AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA | DEPARTMENT OF EDUCATION AND SCIENCE

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Fisic agus Ceimic — *Gnáthleibhéal*

Marking Scheme — *Leaving Certificate Examination, 2001*

Physics and Chemistry — *Ordinary Level*

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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.

Outline Marking Scheme

SECTION 1 – PHYSICS

Any three questions

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

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

2. (a) State 4×3 Calculate 3×3 What 4×3

   (b) Define 2×3 State 2×3 Calculate 4×3 What 3 × 3

3. (a) Define 4×3 On what 3 Outline 6×3

   (b) Give 3×3 What 2×3 Outline 6×3

4. Explain 5×3 Describe 8×3 What 5×3 Give 4×3

5. (a) What 2×3 Describe 8×3 Name 6

   (b) State 4×3 What 6 What 6 Give 6

6. ***Any two of the following parts***

   (a) Define 2×3 Give 2×3 Describe 5×3 Give 6

   (b) What 3×3 Describe 8×3

   (c) State 2×3 Define 2×3 Calculate 7×3
   (d) What 4×3 How 3×3 State 2×3 State 2×3

SECTION II - CHEMISTRY

Any three questions

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

   (a) 6 (b) 2×3 (c) 6 (d) 2×3 (e) 6 (f) 2×3 (g) 6

   (h) 2×3 (i) 6 (j) 2×3 (k) 2×3 (l) 2×3 (m) 6 (n) 2×3 (o) 2×3

8. (a) What 4×3 Using 4×3 Give 2×3 Give 6

   (b) Explain 4×3 State 6×3

9. (a) State 2×3 Define 2×3 Calculate 7×3

   (b) Explain 6×3 Identify 2×6 What 3

10. What 6×3 (i) Describe 5×3 Give 2×3

    (ii) Name 6 State 2×3 (iii) Calculate 5×3

11. (a) What 4×3 Give 4×3 Name 2×3

    (b) Define 6×3 Identify 3×6

12. ***Any two of the following parts***

    (a) What 2×3 Calculate (i) 3×3 (ii) 3×3 (iii) 3×3

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

    (c) What 2×3 (i) Explain 4×3 (ii) Describe 2×3 (iii) Complete 3×3

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) (*momentum*) mass ... 3

× velocity (speed) ... 3

(b) $a = \frac{v-u}{t}$ / $a = \frac{9-3}{2}$ ... 3

$a = 3$ ... 3

(c) force is proportional to the product of the masses

/ $F \propto M_1M_2$ / $F = GM_1M_2$ ... 3

inversely proportional to the distance squared / $\propto \frac{1}{d^2}$ ... 3

(d) (*Boyle's law*)

pressure (p) / pV / p_1V_1 ... 3

inversely proportional to volume / $\propto \frac{1}{V}$ / $= k$ / $= p_2V_2$ ... 3

(e) magnifying glass / camera / binoculars / spectacles

microscope / telescope / etc. **any one** ... 6

(f) copy the diagram + one ray correct ... 3

2^{nd} ray + image ... 3

(g) compression waves on a spring /

sound waves / ultrasonic waves / etc. **any one** ... 6

QUESTION 1 - continued

(h) *(dispersion)*
show (state): splitting (separation) (breaking up) ... 3
into colours (spectrum) (rainbow) /
when light passes through a prism ... 3

(i) photo ... 3
electric (emission) ... 3

(j) *(diffraction)*
show/state: spreading (bending) of waves ... 3
around (through an opening in) an obstacle ... 3

(k) frequency ... 6

(l) proton (nucleus) ... 3
negative ... 3

(m) protects / prevents / melts / blows /
determines (controls) (dictates) ... 3
an appliance / a fire / if the current is too large /
how much current can go through a circuit ... 3
[to control the flow of charge ... 3]

(n) less heat (energy) ... 3
lost ... 3

(o) a.c. / alternating ... 6

QUESTION 2

(a) State (4×3)

(1st) body remains at rest (constant velocity) ... 3

unless force acts on it ... 3

(2nd) rate of change of momentum / ma ... 3

$\propto$ (=) force (F) ... 3

(3rd) to every action (force) ... 3

equal and opposite reaction (force) ... 3

Award marks for two laws only - maximum ... 4×3

Calculate (3×3)

$F = ma$ 3

$= 8 \times 2.5$ ... 3

$F = 20$ N ... 3

incorrect/no units(–2)

What (4×3)

$s = ut + \frac{1}{2} at^2$ ... 2×3

$= 0 + \frac{1}{2} (2.5)(5)^2$ ... 3

$= 31.25$ (31) m ... 3

incorrect/no units(–2)

