

**AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA**

**Leaving Certificate Examinations 2002**

**Physics**

**Ordinary Level**

**Marking Scheme**

## Introduction

**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. Mathematical errors carry a penalty of one mark.
6. The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable.
7. The abbreviation h/m denotes hit or miss, i.e. the answer is either correct or not.
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.

## OUTLINE MARKING SCHEME

### SECTION A (120 MARKS)

**Three questions to be answered.**

1	2	3	4
Draw 4×3	Set vibrating 6+3	Draw 3×3	Name 6 or 3
Describe 3×3	Adjust length 2×3	Describe 4+3	Explain 3×3
What 6 h/m	Complete 2×3	Show 2×3	How 6 h/m
Outline 3×3	Graph 4×3	Using formula 6×3	Graph 4×3
Precaution 4 or 2	What 3+2+2		Estimate 7 or 5 or 3

### SECTION B (280 MARKS)

**Any five questions to be answered.**

5 any eight parts	6	7	8
(a) 7 h/m	Define 2(2×3)	Explain 2(6+3)	Explain 2(2×3)
(b) 7 or 4	Complete 2×3	Describe 4×3	One difference 6 or 3
(c) 7 or 4	What L>W 6	Name 6 h/m	Calculate R 3×3
(d) 7 or 4	What T>R 6	What 2×3	Calculate $I_c$ 2×3
(e) 7 or 4	Calculate work 2×3	Describe 2×3	Calculate $I_3$ 2×3
(f) 4 + 3	Calculate acceleration 3×3	Uses 6+2	How 2×3
(g) 4 + 3	What force 2×3		Draw 6 or 3
(h) 7 or 4	Explain 3 + 2		Give 5 or 3
(i) 7 or 4			
(j) 7 or 4			
9	10	11	
What 3×3	What 3×3	(a) 4+3	
Describe 4×3	Name 4×3	(b) 7 or 4	
Name 2×3	Functions 2×6	(c) 7 or 4	
Name 3×3	Deflected 6 h/m	(d) 7 or 4	
What 3×3	Use 3	(e) 7 or 4	
How 6 or 3	Sketch 3×3+2	(f) 4 + 3	
What 5 or 3	Why 3	(g) 7 or 4	
		(h) 4 + 3	

**Q 12:** any two parts

<b>12 (a)</b>		<b>12 (b)</b>		<b>12 (c)</b>		<b>12 (d)</b>	
Pressure	2×3 + 3	Define	3×3	Define	2×3	Lines	2×3
Instrument	6 or 3	Calculate <i>E</i>	3×3	What	2×3 + 4	Describe	4×3
Explain	3×3	Calculate <i>P</i>	2×3	Demonstrate	4×3	Two factors	2×3
Calculate	4	Why	4 h/m			Device	4

**Section A (120 marks)**

**Three questions to be answered.**

**Question 1 40 marks**

**Draw 4 × 3**

labelled diagram to show:

falling object/ball	// pendulum bob	3
timer: millisecond-clock/stop-watch/light gates and timer/other valid variation		3
stop/start mechanism	// fixed point	3
detail e.g. means of suspending ball,	// split cork, etc	3

**NOTE:** no labels, deduct 2

**Describe 3 × 3**

release ball/flick switch (which starts the timer)	// swing pendulum	3
timer stops (when ball hits trapdoor)	// time for $n$ oscillations	3
record the time (on the timer)/divide/get average		3
record the time may be implied		

**What 6 h/m**

distance	// length	6
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**Outline 3 × 3**

substitute (for  $t$  and  $s$ ) into the equation 3

$$g = \frac{2s}{t^2} / s = \frac{1}{2}gt^2 \quad // \quad g = \frac{4\pi^2 l}{T^2} / T = 2\pi \sqrt{\frac{l}{g}} \quad 2 \times 3$$

valid partial answer e.g.  $g = \frac{2s}{t}$  (3)  
 $// \quad -g = \frac{4\pi l}{T^2}$

draw a graph (of  $T^2$  versus  $l$ ) (3)

**Precaution 4 or 2**

any valid specific precaution, which has not already been awarded marks  
 e.g. use the smallest time value recorded for  $t$  // swing through small angle 4  
 any valid general precaution e.g. repeat the experiment a number of times (2)

**Question 2**      **40 marks**

**Set vibrating**      **6 + 3**

tuning fork      // signal/frequency generator      6

other relevant detail e.g.

