Coimisiún na Scrúduithe Stáit
State Examinations Commission

# LEAVING CERTIFICATE 2010

# MARKING SCHEME

# PHYSICS

## ORDINARY LEVEL

**General Guidelines**

## In considering this marking scheme the following points should be noted.

**1.** In many instances only key words are given, words that must appear in the correct context in the candidate's answer in order to merit the assigned marks.

**2.** Marks shown in brackets represent marks awarded for partial answers as indicated in the scheme.

**3.** Words, expressions or statements separated by a solidus, /, are alternatives which are equally acceptable.

**4.** Answers that are separated by a double solidus, //, are answers which are mutually exclusive. A partial answer from one side of the // may not be taken in conjunction with a partial answer from the other side.

**5.** The descriptions, methods and definitions in the scheme are **not** exhaustive and alternative valid answers are acceptable. Marks for a description may be obtained from a relevant diagram, depending on the context.

**6.** Where indicated, 1 mark is deducted for incorrect/ no units.

**7.** Each time an arithmetical slip occurs in a calculation, one mark is deducted.

**8.** The context and the manner in which the question is asked and the number of marks assigned to the answer in the examination paper, determine the detail required in any question. Therefore, in any instance, it may vary from year to year.

**Question 1 40 marks**

**(i) Draw a labelled diagram of the apparatus you used** **3 × 3**

labelled diagram to show:

trolley / rider
runway / air-track
means of applying a force e.g. string over pulley to weight on pan
means of measuring acceleration e.g. 2 photo-gates (and timer) // tickertape (and timer)

3 lines correct 3 × 3

**NOTE:** no labels, deduct 2
accept valid alternatives e.g. data logging methods, which fit the scheme

**(ii) How did you measure the applied force?** **6 or 3**

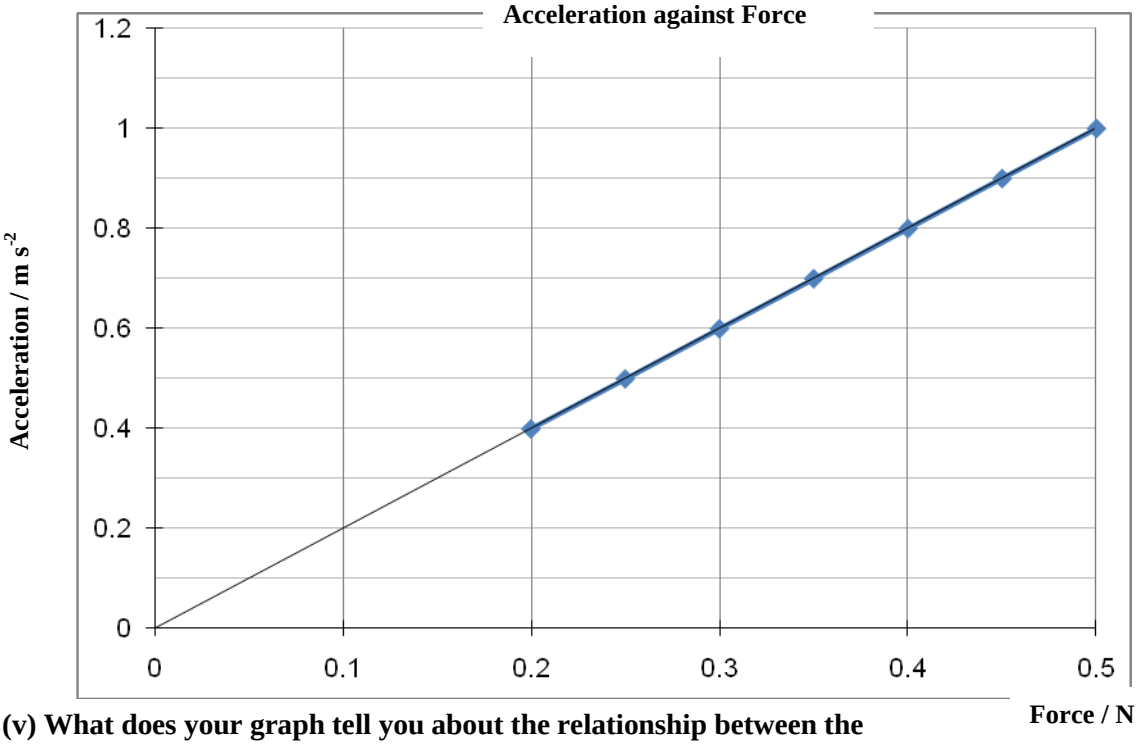
weighed the mass (and pan) / *mg* // from the (digital Newton) balance 6
partial answer (3)

