



AN ROINN OIDEACHAIS
AGUS EOLAÍOCHTA | DEPARTMENT OF
EDUCATION
AND SCIENCE

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Fisic

Marking Schemes

Physics

Scrúduithe Ardteistiméireachta, 1999

Gnáthleibhéal

Leaving Certificate Examinations, 1999

Ordinary Level

An Roinn Oideachais agus Eolaíochta

Leaving Certificate Examinations 1999

PHYSICS

ORDINARY LEVEL

Marking Scheme

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 on the scheme.
3. Words shown in brackets in this marking scheme are not required.
4. Words, expressions or statements separated by a solidus, /, are alternatives which are equally acceptable.
5. 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.
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. In general, when a candidate makes an arithmetical error in a calculation three marks are deducted but no further penalty is incurred provided the final answer is consistent with the error.
9. The detail required in any question is determined by the context and the manner in which the question is asked and by the number of marks assigned to the answer in the examination paper and in any instance, therefore, may vary from year to year.

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OUTLINE MARKING SCHEME.

SECTION A (120 MARKS).

Answer each question.

Q1. Answer *five*.

(i) 6 or 3 (ii) 6 (iii) 6 (iv) 6 (v) 6 (vi) 6

Q2. Answer *five*

(i) 6 (ii) 6 or 3 (iii) 6 h/m (iv) 6 h/m (v) 6 h/m (vi) 2 x 3

Q3. Answer *five*

(i) 2 x 3 (ii) 6 or 3 (iii) 6 h/m (iv) 6 h/m (v) 6 h/m (vi) 6 or 3

Q4. Answer *five*

(i) 2x3 (ii) 6 or 3 (iii) 6 or 3 (iv) 6 or 3 (v) 6 h/m (vi) 6 or 3

SECTION B (82 MARKS).

Answer two questions.

Q5. (i) 5 x 3 (ii) 2 x 4 (iii) (a) 6 or 3, 6 or 3 (b) 6 or 3

Q6. (i) 3 x 3 (ii) 3, 3, 3 (iii) 6

(i) 3 x 3 (ii) 3, 2, 3

Q7. (i) 2 x 3 (ii) 6 (iii) 5 (iv) 6 x 3 (v) 2 x 3

SECTION C (198 marks)

Answer three questions.

Q8. State 3×3

What 6 or 3 , 6 or 3

Describe 8×3

Calculate (i) $4 \times 3^*$, (ii) $3 \times 3^*$

Q9. Draw (i) 3×3 , (ii) 3×3

Describe 7×3

Find (i) 3×3 , (ii) 2×3

Give (i) 6 h/m (ii) 6 h/m

Q10. (a) Draw 4×3

Describe 5×3

Copy 2×3

(b) What 6 or 3

Describe 7×3

Give 6 h/m

Q11. What 3×3

State 3×3

Explain 4×3

(i) 2×3 ; (ii) 6 h/m ; (iii) 6 h/m ; (iv) 6 h/m ; (v) 6 h/m

Name 6 h/m

Q12. (a) What 3×3
Name 2×6
State 2×3 , 2×3

(b) What 6 or 3
Name 3×3
State 3×3
Which 3×3

Q 13. Answer any *two* parts.

(a) State (i) 6 or 3 , (ii) 6 or 3
Give 2×3
Calculate (i) 3×3 , (ii) 2×3

(b) Write 2×3
Draw 3×3
What 3×3
How 3×3

(c) (i) 6 (ii) 6 (iii) 6 (iv) 6 (v) 3×3

(d) (i) 3×6 (ii) 5×3

*** Deduct 2 marks for omission of units or use of incorrect units.**

MARKING SCHEME

SECTION A (120 Marks)

