



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

**Junior Certificate Examination, 2004**

**Science**

**Higher Level**

**Marking Scheme**

# Junior Certificate Examination

## SCIENCE

### Higher Level Paper

#### Structure

Five sections A, B, C, D, E.

Section A:		3 question (attempt all questions) 10 parts in each question (attempt any 8 parts)
Section B:	Physics	2 questions (attempt any 1 question)
Section C:	Chemistry	2 questions (attempt any 1 question)
Section D:	Biology	2 questions (attempt any 1 question)
Section E:	Applied Sc.	6 questions (attempt any 2 questions)

#### Marking

Without Local Studies:	$(6 \times 48) + (2 \times 36) = 288 + 72 = 360$ marks
With Local Studies:	$(6 \times 48) = 288$ marks

#### Grades

Grade	Marks	
	<i>Without LS</i>	<i>With LS</i>
<b>A</b>	306 - 360	245 - 288
<b>B</b>	252 - 305	202 - 244
<b>C</b>	198 - 251	158 - 201
<b>D</b>	144 - 197	115 - 157
<b>E</b>	90 - 143	72 - 114
<b>F</b>	36 - 89	28 - 71
<b>NG</b>	0 - 35	0 - 27

## CANCELLED REPEATED OR EXCESS ANSWERS

### CANCELLED ANSWERS

**SECTION A** If an answer is cancelled and a second answer given you should accept the cancellation and award marks for the uncanceled answer. If neither is cancelled then give zero except in the case where both answers are correct.

**SECTION B, C, D and E** If candidates answer a question or part of a question only once and then cancel, you should ignore the cancelling and mark in the usual way. If candidates answer a question or part of a question more than once and then cancel one attempt, you should ignore the cancelling and mark all the answers whether cancelled or not, however count only the marks gained in respect to the highest scoring answer. The disallowed marks should be enclosed in square brackets.

### REPEATED ANSWERS

**SECTIONS B, C, D AND E** If candidates repeat an answer (answer the same question twice) you should mark both answers and allow marks for the highest scoring answer. The disallowed marks should be enclosed in square brackets.

### EXCESS ANSWERS

**SECTION A** Mark all parts but count only the marks for the eight highest scoring parts. Disallowed marks should be enclosed in square brackets.

**SECTION B, C AND D** Mark all questions but count only the marks awarded to the highest scoring question in each section. Disallowed marks should be enclosed in square brackets.

**SECTION E** Mark all questions but count only the marks awarded to the two highest scoring questions. Disallowed marks should be enclosed in square brackets. Extra care should be taken with Q.10 (Earth Science), Q.11 (Horticulture) and Q. 13 (Food):  
count only the marks awarded to the two highest scoring parts (a), (b) or (c). Care should also be taken with options in Q.12 (Materials Science).

### DEDUCTION OF MARKS FOR OMITTED DIAGRAM

Assign marks in the usual way. Then use square brackets to deduct the marks.

