



# **Coimisiún na Scrúduithe Stáit** **State Examinations Commission**

*Scéimeanna Marcála*

*Scrúduithe Ardteistiméireachta, 2003*

*Fisic agus Ceimic*

*Ardleibhéal*

*Marking Scheme*

*Leaving Certificate Examination, 2003*

*Physics and Chemistry*

*Higher Level*

# **Leaving Certificate Examination**

**2003**

## **Physics & Chemistry Higher Level**

### **Marking Scheme**

**CONFIDENTIAL**

**SECTION I – PHYSICS**

**Answer any three questions**

1. Answer ***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, 6                      State 3×3                      Explain 3×3                      Describe 6×3  
Calculate (i) 3×3                      (ii) 3×3
3. State 4×3    Describe 6×3    Draw 3×3    Find 4×3    Use 5×3
4. State 2×3    Draw 3×3    Explain 2×3    Plot 4×3  
Explain 3×3    Calculate 4×3    How 3    How 6    Give 3
5. (a)    Define 2×3    Give 2×3    Describe 4×3    Calculate 4×3  
(b)    State 2×3    Describe 3×3    Calculate 3×3    Give 2×3
6. ***Answer any two of the following parts.*** Each part carries 33 marks.  
(a)    Give 2×3    Use 3×3    Calculate 6×3  
(b)    Explain 4×3    Describe 3×3    Calculate 4×3  
(c)    (i)Name 2×3    What 6    (ii)What 2×3    Explain 3×3    (iii)What 6  
(d)    Explain 3×3    Describe 4×3    Write 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.**

## SECTION II - CHEMISTRY

### Answer any three questions

7. Answer *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
8. (a) Define 4×3 Sketch 3 Identify 2×3  
(b) Explain 4×3 Calculate 4×3  
(c) What 2×3 Give 6 Explain 3×3
9. (a) State 2×3 What 2×3 Calculate 7×3  
(b) Write 3×3 (i) State 2×3 Describe 4×3 (ii) Write 2×3
10. Define 3×3 Identify 4×3 Write 2×3 (i) Express 2×3  
(ii) Calculate 3×3 (iii) Calculate 3×3 Explain 5×3
11. Explain 4×3 (i) 4×3 (ii) 6 3×3 (iii) 3×6 (iv) 3×3
12. *Answer any three of the following parts.* Each part carries 22 marks  
(a) Define 4×3 Identify 2×3 2×2  
(b) State 2×3 Write 2×3 Calculate 2×3 2×2  
(c) Describe 2×3 Sketch 3×3 State 3 Explain 2×2  
(d) Define 2×3 Calculate 4×3 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.**

## CONFIDENTIAL

<b>SECTION I - PHYSICS</b>
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### QUESTION 1

**Any eleven parts**

- (a)  $W = mgh$  /  $W = (100)(9.8)(15)$  ... 3  
 $W = 14,700$  ... 3
- (b) when A exerts a force on B / to every action ... 3  
B exerts an equal but opposite force on A /  
there is an equal but opposite reaction ... 3
- (c) the separation (splitting, spreading) of light ... 3  
into its constituent colours (different wavelengths) ... 3  
[ good diagram ... 2×3]
- (d)  $W = VQ$  /  $30 = V \times 2.5$  ... 3  
 $V = 12$  ... 3
- (e) A = compression ... 3  
B = rarefaction ... 3  
[reverse order ... 3 only]
- (f) current carrying conductor in a magnetic field ... 3  
experiences a force (moves) ... 3
- (g) two parallel conductors / 1 metre apart / in a vacuum /  
exert a force of  $2 \times 10^{-7}$  N/m ... 2×3  
**any two** ... (3)