**(iii) How did you minimise the effect of friction during the experiment?** **6 or 3**

slant/clean the runway // oil (the trolley) wheels / frictionless wheels 6
partial answer (3)
This may be inferred from the diagram in (i)

**(iv) Plot a graph on graph paper of the body's acceleration against the force applied to it.** **4 × 3**

label one axis correctly- name/symbol/unit acceptable 3
plot four points correctly 3
plot another three points correctly 3
straight line 3
if graph paper is not used maximum mark 3×3




**(v) What does your graph tell you about the relationship between the acceleration of the body and the force applied to it?** **7 or 4**

(they are ) proportional / ∝ / straight line through the origin 7
partial answer e.g. any reference to proportional (4)

**Question 2 40 marks**

**A student carried out an experiment to measure the specific heat capacity of a substance.**

**(i) Draw a labelled diagram of the apparatus used in the experiment.** **4 × 3**

labelled diagram to show:

| | |
|---|---|
| block of metal // calorimeter with liquid | 3 |
| means of heating e.g. coil (and power supply) | 3 |
| means of measuring energy supplied e.g. joulemeter | 3 |
| insulation / (electronic) balance / stirrer /thermometer /other detail | 3 |

incorrect experiment, maximum mark 3×3

No labels, deduct 2

accept valid alternatives

**(ii) Describe how the mass of the substance was determined.** **6 or 3**

(mass of metal block obtained with an electronic) balance //

| | |
|---|---|
| mass of calorimeter and warm water - mass of calorimeter | 6 |
| partial answer e.g. weigh it | (3) |

**(iii) What other measurements did the student take during the experiment?** **6 + 3**

initial/minimum temperature

final/maximum temperature

joules supplied /*VIt*

mass of calorimeter

| | |
|---|---|
| 2 lines correct | 6 + 3 |
| 1 line correct | (6) |
| partial answer e.g. current, voltage, time | (3) |

**(iv) Give the formula used to calculate the specific heat capacity of the substance.** **7 or 4**

| | |
|---|---|
| $E = mc\Delta\theta$ // $VIt = m_w c_w \Delta\theta + m_{cal} c_{cal} \Delta\theta$ // any valid formula | 7 |
| partial answer e.g. one part correct // attempts word version of the formula | (4) |

**(v) Give a precaution that the student should have taken to get an accurate result.** **6 or 3**

initial temperature below room temperature (to help compensate for heat loss),

| | |
|---|---|
| repeat and get an average, insulate, etc. one correct | 6 |
| partial answer e.g. repeat | (3) |

insulate may be inferred from the diagram in (i)

answers to (iv) and (v) may merit full marks if consistent with incorrect (i)

**Question 3 40 marks**

**A student carried out an experiment to measure the focal length of a concave mirror.**

**(i) Draw a labelled diagram showing how the apparatus was arranged** **4 × 3**

labelled diagram to show

concave mirror
object e.g. crosswire
image
correct arrangement
detail e.g. optical bench, metre-stick, screen, ray-box, etc.

