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Leaving Certificate Examination 2002

Physics & Chemistry

Higher 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 I – 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) 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) 2×3 (o) 2×3

2. Define 2×3 Describe 7×3 State 2×3
   Calculate 3×3 Calculate (i) 2×3 (ii) 3×3 (iii) 3×3

3. What 4×3 Describe 6×3 Calculate 6×3
   State 4×3 Give 2×3

4. (a) State 2×3 Plot 4×3 Explain 2×3 Give 2×3

   (b) What 3×3 Give 3×3 Calculate 4×3
   Name 3 State 3

5. (a) State 2×3 Describe 4×3 (i) What (ii) How 5×3

   (b) State 2×3 Calculate (i) 5×3 (ii) 2×3 (iii) 2×3

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

   (a) State 2×3 Describe 6×3 Name 3 Give 2×3

   (b) Define 2×3 Calculate (i) 3×3 (ii) 3×3 What 2×3 Give 3

   (c) Explain 2×3 Draw 3×3 Explain 3×3 What 2×3 Give3

   (d) What 2×3 (i) Write 3×3 (ii) Calculate 4×3 Name 3 Give 3

SECTION II - CHEMISTRY

Any three questions

7. Any eleven of the following items, (a), (b), (c), etc.
(a) 2×3 (b) 2×3 (c) 2×3 (d) 6 (e) 2×3 (f) 2×3 (g) 6 (h) 2×3
(i) 2×3 (j) 2×3 (k) 2×3 (l) 2×3 (m) 2×3 (n) 2×3 (o) 2×3

8. Define 6×3 Explain 4×3 Use 2×3 State 4×3 Explain 6×3

9. Explain 2×3 Give 2×3 (i) Name 2×3 Describe 6×3
(ii) Name 2×3 (iii) Write 3×3 (iv) Calculate (a) 3×3 (b) 2×3

10. (a) Define 3×3 Identify 4×3

(b) Place 2×3 Name (i) 3 (ii) 3 Give 3 Write 2×3
Describe 2×3

(c) Define 2×3 Calculate 4×3

11 (i) Name 2×3 Draw 4×3 (ii) Identify 2×3 (iii) What 3
Write 3×3 (iv) Give 6, 2×3 (v) Write 4×3 Name 2×3

12. ***Any three of the following parts***. Each part carries 22 marks.

(a) State 6×3 Write 2 What 2

(b) Give 2×2 Calculate 6×3

(c) Explain 2×2 Calculate 6×3

(d) Identify 2×3 Write 2×3 Write 2×3 2×2

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

SECTION I - PHYSICS

QUESTION 1

Any eleven parts

(a)	body remains at rest or uniform motion / constant velocity / no acceleration		…	3
	unless external (outside) (resultant) (unbalanced) force acts		…	3
(b)	force of 1 newton (N)		…	3
	a distance of 1 metre (m)		…	3
	[1 J = 1 N × 1 m / work = force × distance … 3]			
(c)	(i)	absolute zero / 0 K / –273 °C	…	3
	(ii)	volume	…	3
(d)	kinetic energy (speed)		…	3
	of the molecules (particles)		…	3
(e)	obeys Boyle's law (gas laws) / satisfies K. T. assumptions		…	3
	always / exactly / at all temperatures and pressures		…	3
(f)	diagram to show incident ray striking prism at an angle		…	3
	show appropriate emergent rays		…	3
	[no labels … –3]			
(g)	incident ray, normal, reflected ray in same plane		…	3
	angle of incidence (i) = angle of reflection (r)		…	3

QUESTION 1 - continued

(h) $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$ / $-\frac{1}{12}=\frac{1}{4}+\frac{1}{v}$ … 3

$v = 3$ … 3

[behind the mirror … 3 only]

(i) solenoid and current indicated … 3
correct field pattern (one loop above and below) … 3

(j) $C=\frac{\varepsilon A}{d}$ / $C \propto \frac{A}{d}$ … 2×3

[any one quantity omitted … 3 only]

(k) current carrying conductor … 3
in magnetic field experiences force (moves) … 3