fork (vibrating) on the wire/bridge/sonometer // current in wire/( U-) magnet/  
current is a.c.      3

a labelled diagram may merit marks

**Adjust length**      **2 × 3**

move      3

bridge      3

**Complete**      **2 × 3**

$\frac{1}{\text{length}} / \text{m}^{-1}$	5.0	3.0	2.2	2.0	1.5	1.3	1.25
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any three correct      3

another three correct      3

**Graph**      **4 × 3**

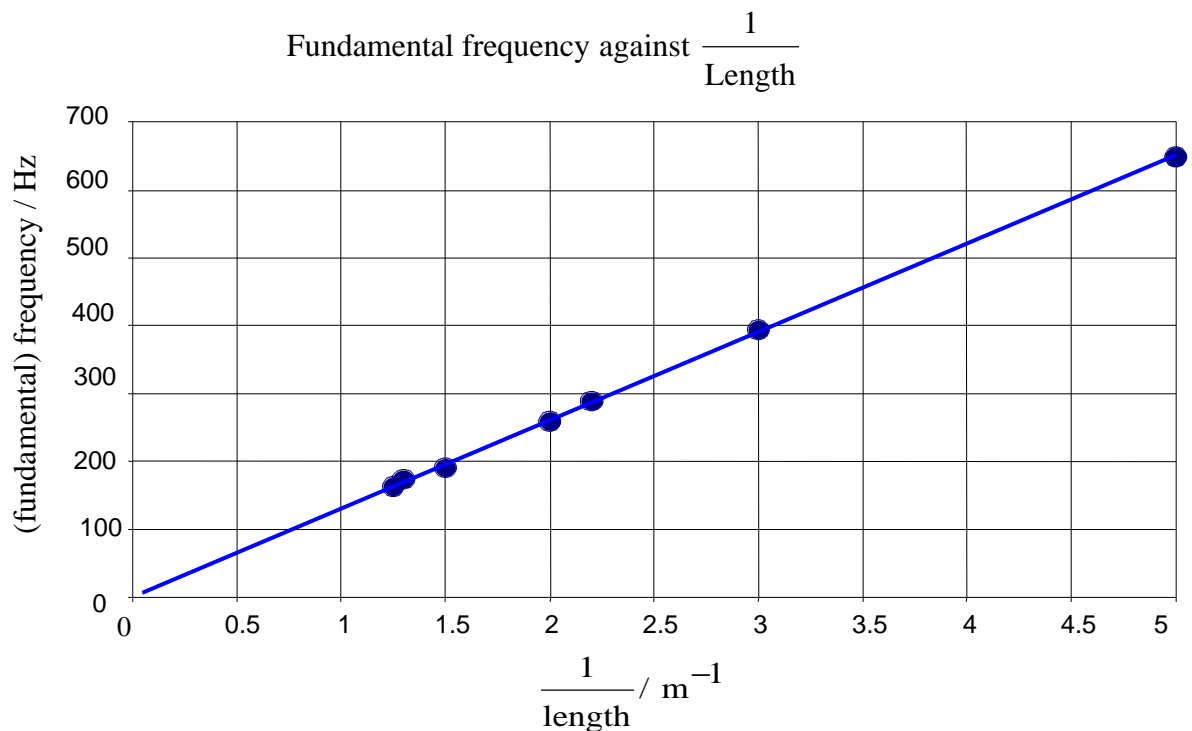
label axes correctly, ( $f$  on the vertical axis)- name/symbol/unit acceptable      3

plot three points correctly      3

plot another three points correctly      3

straight line      3

if graph paper is not used maximum mark 3×3



**What**      **3 + 2 + 2**

(straight) line (through the origin)      3

(implies that the frequency is ) inversely      2

proportional (to the length of string)      2

**Question 3**      **40 marks**

**Draw**              **3 × 3**

labelled diagram to show:

concave mirror		3
object e.g. pin	// ray box	3
search pin / screen		3

**NOTE:** no labels, deduct 2

**Describe**          **4 + 3**

move search pin	// move screen	4
until search pin coincides with image/ no parallax	// until image is found/ clear image	3

accept valid alternatives

a labelled diagram may merit marks

**Show**              **2 × 3**

distance from mirror to object (in front of mirror) shown for $u$	3
distance from mirror to image shown for $v$	3
reverse order	(3)

