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Leaving Certificate Examination 2002

Physics & Chemistry

Ordinary Level

Marking Scheme

Introduction

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

1. Words or expressions separated by a solidus, /, are alternative answers which are equally acceptable for the award of the assigned mark.

2. Words or expressions in round brackets, ( ), are alternatives to parts of an acceptable answer.

3. In some instances acceptable partial answers are given in square brackets, [ ], after the full answer to the particular item. In such cases, the marks indicated within the brackets cannot be awarded in addition to any marks already awarded for the item.

4. Where parts of an answer are assigned separate marks, alternatives from one part must correspond to alternatives from the other part(s) to merit the award of the marks assigned to both (all) parts.

5. The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable.

6. The detail required in any answer is determined by the context and manner in which the question is asked and by the number of marks assigned to the item in the examination paper. In any instance, therefore, the detail required may vary from year to year.

SECTION 1 – PHYSICS

Any three questions

1. Eleven of the following items, (a), (b), (c), etc.

   (a) 6 (b) 2×3 (c) 2×3 (d) 2×3 (e) 2×3 (f) 2×3 (g) 2×3
   (h) 2×3 (i) 2×3 (j) 2×3 (k) 6 (l) 6 (m) 2×3 (n) 2×3
   (0) 2×3

2. Define 6×3 State 2×3 (i) What 3×3
   (ii) Calculate 3×3 (iii) What 4×3 (iv) What 4×3

3. (a) State 4×3 Show 2×3 Describe 5×3

   (b) (i) Draw 4×3 (ii) Describe 2×3 (iii)Find 3×3 (iv) Give 6

4. (a) Explain 4×3 Describe 3×3 Give 2×3 Name 6
   (b) State 2×3 Describe 4×3 Draw 2×3 Identify 3×3

5. (a) State 3×3 Name 3× 6 What 2×3

   (b) What 3×3 (i) What 2×3 (ii) Name 3×3 (iii) What 6
   (iv) Name 3

6. *Any two of the following parts.* Each part carries 33 marks.

   (a) State 3×3 List 2×3 Draw 2×3 What 2×3 Give 2×3

   (b) What 4×3 List 3×3 What 2×3 Give 2×3

   (c) State 3×3 What 2×3 Calculate 6×3

   (d) Explain 6×3 State 6 Name 3 Give 2×3

SECTION 11 – CHEMISTRY

Any three questions

7. Eleven of the following items, (a), (b), (c), etc.

   (a) 2×3 (b) 2×3 (c) 6 (d) 2×3 (e) 2×3 (f) 2×3 (g) 2×3 (h) 2×3
   (i) 2×3 (j) 2×3 (k) 2×3 (l) 2×3 (m) 2×3 (n) 6 (o) 2×3

8. What 6×3 Give 2×3 Give 4×3

   Explain 6×3 Show 4×3

9. Justify 6×3 Write 2×3 Name 2×3

   Define 4×3 What 6 Complete 2×3 Name 2×6

10. (i) Name 2×6 Which 3 (ii) Describe 6×3 (iii) 2×6

    (iv) Name 6 What 2×3 Calculate 3×3

11. Explain 4×3 Name 6 (i) Describe 6×3

    (ii) State 6 (iii) Describe 4×3 Write 2×3 Describe 2×3

12. *Any two of the following parts.* Each part carries 33 marks.

    (a) Define 6×3 What 2×3 Name 3×3

    (b) (i) Name 3×6 (ii) What 6 (iii) Give 3×3

    (c) State 3×3 Define 4×3 Calculate 4×3

NOTE: All questions will carry the same number of marks.
However, one additional mark will be given to each of the first two questions in each Section for which the highest marks are obtained by the candidate

Deduct 2 marks for incorrect / no units where indicated to a maximum of one such deduction per question.