(l) labelled axes, i.e. V and t … 3
sinusoidal graph … 3

(m) $P = V \times I$ / $75 = 12 \times I$ … 3

$I = 6.25$ … 3

(n) cancer treatment / cracks in metals / tracers / pacemaker /
power (energy) source / space craft / nuclear bombs (weapons) / etc.
any two… 2×3

[fission / fusion … 0]

(o) (i) alpha … 3
(ii) gamma … 3

QUESTION 2

Define(2×3) *(momentum)* mass … 3
× velocity … 3
[$m \times v$ … 3 only]

Describe(7×3)

Apparatus: timing device, trolley (rider), means of applying force … 2×3
[any one part omitted … 3 only]

Method:
release trolley
determine *s* and *t*
calculate velocity
calculate acceleration
appropriate equations
keep mass (force) constant
determine force (mass) **any four** … 4×3

Result: **State or show**
graph of *F* vs *a* ($\frac{1}{m}$) is a straight line through (0,0) … 3

State (2×3) energy cannot be created / in a closed system … 3
or destroyed / the total energy is constant … 3

Calculate (3×3)

$v^2 = u^2 + 2as$ / $v^2 = 0 + 2 \times 9.8 \times 0.75$ …. 3

$= 14.7$ … 3

$v = 3.8$ m s^{-1} … 3
incorrect / no units (–2)

OR

$s = ut + \_ at^2$ / $0.75 = 0 + 4.9 \times t^2$ … [3]

$t = 0.39$ … [3]

$v = 3.8$ m s^{-1} … [3]
incorrect / no units (–2)

QUESTION 2 - continued

Calculate (i) (2×3)

$v^2 = u^2 + 2as \;/\; 0 = u^2 + 2 \times -9.8 \times 0.3$ …. 3

$u = 2.43 \text{ m s}^{-1}$ … 3

incorrect / no units (–2)

(ii) (3×3)

change in momentum $= mv - mu$ … 3

$= 0.2 \times 2.43 - 0.2 \times -3.8$ … 3

$= 1.25 \text{ kg m s}^{-1}$ … 3

incorrect / no units (–2)

(iii) (3×3)

$F = \dfrac{mv - mu}{t}$ / $F = \dfrac{m(v-u)}{t}$ … 3

$= \dfrac{1.25}{0.15}$ … 3

$= 8.33 \text{ N}$ … 3

incorrect / no units (-2)

QUESTION 3

What (4×3)

(i*nterference*) addition (superposition) of … 3
two waves / waves from more than one source … 3

[constructive (destructive) interference explained with diagrams … 2×3]

(p. effect) emission of electrons / from surface of a metal / by electromagnetic radiation (light) . … 2×3
[any two … 3 only]

Describe(6×3)

Apparatus: monochromatic light source / laser
Young's slits / diffraction grating
spectrometer / screen … 2×3
[any one part omitted … 3 only]

Method: correct arrangement
note slit separation / note grating constant
read angles / measure correct distance
count number of bright lines / record order
calculate wavelength using correct equation
any four … 4×3

Calculate (6×3) (i)

$E = hf$ … 3
$3.3 \times 10^{-19} = 6.6 \times 10^{-34} \times f$ … 3
$f = 5 \times 10^{14}$ Hz … 3
incorrect / no units (–2)

(ii)

$c = f \times \lambda$ … 3
$3 \times 10^{8} = 5 \times 10^{14} \times \lambda$ … 3
$\lambda = 6 \times 10^{-7}$ m … 3
incorrect / no units (–2)

State (4×3)

Apparatus: zinc plate, electroscope, UV source … 3

Method: place zinc plate on cap and charge electroscope negatively … 3

Result: leaves collapse when UV shines … 3

Conclusion: electrons are emitted from the zinc … 3

Give (2×3) burglar alarms / automatic doors / etc. **any two** … 2×3

QUESTION 4

(a)State (2×3) *(Boyle's law)*

fixed mass of gas / at constant temperature /
pressure (p) / inversely proportional to volume ($\propto 1/V$) … 2×3

[any two / $pV = k$ …3 only]

p /kPa	120	140	160	180	200	220	240
$1/V$ /cm^{-3}	0.04	0.048	0.053	0.059	0.067	0.071	0.083

Plot (4×3) axes labelled correctly
plot 5-7 points correctly
one relevant straight line
good distribution (best fit) … 4×3