**QUESTION 1 ( continued )**

- |     |  |         |            |            |
|-----|--|---------|------------|------------|
| (h) | 100 / $X_0 - X_0 \div$ / $X_{100} - X_0$<br>[ T- ... 3 273 ... 3 ]<br>[100 / $X_{100} - X_0 \div$ $X_0 - X_0$ ... 3 ]                                      | any two | ...<br>... | 2×3<br>(3) |
| (i) | total<br>internal reflection   |         | ...<br>... | 3<br>3     |
| (j) | infrared ultraviolet X-rays gamma<br>[all in reverse order / 3 consecutively correct ... 3]  |         | ...        | 2×3        |
| (k) | small current / low voltage and high current<br>heating effect of electric current / $P \propto I^2$   |         | ...<br>... | 3<br>3     |
| (l) | emission of electrons<br>when electromagnetic radiation (light) of suitable frequency<br>falls on the metal / UV light shines on zinc / light on sodium... |         | ...<br>... | 3<br>3     |
| (m) | positive charge on the sphere close to the charged rod<br>negative charge on opposite side of the sphere   |         | ...<br>... | 3<br>3     |
| (n) | light (small) nuclei join<br>to form a heavier (larger) nucleus  |         | ...<br>... | 3<br>3     |
| (o) | loss in mass<br>converted to energy / $E = mc^2$   |         | ...<br>... | 3<br>3     |

1/2

## QUESTION 2

### Define (2×3, 6)

(i) ( <i>momentum</i> )	mass	...	3
	× velocity	...	3
(ii) ( <i>kinetic energy</i> )	energy due to motion / $\frac{1}{2}mv^2$	...	6

### State (3×3)

(PCM)	no external forces / closed system	...	3
	momentum before = / $m_1u_1 + m_2u_2 =$	...	3
	momentum after / $m_1v_1 + m_2v_2$	...	3

### Explain (3×3)

spacecraft expels gases with a certain momentum	...	3
the spacecraft gains the same momentum	...	3
in the opposite direction	...	3

[ diagram / if momentum is not mentioned ... 6 max ]

### Describe (6×3)

<i>App:</i>	2 trolleys, timing device, means of joining (separating)		
	<b>any two</b>	...	3

<i>Method:</i>	correct arrangement shown (stated )	...	3
	measure the mass of both trolleys	...	3
	give push (release the spring)	...	3
	explain how to measure velocity	...	3
	explain how the result verifies P.C.M. / $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$	...	3

## QUESTION 2 ( continued )

**Calculate (i) (3×3)**

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2 \quad \dots \quad 3$$

$$(0.16)(2.5) + (0.16)(0) = (0.16) v + (0.16)(2.4) \quad \dots \quad 3$$

$$v = 0.1 \text{ m s}^{-1} \quad \dots \quad 3$$

**incorrect / no units (-1)**

**(ii) (3×3)**      $E_k \text{ initially} \quad \frac{1}{2} (0.16)(2.5)^2 \quad / \quad 0.5 \quad \dots \quad 3$

$$E_k \text{ finally} \quad \frac{1}{2} (0.16)(0.1)^2 + \frac{1}{2} (0.16)(2.4)^2 \quad / \quad 0.46 \quad \dots \quad 3$$

$$E_k \text{ lost} \quad 0.04 \text{ J} \quad \dots \quad 3$$

**incorrect / no units (-1)**



### QUESTION 3

**State (4×3) (laws of refraction)**

- |           |  |     |   |
|-----------|--|-----|---|
| <b>I</b>  | incident ray ( <b>angle</b> ), refracted ray ( <b>angle</b> ) and normal are in the same plane | ... | 3 |
|           |  | ... | 3 |
| <b>II</b> | $\sin i \propto \frac{\sin r}{\text{constant}}$ / $\sin i = \text{constant} \sin r$            | ... | 3 |
|           |  | ... | 3 |

**Describe (6×3)**

- |           |  |     |     |
|-----------|--|-----|-----|
| <b>I</b>  | <i>Apparatus:</i> glass block, pins (ray), paper                                 | ... | 3   |
|           | <i>Method:</i> correct arrangement shown (stated )                               | ... | 3   |
|           | incident and emergent ray defined  | ... | 3   |
|           | draw normal and refracted ray (shown / stated)                                   | ... | 3   |
|           | measure correct <b><i>i</i></b> and <b><i>r</i></b>                              | ... | 3   |
|           | refractive index = $\sin i / \sin r$   |     |     |
|           | (slope of graph of $\sin i$ vs $\sin r$ )  | ... | 3   |
| <b>II</b> | <i>Apparatus:</i> glass block, powder, travelling microscope                     | ... | (3) |
|           | <i>Method:</i> correct arrangement shown (stated )                               | ... | (3) |
|           | mark on paper, focus microscope  |     |     |
|           | and read the scale (x)   | ... | (3) |
|           | glass block over mark & read scale(y)  | ... | (3) |
|           | powder on block & read scale (z)   | ... | (3) |
|           | refractive index = $\frac{\text{real depth (z-x)}}{\text{apparent depth (z-y)}}$ | ... | (3) |