SECTION I – PHYSICS

QUESTION 1

Any eleven parts

(a) Joule (J) / newton metre (N m) … 6
[force × distance … 3 only]

(b) energy cannot be created / total energy … 3
or destroyed / is constant /
it can only be changed from one form to another … 3

(c) $W = m \times g$ / $W = 100 \times 1.6$ … 3
$= 160$ … 3
[160 only … 2×3]

(d) $T = \theta + 273$ / $27 + 273$ … 3
300 … 3
[273 only … 3; 300 only … 2×3]

(e) elastic collisions / rapid motion /
negligible volume / random motion /
negligible duration of collisions / straight line motion /
temperature depends on kinetic energy (speed) /
large number of particles (molecules) **any two** … 2×3

(f) incidence … 3
reflection … 3

QUESTION 1 - continued

(g) (i) red … 3
(ii) violet (purple) (indigo) (blue) … 3
[reverse … 3 only]

(h) $c = f \times \lambda$ **or** $200 = f \times 10$ … 3
$f = 20$ … 3
[20 only … 2×3]

(i) field lines between the spheres … 3
correct direction … 3

(j) emission (release) of electrons /
when radiation (light) / falls on a metal **any two** … 2×3

(k) resistance / current / time / voltage **any one** … 6

(l) volt / V … 6

(m) $C = C_1 + C_2$ / $C = 6 + 3$ … 3
$= 9$ … 3
[9 only … 2×3]

(n) protons / total number of particles … 3
and neutrons / in the nucleus … 3

(o) nuclei / atoms / elements … 3
join / fuse … 3
[example … 3 only]

QUESTION 2

Define (6×3)

(acceleration) (i) rate of change / change in velocity (speed) / $\frac{v-u}{t}$ … 3
of velocity (speed) / w.r.t. time … 3

(force) (ii) that which causes acceleration / ma … 2×3

[causes motion / changes shape / a push or a pull / example … 3 only]

(E_k) (iii) energy / work … 3
due to motion (momentum) … 3
[$\frac{1}{2}mv^2$ … 2×3; example …. 3 only]

State (2×3)

(2^{nd} law) force … 3
proportional (equal) to the rate of change of momentum (ma) … 3

(i)What (3×3)

$v = u + at$ … 3
$20 = 0 + a \times 10$ … 3
$a = 2 \text{ m s}^{-2}$ … 3
incorrect / no units (–2)

(ii)Calculate (3×3)

$F = ma$ … 3
$= 3000 \times 2$ … 3
$= 6000 \text{ N}$ … 3
incorrect / no units (–2)

(iii)What (4×3)

$s = ut + \frac{1}{2}at^2$ … 2×3
$= 0 + \frac{1}{2} \times 2 \times 10^2$ … 3
$= 100 \text{ m}$ … 3
incorrect / no units (–2)
[110 m alone … max 3×3]

(iv)What (4×3)

$E_k = \frac{1}{2}mv^2$ … 2×3
$= \frac{1}{2} \times 3000 \times 20^2$ … 3
$= 6 \times 10^5$ (600 000) J … 3
incorrect / no units (–2)
[any elements missing from equation … max 3×3]

QUESTION 3

(a) State(4×3) I	incident ray, normal, refracted ray	…	3
	on same plane	…	3
II	sin *i*	…	3
	$\propto$ sin *r*	…	3
Show (2×3)	correct angles shown	…	2×3
Describe (5×3)	draw the outline of the glass block / incident ray defined /emergent ray defined / refracted ray defined / measure angle *i* / measure angle *r* / find sin *i* / find sin *r* / $n = \frac{\sin i}{\sin r}$ / repeat for other values and find average / graph sin *i* vs sin *r* **any five**	…	5×3
(b) (i) Draw(4×3)	lens principal axis and focus object indicated and one ray correct second ray correct and image [mirror diagram … max 3×3]	…	4×3
(ii)Describe (2×3)	virtual / magnified / erect **any one** [shown on a diagram / correct mirror image … 3 only]	…	2×3
(iii)Find (3×3)	$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$	…	3
	$\frac{1}{10} = \frac{1}{5} + \frac{1}{v}$	…	3
	v = 10 cm **incorrect / no units (–2)**	…	3
(iv)Give (6)	camera / microscope / telescope / glasses / etc. **any one**	…	6