4 lines correct 4×3

approximate method maximum mark 3×3

No labels, deduct 2
accept valid alternatives

**(ii) Mark the distances *u* and *v* on your diagram.** **2 × 3**

distance from the object/crosswire to the mirror shown as *u* 3
distance from the image/screen to the mirror shown as *v* 3
partial answer e.g. reversed (3)

**(iii) How was the position of the real image located?** **6 or 3**

move the screen/object until a clear (inverted) image (is obtained) // by focussing 6
partial answer e.g. mention of screen (3)

**(iv) Calculate the value for the focal length *f* of the mirror using the data.** **4 × 3**

| *u*/cm | 20 | 30 | 50 |
|---|---|---|---|
| *v*/cm | 65 | 32 | 23 |

*f* = 15.5 (cm) 4 × 3

$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$

$\frac{1}{f}=\frac{1}{20}+\frac{1}{65}=\frac{13}{260}+\frac{4}{260}=\frac{17}{260} \Rightarrow f = 15.29$

$\frac{1}{f}=\frac{1}{30}+\frac{1}{32}=\frac{16}{480}+\frac{15}{480}=\frac{31}{480} \quad f = 15.48$

$\frac{1}{f}=\frac{1}{50}+\frac{1}{23}=\frac{23}{1150}+\frac{50}{1150}=\frac{73}{1150} \Rightarrow f = 15.75$

two correct (3 × 3)
one correct (2 × 3)

partial answer e.g. the equation, average, etc. (3)

**(v) Why did the student repeat the experiment?** **4 or 2**

greater accuracy / more reliable result / minimise errors 4
partial answer e.g. to get an average (2)

**Question 4** **40 marks**

**In an experiment to determine the resistivity of the material of a wire, a student measured the length, diameter and resistance of a sample of nichrome wire.**

**(i) Describe how the student measured the resistance of the wire.** **6 or 3**

ohmmeter / (digital) multimeter / measure $V$ and $I$ and hence determine $R$ / $R = \frac{V}{I}$ 6

partial answer e.g. measure $I$ / ammeter (3)

**(ii) Describe how the length of the wire was measured.** **4 or 2**

(ensure the wire is taut and measure the length between the crocodile clips using a) metre-stick 4

partial answer e.g. detail such as ensure no kinks (2)

**(iii) What instrument did the student use to measure the diameter of the wire?** **2(6 or 3)**

micrometer / digital callipers 6

partial answer e.g. vernier (3)

**Why did the student measure the diameter of the wire at different places?**

to get average (diameter) // as wire may not be uniform 6

partial answer e.g. detail (3)

**(iv) Using the data, calculate the cross-sectional area of the wire.** **3 × 3**

$3.03 - 3.14 \times 10^{-8}$ ($m^2$) 3 × 3

$A = \pi(0.1 \times 10^{-3})^2$ (2 × 3)

average $d$ = 0.197 / 0.20 mm // $r$ = 0.1 mm (3)

**(v) Find the resistivity of nichrome.** **3 × 3**

$1.25 - 1.29 \times 10^{-6}$ (Ω m) // answer consistent with (iv) 3 × 3

$$\rho = \frac{(20.2)(3.14 \times 10^{-8})}{0.488}$$ (2 × 3)

partial answer e.g. one quantity substituted correctly into the equation (3)

**Question 5** **any *eight* parts** **56 marks**

**The <u>best 8</u> from 10 parts**

**(a) State Boyle's law** **7 or 4**

(for a fixed mass of gas kept at a constant temperature) the pressure is inversely proportional to the volume // $PV = k$ (when $T$ and $m$ are fixed) 7

partial answer e.g. incomplete statement (4)

**(b) A concrete mixer delivered 50 m$^3$ of concrete to a building site, what was the mass of the concrete delivered?** ( $\rho = \frac{m}{V}$ density of concrete = 2400 kg m$^{-3}$) **7 or 4**

( m =2400 × 50 =) 120000(kg) 7

partial answer e.g. substitutes one quantity correctly into the equation // $m = \rho V$ (4)

