital signal.

State **two** advantages of sending a digital signal instead of an analogue signal.

(2)

1 .....

.....

2 .....

.....

(b) The signal is sent using microwaves. Microwaves are transverse waves.

Describe the difference between transverse waves and longitudinal waves.

(2)

.....

.....

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.....

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.....

(c) Astra's orbital speed is 3054 m/s and the radius of its orbit is 42 000 km.

(i) Calculate the time it takes for Astra to orbit the Earth once.

State an appropriate unit.

(3)

time = ...

(ii) Use your answer to (i) to suggest why Astra follows this particular orbit.

(3)

.....

.....

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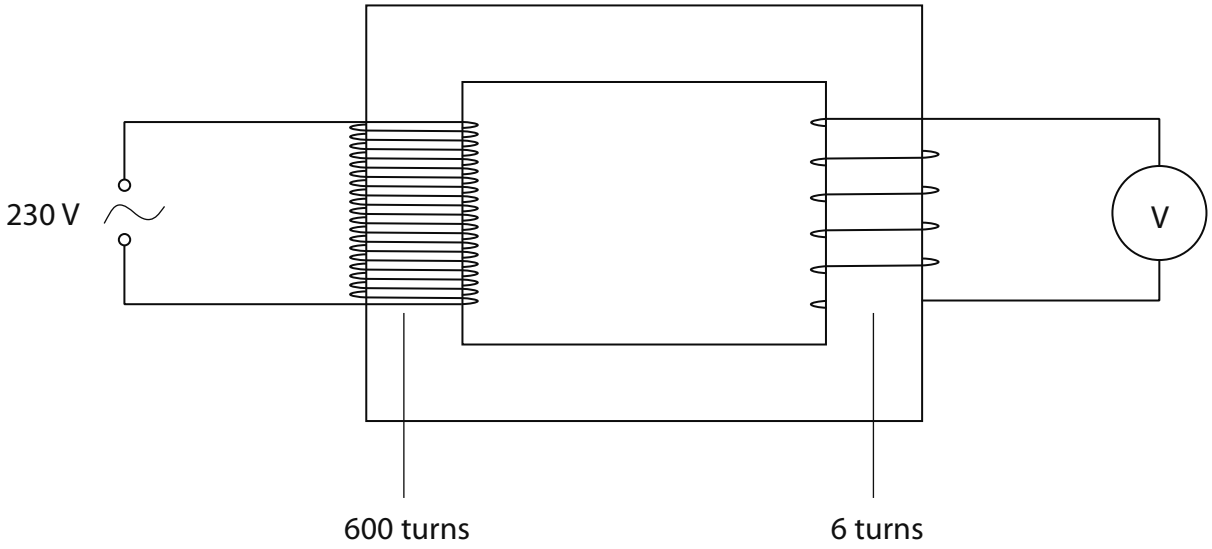
.....

.....

(Total for Question 6 = 10 marks)

7 The diagram shows a step-down transformer.



(a) On the diagram, label the **primary coil** and the **secondary coil**.

(1)

(b) (i) State the equation linking the numbers of turns on each coil and the voltages across each coil.

(1)

(ii) Calculate the voltage across the secondary coil.

(2)

Secondary voltage = ... V

(c) Step-up transformers are used at power stations to provide high voltages for electricity transmission.

Explain the advantage of transmitting electrical energy using high voltage cables.

(5)

(Total for Question 7 = 9 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Paper 2P

Question number	Answer	Notes	Marks
1 (a)	wind / solar / tidal	If more than one answer given, all must be correct to score mark	1
(b)	coal / oil / gas	If more than one answer given, all must be correct to score mark	1
(c)	80 (%)		1
(d)	A description which includes some of the following: <u>Advantages:</u> • large amount of energy produced • reliable source • existing infrastructure/cost-effective <u>Disadvantages:</u> • non-renewable/running out • specific pollutant (e.g. CO_2, SO_2) • correct consequence of specific pollutant (e.g. global warming, acid rain)	max 3 marks for each of advantages or disadvantages IGNORE 'pollution' unless qualified	max 5
			Total: 8