QUESTION 4

(a) Explain (4×3)

(i) (heat)	energy		…	2×3
(ii) (temperature)	is a measure (degree)		…	3
	of hotness (coldness)		…	3

Describe (3×3)	sealed			
(show / state)	tube			
	bulb of mercury (mercury at end)			
	scale			
		any three	…	3×3

Give (2×3)	length / volume		…	3
	of mercury (liquid)		…	3
Name (6)	alcohol / gas thermometer / etc.		…	6

(b) State (2×3)

(Boyle's law)	pressure (p)	/ pV / p_1V_1	…	3
	inversely proportional to volume / $\propto \frac{1}{V}$	/ = k / = p_2V_2	…	3

Describe (4×3)	read pressure (volume)		…	3
	read volume (pressure)		…	3
	vary / repeat		…	3
	pressure (volume) / different values		…	3

Draw (2×3)	pressure guage / J-tube			
	enclosed volume of air			
	pump / plunger / mercury	**any two**	…	2×3

[any one omitted / no labels …3 only]

Identify (3×3)	p (V) and $\frac{1}{V}\left(\frac{1}{p}\right)$	**1st correct**	…	2×3
		2nd correct	…	3

[x and y-axis …. 3 only]

QUESTION 5

(a) State (3×3)	current (conductor)		…	3
	in a magnetic field		…	3
	experiences a force / moves		…	3
Name (3×6)	A =	scale / dial	…	6
	B =	coil (core)	…	6
	C =	magnet	…	6
What (2×3)	moves	/ uniform (radial)	…	3
	when current flows	/ magnetic field	…	3
(b) What (3×3)	emf (current)		…	3
	induced / produced / generated		…	3
	due to change in magnetic field		…	3
(i)What (2×3)	step up / step down / increase / decrease / change		…	3
	voltage / current		…	3
(ii)Name (3×3)	A = core		…	3
	B = primary		…	3
	coil		…	3
(iii)What (6)	power (voltage) supply / mains		…	6
(iv)Name (3)	computer / radio / TV / etc.	**any one**	…	3

QUESTION 6

Any two parts

(a) State (3×3)	force		…	3
	is proportional (equal) to product of the masses /			
	$\propto (=) M_1 M_2$		…	3
	inversely proportional to distance squared			
	$/ \propto \frac{1}{d^2}$		…	3
List (2×3)	pendulum (ball) /			
	support (free fall apparatus) /			
	timer	**any two**	…	2×3
Draw (2×3)	apparatus arranged correctly		…	2×3
What (2×3)	length / distance		…	3
	time		…	3
Give (2×3)	repeat /			
	small angle (lowest value of t) /			
	length (distance) not too small /			
	motion in one plane / reset timer /			
	large number of oscillations			
		any two	…	2×3
(b) What (4×3)				
(i)(diffraction)	spreading of waves		…	3
	around an obstacle / region beyond a gap			
	[*shown / stated*]		…	3
(ii)(interference)	two waves		…	3
	meeting (adding) together			
	[*shown / stated*]		…	3
List (3×3)	laser / sodium (monochromatic) light		…	3
	diffraction grating / Young's slits		…	3
	screen / spectrometer		…	3
What (2×3)	read angles / measure distance			
	order / number of fringes			
	separation of slits / grating constant	**any two**	…	2×3
Give (2×3)	$n\lambda$ =		…	3
	$s \sin\theta$ / $\frac{sx}{D}$		…	3

(c) State (3×3)

(Ohm's law)	voltage (V)	…	3
	∝ current (I) / = RI	…	3
	at constant temperature	…	3
What (2×3)	opposition to	…	3
(resistance)	current	…	3

[$R = \frac{V}{I}$ … 2×3]

Calculate (6×3)	(i) $R = R_1 + R_2$ / $R = 4 + 6$	…	3
	$= 10\ \Omega$	…	3
	[10 only … 2×3]		
	incorrect / no units (–2)		
	(ii) $V = R \times I$ / $24 = 10 \times I$	…	3
	$I = 2.4$ A	…	3
	incorrect / no units (–2)		
	(iii) $V = R \times I$ / $V = 4 \times 2.4$	…	3
	$= 9.6$ V	…	3
	incorrect / no units (–2)		