**Using formula**    **6 × 3**

any correctly substituted formula e.g.  $\frac{1}{f} = \frac{1}{20} + \frac{1}{64}$       3

any calculated value for  $\frac{1}{f}$       e.g. 0.066, 0.057, 0.049, 0.049      3

any consistent value for  $f$  e.g. 15.2, 17.67, 20.2, 20.6      3

another correctly substituted formula any other correct value for  $f/\frac{1}{f}$       3

two more calculated values for  $f/\frac{1}{f}$       3

average value for  $f$ ,  $18.4 \pm 0.2$  (cm)      3

accept other valid methods e.g. correct graph of  $\frac{1}{u}$  against  $\frac{1}{v}$  and correct

reading for  $\frac{1}{f}$       (5×3)

correct graph of  $\frac{1}{u}$  against  $\frac{1}{v}$       (4×3)

correct values for  $\frac{1}{u}$  and  $\frac{1}{v}$       (2×3)

scaled diagrams fit the scheme

averages  $u$  and  $v$  first and gets  $f \approx 20$  (cm) maximum mark 4×3 points

**Question 4      40 marks**

**Name            6 or 3**

ohmmeter/multimeter 6  
 (milli)ammeter/galvanometer/voltmeter (3)

**Explain        3 × 3**

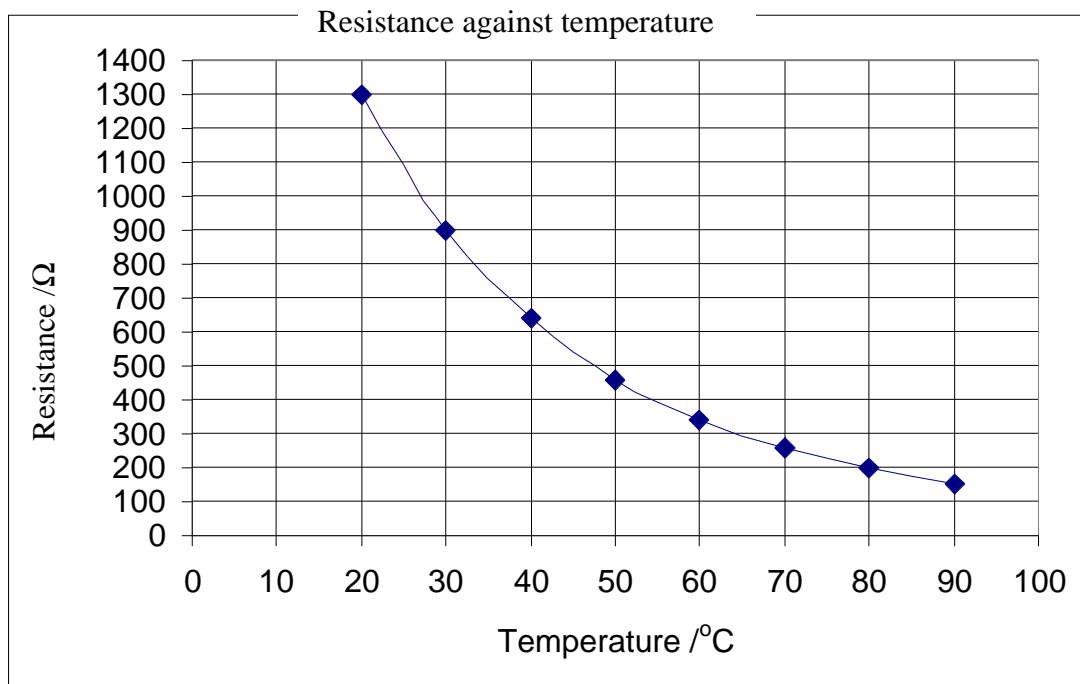
turn on 3  
 bunsen/heater 3  
 beaker/container with liquid 3  
**NOTE:** no labels, deduct 2

**How            6 h/m**

thermometer 6

**Graph        4 × 3**

label axes correctly- name/symbol/unit acceptable 3  
 plot four points correctly 3  
 plot another three points correctly 3  
 smooth curve 3  
 if graph paper is not used, maximum mark 3×3



**Estimate        7 or 5 or 3**

$35 \pm 3$  (°C) or value consistent with graph 7  
 horizontal line drawn from, 740 Ω on, the vertical axis to the curve and dropped  
 vertically to the temperature axis (5)  
 horizontal line drawn from, 740 Ω on, the vertical axis to the curve (3)



**SECTION B (280 Marks)**

**Five questions to be answered**

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

**Take the best 8 from 10 parts**

- (a) force / resists (motion) 7  
example e.g. applying brakes, rubbing hands together, etc. (7)
- (b) 40 000 (J) 7  
correctly substituted formula (4)
- (c)  $A \rightarrow 2$ ,     $B \rightarrow 3$ ,     $C \rightarrow 1$  7  
one correct (4)
- (d) increases conductivity/heat transferred/lost //decreases insulation 7  
reference to insulation/heat loss in context (7)  
reference to heat (4)
- (e) sound (intensity level) 7  
partial answer (4)
- (f) converging/convex 4  
0.02 (m)/2 (cm) 3
- (g) (physical property that) changes (measurably/continually) 4  
with temperature (change) 3  
valid example (4)
- (h) complete example e.g. pitch of moving sound source changes as it goes past 7  
definition/incomplete example e.g. when a car passes by, (4)
- (i) prevent (current) overload, prevent electrocution, safety, prevent fire 7  
reference to fuse/stops current (4)