**(c) State Archimedes' Principle** **7 or 4**

(when a body is immersed in a fluid/liquid it experiences an) upthrust equal (in size) to the weight of the fluid displaced 7

partial answer e.g. incomplete statement / mention of upthrust (4)

**(d) Which of these scientists is associated with the law of refraction of light?** **7**

**Rutherford Snell Joule Einstein**

Snell 7

**(e) If the temperature of an object is 28°C, what is its temperature in Kelvin?** **7 or 4**

**(**273.15+28 = ) 301(.15 K) 7

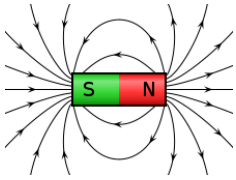
partial answer e.g. 273 / mention of adding // 245 (4)

**(f) Give one difference between a light wave and a sound wave** **7 or 4**

(light waves) travel faster (than sound waves)// light travels in transverse waves // sound in longitudinal waves // etc. 7

partial answer e.g. difference stated but in reverse order (4)

**(g) Sketch the magnetic field surrounding a bar magnet** **7 or 4**




correct diagram to show magnet, two field lines, correct direction on lines 7

partial answer e.g. incomplete diagram (4)

**(h) Give a common use of capacitors?** **7 or 4**

store charge // tune radio // flash guns // smoothing // filtering // etc. 7

partial answer e.g. used in radios/cars (4)

**(i) In relation to semiconductors, what is meant by the term doping?** **7 or 4**

adding impurity/atoms and a relevant detail e.g. to change conductivity 7

partial answer e.g. adding impurities, adding a substance (4)

**(j) What type of nuclear reaction occurs in a nuclear power station?** **7 or 4**

fission 7

partial answer e.g. fusion (4)

**Question 6** **56 marks**

**Define (a) momentum (b) kinetic energy** **2(6 or 3)**

***momentum*** = (mass)(velocity) // $p = mv$ 6

partial answer (3)

***kinetic energy***: energy due to motion // $\frac{1}{2}mv^2$ 6

partial answer (3)

**State the principle of conservation of momentum. Explain how this principle applies in launching a spacecraft.** **3 × 3+ 3**

momentum before = momentum after // $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$ 3 × 3

deduct 3 marks for each error

partial answer e.g. incomplete equation // in a closed system (3)

momentum of rocket equal but opposite to rocket exhaust 3

**An ice skater of mass 50 kg was moving with a speed of 6 m s$^{-1}$ then she collides with another skater of mass 70 kg who was standing still. The two skaters then moved off together.**

**(i) Calculate the momentum of each skater before the collision?** **2 × 3**

(50 × 6 = ) 300 (kg m s$^{-1}$) 3

(70 × 0 = ) 0 (kg m s$^{-1}$) 3

**(ii) What is the momentum of the combined skaters after the collision?** **6 or 3**

300 (kg m s$^{-1}$) 6

partial answer e.g. 0 (kg m s$^{-1}$) (3)

**(iii) Calculate the speed of the two skaters after the collision.** **6 or 3**

$v$ = 2.5 (m s$^{-1}$) 6

partial answer e.g. (50+70) $v$ (3)

**(iv) Calculate the kinetic energy of each skater before the collision.** **2 × 3**

($\frac{1}{2}mv^2 = \frac{1}{2}(50)(6)^2$ = ) 900 (J) 3

($\frac{1}{2}mv^2 = \frac{1}{2}(70)(0)^2$ = ) 0 (J) 3

**(v) Calculate the kinetic energy of the pair of skaters after the collision** **4 or 2**

($E_k = ½mv^2 = ½ \times 120 \times (2.5)^2$ = ) 375 (J) // answer consistent with (iii) 4

partial answer e.g. correct substitution (2)