(d) Explain (6×3)

(radioactive)	decay (disintegration)	…	3
	of nuclei (atoms)	…	3
(radiation)	particles / rays / example **any one**	…	2×3
(ionisation)	loss / gain	…	3
	of electrons	…	3
State (6)	alpha	…	6
Name (3)	beta / gamma	…	3
Give (2×3)	medical / cancer / carbon dating / detecting leaks / power (energy) source / etc. **any two**	…	2×3

SECTION II - CHEMISTRY

QUESTION 7

(a)	(i) 9	…	3
	(ii) 10	…	3
(b)	*(I.E.)* energy to remove	…	3
	most loosely bound electron / electron from an atom	…	3
(c)	magnesium	…	6
(d)	2 hydrogen atoms and one oxygen atom	…	3
	V – shape	…	3
(e)	mass	…	3
	proportional to quantity of electricity (charge) (*It*)	…	3
(f)	Planck	…	3
	constant	…	3
(g)	can act as an acid	…	3
	or a base	…	3
(h)	M_r of CH_4 = 16	…	3
	= 75%	…	3

QUESTION 7 - continued

(i) diamond / quartz / graphite / buckminsterfullerene / etc.
any one … 2×3
[example of covalent compound … 3 only]

(j) phenol … 2×3
[benzene … 3 only]

(k) $pH = -\log [H^+]$ / $pH = -\log [0.1]$ … 3

$pH = 1$ … 3

(l) COOH … 2×3
[OH / CO … 3 only]

(m) $H_2SO_4 + 2NaOH$ …. 3
$Na_2SO_4 + H_2O$ / $Na_2SO_4 + 2H_2O$ … 3

(n) Propanone (acetone) … 6

(o) Avogadro number / molecular mass / same number of particles … 3
of particles / in grams / as 12 g of C … 3

[6×10^{23} / 22.4 litres … 2×3]

QUESTION 8

What (6×3)					
(ionic bond)	(i)	transfer	/ attraction	…	3
		of electrons	/ between ions	…	3
		[between a metal and a non-metal / E.N. difference > 1.7 … 3 only]			
(covalent)	(ii)	sharing		…	3
		of electrons		…	3
		[2 non-metals / E.N. < 1.7 … 3 only]			
(E.N.)	(iii)	attraction		…	3
		for electrons		…	3
		[determines type of bond formed … 3 only]			
Give (2×3)	(i)	alkali metals / group 1		…	3
	(ii)	halogens / group 7		…	3
Give (4×3)	(i)	$1s^2\ 2s^2$		…	3
		$2p^6\ 3s^1$		…	3
	(ii)	$1s^2\ 2s^2\ 2p^6$		…	3
		$3s^2\ 3p^5$		…	3
Explain (6×3)	(i)	Na = 0.9 Cl = 3.0		…	3
		difference = 2.1(> 1.7)		…	3
		ionic		…	3
	(ii)	Cl = 3.0		…	3
		difference zero (< 1.7)		…	3
		covalent		…	3
Show (4×3)	(i)	Na one electron , chlorine 7 electrons		…	3
		show transfer		…	3
	(ii)	two chlorine atoms with shells overlapping		…	3
		one pair of electrons shared		…	3

QUESTION 9

Justify (6×3)	magnesium reacts			…	3
	readily			…	3
	iron reacts			…	3
	more slowly			…	3
	copper does not react			…	2×3
Write (2×3)	MgO / FeO (Fe_2O_3) / Cu_2O (CuO)			…	2×3
	[symbol of the element … 3 only]				
Name (2×3)	(i)	K / Na / Ca	**any one**	…	3
	(ii)	Hg / Ag / Au	**any one**	…	3
Define (4×3)	(i)	loss		…	3
		of electrons		…	3
	(ii)	gain		…	3
		of electrons		…	3
What (6)	copper			…	6
Complete (2×3)	$FeSO_4$			…	3
	+ Cu			…	3
Name (2×6)	(i) Fe			…	6
	(ii) Cu ($CuSO_4$)			…	6
	[reverse order … 6 only]				