[graph paper not used … deduct 2×3; p vs V … max 2×3]

Explain (2×3) straight line through the origin … 3

shows pressure $\propto \frac{1}{V}$ … 3

Give (2×3) record atmospheric pressure
wait a few minutes after adjusting pressure before reading the volume
read volume meniscus at eye level
start with maximum pressure
allow apparatus to reach room temperature, etc. **any two** … 2×3

(b)What (3×3) property which changes … 3
continuously (measurably) … 3
with temperature (hotness) … 3

Give(3×3) $\theta/100$ = / θ (°C) = … 3

$\frac{X_{\theta} - X_0}{}$ / T (K) … 3

$X_{100} - X_0$ / –273 … 3

QUESTION 4 - continued

Calculate (4×3) (i)

$$\frac{\theta}{100} = \frac{178 - 65}{240 - 65} \quad \ldots \quad 2\times3$$

OR

$240 - 65 = 175$ and $1\ ^\circ C = 1.75$ … [3]

$178 - 65 = 113$ … [3]

$\theta = 64.57\ (64.6)$ … 3

(ii) $T = 64.57 + 273$

$= 337.57\ (337.6)$ … 3

Name (3) CVGT / thermocouple / resistance / etc. **any one** … 3

State (3) pressure / emf / resistance / etc. **any one** … 3

QUESTION 5

(a)State (2×3) *(Coulomb's law)*

force proportional to (equals a constant times) / product of the charges / and inversely ∝ to the distance squared … 2×3

[any two / $F \propto (= k)\frac{Q_1 Q_2}{r^2}$ … 3 only]

Describe (4×3)

Apparatus: cooking oil, semolina, 2 metal plates, power supply … 2×3
[any one part omitted … 3 only]

Method: correct arrangement … 3

Result: particles of semolina 'line up' along the field lines … 3

(i)What (ii)How (5×3)

$F \propto (= k) \frac{Q_1 Q_2}{r^2}$ … 2×3

distance halved … 3

4 F … 3

$4Q_1$ / $4Q_2$ / $2Q_1$ $2Q_2$ / $\frac{\varepsilon}{4}$ … 3

(b)State (2×3) *(Ohm's law)*

at constant temperature … 3

$V \propto I$ / $V = RI$, R constant … 3

QUESTION 5 - continued

Calculate (i) (5×3) $R = 6 + 2$ / $R = 8$ … 3

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ / $\frac{1}{R} = \frac{1}{8} + \frac{1}{2}$ … 3

$\frac{1}{R} = \frac{5}{8}$ … 3

$R = 1.6$ … 3

$R = 11.6\ \Omega$ … 3

incorrect / no units (–2)

(ii)(2×3) $V = R \times I$ / $9 = 11.6 \times I$ … 3

$I = 0.78$ A … 3

incorrect / no units (–2)

(iii) (2×3) $V = 10 \times 0.78$ … 3

$V = 7.8$ V … 3

incorrect / no units (–2)

QUESTION 6

Any two parts

(a)State (2×3) force proportional to (equals a constant times) /
product of the masses /
inversely ∝ to the distance squared … 2×3

[any two / $F \propto (= G)\ \frac{Mm}{d^2}$ … 3 only]

Describe (6×3) *(Free Fall)*

Apparatus: timer, electromagnet, ball / timer ball … 2×3
[any one part omitted … 3 only]

Method: measure distance, *s*, from ball to trapdoor (ground)
allow ball to fall onto trapdoor (ground)
record time, *t*
graph *s* vs t^2 / repeat and calculate average value for *g*
$g = 2 \times$ slope / $s = \_\ gt^2$ **any four** … 4×3

OR

(Pendulum)
Apparatus: pendulum, stopwatch, cork (support) … [2×3]
[any one part omitted … 3 only]

Method: measure length of pendulum, *l*
allow pendulum to swing for 20 oscillations
determine time for one oscillation
graph *l* vs T^2 / repeat and calculate average value for *g*
$g = 4\pi^2 \times$ slope / $T = 2\pi\sqrt{\frac{l}{g}}$ **any four** … [4×3]