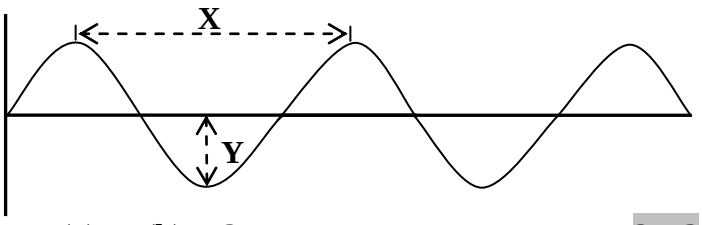
**(vi) Comment on the total kinetic energy values before and after the collision** **4 or 2**

kinetic energy not conserved in collision // answer consistent with (iv) and (v) 4

partial answer (2)

**Question 7** **56 marks**

**The diagram shows a waveform.**




**(i) What is the name given to the distance (a) X, (b) Y?** **2 × 3**

X = Wavelength / λ 3
Y = Amplitude /height /depth 3
partial mark if both correct but reversed (3)

**(ii) What is meant by the frequency of a wave?** **6 or 3**

number of waves (passing a point) per second 6
partial answer (3)

**(iii) Explain the term natural frequency?** **6 or 3**

frequency objects tends to vibrate at (when set in motion) // resonance frequency 6
partial answer e.g. lowest frequency (3)

**(iv) If the natural frequency of a string is 250 Hz calculate the wavelength of the sound wave produced.** **3 × 3**

1.36 (m) 3 × 3
$340 = 250 \times \lambda$ (2 × 3)
partial answer e.g. one quantity substituted correctly into the equation / $\lambda = \frac{c}{f}$ (3)

**(v) State the wave property on which (c) the loudness, (d) the pitch, of a musical note depends** **3 × 3**

(c) (loudness depends on) amplitude / energy // frequency
(d) (pitch depends on ) frequency / wavelength
two lines correct 3 × 3
one line correct (2 × 3)
partial answer e.g. other property (3)

**An opera singer, singing a high pitched note, can shatter a glass. Explain why.** **6 or 3**

resonance // transfer of energy 6
partial answer

**Describe a laboratory experiment to demonstrate resonance** **4 × 3 + 2**

*apparatus*: Barton's pendulums // tuning fork and adjustable length of air 3
*procedure*: hang the pendulums (vertically) from a horizontal string //
hold the vibrating tuning fork near air column 3
set one of the pendulums swinging // adjust the length of the air column 3
*observation*: the pendulum of the same length also swings //
at a certain length the note emitted by the tuning fork gets louder 3
*conclusion*: a transfer of energy occurs / resonance occurs 2

marks may be obtained from a diagram
accept valid alternatives

**Question 8 56 marks**

**(a) What is heat?** **6 or 3**

(heat is a form of) energy 6

partial answer (3)

**Explain how heat transferred in a solid?** **3× 3**

atoms are touching / in contact 3

(heat/energy transferred from) one to the other 3

by vibration / without the atoms moving along 3

mentions conduction / without the movement of matter / warmer to cooler (2 × 3)

partial answer (3)

**Describe an experiment to compare the rates of heat transfer through different solids.** **4 × 3**

*apparatus*: bath of water containing different rods which protrude at the same height // four different metals bars arranged like spokes and touch in the middle 3

melt candle wax onto the outer end of each rod/metal and stick a matchstick/pin into the candle wax 3

*procedure*: heat the water-bath // heat the metals over a Bunsen 3

*observation // conclusion*: heat is conducted along the rods and the matchsticks fall off at different times // heat is transferred at different rates 3

marks may be obtained from a diagram

partial answer (3)

accept valid alternatives

**Explain the term U-value** **6 or 3**

measure of heat transmission / measure of insulation 6

partial answer e.g. insulation (3)

**How can the U-value of the walls of a house be reduced?** **4 or 2**

any valid example e.g. **(**thicker) insulation, double glazed windows, etc. 4

partial answer e.g. close windows (2)