QUESTION 2 - continued

(b) **Define (2×3)**

(K.E.) energy due to / example ... 3
motion ... 3

[$\frac{1}{2} mv^2$ ... 2×3]

State (2×3)

(P.C.E.) energy cannot be created / total energy ... 3
or destroyed / is constant ... 3

Calculate (4×3) KE = $\frac{1}{2} mv^2$ ... 2×3

= $\frac{1}{2}$ (1000) $(20)^2$ ... 3

= 2×10^5 J ... 3

incorrect / no units (–2)

What (3×3) changes / reduced / drops ... 2 × 3

heat / sound / to zero ... 3

QUESTION 3

(a) Define (4×3)

(i) *(temperature)*

degree / °C / measure ... 3
of hotness ... 3
[how hot (cold) ... 2×3]

(ii)*(thermometric property)*

property that changes / an example ... 3
with temperature ... 3

On which (3) length ... 3

Outline (6×3)

Apparatus: mercury thermometer / ice / steam ... 3×3

Method: length in ice (freezing point) ... 3
length in steam (boiling point) ... 3
difference between the two points = 100 ... 3

(b) Give (3×3) elastic collisions / rapid motion /
negligible volume of particles / random motion /
negligible duration of collisions / straight line motion /
KE $\propto$ temperature **any three** ... 3×3

What (2×3) *(Brownian motion)*

molecules (particles) ... 3
motion ... 3

Outline (6×3)

App: smoke cell / lamp / microscope **any two** ... 2×3

Method: fill cell ... 3
with smoke ... 3

Result:

show / state: moving ... 3
particles ... 3

QUESTION 4

Explain (5×3)

(i) (refractive index) $\sin i$ / real depth ... 3
$\div \sin r$ / ÷ apparent depth ... 3

[$1 \div \sin C$ ... 2×3]

(ii) (t.i.r.) angle of incidence / light reflected (bounces) ... 3
greater than / back into ... 3
the critical angle / the denser medium ... 3

Describe (8×3)

Apparatus: pins ... 3
plane mirror (ray box) ... 3
container ... 3

Method: **I** correct arrangement - container and mirror ... 3
- 2 pins ... 3
position of no parallax ... 3
measure (show) R.D. and A.D. ... 3
$n = \frac{\text{R.D.}}{\text{A.D.}}$ ... 3

OR **OR**

II correct arrangement ... 2×3
position of incident & emergent ray ... 3
measure (show) angle *i* and angle *r* ... 3
$n = \frac{\sin i}{\sin r}$ ... 3

What (5×3) $n = \frac{\sin i}{\sin r}$ ... 3

$1.5 = \frac{\sin 40°}{\sin r}$ ... 2×3

$\sin r = 0.43$ (0.4285) ... 3

$r = 25$ ... 3

Give (4×3) reflector on a bicycle (car) / reflective road signs /
examples where prisms are used e.g. binoculars, periscope /
endoscope / telecommunications / optical fibres / etc.
1st correct ... 3×3
2nd correct ... 3

QUESTION 5

(a) What (2×3)

(electric current)	flow / movement	...	3
	charge / electrons	...	3

Describe (8×3) (i) *(heating effect)*

Apparatus:	battery (power supply)	...	3
	element / heating coil / fuse wire	...	3
Method:	turn on the current	...	3
Result:	temperature rises / fuse wire melts	...	3

(ii) *(force on conductor)*

Apparatus:	battery (power supply) / magnet / foil (conductor) **any two**	...	2×3
Method:	turn on the current	...	3
Result:	foil (conductor) moves	...	3
Name(6)	loudspeaker / any moving-coil meter / motor / etc. **any one**	...	6

(b) State (4×3)

I	emf (current) induced	...	3
	$\propto$ rate of change of magnetic flux (field)	...	3
II	current (emf) induced	...	3
	opposes change	...	3
What (6)	opposite direction / left	...	6
What (6)	left	...	6
Give (6)	generator, transformer / etc. **any one**	...	6

QUESTION 6

Any two parts

(a) Define (2×3)

(capacitance)	ratio of charge / charge (Q) divided		...	3
	to potential / V		...	3
Give (2×3)	area / distance / permittivity (dielectric)	**any two**	...	2×3

Describe (5×3)

Apparatus:	parallel plates		...	3
	electroscope		...	3
Method:	correct arrangement		...	3
	change distance (area)		...	3
Result:	$C \propto A$ / $C \propto \frac{1}{d}$		...	3
Give (6)	rectifiers / TVs / electronic flash / tuning of radios / to store charge / etc.	**any one**	...	6

(b) What (3×3)

(monochromatic)	single / one		...	3
	wavelength / frequency / colour		...	2×3

Describe (8×3)