QUESTION 10

(i)	**Name (2×6)**	B = burette		…	6
		C = pipette		…	6
		[reverse order … 6 only]			
	Which (3)	C / pipette		…	3
(ii)	**Describe (6×3)**				
	(burette)	wash with water /			
		wash with the acid /			
		place funnel in the top /			
		fill above zero mark /			
		open tap /			
		bring meniscus to zero	**any three**	…	3×3
	(pipette)	wash with water /			
		wash with the base /			
		using filler / draw base into pipette /			
		allow base to run into beaker /			
		until meniscus is level with mark	**any three**	…	3×3
(iii)	**(2×6) Name**	A = flask		…	6
	How	swirl (shake) the flask		…	6
(iv)	**Name (6)**	any named indicator		…	6
	What (2×3)	correct colour change		…	2×3
	Calculate (3×3)	$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$		…	3
		$\frac{0.1 \times 27.5}{1} = \frac{M_2 \times 25}{1}$		…	3
		M_2 = 0.11 M (moles/litre)		…	3
		incorrect / no units(–2)			

QUESTION 11

Explain (4×3)

(h. series) successive members differ by CH_2 / same general formula / gradual change in physical properties — **any one** … 2×3

[same functional group … 3 only]

(unsaturated) double (triple) … 3

bonds … 3

[not all valencies satisfied … 3 only]

Name (6) alkenes … 6

(i) Describe (6×3)

Apparatus: test-tube, trough, gas jar, bunsen — **any three** … 3×3

[no diagram … deduct 3]

Method: alcohol and glass wool in test tube / Al_2O_3 (catalyst) / sealed tube / heat / collect gas in gas jar — **any three** … 3×3

(ii) State (6) disconnect before removing heat / prevent suckback / discard first jar of gas — **any one** … 6

(iii) Describe (4×3) decolourises … 2×3

bromine / potassium … 3

water / permanganate … 3

Write (2×3) $C_2H_4 + O_2$ … 3

$\rightarrow CO_2 + H_2O$ … 3

Describe (2×3) lime water / cobalt chloride paper / boils / freezes / density … 3

turns milky / turns blue / 100 / 0 / 1 … 3

QUESTION 12

(a) Define (6×3)

(acid)	(i)	proton / H^+	…	3
		donor	…	3
(base)	(ii)	proton / H^+	…	3
		acceptor	…	3
(c. pair)	(iii)	acid and base / two species	…	3
		which differ by a proton	…	3

What (2×3) poor proton / slightly … 3
donor / dissociated … 3

Name (3×3)

(i) H_2SO_4 … 3

(ii) HF … 3

(iii) H_2SO_4 HSO_4^- / HF H_2F^+ … 3

(b)(i) Name (3×6)

A = acid … 6
C = sulphuric acid … 6
B = sulphite e.g. sodium sulphite /copper … 6

(ii) What (6) remove water / dehydrate / purify … 6

(iii) Give (3×3)

(chemical) reacts with alkalis / reducing agent / acidic oxide / etc.
any one … 3

(physical) gas / colourless / choking smell / poisonous /
soluble in water / etc. **any one** … 3

(use) bleach / manufacture of sulphuric acid / etc.
any one … 3

QUESTION 12 - continued

(c) State (3×3)

(Hess's law)	heat change	…	3
	independent	…	3
	of path	…	3

Define(4×3)

(heat of reaction)	heat change for	…	3
	chemical equation	…	3
(heat of formation)	heat change when 1 mole	…	3
	is formed from its elements	…	3

Calculate (4×3)

$2Fe_2O_3 \rightarrow 4Fe + 3O_2 \quad \Delta H = 822$ … 3

$3C + 3O_2 \rightarrow 3CO_2 \quad \Delta H = -1179$ … 2×3

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

$\Delta H = -357$ … 3