**(b)**

**(i) How is the sun's energy transferred to the solar collector?** **3**

radiation / rays 3

**(ii) Why is the solar collector normally painted black?** **3**

(black surfaces are) better absorbers (of heat/radiation) 3

**(iii) How is the heat transferred from the solar panel to the hot water tank?** **3**

by the water flowing/pumped (through the collector and the heating coil) 3

**(iv) The heating coil for the hot water tank are placed at the bottom, explain why** **4 or 2**

water is heated by convection / hot water rises, etc. 4

partial answer (2)

**(v) Give an advantage and a disadvantage of a solar heating system** **2 × 3**

any valid advantage e.g. reduces costs, unlimited supply, no pollution, etc. 3

any valid disadvantage e.g. needs sun, requires a back-up, costly to install, etc. 3

**Question 9 56 marks**

**(a) State Coulomb's law of force between electric charges.** **3 × 3**

force proportional / $F \propto$ 3

product of charges / $Q_1Q_2$ 3

inversely proportional to the square of the distance between them / $\propto \frac{1}{d^2}$ 3

**(i) How would you detect the presence of an electric field?** **3 × 3**

using an electroscope // electric field sensor // electric field meter $3 \times 3$

using a meter // charged object/fluorescent bulb $(2 \times 3)$

partial answer e.g. mention of charge, detects magnetic field (3)

**(ii) What is the unit of electric charge?** **4 or 2**

coulomb / C 4

partial answer e.g. other electrical unit (3)

**(iii) How does the lightning conductor prevent damage to the building?** **6 or 3**

provides (safe) path for flow of current if struck // it earths the building //

allows easy path for discharge //other suitable explanation 6

partial answer (3)

**(iv) Suggest a suitable material for a lightning conductor** **4 or 2**

metal / named metal e.g. copper / aluminium 4

partial answer (2)

**(b) State Ohm's law** **6 or 3**

$V \propto I$ // $V = I R$ (at a constant temperature) 6

$V$ / $I$ / $R$ / $\propto$ / at a constant temperature (3)

**The diagram shows a number of resistors connected to a 12 V battery and a bulb whose resistance is 4 Ω.**

**Calculate**

**(i) The combined resistance of the 15 Ω and 30 Ω resistors in parallel.** **6 or 3**

10 (Ω) 6

partial answer e.g. $\frac{1}{15} + \frac{1}{30}$ (3)

**(ii) The total resistance of the circuit** **6 or 3**

24 (Ω) // answer consistent with (i) 6

partial answer e.g. 20 Ω (3)

if equations in (i) and (ii) are reversed maximum mark $2 \times 3$

**(iii) The current flowing in the circuit** **6 or 3**

0.5 (A) // answer consistent with (ii) 6

partial answer e.g. valid equation, $I = \frac{V}{R}$ (3)

**Question 10 56 marks**

**X-rays are produced when high speed electrons collide with a target in an X-ray tube as shown in the diagram**

**(i) What process occurs at the filament A?** **6 or 3**

thermionic emission / release of electrons // heating 6

partial answer e.g. incomplete answer (3)

**(ii) Name a substance commonly used as the target B** **6 or 3**

tungsten / molybdenum 6

partial answer e.g. metal / named metal (3)

**(iii) Give three properties of X-rays** **3 × 3**

(electromagnetic) waves / have short wavelength, ionise, penetrate, no mass, no charge, effect photographic film, cause fluorescence, diffraction, etc.

three correct $3 \times 3$

two correct $(2 \times 3)$

one correct (3)

**(iv) Give two uses of X-rays** **2 × 3**

specific medical use e.g. X-ray photo, photo organs, destroy cancerous cells

specific industrial use e.g. detect cracks in metals, determine thickness of materials

two correct $2 \times 3$

one correct (3)

partial answer e.g. general use such as medicine/industry/photos (3)

**(v) State the function of the part marked C** **5 or 3**

protection / shielding 5

partial answer e.g. maintain a vacuum (3)