Name (3) mass of the earth / distance from centre of earth … 3

Give(2×3) $g \propto$ … 3

M / $\frac{1}{r^2}$ … 3

[$g = \frac{GM}{r^2}$ … 2×3]

QUESTION 6 - continued

(b) Define (2×3) (*refractive index*)

ratio of sin *i* (the speed in the less dense medium) … 3
to sin *r* (to the speed in the more dense medium) … 3

Calculate (i) (3×3)

$$n = \frac{\sin 40^{o}}{\sin 25^{o}} \quad \ldots \quad 3$$

$$= \frac{0.6428}{0.4226} \quad \ldots \quad 3$$

$$= 1.5 \quad \ldots \quad 3$$

[1.5 and no work shown … 3 only; 1.52 and no work shown … 3×3]

(ii) (3×3) $n = \frac{1}{\sin C}$ / $1.5 = \frac{1}{\sin C}$ … 3

$\sin C = 0.667$ … 3

$C = 42°$ … 3

[42° and no work shown … 3 only;
41.8° (41° 49') and no work shown … 3×3]

What (2×3) total internal … 3
reflection … 3

Give (3) optical fibres (endoscopes) /
reflectors cars (bicycles) /
prisms in binoculars / etc. **any one** … 3

(c) Explain (2×3) emf (voltage) induced /
(*E. induction)* changing flux (magnetic field lines) /
in a closed loop (cut by conductor) … 2×3

[any two / $E = \frac{d\Phi}{dt}$ … 3]

QUESTION 6 - continued

Draw(3×3)		primary coil	…	3
		secondary coil	…	3
		core	…	3
		[no labels deduct 3]		
Explain(3×3)		alternating (changing) current in primary coil	…	3
		alternating (changing) magnetic field in core	…	3
		emf (voltage) induced in secondary	…	3
What(2×3)	(*inc*)	more turns in secondary than primary coil	…	3
	(dec)	fewer turns in secondary than primary coil	…	3
Give(3)		induction coil (motor) / generator / alternator **any one**	…	3

(d) What (2×3) *(mass-energy)*

mass-energy of reactants / loss in mass	…	3
= mass-energy of products / = gain in energy	…	3

[mass and energy are equivalent / $E = mc^2$ … 3 only]

(i)Write (3×3)	$2(^{2}_{1}\text{H})$	…	3
	$^{4}_{2}\text{He}$	…	3
	equation	…	3
(ii) Calculate (4×3)	$2(3.34 \times 10^{-27})$ / 6.68×10^{-27}	…	3
	loss in mass = 0.03×10^{-27}	…	3
	$E = mc^2$ / = $(0.03 \times 10^{-27})(3 \times 10^{8})^2$	…	3
	$E = 2.7 \times 10^{-12}$ J **incorrect / no units (–2)**	…	3
Name (3)	fusion	…	3
Give (3)	sun / stars	…	3

SECTION II - CHEMISTRY

QUESTION 7

Any eleven parts

(a) energy required to remove the first (most loosely bound) (outermost) electron … 3
from a neutral (isolated) (gaseous) atom … 3

(b) negative charge / very small mass / orbits the nucleus / deflection in electric (magnetic) fields / fluorescence **any two** … 2×3

(c) alters (changes) the rate / of a chemical reaction / is not used up in the reaction **any two** … 2×3

(d) H_2SO_4 / HSO_4^- … 6

(e) *(S.A.)* donates protons readily / is largely (100%) dissociated / has a weak conjugate base **any one** … 3

(W.A.) it does not donate protons readily / is slightly dissociated / has a strong conjugate base **any one** … 3

(f) linear [state / show] … 2×3
[symmetrical … 3 only]

(g) O_3 … 6

(h) mass of an atom … 3
compared with $\frac{1}{12}$th of the mass of the C atom … 3

QUESTION 7 - continued

(i) 1 mole = 6×10^{23} molecules / M_r (H_2S) = 34 g / 0.1 moles H_2S … 3
1.8×10^{23} … 3

(j) heat change when 1 mole of a substance (solute) … 3
dissolves in excess solvent (solution) … 3

(k) compound of hydrogen and carbon … 3
containing a benzene ring … 3

[any one property / benzene ring with CH_3 … 3;
ring showing C, H and CH_3 … 2×3]