- (j)  7

correct distribution of negative charge/all positive charge near pointed end (4)

**Question 6**      **56 marks**

<b>Define</b>	<b>2(2 × 3)</b>	
(i) velocity:	rate of change // distance ÷ time / speed	3
	(of) displacement //in particular direction	3
	correct unit	(3)
(ii) acceleration:	rate of change // change in velocity/speed	3
	of velocity/speed // per second	3
	$a = \frac{v - u}{t}$	(2×3)
	correct unit	(3)
<b>Complete</b>	<b>2 × 3</b>	
	acted on by a/there is a (in correct context)	3
	(resultant/external) force	3
<b>What happens L&gt;W</b>	<b>6</b>	
	climbs/ goes up/ gets higher / accelerates upwards	6
<b>What happens T&gt;R</b>	<b>6</b>	
	accelerates/ goes faster	6
	accelerates merits 1 × 6 only, if it appears in both <b>what happens</b> , unless qualified	
<b>Calculate work</b>	<b>2 × 3</b>	
	$W = T \times s$ / (20 000 × (500 × 1000))	3
	$1 \times 10^{10}$ (J)	3
<b>Calculate acceleration</b>	<b>3 × 3</b>	
	$u = 60, v = 0, t = (2 \times 60)$ /rearranged equation $a = (v-u)/t$	3
	$0 = 60 + a(120)/ a = (0-60)/120$	3
	$a = - 0.5$ (m s <sup>-2</sup> )	3
<b>What force</b>	<b>2 × 3</b>	
	$F = 50\,000 \times 0.5$	3
	25 000 (N)	3
	answer consistent with incorrect acceleration above	(2×3)
<b>Explain</b>	<b>3 + 2</b>	
	moving (with constant velocity)/ thrown forward/ fall/ /feel lighter	3
	because no (external) force acts	2

**Question 7 56 marks**

**Explain 2(6 + 3)**

(refraction is the) bending/changing direction/change of velocity of waves 6  
at the boundary/surface/ (when waves) travel from one medium to another 3  
accept light/sound for waves

a labelled diagram or correct example may merit marks

(diffraction is the) spreading out of waves/light/sound 6  
at the other side / at an obstacle/opening 3

a labelled diagram or correct example may merit marks

**Describe 4 × 3**

apparatus: (white light) source, obstacle with a slit, prism/(diffraction) grating  
any two 2 × 3

method: shine the (narrow beam of) light through the prism/grating 3

observation: (the white) light is split into (seven) colours 3

a labelled diagram may merit marks

**Name 6 h/m**

refraction, diffraction, polarisation, interference, same speed, reflection,  
transverse (waves), can travel through vacuum any one 6

**What 2 × 3**

$$f = (3 \times 10^8) \div 100 \quad 3$$

$$= 3 \times 10^6 \text{ (Hz)} \quad 3$$

$$3 \times 10^8 = f \times 100 / f = \frac{c}{\lambda} \quad (3)$$

**Describe 2 × 3**

apparatus: (blackened) thermometer (bulb)/thermopile/infrared camera/night  
vision binoculars, etc. 3

method: the temperature rises/picture shows ( presence of infrared)/etc. 3

a labelled diagram may merit marks

**Uses 6 + 2**

radar, (mobile) phones, speed trap, (microwave) oven/cooking/defrosting any one 6  
any other 2

**Question 8      56 marks**

<b>Explain</b>	<b>2(2 × 3)</b>	
potential difference:	work done/energy	3
	moving (unit) charge	3
unit		(3)
electric current:	electron/charge	3
	flow/moving	3
unit		(3)

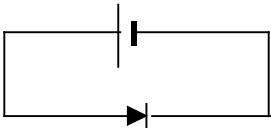
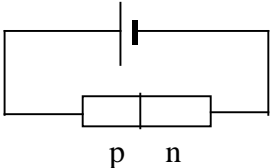
<b>One difference</b>	<b>6 or 3</b>	
(charge carried by) holes/two types of charge carriers/correct variation of resistance with temperature		6
conduction easier/better in metals		(3)
any reference to resistance/conduction		(3)