**The photoelectric effect can be regarded as the inverse of X-ray production**

**(vi) What is meant by the photoelectric effect?** **2 × 3**

emission of electrons (from the surface of a metal by) 3

(electromagnetic) radiation / light (of a suitable frequency) 3

**(vii) Describe an experiment to demonstrate the photoelectric effect** **4 × 3**

*apparatus*: (gold leaf) electroscope, 3

UV lamp 3

*procedure*: place a zinc plate on the cap of the electroscope / charge the electroscope negatively / shine the UV lamp on the zinc plate. 3

*observation //conclusion*: the leaf collapses // electrons emitted 3

marks may be obtained from a diagram

accept valid alternatives

**(viii) Give two applications of the photoelectric effect** **2 × 3**

burglar alarms, automatic doors, central heating control, film sound track, etc.

two correct $2 \times 3$

one correct (3)

**Question 11 56 marks**

Read this passage and answer the questions below.

In 1819 the Danish physicist Hans Christian Oersted discovered that an electric current flowing through a wire deflected a compass needle.
A year later the Frenchman François Arago found that a wire carrying an electric current acted as a magnet and could attract iron filings. Soon his compatriot André-Marie Ampère demonstrated that two parallel wires were attracted towards one another if each had a current flowing through it in the same direction. However, the wires repelled each other if the currents flowed in the opposite directions.
Intrigued by the fact that a flow of electricity could create magnetism, the great British experimentalist Michael Faraday decided to see if he could generate electricity using magnetism. He pushed a bar magnet in and out of a coil of wire and found an electric current being generated. The current stopped whenever the magnet was motionless within the coil.

(Adapted from '*Quantum' by Manjit Kumar, Icon Books 2008*)

**(a) Who discovered that an electric current can deflect a compass needle?** **7**

Oersted /Hans / Christian 7

**(b) What did Arago discover?** **7 or 4**

a wire carrying an electric current acted as a magnet / could attract iron filings 7

partial answer e.g. incomplete answer (4)

**(c) What happens when currents flows in the same direction in two parallel wires?** **7 or 4**

the wires attract 7

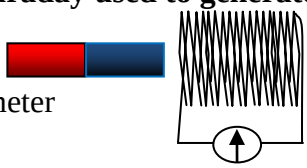
partial answer e.g. the wires move (4)

**(d) How could two parallel wires be made to repel each other?** **7 or 4**

reverse one of the currents / current in opposite directions 7

partial answer (4)

**(e) Draw a sketch of the apparatus Michael Faraday used to generate electricity** **7 or 4**



correct diagram to include magnet, coil and meter 7

partial answer e.g. incomplete diagram (4)

**(f) What name is given to the generation of electricity discovered by Michael Faraday?** **7 or 4**

electromagnetic induction 7

partial answer e.g. induction (4)

**(g) What energy conversions that take place in Faraday's experiment** **7 or 4**

kinetic to electric 7

partial answer e.g. one energy correct (4)

**(h) How does Faraday's experiment show that a changing magnetic field is required to generate electricity?** **7 or 4**

current stopped whenever the magnet was motionless // electricity is only generated when the magnet or coil is moving 7

partial answer e.g. incomplete answer (4)

**Question 12 56 marks**

**Part (a)**

**The diagram shows a cyclist on a bike; their combined mass is 120 kg.**
**The cyclist starts from rest and by pedalling applies a net force of 60 N to move the bike along a horizontal road. Calculate:**

**(i) The acceleration of the cyclist** **6 or 3**

($a = \frac{F}{m} = \frac{60}{120}$ =) 0.5 (m $s^{-2}$) 6

partial answer e.g. one quantity substituted correctly into the equation / $a = \frac{F}{m}$ (3)