Each question to be answered

Question 1 5 x 6

(i)	C	6
(ii)	B	6
(iii)	B	6
(iv)	C	6
(v)	E	6
(vi)	B	6

Question 2 5 x 6

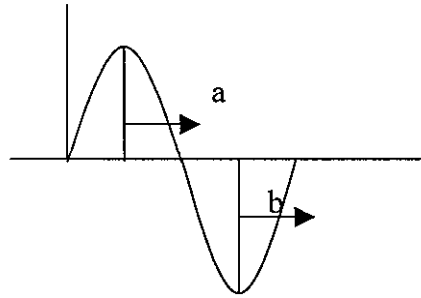
(i)	Length (of column of liquid) / Resistance / emf/ PV /Pressure /Volume / Colour / etc.	6
	Mercury or alcohol	(3)
	Expansion	(3)
(ii)	Less (weight) of air above / Density of air is less / pressure decreases with altitude	6
	Mention of air / gas / gravity	(3)
(iii)	Friction between shoe and ground / any example	6
(iv)	(Common) area / size / permittivity / distance (between plates)	6
	accept symbols, A , ϵ , d	
(v)	0 (°C) / approx. zero / f.p. of water / lower fixed pt. of Celsius scale	6
(vi)	Current / I	3
	Potential difference / P.D./ Voltage / V	3
	Order incorrect	(3)

Question 3 5 x 6

(i) Refraction / interference / diffraction / polarisation
 (any two) 2 x 3
 (Accept "transfer of energy")

(ii) $v = f\lambda$ 6
 $f\lambda$ (3)

(iii)



indicate a or b 6

(iv) Sound need a medium / lesser speed 6
 Cannot be polarised / longitudinal wave
 (Accept converse for light)

(v) Singer breaks glass / paper rider falling from wire 6
 / loud sound from a resonance tube
 / Barton's pendulum / (child's) swing
 / any suitable musical instrument
 / wind resonance / structural resonance, etc

(vi) Horn of a car or siren (changing frequency) as it 6
 approaches and moves away from a person
 / speed trap / red shift / etc.
 Source moving, e.g. ambulance siren (3)

Question 4 5 x 6

- | | | |
|-------|--|----------|
| (i) | Negligible or small or no mass / orbits the nucleus
Negative charge etc, <u>Any two</u> | 2 x 3 |
| (ii) | Thermionic emission
Electrons boiled off | 6
(3) |
| (iii) | Electrons strike the target / Electrons stopped by
the target / electron energy converted to heat
Electrons cause it | 6
(3) |
| (iv) | To accelerate the electrons / control the penetrating
power of X – Rays
/ gives more energy to electrons or X –rays / attract electrons
To produce X - rays | 6
(3) |
| (v) | Medical uses / cracks in metals / thickness of materials | 6 |
| (vi) | Cathode ray tube / TV / VDU / electron microscope
Photocell / GM tube | 6
(3) |

SECTION B (82 MARKS)

Question 5

(i) Explain 5 x 3

Glass block and pins // glass block and ray box 3

Place object pins at one at one side of block // shine ray of light into block 3

Put image pins in line with the object pins (on looking through the block) // observe the emerging ray (through the block.) 3

Mark position of pins // mark the position of the rays 3

Note : Some of the above points may be obtained from a diagram.

Indicates the incident and refracted rays on diagram 3

Note: If a candidate uses a mirror rather than a glass block (i.e. reflection) can obtain second point above only.

(ii) Show 2 x 4

Correct angle of incidence shown 4

Correct angle of refraction 4

If candidate uses a mirror and the angle of incidence is correctly shown then allow 4 marks

(iii) Name 2 x 6

Sin i 6

Sin r 6

accept i and r (2 x 3)

What 6

Sin I / Sin r = constant / Direct proportion / in proportion / same ratio / linear 6

Constant / verifies Snell's law (3)

Question 6

(i) How might 3 x 3

- (test-tube) in beaker of water 3
heat the water 3
until it boils (for a while) 3
If rivets heated directly, e.g. in oven, (3)

(ii) Calculate 3 x 3

- (a) $98.6 - 60 = 38.6 \text{ g}$ 3
(b) $100 - 23.8 = 76.2 \text{ (}^\circ\text{C)}$ 3
(c) $23.8 - 16.2 = 7.6 \text{ (}^\circ\text{C)}$ 3

(iii) State 6

- no insulation / splashing / no lid / wet rivets
/ temperature of the rivets not at $100 \text{ }^\circ\text{C}$
/ not stirring water and rivets etc. 6