Apparatus:	laser / sodium / monochromatic light		...	3
	diffraction grating / Young's slits		...	3
	screen / spectrometer		...	3
Method:	apparatus arranged correctly		...	2×3
(measurements)	s / n / θ (x, D)	**any two**	...	3
	$n\lambda =$		...	3
	$s \sin\theta$ / $\frac{sx}{D}$		...	3

QUESTION 6 - continued

(c) State (2×3)

(Ohm's law)

voltage (V) ... 3

proportional to current (I) / = RI ... 3

Define (2×3)

(potential difference)

work done / energy required ... 3

unit charge ... 3

[needed for charge to move ... 3]

Calculate (7×3)

(i)

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ ... 3

$\frac{1}{R} = \frac{1}{4} + \frac{1}{4}$ ... 3

$\frac{1}{R} = \frac{2}{4}$ ... 3

R = 2 ohms ... 3

incorrect / no units(–2)

(ii)

$V = R \times I$ ... 3

$6 = 2 \times I$ ... 3

I = 3 amps ... 3

incorrect / no units (–2)

(d) What (4×3)

(i) *(radioactivity)*	decay (disintegration) of nuclei (atoms)	...	3
	with the emission of radiation (energy) (particles)	...	3
(ii) *(half-life)*	time for half / time for a sample	...	3
	nuclei (atoms) to decay / to decrease to half its activity (mass)	...	3
How (3×3)	3 half lives	....	3
	½ × ½ × ½	...	3
	$1/8^{th}$	...	3
State (2×3)	skin burns / leukaemia / cataracts / radiation sickness / bone marrow disease / genetic defects / cancer /death / etc. **any two**	...	2×3
Give (2×3)	don't handle directly / store in safe place / wear protective clothing / reduce duration of exposure / do not eat (drink) near source / etc. **any two**	...	2×3

SECTION II - CHEMISTRY

QUESTION 7

Any eleven parts

(a)	neon	...	6
(b)	region (space) where electrons	...	3
	likely to be found	...	3
(c)	ice / iodine / dry ice / organic solids / etc. **any one**	...	6
(d)	N and 3 bonds	...	3
	correct shape	...	3
(e)	variable valency / coloured compounds / catalysts **any one**	...	6
(f)	heat	...	3
	taken in / absorbed	...	3
	[example ... 3]		
(g)	Al_2O_3	...	6
(h)	40 + 12 + 48 / 100	...	3
	40	...	3
(i)	OH / hydroxyl	...	6
(j)	Na_2SO_4	...	3
	2NaOH	...	3
(k)	$pH = -\log_{10}[H^+]$ / $pH = -\log_{10}(0.01)$	...	3
	$pH = 2$	...	3

(l)	an acid	...	3
	a carbonate	...	3
(m)	vinegar / cellulose acetate / rayon / solvent etc **any one**	...	6
(n)	C_6 / benzene ring with double bonds (circle)	...	3
	H_6	...	3
(o)	1 mole (12 g) = 6×10^{23} / $8 \div 32$ / 0.25	...	3
	1.5×10^{23}	...	3

QUESTION 8

(a) What (4×3)

(i) *(ionic bond)* transfer of electrons / attraction ... 3
from one atom to another / oppositely charged
ions ... 3

[E.N. difference > 1.7 / between a metal and a non-metal ... 3]

(ii) *(electronegativity)* attraction ... 3
for electrons ... 3
[determines what type of bond is formed ... 3]

Using (4×3) Mg = 1.2 ... 3
O = 3.5 ... 3
difference = 2.3 ... 3
> 1.7 ... 3

Give (2×3) name ... 3
formula ... 3

Give (6) high m.p. / high b.p. / crystalline /
solids / hard / brittle / soluble in water /
conduct electricity
any one ... 6

(b) Explain (4×3)

(i) *(mass no.)* number of protons ... 3
and neutrons ... 3

(ii) *(isotope)* same number of protons (atomic number) /
same element (atom) ... 3
different number of neutrons (mass number) ... 3

State (6×3)

	electrons	**protons**	**neutrons**
$^{12}C_6$	6	6	6
$^{14}C_6$	6	6	8

... 6×3

QUESTION 9

(a) State (2×3)

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

Define (2×3)

(heat of combustion)	heat change when one mole	...	3
	burned in oxygen	...	3

Calculate (7×3)

$C_2H_2 \rightarrow 2C + H_2 \quad \Delta H = -225 \text{ kJ mol}^{-1}$ ... 2×3

$2C + 2O_2 \rightarrow 2CO_2 \quad \Delta H = -786 \text{ kJ mol}^{-1}$ ... 2×3

$H_2 + \frac{1}{2} O_2 \rightarrow H_2O \quad \Delta H = -286 \text{ kJ mol}^{-1}$ ... 2×3