## Science – Higher level 2004

### Marking Scheme

Section A	Q.1		8 x 6	
	Q.2		8 x 6	
	Q.3		8 x 6	
Section B	Q.4	(a)	4 x 3, 1 x 3, 1 x 3, 2 x 3,	
		(b)	2 x 3, 3 x 3, 1 x 3, 2 x 3,	
	Q.5	(a)	2 x 3, 3 x 3, 2 x 3,	
		(b)	3 x 3, 1 x 3,	
		(c)	2 x 3, 3 x 3,	
Section C	Q.6	(a)	1 x 3, 2 x 3, 2 x 3, 1 x 3, 2 x 3,	
		(b)	2 x 3, 1 x 3, 2 x 3, 3 x 3,	
	Q.7	(a)	2 x 3, 2 x 3, 3 x 3, 1 x 3,	
		(b)	1 x 3, 2 x 3, 1 x 3, 2 x 3, 2 x 3,	
Section D	Q.8	(a)	2 x 3, 3 x 3, 3 x 3,	
		(b)	2 x 3, 2 x 3, 4 x 3,	
	Q.9	(a)	2 x 3, 1 x 3, 1 x 3, 1 x 3, 3 x 3,	
		(b)	1 x 3, 3 x 3, 2 x 3, 2 x 3,	
Section E	Q.10	(a)	2 x 6, 1 x 6,	
		(b)	1 x 3, 2 x 3, 3 x 3,	
		(c)	1 x 3, 1 x 3, 1 x 3, 2 x 3, 1 x 3,	Any two parts
	Q.11	(a)	3 x 3, 3 x 3,	
		(b)	4 x 3, 2 x 3,	
		(c)	1 x 3, 1 x 3, 1 x 3, 1 x 3, 1 x 3, 1 x 3,	Any two parts
	Q.12	(a)	3 x 3, 3 x 3,	
		(b)	2 x 3, 4 x 3,	Any one of four (i) - (iv)
	Q.13	(a)	2 x 3, 1 x 3, 1 x 3, 2 x 3,	
		(b)	2 x 3, 2 x 3, 2 x 3,	
		(c)	3 x 3, 2 x 3, 1 x 3,	
	Q.14	(a)	4 x 3, 1 x 6,	
		(b)	2 x 3, 2 x 3, 1 x 3, 1 x 3,	
	Q.15	(a)	2 x 3, 3 x 3, 1 x 3,	
		(b)	1 x 3, 1 x 3, 2 x 3, 2 x 3,	

**SECTION A (144 MARKS)**  
**Answer each of the questions 1, 2 and 3.**

**Question 1. Any *eight* items, (a), (b), (c), etc. (8 X 6 marks)**

- |   |            |     |
|---|------------|-----|
| (a) Graduated (measuring) cylinder<br>0.2   | (3)<br>(3) | [6] |
| (b) 750 <i>or</i> 75 000<br>500 x 1.5 or 500 x 150 allow 3 marks  | (6)        | [6] |
| (c) pressure<br>gets less (lower)/ increases with depth/ depends on depth   | (3)<br>(3) | [6] |
| (d) <b>any two from:</b> double glazing/ attic insulation/ wall insulation/ exclude draughts/ cavity wall (cavity)/ curtains/ carpets/ keep doors (windows) closed<br>(accept insulation only once) | (2x3)      | [6] |
| (e) Brass (one) expands more (faster)/ Invar expands less (slower)  | (3)        |     |
| thermostat (control temperature)/ flashing lamp/ switch/ fire alarm/ iron/ heater etc.  | (3)        | [6] |
| (f) melting<br>takes heat from the water/ cools it  | (3)<br>(3) |     |
| latent heat/ heat of fusion only, <b>allow</b> (6)  |            | [6] |
| (g) B   | (3)        |     |
| shorter wavelength/ more waves (crests) (troughs)   | (3)        | [6] |
| (h) safety/protection/ limit current/ prevent overload/ break circuit   | (3)        |     |
| 13  | (3)        | [6] |
| (i) sound<br>reflected/ bounce/ rebound   | (3)<br>(3) | [6] |
| (j) Electrical/ static/ electricity   | (3)        |     |
| light travels faster than sound/ light travels faster/ sound travels slower   | (3)        | [6] |