Calculate 3 x 3, 3 +2+3

(i) Heat lost $E = mc\Delta\theta$ 3
 $= (0.0098)(3.9 \times 10^2)(76.2)$ 3
 $= 291.2 \text{ J}$ 3

(ii) Heat gained $E = mc\Delta\theta$ 3
 $= (0.0386)(4.2 \times 10^3)(7.6)$ 2
 $= 1232.1 \text{ J}$ 4

If units omitted in both (i) and (ii) or incorrect units given in both (i) and (ii) deduct 2 marks only

Question 7

(i) Name 2 x 3

Thermometer 3

Temperature 3

(ii) Name 6

Y = stirrer 6

Accept: piece of wire

(iii) Name 5

Z = glycerol / liquid paraffin / oil 5

accept: water

(iv) Draw 6 x 3

Label axes correctly on graph paper (accept quantities or units) 3

Suitable scale 3

First point plotted correctly 3

Next two points plotted correctly 3

Remaining two points plotted correctly 3

Graph correctly drawn on graph paper 3

If candidate plots an incorrect relationship between resistance and temperature (e.g. R vs T^2) allow third, fourth and fifth point above only (i.e. for correctly plotting points).

Estimate 2 x 3

Indicates that reading taken from graph 3

Correct value: Range 24 to 28°C 3

SECTION C (198 MARKS)

Question 8

State 3 x 3

Force	3
Proportional to the product of masses	3
Inversely proportional to the square of distance	3

$$F \propto \frac{m_1 m_2}{r^2} / \quad F = \frac{G m_1 m_2}{r^2} / \quad F = \frac{k m_1 m_2}{r^2} \quad (3 \times 3)$$

$$F = \frac{m_1 m_2}{r^2} / \quad F \propto \frac{m_1 m_2}{r} \quad (2 \times 3)$$

What 2 x 6

M = Mass of earth	6
Mass	(3)
r = radius of earth	6
Radius	(3)

Describe 8 x 3

Pendulum bob and string	// Ball bearing suspended / held,	3
Point of suspension	// trap door	3
Measure the length (l)	// Measure the distance (s)	3
Time a number of swings	// Release ball bearings	3
Find period	// Time the fall of the ball	3
Repeat	// Repeat	3

point of detail e.g. small angle / split cork // minimum t/ detail of measuring 3

$$T = 2\pi \sqrt{\frac{l}{g}} \quad / \quad \text{Plot } T^2 \text{ against } l \quad // \quad s = \frac{1}{2} g t^2 \quad / \quad \text{Plot } s \text{ against } t^2$$

$$g = \frac{4\pi^2}{\text{slope}} \quad // \quad \text{slope} = 2g \quad 3$$

Accept any other valid laboratory method

(i) Calculate 4 x 3

$$s = ut + \frac{1}{2}at^2 \quad / \quad s = \frac{1}{2}gt^2 \quad 3$$

$$12 = \frac{1}{2}(9.8) t^2 \quad 3$$

$$t^2 = \frac{24}{9.8} \quad 3$$

$$t = 1.56 \text{ s}^* \quad 3$$

(ii) Calculate 3 x 3

$$/ \quad 3$$

$$v^2 = 2(9.8)(12) \quad / \quad v = (9.8)(1.56) \quad / \quad mgh = \frac{1}{2}mv^2$$

3

$$v = 15.3 \text{ m s}^{-1} *$$

3

(Final value will depend on value for t in (i))

****Deduct two marks for incorrect units or omission of units***

Question 9.