- |                   |                         |     |   |
|-------------------|-------------------------|-----|---|
| <b>Draw (3×3)</b> | object inside the focus | ... | 3 |
|                   | one correct ray         | ... | 3 |
|                   | second ray and image    | ... | 3 |

### QUESTION 3 ( continued )

**Find (4×3)**

$$v = 3u \quad \dots \quad 3$$

$$1/f = 1/u + 1/v \quad / \quad 1/12 = 1/u - 1/3u \quad \dots \quad 3$$

$$2/3u = 1/12 \quad \dots \quad 3$$

$$u = 8 \text{ cm} \quad \dots \quad 3$$

**incorrect / no units (-1)**

**Use (5×3)**

two converging lenses

show focal lengths of lenses

formation of intermediate image

$I_1$  at or inside  $f_e$

consistent rays from  $I_1$  to  $I_2$  ... 5×3

## QUESTION 4

### State (2×3)

(Ohm's law) at constant temperature ... 3  
 $V \propto I$  /  $V = RI$ ,  $R$  constant ... 3

$V/V$	0.5	1.5	2.5	3.5	4.5	5.5	6.5
$I/A$	0.03	0.09	0.15	0.21	0.26	0.33	0.38

### Draw (3×3)

power supply (battery), ammeter, voltmeter,  
rheostat, metallic conductor ... 2×3  
[any two ... 3]  
correct arrangement ... 3

### Explain (2×3)

explain how to vary  $V/I$  ... 3  
read  $I$  and  $V$  ... 3

### 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]

### Explain (3×3)

straight line  
through the origin  
shows that  $V \propto I$  /  
verifies Ohm's law (if correct at start) ... 3×3

### QUESTION 4 - continued

**Calculate (4×3)**

equation for the slope	...	3
two points on the line	...	3
resistance ( 16 – 17 ) ohms	...	2×3

**incorrect / no units (–1)**

[ calculate resistance from average ...6 only]

**How (3)**

immerse in a beaker of water (non-conducting liquid / ice / a flow of cold water)/ blow cold air	...	3
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**How (6)**

non-linear (stated / implied) [ reference to resistance ... 3]	...	6
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**Give (3)**

use a small current/more accurate ammeter (voltmeter) etc. ...	...	3
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## QUESTION 5

**(a) Define (2×3)**

*(capacitance)*

ratio of charge	...	3
to potential (voltage, p.d.)	...	3

$[C = Q/V \quad \dots 3 ; \text{explain the three terms } \dots 3]$

**Give (2×3)**

distance between the plates		
common area		
permittivity (dielectric)	<b>any two</b>	...
		2×3

**Describe (4×3)**

*Apparatus:*

parallel plates, detector	...	3
---------------------------	-----	---

*Method:*

correct arrangement	...	3
increase (decrease) distance (area) (permittivity)	...	3

*Result:*

divergence of leaves increases (decreases)		
capacitance decreases (increases)	...	3

**Calculate (4×3)**

(i) $C = C_1 + C_2 \quad / \quad C = 4 + 2 \quad / \quad C = 6$	...	3
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$1/C = 1/C_1 + 1/C_2 \quad / \quad 1/C = 1/9 + 1/6$	...	3
---	-----	---

$C = 3.6 \mu\text{F}$	...	3
-----------------------	-----	---

**incorrect / no units (–1)**

$[5 \div 18 \quad / \quad 10.3 \mu\text{F} \quad \dots \quad 2 \times 3 \text{ max}]$

(ii) $Q = 2.16 \times 10^{-5} \text{ C}$	...	3
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**incorrect / no units (–1)**

### QUESTION 5 ( continued )

**(b) State (2×3)**

<i>(Faraday's law)</i>	induced emf (current) proportional to	...	3
	rate of change of flux	...	3

**Describe (3×3)**

*Apparatus:* coil, galvanometer, magnet ... 3

*Method:* move magnet relative to coil ... 3

*Result:* deflection in the galvanometer ... 3

[ Lenz's law ... deduct 3]

**Calculate (3×3)**

$$V_{in} / V_{out} = N_p / N_s \quad \dots \quad 3$$

$$230 / V_{out} = 4000 / 200 \quad \dots \quad 3$$

$$V_o = 11.5 \text{ V} \quad \dots \quad 3$$

**incorrect / no units (–1)**

**Give (2×3)**

- use an iron core
- lamine the core
- use thick wires ( wires of low resistance )
- tightly wound coils etc.