(l) *(name)* propene … 3
(formula) C_3H_6 … 3

(m) (i) chlorine … 3
(ii) sodium … 3

[(i) Cl^- (ii) Na^+ … 3 only]

(n) 2-chloro … 3
propane … 3

(o) weak acid / forms salts with alkalis / reaction with Na /
substitution with Br_2 / etc. **any two** … 2×3

QUESTION 8

Define(6×3)				
(*E.N.)*	(i)	attraction an atom (element) has	…	3
		for a shared pair of electrons	…	3
(ionic b.)	(ii)	attraction / transfer of electrons	…	3
		between oppositely charged ions / between two atoms	…	3
		[E. N. difference > 1.7 … 3 only]		
(polar cov. b.)	(iii)	unequal sharing (distribution) / slightly different E.N. (E. N. difference < 1.7)	…	3
		of electrons (charge) in a bond / between two atoms	…	3
Explain(4×3)	(a)	decrease in atomic radius	…	3
		increase in nuclear charge	…	3
	(b)	increase in atomic radius	…	3
		screening effect of inner electrons	…	3
Use (2×3)	(a)	covalent	…	3
	(b)	ionic	…	3
State (4×3)		*(graphite)* covalent *(I_2)* molecular		
		(Cu) metallic *(KCl)* ionic	…	4×3
Explain (6×3)	(i)	(Cu) free electrons		
		(I_2) no free electrons	…	2×3
	(ii)	ions in KCl / no ions in graphite	…	3
		attraction for water / no attraction for water	…	3
		[KCl ionic (polar) / graphite non-polar … 3		
		water polar … 3]		
	(iii)	I_2 non-polar	…	3
		'like dissolves like'	…	3

QUESTION 9

Explain (2×3) *(p. standard)*

pure substance	…	3
used to make a solution of known concentration	…	3

Give (2×3)

stable in air			
dissolves easily in water			
fairly high relative molecular mass			
rapid and complete reaction in volumetric analysis			
not hydrated	**any two**	…	2×3

(i)Name (2×3)

(a) *(acid)* – burette		…	3
(b) *(base)* – pipette		…	3

Describe (6×3)

(burette)

wash with deionised water			
wash with acid			
fill above zero mark			
bring meniscus to zero / ensure part below tap is filled			
allow acid to flow			
read meniscus	**any three**	…	3×3

(pipette)

wash with deionised water			
wash with base			
fill pipette above mark			
bring meniscus to mark			
allow base to run into flask			
touch tip to side of flask / don't blow out last drop			
	any three	…	3×3

(ii)Name (2×3)

methyl orange (red)		…	3
yellow (orange) to red (pink)		…	3

QUESTION 9 - continued

(iii)Write (3×3) **LHS**: Na_2CO_3 + HCl … 3

RHS: NaCl + H_2O + CO_2 … 3

Balanced: Na_2CO_3 + 2HCl $\rightarrow$ 2NaCl + H_2O + CO_2 … 3

(iv)Calculate (a)(3×3)

$$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$$ … 3

$$\frac{M_1 \times 22.3}{2} = \frac{0.1 \times 20}{1}$$ … 3

M_1 = 0.18 (0.179) M (moles /litre) … 3

incorrect / no units(–2)

(b) (2×3) M_r of HCl = 36.5 … 3

conc. (g/litre) = 6.5 – 6.6 (6.547) … 3

QUESTION 10

(a)Define (3×3)

(i) *(oxidation)* loss … 3
of electrons … 3

(ii) *(reduction)*gain of electrons … 3

Identify (4×3) *(ox):* Cu I^- (KI) … 2×3

(red): S Cl_2 … 2×3
[in reverse order … 3 only]

(b)Place (2×3) K Ca Mg Zn Fe Cu … 2×3
[3 in correct order / all in reverse order … 3]

Name (i)(3) copper … 3

(ii) (3) potassium … 3

Give (3) copper is unreactive /
potassium is very reactive … 3

Write (2×3) $Zn + CuSO_4$ … 3
$\rightarrow ZnSO_4 + Cu$ … 3

Describe(2×3) zinc becomes coated (turns brown) with /
zinc displaces … 3
copper … 3

(c) Define (2×3)