$C_2H_2 + 2\frac{1}{2}O_2 \rightarrow 2CO_2 + H_2O \quad \Delta H = -1297 \text{ kJ mol}^{-1}$ ... 3

(b) Explain (6×3)

(i) *(oxidation)*	loss	...	2×3
	of electrons	...	3
(ii) *(reduction)*	gain	...	2×3
	of electrons	...	3
	[words loss and gain in reverse ... 2×3]		

Identify(2×6)

	(*oxidised*): H_2	...	6
	(*reduced*) Cu / CuO	...	6
	[reverse order ... 6]		

What (3)

	CuO	...	3

QUESTION 10

What (6×3)

(i) *(standard solution)*	concentration / molarity	...	2×3
	known	...	3
(ii) *(neutralisation)*	acid	....	3
	a base	...	3
	salt and water	...	3

(i) Describe (5×3)

rinse burette with acid (base) /
rinse pipette with base (acid) /
acid (base)in burette /
read volume of acid(base) /
pipette base (acid) into flask
base (acid) in flask /
add indicator /
add acid to base (base to acid) /
stop when indicator changes colour /
read volume of acid (base)

any five ... 5×3

Give (2×3)

white tile / rinse apparatus with water/
add acid slowly (drop wise) /
swirl flask continuously /
wash down the sides of the flask /
read bottom of the meniscus /
three accurate titres

any two ... 2×3

(ii) Name (6)

any named indicator / universal indicator ... 6

State (2×3)

initial colour in the flask ... 3
final colour at end point ... 3
[reverse order ... 3]

(iii) Calculate (5×3)

$$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2} \quad \text{... } 2\times3$$

$$\frac{M_1 \times 25}{1} = \frac{22.5 \times 0.1}{1} \quad \text{... } 2\times3$$

$$M_1 = 0.09 \quad \text{... } 3$$

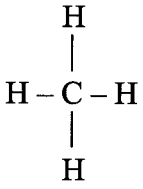
QUESTION 11

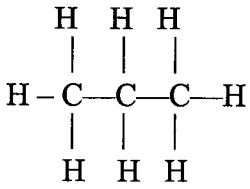
(a) What (4×3)

(i) *(Saturated)* single ... 3
bonds ... 3
[all valencies satisfied... 2×3]

(ii) (homologous series)
successive members differ by CH_2/
same general formula /
gradual change in physical properties /
any one ... 2×3
[same functional group ... 3]

Give (4×3) Methane Propane ... 2×3





... 2×3

Name (2×3) alkanes ... 2×3
[- ane ... 3]

(b) Define (6×3)

(i) *(acid)* proton / H^+ / pH < 7 ... 3
donor ... 3

(ii) *(base)* proton / H^+ / pH > 7 ... 3
acceptor ... 3

(iii) *(conj. pair)* two species / acid + base ... 3
differ by a proton ... 3

Identify (3×6)

(acid) CH_3COOH ... 6

(base) H_2O ... 6
[reverse order ... 6]

(conj. pair) $CH_3COOH + CH_3COO^- / H_2O + H_3O^+$ ... 6

QUESTION 12

Any two parts

(a) What (2×3)

(mole) Avogadro number, of particles / 6 × 10^{23}
molecular mass, in grams / same number of particles as 12 g of C

any one … 2×3

[22.4 litres … 3]

Calculate

(i) (3×3) 12 g ⟶ 1 mole … 3

3 g ⟶ 0.25 mole …. 3

0.25 … 3

(ii) (3×3) 12 + 32 … 3

44 … 3

11 g … 3

incorrect / no units (–2)

(iii) (3×3) 1 mole CO_2 ⟶ 22.4 litres … 3

22.4 × 0.25 … 3

5.6 litres … 3

incorrect / no units (–2)

(b) (i)Why (2×3) conduct … 3
current / electricity … 3

(ii) Name (6) carbon / platinum / stainless steel **any one** … 6

(iii) Name (2×6) X = hydrogen … 6
Y = oxygen … 6

[correct gases in reverse order … 6]

(iv)How (3×3) glowing splint / burns … 3
relights / with a pop … 2×3

(c) What (2×3)	list of elements / in order	...	3
	of activity(reactivity) / ability to lose electrons	...	3
(i) Explain (4×3)	K – very reactive		
	Mg – reacts slowly		
	Cu – no reaction		
	1st correct	...	2×3
	2nd correct	...	3
	3rd correct	...	3
(ii) Describe (2×3)	coated / covered	...	3
	with copper	...	3
	[turns brown ... 2×3]		
(iii) Complete (3×3)	$MgSO_4$, Cu		
	1st correct	...	2×3
	2nd correct	...	3