**Question 2. Any eight items, (a), (b), (c), etc. (8 X 6 marks)**

- (a) A pestle (3)  
B mortar (3) [6]  
(reversed allow 3 marks only)
- (b) heat absorbed (taken in) by the reaction (3)  
ammonium chloride in water/ eating sherbet/ photosynthesis/  
use of cold pack etc. (3) [6]
- (c) A separating (tap) (dropping) funnel (3)  
Any two immiscible liquids (3) [6]
- (d) copper sulphate (CuSO<sub>4</sub>)/ cobalt chloride (CoCl<sub>2</sub>) (3)  
white to blue *or* blue to pink matching (3) [6]
- (e) surface (3)  
tension (3) [6]
- (f) returns/ reacts (forms compounds) (3)  
**matched:** to ore/ with air (water)/ (3) [6]  
oxidises/ oxidation allow 6 marks  
rusting / weathering allow only 3 marks
- (g) electroplating/ electrolysis/ copper plating (3)  
dissolves/ idea of getting smaller/ forms ion/ loses electrons/  
oxidised (3) [6]
- (h) **any two from:** screening/ settling (sedimentation)/ filtration/  
chlorination/ flocculation  
(accept: fluoridation/ pH adjustment/ removal of hardness/  
add chemicals to disinfect) (2x3) [6]
- (i) soap (3)  
scum formed/ no lather/ more soap needed (3) [6]
- (j) **gas:** sulphur dioxide (SO<sub>2</sub>) (SO<sub>x</sub>)/ nitrogen dioxide (NO<sub>2</sub>)  
(NO<sub>x</sub>)/  
carbon dioxide (CO<sub>2</sub>) (3)  
**effect:** acid rain/ throat/ lungs/ trees/ fish/ stone/ metal/  
greenhouse effect/ ozone layer (3) [6]

**Question 3. Any eight items, (a), (b), (c), etc (8 X 6)**

- (a) **any two from:** any two examples of movement/ growth/ repair/ heat/electrical (nerve impulse) (2x3) [6]
- (b) stop evaporation (3)
- plant absorbs water/ transpiration/ loss of water through leaves (3) [6]
- (c) name e.g. fish/ bird/ insect etc. (3)
- matched adaptation e.g. gills/ wings/ spiracles etc. (3) [6]
- (d) Geotropism/ response to gravity/ phototropism/ response to Light any one 6 marks (6) [6]  
(Allow light or gravity only for 3 marks)
- (e) Xylem/ phloem (2x3) [6]  
Vascular tissue only - allow 3 marks
- (f) lung (3)  
CO<sub>2</sub> (water) removed / O<sub>2</sub> added/ CO<sub>2</sub> and O<sub>2</sub> are exchanged (3) [6]
- (g) **humus, any one from:** supplies minerals(nutrients) /more fertile (fertilises soil)/ acts as food for soil organisms / retains moisture / helps soil structure/ helps aerate the soil / assists drainage / helps control soil pH (3)  
**leaching:** loss of minerals (a named mineral) from soil (3) [6]
- (h) **A:** retina/ fovea/ yellow spot/ rods and cones (3)  
**B:** focus/ forms image (3) [6]
- (i) **ligaments:** connect bone to bone (3)  
**tendons:** connect muscle to bone (3) [6]
- (j) root with X (3)  
starch/ any named carbohydrate/ sugar (3) [6]

## SECTION B – PHYSICS (48 marks)

Answer either question 4 or question 5.

### Question 4. (48 marks)

- |     |                 |  |  |
|-----|-----------------|--|--|
| (a) | <u>Draw</u>     | scale for velocity on y-axis (3)<br>scale for time on x-axis (3)<br>points plotted (3)<br>line drawn (3) <b>[12]</b><br>(axes reversed deduct 3 marks)<br>(no graph paper deduct 3 marks)  |  |
|     | <u>Use</u>      | (i) 7 (+ or – 0.1) (3) <b>[3]</b><br>(ii) 22.5 (+ or –0.2) (3) <b>[3]</b><br>(iii) 2.5 (3)<br>m/s <sup>2</sup> or minus sign (3) <b>[6]</b>  |  |
| (b) | <u>Define</u>   | point through which (3)<br>weight (gravity) acts (3) <b>[6]</b>  |  |
|     | <u>Describe</u> | <b>Show or state:</b><br>suspend card and plumb line from pin<br>and mark the line on the card/ balance<br>card over edge of bench and mark<br>line on the card (3)  |  |
|     |                 | suspend card and plumb line from pin<br>at second point and mark the line on<br>the card./ move card to new position<br>over edge of bench and mark line on<br>the card (3) <b>[9]</b>   |  |
|     | <u>What?</u>    | the centre of gravity is where the two<br>lines cross (3)<br><b>[no diagram – deduct 3 marks]</b><br>steady / balanced / not likely to fall<br>(topple) over/ equilibrium/ a measure<br>of difficulty to topple (3) <b>[3]</b>   |  |
|     | <u>Where?</u>   | near the ground (wheels) (chassis)<br>/ low (3)  |  |
|     | <u>Give</u>     | To stop it turning over/ to improve<br>stability/<br>a vertical line from high c.g. would<br>be outside wheel base and the bus<br>would topple / low c.g. means that the<br>bus can tilt without its weight acting<br>outside wheel base and falling over (3) <b>[6]</b> |  |