**any two** ... 2×3

### QUESTION 6

**Answer any two parts**

**(a) Give (2×3)**  $F \propto (=) / GM_1M_2 / 1/d^2$  ... 2×3  
**[any two ... 3 only]**

<b>Use (3x3)</b>	$F = GMm/d^2$	...	3
------------------	---------------	-----	---

$$F = m \times g \qquad \dots \qquad 3$$

$$mg = GMm/r^2 \quad \dots \quad 3$$

**Calculate (6×3)**

(i)  $r = (6.38 \times 10^6) + (5.74 \times 10^5) / 6.954 \times 10^6 \quad \dots \quad 3$

$$g = \frac{(6.67 \times 10^{-11})(5.98 \times 10^{24})}{(6.954 \times 10^6)^2} \quad \dots \quad 2 \times 3$$

$$g = 8.25 \text{ m s}^{-2} \quad \dots \quad 3$$

**incorrect / no units (−1)**

(ii)  $W = mg / W = 80 \times 8.25 \dots 3$

$$W = 660 \text{ N} \qquad \dots \qquad 3$$

**incorrect / no units (−1)**

[ accept  $W = 784 \text{ N}$  for  $g = 9.8$  ]

### QUESTION 6 ( continued )

#### (b) Explain (4×3)

(i) (*ideal gas*)

obeys Boyle's law (gas laws)(satisfies K.T. assumptions) ... 3

always (exactly)(at all temperatures and pressures) ... 3

(ii) (*Brownian movement*)

constant (continuous) motion of particles (molecules) ... 3

in a fluid (liquid or gas ) ... 3

#### Describe (3×3)

microscope, smoke cell(cell and light source) ... 3

correct arrangement ... 3

observation ... 3

#### Calculate (4×3)

$PV = nRT$  ... 3

$(150 \times 10^3)(1.2 \times 10^{-3}) = 0.07 (8.3)T$  ... 3

$T = 310$  ... 3

$^{\circ}\text{C} = 37$  ... 3



### QUESTION 6 (continued)

(c) (i) Name (2×3)	diffraction / light spreads out	...	3
	interference	...	3
What (6)	light is a wave	...	6
(ii) What (2×3)	bright and dark	...	3
	fringes / spots	...	3
Explain (3×3)	two waves meet	...	3
	interfere constructively / bright	...	3
	interfere destructively / dark	...	3
[no diagram –3]			
(iii) What (6)	wavelength	...	6
(d) Explain (3×3) (radioactive)	the decay (disintegration) of nuclei / unstable	...	3
	with the emission of radiation (alpha/gamma/energy)	...	3
	(beta particle) electron / ${}^0_{-1}e$	...	3
<b>Describe (4×3)</b>			
Apparatus	detector, beta source	...	3
Method	correct arrangement	...	3
	vary distance / detect track	...	3
Result	count changes accordingly / measure length of track	...	3
[ cloud chamber ... 4×3; penetrating power ... deduct 3]			
Write (4×3)	${}^{14}_6\text{C}$	...	3
	${}^{14}_7\text{N}$	...	3
	${}^0_{-1}e$ / ${}^0_{-1}\beta$	...	3
	correct order	...	3