<b>Calculate R</b>	<b>3 × 3</b>	
correct substitution/	$\frac{1}{R} = \frac{1}{3} + \frac{1}{6}$	3
	$\frac{1}{2}$	3
	$R = 2 (\Omega)$	3

<b>Calculate I in circuit</b>	<b>2 × 3</b>	
1.5 = I (2)    // $(I =) \frac{V}{R}$ // $\frac{1.5}{2}$		3
0.75 (A)		3

<b>Calculate I in 3 Ω</b>	<b>2 × 3</b>	
1.5 = I (3)    // $\frac{1.5}{3}$ // (divide in) ratio 6:3		3
0.5 (A)		3

<b>How</b>	<b>2 × 3</b>	
dope // add (impurity)		3
(with) B/Al/Ga/In/group-3 element/extra holes/short of (lattice) electrons		3

<b>Draw</b>	<b>6 or 3</b>	
	//	
reverse bias		6 (3)

<b>Give</b>	<b>5 or 3</b>	
rectifiers, transistors, diodes, thermistors, thermometers, radios/TV, etc. any two		5
one use		(3)





**Question 11 56 marks**

- (a) release/leakage 4  
of radiation/radioactive materials/energy (due to a mishap/fire/explosion) 3
- (b) splitting of a nucleus/atom (into two parts) 7  
reference to splitting, /releasing energy/neutrons/ $\gamma$ /radiation (4)
- (c) coolant, fuel rods, control rods, shielding, moderator, core  
any two 7  
one correct (4)
- (d) rate of decay /activity (of a radioactive substance) ) 7  
reference to number of emissions (4)
- (e) iodine, caesium, radon, carbon 14, etc. any two 7  
one correct (4)
- (f) time it takes 4  
(for ) half the radioactive nuclei/atoms/substance to decay // activity to halve 3
- (g) (radiation which is) in the environment/atmosphere/air/always there/due to  
rocks/cosmic/natural (radiation) 7  
partial answer (4)
- (h) cancer, skin burns, sickness, kills cells genetic effects, death, cures cancerous  
effects, sterilise, etc. any one 4  
any other 3

**Question 12 56 marks**

**Part(a)**

**Pressure**  $2 \times 3 + 3$

force 3

(per unit) area 3

$P = \frac{F}{A}$  + explanation of symbols (2×3)

(unit is) Pascal/Pa // N m<sup>-2</sup> 3

**Instrument** **6 or 3**

bourdon gauge/pressure gauge/manometer/barometer 6

gauge/meter (3)

**Explain** **3 × 3**

pressure outside // atmosphere (outside) 3

greater than // pushing in 3

pressure inside/vacuum // no air inside to push out 3

**Calculate** **4**

50 (Pa) 4

**Part (b)**

**Define** **3 × 3**

heat/energy (required to) 3

raise/change temperature 3

of 1 kg by 1 °C/1 K 3

**Calculate energy** **3 × 3**

$\_\_ = 85$  3

$Q = (1.5)(4180)(85)$  3

$Q = 532\ 950$  (J) 3

**Calculate power** **2 × 3**

$P = (532\ 950) \div (4 \times 60)$  3

$2221 \pm 1$  (W) 3

**Why** **4 h/m**

more efficient/ hot water will rise/heats quicker/ water poor conductor/etc 4



**Part (c)****Define**            **2 × 3**

charge	3
divided by potential	3
$\frac{Q}{V}$	(3)
explain the notation	(3)

**What**            **2 × 3 +4**

(in diagram A) bulb lights	3
(in diagram B) bulb does not light	3
reverse order	(3)
explain: the capacitor conduct a.c./capacitor in A charging-discharging	4

**Demonstrate**    **4 × 3**

apparatus	e.g. circuit, battery and capacitor	3
procedure	connect to battery to charge capacitor	3
	disconnect capacitor from battery, touch leads from capacitor	3
observation	spark observed/current flows	3
a labelled diagram may merit marks		

**Part(d)****Lines**            **2 × 3**

diagram shows at least two lines between poles	3
direction from N to S	3

**Describe**            **4 × 3**

apparatus	power supply and conductor	3
	magnetic field	3
procedure	turn on power supply/current	3
observation	conductor moves/deflects	3
a labelled diagram may merit marks		

**Two factors**      **2 × 3**

strength of magnetic field/ $B$	
size of current flowing/ $I$	
length of conductor in magnetic field/ $l$	
angle between conductor and magnetic field/ $\theta$ / $\sin \theta$	
medium	any two 2 × 3

**Device**            **4**

motor, (moving coil) meter, loudspeaker, named device which contains motor e.g. electric shaver	4
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