**Question 5. (48 marks)**

- (a) What? (i) clips are attracted to solenoid / clips lifted by solenoid/ magnetised (3)  
(ii) clips drop / solenoid loses its attraction/ loses magnetism (3) [6]  
(clips move allow only 3 marks)
- Describe solenoid on (under) paper (3)  
sprinkle iron filings / mark direction (3)  
of compass needle (3) [9]  
tap paper / move compass and mark direction again (join marks)
- Draw **sketch:** two lines, one on each side (3)  
correct direction shown on both lines (3) [6]
- (b) Calculate  $R = V/I \quad / = 12/5$  (3)  
2.4 (3)  
Ohms /  $\Omega$  (3)  
**note** 2.4 alone merits (2x3)
- What? heating (3) [12]
- (c) Name **A:** red (3)  
**B:** violet/ blue/ indigo (3)  
(reverse order allow 3 marks)
- Explain **State or show**  
light changes direction/ bends (3)  
when it passes (3)  
from one medium to another (3) [15]

## SECTION C - CHEMISTRY (48 marks)

Answer either question 6 or question 7.

### Question 6. (48 marks)

- (a) Explain      **elements:** all atoms the same (similar)/ cannot be broken down/ simplest form of matter      (3)
- mixture:** two or more substances      (3)  
                         not chemically combined/ can be separated by physical means/physically mixed (mingled)/ variable composition      (3)
- compound:** two or more elements (substances)      (3)  
                         chemically combined/ can be separated by chemical means/ fixed composition      (3)      [15]
- Draw      State or show  
                         2, 8, 8      (3)      [3]
- Is?      reduced      (3)
- Give      gains electrons/  $e^-$       (3)      [6]
- (b) Name      **A:** hydrogen peroxide /  $H_2O_2$       (3)
- B:** manganese dioxide /  $MnO_2$   
                         (reverse order allow 3 marks)      (3)      [6]
- What?      catalyst      (3)      [3]
- How?      relights      (3)  
                         a glowing splint      (3)      [6]
- Write       $Mg + \frac{1}{2} O_2 = MgO$   
                         *or*  $2Mg + O_2 = 2MgO$   
                         any *two* formulae correct      (2x3)  
                         three correct formulae balanced      (3)      [9]



## SECTION D – BIOLOGY (48 marks)

Answer either question 8 or 9.

### Question 8. (48 marks)

- (a) Explain Elimination (removal) of waste (toxic substances) (3)  
from the body (3) [6]
- Name A: kidney (3)  
B: ureter (3)  
C: bladder (3) [9]
- Give A: removes (extracts) (excretes) wastes ( urea, (3)  
...)from blood / makes urine/ filters/ controls (3)  
amount of water (3)  
B: transports waste (urine /urea ..... ) (3) [9]  
C: stores waste (urine /urea.....)
- (b) What? Chemical/ substance (3)  
Messenger/ control/ regulate (3) [6]
- Identify and Name **selected letter with *one* correctly named gland:**  
P-pituitary (hypophysis) / Q-thyroid (parathyroid) / (3)  
R-pancreas /S-adrenal / T-ovary / U-testis
- Name **matched hormone:**  
P-growth hormone (somatotropin) / oxytocin /  
vasopressin / MSH / melatonin / (TSH) / ACTH /  
FSH / LH / prolactin ...  
Q-thyroxine / triiodothyronine / parathormone  
R-insulin / glucagon  
S-adrenaline / noradrenalin / corticosterone  
T-oestrogen / progesterone / relaxin  
U-testosterone /androsterone (3) [6]
- Note: either letter or gland matched to the correct hormone gets second 3 marks**
- Give **sensory:** carries (sends) (3)  
messages/signals/information/ impulses (3)  
to the CNS (brain) (spinal cord) / from sense organs (3)  
(receptors)/ named sense organ  
**motor:** carries (sends) messages (3) [12]  
form the CNS (...) / to muscle (effectors) (3)



## SECTION E – APPLIED SCIENCE (72 marks)

Answer two questions from this section.