SECTION II – CHEMISTRY
------------------------

### QUESTION 7

- |     |  |                |     |     |
|-----|--|----------------|-----|-----|
| (a) | (i) 20 neutrons  | ...            | 3   |     |
|     | (ii) 18 electrons  | ...            | 3   |     |
|     |  |                |     |     |
| (b) | named solvent e.g. hexane, cyclohexane, benzene, toluene etc.<br>[ non-polar solvent ... 3 only] | ...            | 6   |     |
|     |  |                |     |     |
| (c) | attraction an atom (element) has<br>for a shared pair of electrons                               | ...            | 3   |     |
|     |  | ...            | 3   |     |
|     |  |                |     |     |
| (d) | $h$ = Planck's constant<br>$f$ = frequency   | ...            | 3   |     |
|     |  | ...            | 3   |     |
|     |  |                |     |     |
| (e) | the decomposition of a substance<br>by water   | ...            | 3   |     |
|     |  | ...            | 3   |     |
|     |  |                |     |     |
| (f) | specifies the energy level<br>of an electron   | ...            | 3   |     |
|     |  | ...            | 3   |     |
|     |  |                |     |     |
| (g) | graphite, diamond, quartz, carborundum etc.  | <b>any two</b> | ... | 2×3 |
|     |  |                |     |     |
| (h) | complete: $\text{Ca(OH)}_2 + \text{H}_2$   | ...            | 3   |     |
|     | Balance: $\text{Ca} + 2\text{H}_2\text{O}$   | ...            | 3   |     |
|     |  |                |     |     |
| (i) | nickel   | ...            | 3   |     |
|     | manganese  | ...            | 3   |     |

### QUESTION 7 (continued)

- |     |   |            |        |
|-----|---|------------|--------|
| (j) | $M_r$ of $\text{CaCO}_3 = 100$<br><div style="text-align: right; margin-right: 100px;">40</div>   | ...<br>... | 3<br>3 |
|     |   |            |        |
| (k) | heat change<br>when a reaction takes place according to a given chemical equation / when the number of moles indicated in the balanced equation react completely  | ...<br>... | 3<br>3 |
|     |   |            |        |
| (l) | $\text{Mg}$ $\text{Zn}$ $\text{Fe}$ $\text{Cu}$<br>[all in reverse order / 3 consecutively correct ... 3]   | ...        | 2×3    |
|     |   |            |        |
| (m) | alters (changes) the rate<br>of a reaction / is not used up in the reaction   | ...<br>... | 3<br>3 |
|     |   |            |        |
| (n) | functional group<br>two alkyl groups (one hydrogen and one alkyl group)   | ...<br>... | 3<br>3 |
|     |   |            |        |
| (o) | nitro<br><div style="text-align: right; margin-right: 100px;">benzene / phenyl</div> <div style="text-align: right; margin-right: 100px;">[ <math>\text{C}_6\text{H}_5\text{NO}_2</math>   ...   3]</div> | ...<br>... | 3<br>3 |

## QUESTION 8

**(a) Define (4×3)**

**(i) (atomic number)**

number of protons	...	3
in the nucleus (atom)	...	3

**(ii) (atomic orbital)**

region (space) around the nucleus	...	3
where electrons are most likely to be found	...	3

[ path the electron takes around the nucleus ... 3]

Sketch (3) dumb-bell shape	...	3
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**Identify (2×3)**

Silicon	...	3
sodium ion ( $\text{Na}^+$ )	...	3

**(b) Explain (4×3)**

**(i) (R.A.M.)**

mass of an atom	...	3
compared with $\frac{1}{12}$ th of the mass of the carbon atom	...	3

**(ii) (isotope)**

atoms of the same element / with same atomic number that have different mass numbers	...	3
(atomic mass / no. of neutron )	...	3

**Calculate (4×3)**

80 × 20 (1600)	...	3
----------------	-----	---

10 × 21 (210)          10 × 22 (220)	...	3
--------------------------------------	-----	---

2030	...	3
------	-----	---

20.3	...	3
------	-----	---

## QUESTION 8 (continued)

### (c) What (2×3)

*(1<sup>st</sup> I.E.)*

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

### Give (6)

increase in atomic radius					
screening effect of inner electrons		<b>any one</b>	...		6

### Explain (3×3)

*(K lower 1<sup>st</sup> I.E. than Ca )*

outer electron in K (Ca) farther from (closer to) the nucleus /  
 larger (smaller) atomic radius /  
 lower (higher) number of protons in the nucleus (nuclear charge) /  
 full sub-shell in Ca and more energy required (extra stability) /  
 not full sub-shell in K and less energy required (less stable) /

*(K higher 2<sup>nd</sup> I.E. than Ca)*

electron removed from full (half-full) shell (sublevel)

full shell requires more energy (is more stable) /  
 (half-full sublevel requires less energy (is less stable))