**(ii) The maximum velocity of the cyclist after 15 seconds** **6 or 3**

($v = u + at = 0 + (0.5)(15)$ =) 7.5 (m $s^{-1}$) // answer consistent with (i) 6

partial answer e.g. one quantity substituted correctly into the equation (3)

**(iii) The distance travelled by the cyclist during the first 15 seconds** **3**

($s = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2}(0.5)(15)^2$ =) 56.25 (m) // answer consistent with (i) 3

**The cyclist stops peddling after 15 seconds and continues to freewheel for a further 80 m before coming to a stop**

**(iv) Why does the bike stop?** **6 or 3**

due to friction / air resistance // no forward force 6

partial answer e.g. cyclist stops peddling (3)

**(v) Calculate the time taken for the cyclist to travel the final 80 m?** **7 or 4**

($s = \frac{(u+v)}{2}t \Rightarrow 80 = \frac{(7.5+0)}{2}t \Rightarrow t = \frac{2(80)}{7.5}$ =) 21.33 (s) // answer consistent with (ii) 7

partial answer e.g. one quantity substituted correctly into the equation (4)

**Part (b)**

**What is meant by dispersion of light?** **2 × 3**

breaking up of (white) light 3

into different colours // into constituent colours 3

partial answer (3)

**Describe an experiment to demonstrate the dispersion of light** **4 × 3**

*apparatus*: white light 3

prism, (diffraction) grating, CD 3

*procedure*: shine a beam of light at the prism/CD/grating 3

*observation //conclusion*: : different colours / 3 named colours / spectrum

white light is dispersed // white light consists of different colours 3

marks may be obtained from a diagram

accept valid alternatives

**Give an example of the dispersion of light occurring in nature** **4 or 2**

rainbow / oil film colours / soap bubble colours / CD colours 4

partial answer e.g. incomplete answer (2)

**Only red, green and blue lights are needed to create most lighting effects.**
**Explain why** **6 or 3**

all colours can be made by mixing red, green and blue // primary colours 6

partial answer e.g. incomplete answer (3)

**Part (c)**

**The diagram shows a plug which contains a fuse, an MCB and an RCD**

**(i) Explain how a fuse works** **2 × 3**

wire melts, with too high a current, breaking circuit — two correct 2 × 3; one correct (3)

**(ii) How does the fuse improve safety?** **4 or 2**

prevents too high a current flowing / reduce fire risk 4

partial answer (2)

**(iii) What is an MCB?** **3**

miniature circuit breaker / trip switch / safety device 3

**(iv) What is the function of an RCD?** **6 or 3**

to protect against electrocution /shut off current in event of a fault /safety switch 6

partial answer e.g. safety, residual-current device (3)

**(v) Why should an appliance be earthed?** **6 or 3**

provide path for current in event of a fault // to protect against electrocution 6

partial answer e.g. safety (3)

**(vi) Give one other precaution that should be taken to improve safety when using electricity in the home** **3**

do not use appliances near water / do not overload sockets, etc. 3

**Part(d)**

**What is radioactivity?** **2 × 3**

disintegration/decay of nuclei/atoms 3

with emission of radiation/energy /α / β / γ 3

**The diagram shows a shielded radioactive source emitting nuclear radiation.**

**(i) How do you know that the source is emitting three types of radiation?** **3**

one type stopped by the paper, 2nd by the aluminium and the 3rd by the concrete 3

**(ii) Name the radiation blocked by each material** **2 × 3**

paper blocks alpha / α,
aluminium blocks beta/ β,
concrete blocks gamma/ γ

two correct 2 × 3

**(iii) Give one danger associated with nuclear radiation** **3**

cancer, radiation sickness, ionises/kills/damages cells, etc. — one correct 3

**(iv) State two precautions that should be taken when handling radioactive substances** **4 or 2**

use tongs, wear gloves, do not point at body, etc — two correct 4; one correct (2)

**(v) Give two uses for radioactive substances** **2 × 3**

medical / energy source / industrial, — two correct 2 × 3; one correct (3)