### Question 10 – Earth Science (36 marks). Answer any two of (a), (b), (c).

- (a) Explain    **State or show**  
**summer:** axis (northern hemisphere) (Ireland)  
tilted towards the sun (6)  
**(allow:** more heat (light) / longer days for 3 marks)  
**winter:** axis (northern hemisphere) (Ireland) tilted  
away from the sun (6)    **[12]**  
**(allow:** less heat (light) / shorter days for 3 marks)
- How?    365.25 days (6)    **[6]**  
(allow 1 year/ 365 days for 3 marks)
- (b) What?    barometer (3)    **[3]**
- How?    decreases (3)
- Give    air density lower / less air above (3)    **[6]**
- List    Cold/ low temperature  
clear (no clouds) (high pressure)  
calm (no wind)  
water vapour (humid)    Any three 3x3 marks (3x3)    **[9]**
- (c) Name    rain gauge (3)    **[3]**
- What?    millimetres (mm) / centimetres (cm)/ inches (3)    **[3]**
- Give    collect rain (3)    **[3]**
- Describe    In the ground (3)  
Not flush with surface/ away from trees  
(buildings)/ (3)    **[6]**  
in the open
- Name    anemometer (3)    **[3]**



**Question 12 – Materials Science (36 marks). Answer both parts, (a) and (b).**

- (a) Name **metal, any one from:** aluminium / steel/ tin ... (3)  
**plastic, any one from:** polythene / PVC / polystyrene /  
cellophane / nylon ... (3)  
**other, any one from:** glass / ceramic / card / wood /  
paper ... (3) [9]

Give **any three matched properties e.g.** (3x3) [9]  
*aluminium*-light / does not tarnish; *steel*-strong;  
*polythene*-transparent / strong; *PVC*-rigid; *expanded*  
*polystyrene*-soft support; *cellophane*-transparent /  
*nylon*-strong; *glass*-transparent / strong / inert;  
*ceramic*-attractive finish; *card*-easy to print;  
*wood*-attractive / natural; *paper*-absorbent

(Allow 'can be recycled' only once)

**(b) Answer any one of the following (i), (ii), (iii), (iv).**

**(i) Plastics**

Explain big molecule/ long chain (3)  
made of repeating units /small molecules (monomers) joined (3) [6]

Describe **show or state**  
clamp plastic strip at one end (3)  
add weight to opposite end (3)  
measure and record bend (3)  
repeat for second plastic, compare (3) [12]  
**accept equivalent experiments**



(ii) Metals

<u>Name</u>	<b>any one from:</b> aluminium alloys (duralumin ...) / copper alloys (brass) (bronze) / iron alloys (steels)	(3)	
<u>State</u>	<b>use, matched to alloy, any one from:</b> <b>aluminium alloys:</b> aircraft / bicycles / cooking foil / car pistons (cylinders) / drink cans / ladders / rivets ... <b>copper alloys:</b> door handles (locks) / hinges / musical instruments / plug pins / keys / screws ... <b>iron alloys:</b> cutlery / bicycles / cars / food cans / chains / hinges / girders / keys / pots (pans) / nails / nuts & bolts scaffolding / tools ...	(3)	[6]
<u>Describe</u>	<b>show or state</b> copper (lead) ore (compound) mix with charcoal wrap in aluminium foil/ boiling tube heat strongly / bunsen <b>accept equivalent experiments</b>	(3) (3) (3) (3)	[12]