<b>any one</b>	...				2×3
<b>2<sup>nd</sup> correct</b>	...				3

## QUESTION 9

**(a) State (2×3)**

*(Hess's law)*

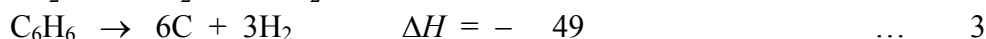
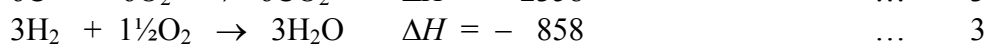
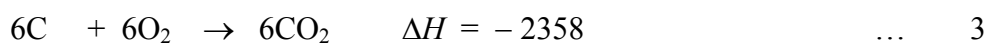
heat for a reaction	...	3
independent of the path followed	...	3

**What (2×3)**

*(heat of comb)*

heat change when one mole	...	3
burned in oxygen (completely)(excess)	...	3

**Calculate (7×3)**



$\Delta H = -3265 \text{ kJ mol}^{-1}$	...	2×3
<b>incorrect / no units (-1)</b>		

**(b) Write (3×3)  $\text{Na}_2\text{O}$**

$\text{Al}_2\text{O}_3$

$\text{FeO}$  (  $\text{Fe}_2\text{O}_3$  )

	...	3×3
--	-----	-----

**(i) State (2×3)**

basic

amphoteric

basic (amphoteric)

**any two**

	...	2×3
--	-----	-----

**Describe (4×3)**

*Sodium(aluminium) oxide*

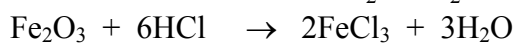
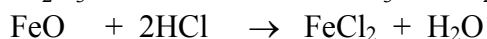
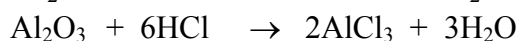
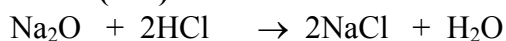
white / crystalline / solid

*FeO (  $\text{Fe}_2\text{O}_3$  )*

black (brown, red) / powder / solid

<b>any two properties for any two compounds</b>	...	4×3
---	-----	-----

**(ii) Write (2×3)**



<b>any one complete /LHS</b>	...	3
------------------------------	-----	---

<b>balanced / RHS</b>	...	3
-----------------------	-----	---

### QUESTION 10

**Define (3×3)**

(i) (*base*)      proton acceptor      ...      3

(ii) ( <i>conj pair</i> ) acid and a base / two species	...	3
which differ by a proton	...	3
[ example ... 3 only]		

### Identify (4×3)

$$\text{NH}_3 \quad \text{OH}^- \quad \dots \quad 2 \times 3$$
$$\text{OH}^- \quad \text{C}_2\text{H}_5\text{COO}^- \quad \dots \quad 2 \times 3$$

**Write (2x3)**  $\text{NH}_3, \text{NH}_4^+$  /  $\text{H}_2\text{O}, \text{OH}^-$  ... 3

$$\text{OH}^-, \text{H}_2\text{O} \quad / \quad \text{C}_2\text{H}_5\text{COOH}, \text{C}_2\text{H}_5\text{COO}^- \quad \dots \quad 3$$

**(i) Express (2×3)**

$$M_r \text{ of NaOH} = 40 \text{ / conc (g/l)} = 0.09 \times 40 \quad \dots \quad 3$$

3.6 ... 3

**(ii) Calculate (3×3)**

$pH = -\log [H^+] / pOH = -\log [OH^-] / pOH = -\log [0.09]$   
**any one** ... 3

$pOH = 1.1$  ... 3

$pH = 12.9$  ... 3

### QUESTION 10 (continued)

#### (iii) Calculate (3×3)

$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \quad \dots \quad 3$$

$$\frac{M_1 \times 9}{1} = \frac{0.09 \times 20}{2} \quad \dots \quad 3$$

$$M = 0.1 \quad \dots \quad 3$$

#### Explain (5×3)

(i) easier to detect colour change (end-point) ... 3  
... 3

(ii) to determine the approximate end-point/ point of neutralisation / volume of acid added ... 3

(iii) all chemicals / no chemicals / reaction is ... 3  
 reacts / remain on the sides / complete ... 3



## QUESTION 11

### Explain (4×3)

- |                          |   |                |
|--------------------------|---|----------------|
| (i) ( <i>h. series</i> ) | successive members differ / group of compound with<br>by CH <sub>2</sub> / same general formula (functional group)          | ... 3<br>... 3 |
| (ii) ( <i>fun. gp.</i> ) | atom (group of atoms) which determine / reactive part<br>the chemical properties / of a molecule<br>[correct example ... 3] | ... 3<br>... 3 |