(electrolysis) electric current (electricity) produces … 3
chemical reaction … 3

Calculate (4×3) $Q = It$ / $Q = 4 \times 772$ … 3

$Q = 3088$ … 3

96 500 C (1 F) produces 108 g … 3

3.5 g … 3

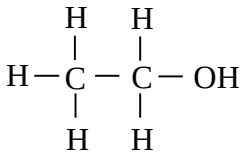
incorrect / no units (–2)

QUESTION 11

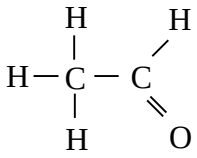
(i) Name (2×3) alcohols … 3

aldehydes … 3

Draw (4×3)



… 2×3



… 2×3

[molecular formulae only … 3 each]

(ii) Identify (2×3)

(acid) sulphuric … 3

(ox. agent) sodium (potassium) dichromate (chromate) / potassium permanganate … 3

(iii) What (3) red (yellow) solid is formed … 3

Write (3×3) CH_3CHO + … 3

$C_6H_5NHNH_2 \rightarrow$ … 3

$CH_3CHNNHC_6H_5 + H_2O$ … 3

(iv) Give (6, 2×3) ethanoic (acetic) acid … 6

CH_3COOH … 2×3

[– COOH … 3 only]

(v) Write (4×3)

(a) $C_2H_5OH \rightarrow$ … 3

$C_2H_4 + H_2O$ / $C_2H_5OC_2H_5 + H_2$ … 3

(b) $C_2H_5OH + Na \rightarrow$ … 3

$C_2H_5ONa + H_2$ … 3

Name (2×3) ethene / ethoxyethane (diethyl ether) … 3

sodium ethoxide … 3

QUESTION 12

Any three parts

(a) **State(6×3)**

(energy levels)	(i)	fixed (discrete) (specific) levels of energy	… 3
		which an electron in an atom can have	… 3
(sub-level)	(ii)	group of orbitals / e.g. p-subshell has three p-orbitals	… 3
		having same energy	… 3
		OR	
		an energy level may be split	… [3]
		into two / more levels of energy	… [3]
(orbitals)	(iii)	region (space) (area) around nucleus	… 3
		where electrons are likely to be found	… 3
Write (2)		$1s^2\ 2s^2\ 2p^6$	… 2
What (2)		neon	… 2

(b) **Give (2×2)**

	(i)	combustion reactions / anhydrous $CuSO_4$ and water / etc.	… 2
	(ii)	water and ammonium nitrate (ammonium chloride) (sherbet) / etc.	… 2

Calculate (6×3)

$\Delta H = \Delta H_{products} - \Delta H_{reactants}$	…	3
$2(NO_2)$ / $\Delta H_{products} = 2 \times 31$	…	3
$2(NO)$ / $\Delta H_{reactants} = 2 \times 90 + 0$	…	2×3
$\Delta H = 62 - 180$	…	3
$= -118$	…	3

OR

$\_\ N_2 + \_\ O_2 \rightarrow NO \quad \Delta H = 90$ … [3]

$\_\ N_2 + O_2 \rightarrow NO_2 \quad \Delta H = 31$ … [3]

$2NO \rightarrow N_2 + O_2 \quad \Delta H = -180$ … [2×3]

$N_2 + 2O_2 \rightarrow 2NO_2 \quad \Delta H = 62$ … [3]

$\Delta H = -118$ … [3]

(c) Explain(2×2) pass the gas through … 2
a tower of quicklime (lime) … 2

Calculate (6×3)

(i) M_r of $NH_4Cl = 53.5$ … 3

0.05 moles NH_4Cl … 3

M_r of $Ca(OH)_2$ = 74 / 0.025 moles of $Ca(OH)_2$ … 3

1.85 g … 3
incorrect / no units (–2)

(ii) 3×10^{22} … 3

(iii) 1.12 litres … 3
incorrect / no units (–2)

(d)Identify (2×3)

(i) SO_3 … 3
(ii) MgO … 3

Write (2×3) $SO_3 + H_2O \rightarrow$ … 3

H_2SO_4 … 3

Write (2×3, 2×2) MgO + … 3

$2HCl \rightarrow$ … 3

$MgCl_2 + H_2O$ … 2×2