



**Coimisiún na Scrúduithe Stáit**  
State Examinations Commission

**Junior Certificate 2018**

**Marking Scheme**

**Science**

**Higher Level**

## **Note to teachers and students on the use of published marking schemes**

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

## **Future Marking Schemes**

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

## GUIDELINES TO EXAMINERS

### General Points regarding the Marking Scheme for Junior Certificate Science

1. In many cases only key phrases are given in the marking scheme. These points contain the information and ideas that must appear in the candidate's answer in order to merit the assigned marks.
2. The descriptions, methods and definitions given in a marking scheme are not exhaustive and alternative valid answers are acceptable.
3. The detail required in any answer is determined by the context and the manner in which the question is asked and by the number of marks assigned to the answer in the examination paper. This may vary from year to year.
4. The word(s) / phrase(s) used in the scheme indicate the essential points required in the candidate's answer. A double solidus (//) separates points for which separate marks are allocated in a part of the question. Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable for a particular point. A word or phrase given in brackets is an acceptable alternative to the preceding word or phrase. Note, however, that words, expressions or phrases must be correctly used in context and not contradicted. Where there is evidence of incorrect use or contradiction, the marks may not be awarded.
5. In general, names and formulas of elements and compounds are equally acceptable except in cases where either the name or the formula is specifically asked for in the question. However, in some cases where the name is asked for, the formula may be accepted as an alternative. This is clarified within the scheme.
6. There is a deduction of one mark for each arithmetical slip made by a candidate in a calculation. If the incorrect calculated value is used in a subsequent calculation 'correctly' allow the marks for the subsequent calculation.
7. **Cancelled & / or Repeated Answers**
  - a. In the case of short-answer questions, if an answer is cancelled and a second answer given, the cancellation is accepted and marks are awarded for the uncanceled answer.
  - b. If more than the required number of (uncanceled) answers are given, surplus incorrect answers cancel the marks awarded for correct answers.
  - c. If the only answer offered is cancelled, the cancelling is ignored and the answer marked as normal. However, in MCQ-type questions cancelling of an incorrect and correct answer applies.

For answers to "describe an investigation / an experiment", multiple attempts will be dealt with as follows:

If a candidate answers a question or part of a question once only and then cancels, the cancelling is ignored and the answer marked as normal. If a candidate answers a question or part of a question more than once and then cancels one attempt, the cancelling will be ignored and all the answers, whether cancelled or not, marked as normal. However, only the marks gained in respect to the highest scoring attempt will be counted. Points cannot be “mixed and matched from two attempts”. The disallowed marks should be enclosed in square brackets.

**8. Recording a mark of zero**

A zero should only be recorded in the question grid when the candidate has attempted the question but does not merit marks.

\*Do not enter zero for examination components that were not presented

If a candidate does not attempt a question (or part of) record a dash –

**9. Deduction of marks for omitted labelled diagrams**

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

**10. Application of the marking scheme**

Apply the marking scheme as agreed.

Examiners should enter marks in ‘Examiner use only’ Column 1.

Advising Examiners should also use Column 1.

Column 2 to be used by Appeal Examiners.

Disallowed marks should be placed in square brackets i.e. ‘[ ]’.

**11. Transfer of marks**

All marks should be transferred to the grid on the cover page of the examination paper. Marks should be totalled, the bonus for answering through Irish applied where relevant.

**12. Bonus for Irish**

Bonus marks at the rate of 10% of the marks obtained in the written paper will be given to a candidate who answers the written paper entirely through Irish and who obtains less than 75% of the total mark available in the written paper (i.e. less than 75% of 390). In calculating the bonus to be applied decimals are always rounded down, not up e.g., 4.5 becomes 4; 4.9 becomes 4, etc. No bonus applies to the coursework. The table below should be used where a candidate is awarded more than 75% of the total mark in the written paper.



## Coimisiún na Scrúduithe Stáit

### 390@10%

#### *Marcanna Breise as ucht freagairt trí Ghaeilge*

Léiríonn an tábla thíos an méid marcanna breise ba chóir a bhronnadh ar iarrthóirí a ghnóthaíonn níos mó ná 75% d'iomlán na marcanna.