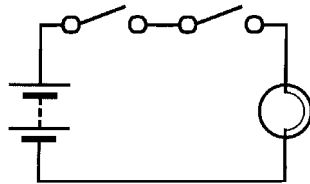


**Question 13 – Food (36 marks). Answer any two of (a), (b), (c).**

- (a) Name      **vitamin, any one from:** A / B / C / D / E / K      (3)
- mineral, any one from:** calcium / chlorine / cobalt / copper / iodine / iron / magnesium / phosphate / potassium / sodium / zinc ...      (3)      [6]
- (Accept correct symbols)
- What?      indigestible (food) plant material / cellulose/ roughage/ food which cannot be absorbed/ carbohydrate      (3)      [3]
- How?      prevents constipation (diseases of the bowel)      (3)      [3]
- Give      **any two from:** eating more (less) food than our body needs / eating too much fatty food / not eating enough fresh fruit (vegetables) / bread (cereals) (potatoes)/ dairy foods (cheese) (milk) ... / protein foods (fish) (meat) ...      (2x3)      [6]
- (b) Name      (i) **any one from:** fruit / fish / cereals / herbs / meat / milk / nuts / soups / vegetables ...      (3)
- (ii) **any one from:** beans (peas) / cereals /dried fruit (vegetables) / fresh fruit (vegetables) /herbs /pepper corns / nuts / spices/poultry (chicken) ...      (3)      [6]
- Explain      (i) water removed      (3)
- microbes (bacteria) (fungi) can not grow/ are killed      (3)
- or**      **or**
- (ii) gamma (ionising)radiation      (3)
- kills microbes (insects) (bacteria)      (3)      [6]
- Give      **advantage, any one from:** *can improve:* colour / flavour / nutritive value / safety / shelf-life / texture / ...      (3)
- disadvantage, any one from:** *can cause:* allergies / blurred vision / headaches / hyperactivity / itching / rashes / destroys vitamins/ tooth decay      (3)      [6]
- (c) Describe      **State or show**
- sugar solution / fruit juice /malt extract/ potatoes      (3)
- add yeast      (3)
- keep warm      (3)      [9]
- Give      **any two from:** cheese / silage / yoghurt ...      (2x3)      [6]
- Why?      preservation / protect against harmful microbes (bacteria)/ increase shelf-life      (3)      [3]

**Question 14 – Electronics (36 marks). Answer both parts (a) and (b).**

- (a) Draw (i) switches in series (3) (ii) switches parallel (3) (2x3)  
complete circuit (3) complete circuit (3) (2x3)



[12]

How? **any one:**  
in circuit (ii) if one switch is closed the second switch  
can not turn off the light /  
in two-way switching the light can be turned on/off  
at  
either switch at any time /  
different type of switch  
used in two-way **or** the  
switch symbol given  
(allow 3 marks)  
**note** complete two-way circuit alone merits (6  
marks)

(6) [6]

- (b) Identify (i) thermistor (ii) transistor

(2x3) [6]

What? **thermistor, any one from:** heat (temperature) sensor  
/ transducer (3)  
**transistor:** switch (3) [6]

Where? Oven/ inside (3) [3]

What? goes out (off) (3) [3]

**Question 15 – Energy Conversions (36 marks). Answer both parts (a) and (b).**

- (a) What? **potential energy, any one from:** energy due to position (condition) of a body / stored energy (3)  
**kinetic energy:** energy due to motion of a body (3) [6]
- Pick (i) A or E (3)  
(ii) C (3)  
(iii) C (3) [9]
- Give **any one from:** rubbing you hands together / striking a match / brakes on car (bicycle) / meteorite (shooting star) / friction ... (3) [3]
- (b) Is? **any one from:** alternating / AC (3) [3]
- Give **any one from:** electrical to magnetic / magnetic to electrical (3) [3]
- Name **X:** core (3)  
**material:** iron (accept steel) (3) [6]
- Would increased (3)
- Give secondary coil has more turns than original coil/ is now a step up transformer (3) [6]