Draw (6 x 3)

Real image 3 x 3

Object outside focus (stated or implied)	3
Two rays drawn from object and reflected correctly	3
Inverted image drawn	3
Uses lens:	(3 only)

Virtual image 3 x 3

Object inside focus (stated or implied)	3
Two rays drawn from object and reflected correctly	3
Upright image drawn	3
Uses lens:	(3 only)

Describe 7 x 3

<u>Method 1</u>		<u>Method 2</u>	
(Mirror) and pins	//	(Mirror), ray box, screen	3
Object pin in front of mirror	//	Ray box in front of mirror	3
Move finder pin	//	Move the screen	3
No parallax	//	Clear image	3
Measure correct image distance and object distance from mirror			3
$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$			3
Repeat / take average			3

Candidate uses convex lens: candidate may obtain points 3, 4, 6, 7 above (4 x 3)

Method 3

Centre of curvature method (7 x 3)

- Mirror & object (3)
- Object in front of mirror (3)
- Move the object (3)
- No parallax between object and image (3)
- Measure distance from object to mirror (3)
- Distance = 2f (3)
- Repeat / take average. (3)

If candidate uses convex lens may obtain points 3, 4, 7 (3 x 3)

Method 4

Distant object method (6 x 3)

- Sheet of paper & mirror (3)
- Cast image of distant object on paper (3)
- Point of experimental detail (3)
- Measure distance from the mirror to the paper (3)
- This is the focal length (3)
- Repeat / take average (3)

If candidate uses a convex lens, may obtain points 2 and 6 (2 x 3)

Find (i) 3 x 3

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \quad 3$$

$$\frac{1}{35} + \frac{1}{v} = \frac{1}{20} \quad 3$$

$$v = 46.7(\text{cm}) \quad \text{Page 16} \quad 3$$

Accept 47 (cm)

(ii) 2 x 3

$$m = \frac{v}{u} \quad 3$$

$$m = \frac{46.7}{35} = 1.3 \quad 3$$

Give 6

(i) Concave

Shaving / make up / (reflecting) telescopes / spotlights 6

Give 6h/m

(ii) Convex

Bad bends / rear view mirrors / security / shops / buses 6

Candidate interchanges uses: allow 6 if both correct

Question 10

(a) Draw 4 x 3

diagram to show	
Metal cap / metal rod	3
Leaves / gold foil	3
Metal case / earth / insulation / glass (front)	3

Deduct one mark from each of the above if the label is missing

Use	Detect p.d. / detect charge / measure charge / show type of charge / measure p.d./ identify insulator	3
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Describe 5 x 3

Object free to move	// use a gold leaf electroscope	3
Charge object	// charge a rod	3
Charge second object	// bring the rod close to the disk	3
Bring charged objects close together	// leaves move apart	3
Movement / repulsion	// since they have same charge	3

If magnets used the maximum the candidate can obtain is 2 x 3 (i.e. first and last point above correct)

Copy 2 x 3

At least two lines between spheres	3
Arrows in correct direction	3

(b) What 6 or 3

A solution/ substance/ liquid in which electrolysis takes place	6
Solution of acids or bases or salts.	(6)
A liquid which conducts electric current (by ions) naming an electrolyte e.g. copper sulphate or a liquid / solution	(6) (3)

Describe 7 x 3

<u>Apparatus:</u> Circuit diagram to include Power source, ammeter, rheostat and voltmeter <i>Any two of these</i>	2 x 3 (3)
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Method:

- Weigh cathode / anode
 - Read current
 - Read time
 - Dry cathode
 - reweigh cathode / anode
 - Find mass change / deposited
- Any four of the above

4 x 3

$z = m/It$ or equivalent

Give 6 h/m

Electroplating / Extraction of metal / Electrolytic
capacitors / cosmetics / purification of metals

6

Question 11**What 3 x 3**

Changing flux / changing magnetic field / moving magnet	3
Through loop / coil / conductor	3
Induced emf / current / electricity	3

State 3 x 3

Induced emf / current	3
is proportional to	3
the rate of change of flux	3
correct mathematical expression	(3 x 3)

Explain 4 x 3

Move magnet (into coil)	3
Note deflection / current	3
Move magnet faster	3
Greater deflection / current	3

State 2 x 3

(i) To step up	3
d.c. voltage	3
Some mention of where used e.g. car ignition	(3)

Name 6

(ii) A: primary	6
-----------------	---

Name 6

(iii) B: secondary	6
--------------------	---

Name 6

(iv) C is the (laminated) core / iron bar	6
---	---

Name 6

(v) sparking (takes place) / v. high voltage / pd / discharge / current passes	6
--	---