### (i) (4×3)

- |                 |                          |       |
|-----------------|--------------------------|-------|
| <b>Identify</b> | X = ethanol              | ... 3 |
|                 | Y = conc. sulphuric acid | ... 3 |

- |              |  |       |
|--------------|--|-------|
| <b>Write</b> | C <sub>2</sub> H <sub>5</sub> OH →               | ... 3 |
|              | C <sub>2</sub> H <sub>4</sub> + H <sub>2</sub> O | ... 3 |

### (ii) (6, 3×3)

- |             |              |       |
|-------------|--------------|-------|
| <b>Name</b> | X = alcohols | ... 6 |
|-------------|--------------|-------|

- |             |                   |       |
|-------------|-------------------|-------|
| <b>Draw</b> | – C – OH          | ... 3 |
|             | remainder correct | ... 3 |

- |             |               |       |
|-------------|---------------|-------|
| <b>Name</b> | hydroxyl / OH | ... 3 |
|-------------|---------------|-------|

### (iii) (3×6)

- |             |                        |       |
|-------------|------------------------|-------|
| <b>What</b> | addition / bromination | ... 6 |
|-------------|------------------------|-------|

- |             |  |       |
|-------------|--|-------|
| <b>Give</b> | bromine water (bromine in 1,1,1-trichloroethane) | ... 6 |
|-------------|--|-------|

- |                |                      |       |
|----------------|----------------------|-------|
| <b>Explain</b> | decolourises / clear | ... 6 |
|----------------|----------------------|-------|

### (iv) (3×3)

- |             |        |       |
|-------------|--------|-------|
| <b>Name</b> | butene | ... 3 |
|-------------|--------|-------|

- |             |                            |         |
|-------------|----------------------------|---------|
| <b>Give</b> | any two correct properties | ... 2×3 |
|-------------|----------------------------|---------|

## QUESTION 12

### Answer any three parts

#### (a) Define (4×3)

(i) (ox. agent)	gain	...	3
	of electrons	...	3
(ii) (red. agent)	loss	...	3
	of electrons	...	3

#### Identify (2×3, 2×2)

(ox. agent)	O <sub>2</sub>	...	3
	Cl <sub>2</sub>	...	3
(red. agent)	Ca	...	2
	KBr / Br <sup>-</sup>	...	2

#### (b) State (2×3) (Faraday's Law)

mass of element liberated (deposited)	...	3
$\propto$ charge (Q)( I×t ) (quantity of electricity) / = $zIt$ / = $zQ$	...	3

[ 2<sup>nd</sup> law      ...      3 max]

Write (2×3)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	equation	...	3
		balanced	...	3

#### Calculate (2×3 2×2)

2F (2 × 96 500) produces 1 mole (22.4 litres ) of Cl <sub>2</sub>	...	3
---	-----	---

$Q = I \times t$ / $Q = 0.25 \times 720$	...	3
--	-----	---

$Q = 180$ ( 180 / 193 000 )	...	2
-----------------------------	-----	---

vol of Cl <sub>2</sub> = 0.02 litres	...	2
--------------------------------------	-----	---

**incorrect / no units (-1)**

## QUESTION 12 (continued)

### (c) Describe (2×3)

pairs of electrons repel each other ... 3

lp:lp > lp:bp > bp:bp ... 3

### Sketch (3×3)

three correct shapes with central atom and Hs correct and  
bond angle / shape stated ... 3×3

### State (3)

$107^0$  ... 3

### Explain (2×2)

different number of lone pairs ... 2

refer to lp:bp ( lp:lp ) repulsion ... 2

### (d) Define (2×3) (mole)

molecular mass / amount of substance ... 3

expressed in grams / which contains same no. of particles as there  
are in 12 g of carbon ( the Avogadro number of particles) ... 3

### Calculate (4×3, 2×2)

(i)  $n = m / M_r$  (1.65 ÷ 31) ... 3  
= 0.053 ... 3

(ii) 1 mole P requires 1.5 moles Cl<sub>2</sub> / correct ratio ... 3  
0.080 ... 3

(iii) 1 mole PCl<sub>3</sub> contains  $6 \times 10^{23}$  molecules ... 2  
 $3.18 \times 10^{22}$  ... 2