Question number	Answer	Notes	Marks
2 (a) (i)	Any **two** from: • area of material • thickness of material • amount / mass of ice • surface area of ice • starting temperature of ice • room temperature		max 2
(ii)	(changing these variables) could also affect the time taken (for the ice to melt)	ACCEPT **control** (to make it a fair test) NOT just "fair test" unqualified	1
(b) (i)	to make it more reliable / to spot anomalous results	NOT "to calculate an average"	1
(ii)	Any **two** from: • ignore the anomalous result • repeat the experiment / take a further reading <u>for plastic</u> • then recalculate the average		max 2
(c)	A description including any **three** from: • (close-packed) regular arrangement in ice • (particles) vibrating in (fixed) position in ice • increase in kinetic energy • (close-packed) irregular arrangement in water • (particles in) random motion in water	ACCEPT clear evidence from diagrams given in support of written answer	max 3
			Total: 9

Question number	Answer	Notes	Marks
3 (a)	An explanation linking any **three** from: • (seat belts) increase the time it takes (driver) to stop • (and) momentum change in the stop is fixed • reference to force = change in momentum/time • so the force is reduced • (and) smaller forces lead to less severe injuries	NB answer must refer to momentum to score 3	max 3
(b)	Any **two** suggestions from: • need evidence from before and after law was in force • need to collect large quantity of data • cannot be sure that conditions remained the same • there are many types of other road users		max 2
			Total: 5

Question number	Answer	Notes	Marks
4 (a) (i)	angle of incidence labelled angle of reflection labelled	*i* *r*	2
(ii)	A description including: • mark position of rays and block (on paper) • use a protractor (or similar) to measure angles • tabulated results		3
(iii)	angles are equal /same	*i* = *r*	1
(b) (i)	critical (angle)		1
(ii)	substitution / correct equation ($0.6991 = \frac{1}{n}$) rearrangement ($n = \frac{1}{0.6991}$) calculation (n = 1.49)	ACCEPT substitution and rearrangement in either order IF any unit given, remove 1 mark	3
			Total: 10

Question number	Answer	Notes	Marks
5 (a) (i)	An explanation linking the following: • transfer of electrons • from cloth to rod		2
(ii)	A description including: • charge different materials/plastics/rods • 'suspend' one rod (on thread/on watch glass etc) • bring (ends of) rods together/close • looking for attraction and repulsion to indicate two types of charge **OR** • charge electroscope (with known charge) • charge different materials/plastics/rods • bring the rods to the electroscope • looking for leaf rising and falling to indicate two types of charge		4
(b)	An explanation linking the following: • movement of electrons (around the body) • repel so spread out as much as possible • force of repulsion enough to move hair		3
			Total: 9

Question number	Answer	Notes	Marks
6 (a)	Any **two** from: • can be (easily) regenerated • are less affected by noise • can be (easily) encrypted / coded • can (easily be made to) carry more information	ACCEPT appropriate mention of increasing frequency, extending bandwidth or multiplexing in order to carry more data	max 2
(b)	transverse : vibration/oscillation is at right angles/perpendicular to energy transfer longitudinal : vibration/oscillation is parallel to energy transfer	ALLOW 1 mark for correct matching of both transverse to perpendicular and longitudinal to parallel, if it is unclear what parallel/right angles is to	1 1
(c) (i)	$T = \frac{2\pi r}{v}$ $T = \frac{2 \times \pi \times 42\,000\,000}{3054}$ 86400 / 86410 / 86409 seconds / s	rearrangement / substitution (1) answer (1) unit (1)	3
(ii)	86400s = 1 day (therefore this is) geostationary orbit so always same direction in sky / eq		3
			Total: 10

Question number	Answer	Notes	Marks
7 (a)	coils labelled correctly		1
(b) (i)	correct equation or variant of $\frac{N_p}{N_s} = \frac{V_p}{V_s}$		1
(ii)	substitution $\frac{600}{6} = \frac{230}{V_s}$ rearrangement / value 2.3 (V)		2
(c)	An explanation linking any **four** from: • idea of lower transmission current • relating raised voltage lowered current • idea of voltage drop • idea of efficiency (anywhere appropriate) • idea of costing (environmental / economic / social) • can transmit energy / electricity further • can use thinner cables and any **one** of : • idea of heating effect (anywhere appropriate) • idea of power losses • mention of an appropriate energy transfer	Acceptable alternatives: • the current is less • use / mention of $V_P I_P = V_S I_S$ • use / mention of V = IR • use / mention of efficiency = input ÷ output e.g. less energy → less pollution • mention of National Grid • use / mention of P = IV (once) • use / mention of P = IV (once) e.g. the current heats the cables NB use / mention must always be in appropriate context	max 5
			Total: 9

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