Name 6 h/m

Dynamo / transformers / induction motor / induction furnace	6
---	---

Question 12

(a)

What 3 x 3

Resistance / Resistivity / conductivity / energy gap / band gap // Free electrons	3
Between that of an insulator // few free electrons at low temperatures	3
and a conductor // more free electrons at room temperatures	3
Mention of electrons and holes	(2 x 3)
P / n -type material	(3)
Correct example	(2 x 3)

Name 2 x 6

A = diode / pn junction	6
B = thermistor	6

State 2 x 3

A allows current to flow in one direction / rectify ac	2 x 3
Refer to use as led's or photodiodes / protect sensitive instruments / valve	(3)

State 2 x 3

B / resistance changes with increased temp / conductivity changes with increased temp resistance changes as temperature changes	2 x 3 (2 x 3)
--	------------------

Refers to uses: e.g. Protect electric motors from over heating/ refer to use of thermistors
in heat switches (3)

12 (b)

What 6 or 3

(Decay) of nucleus / atom	3
emission of radiation / named radiation	3

Name 3 x 3

α / alpha	3
β / beta	3
γ / gamma	3

State 3 x 3

α :-	helium ions	3
β :-	electrons	3
γ :-	electromagnetic / radiation	3

Which 3 x 3

(i)	α particles	3
(ii)	γ - rays	3
(iii)	γ - rays	3

Question 13

Answer any two of the following

13(a)

State 6 or 3

- (i) Ability to do work 6
Gives forms of energy e.g. heat, kinetic, etc. (3)

State 6 or 3

- (ii) Rate of work / energy per sec / work per unit time / $P=W/t$ 6
refers to energy / unit time (3)

Give 2 x 3

- (i) joules / J accept N m 3
(ii) watts / W accept $J s^{-1}$ 3

Calculate 3 x 3

(i)

$$KE = \frac{1}{2}mv^2 \quad 3$$

$$= \frac{1}{2}1000(15)^2 \quad 3$$

$$=112,500 \text{ (J)} \quad 3$$

Calculate 2 x 3

(ii)

$$Power = \frac{energy}{time} \quad / \quad \frac{112500}{5} \quad 3$$

$$=22,500 \text{ (W)} \quad 3$$

Q13 (b)

Write 2 x 3

$$pv = k \quad / \quad p = \frac{k}{v}$$

$$/ p \propto \frac{1}{v}$$

2x3

Draw 3 x 3

Labelled diagram to show

- Enclosed volume of air 3
- Method of changing pressure 3
- Method of measuring pressure / volume 3
- No labels: deduct 2

What 3 x 3

- Measure the volume / length of column of air 3
- Measure the pressure 3
- Repeat / implies more than one measurement of either p or V taken 3

How 3 x 3

- Plot the pressure // multiply each pressure 3
- Against 1/volume // by the corresponding volume 3
- straight line // constant 3
- (through the origin)

13 (c)

How 6

(i) Tighten the string / attach weight to one end of wire 6

How 6

(ii) Increases 6

How 6

(iii) Decreases 6

How 6

(iv) Playing a guitar / piano / violin etc 6

Explain 3 x 3

(v)

Use paper rider // tuner / frequency meter // tuning fork/ freq. generator & speaker
3

Place vibrating tuning fork // pluck string and bring tuner near to it(on bridge) // vary length of string / frequency of sound source
3

Adjust length until paper vibrates // note the reading on the meter. // ear detects when both at same frequency
3

Accept mention of sonometer as an alternative for any of the above points

Other valid methods acceptable e.g.

$$f = \frac{1}{2l} \sqrt{\frac{T}{m}} \quad (2 \times 3)$$

Measure l, T, m (3)

13 (d)

Name 3 x 6

A = (paper) cone / diaphragm 6

B = coil 6

C = (permanent) magnet 6

Explain 5 x 3

(Current flows into the coil)
and the coil moves 3

Current flows in the opposite direction and the
coil moves in the opposite direction 3

Diaphragm moves 3

air around the diaphragm vibrates /sound (wave)
is produced in the air. 3