N.B. Ba chóir marcanna de réir an ghnáthráta a bhronnadh ar iarrthóirí nach ghnóthaíonn níos mó ná 75% d'iomlán na marcanna don scrúdú. Ba chóir freisin an marc bónais sin a **shlánú síos**.

#### *Tábla 390 @ 10%*

Bain úsáid as an tábla seo i gcás na n-ábhar a bhfuil 390 marc san iomlán ag gabháil leo agus inarb é 10% gnáthráta an bhónais.

Bain úsáid as an ghnáthráta i gcás 292 marc agus faoina bhun sin. Os cionn an mharc sin, féach an tábla thíos.

Bunmharc	Marc Bónais
293	29
294 - 296	28
297 - 300	27
301 - 303	26
304 - 306	25
307 - 310	24
311 - 313	23
314 - 316	22
317 - 320	21
321 - 323	20
324 - 326	19
327 - 330	18
331 - 333	17
334 - 336	16
337 - 340	15

Bunmharc	Marc Bónais
341 - 343	14
344 - 346	13
347 - 350	12
351 - 353	11
354 - 356	10
357 - 360	9
361 - 363	8
364 - 366	7
367 - 370	6
371 - 373	5
374 - 376	4
377 - 380	3
381 - 383	2
384 - 386	1
387 - 390	0

### **BIOLOGY**

Question 1 (7 × 6 + 1 × 10)

Question 2 (a) (12)

(b) (12)

(c) (15)

Question 3 (a) (18)

(b) (6)

(c) (15)

### **CHEMISTRY**

Question 4 (7 × 6 + 1 × 10)

Question 5 (a) (15)

(b) (9)

(c) (15)

Question 6 (a) (15)

(b) (24)

### **PHYSICS**

Question 7 (7 × 6 + 1 × 10)

Question 8 (a) (12)

(b) (9)

(c) (18)

Question 9 (a) (24)

(b) (15)

## Biology (130 MARKS)

- Question 1** (52)
- (a)(i) mouse, fox, rabbit, correct animal (3)  
(ii) no back bone (spine) / doesn't have vertebrae (3)
- (b)(i) pulmonary artery (3)  
(ii) lung(s) (3)
- (c)(i) producer (3)  
(ii) decrease (3)
- (d)(i) digestion / produce acid (HCl) / produce enzymes (gastric juices) / churn food / store food (3)  
(ii) liver (3)
- (e)(i) phototropism (3)  
(ii) more light for more photosynthesis (3)
- (f)(i) oxygen (3)  
(ii) carbon dioxide / water vapour (3)
- (g)(i) xylem / vascular (3)  
(ii) leaf / stem / flower (3)
- (h)(i) respiration / digestion / growth (3)  
(ii) place plant in a dark room / cover leaves (3)  
(iii) alcohol / named alcohol e.g. methylated spirits (2)  
(iv) iodine (2)

**Question 2** (39)

(a)(i) sensory (3)

(ii) brain / spinal cord / central nervous system (3)

(iii) protection (3)

(iv) optic (3)

(b)(i) protein (3)

(ii) carbohydrate / starch (3)

(iii) excretion (sweating / urination / breathing out) (3)

(iv) kidney (3)

(c) (i) cells with specific (common) function (3)

(ii) ball and socket (3)

(iii) knee / fingers / toes (3)

(iv) ligament (3)

tendon (3)



**Question 3** (39)

- (a)(i) quadrat / line (belt) transect (3)
- (ii) key (accept textbook / guide book / internet / poster if qualified) (3)
- (iii) water / minerals (named mineral) / nutrients / space (3)
- (iv) anther (3)
- wind (3)
- (v) any valid example of interdependence: insects pollinate plants **AND** plants provide food for insects (3)
- 
- (b)(i) place fingers on wrist (suitable location) / heart monitor (3)
- (ii)  $70 \pm 4$  (3)
- 
- (c) (i) protein (amino acids) (3)
- (ii) A, B or C (3)
- (iii) suitable temperature for reaction to occur (3)
- (iv) food sample with no chemicals / chemical with water / chemical with no food (3)
- (v) translucent spot on brown paper (3)

## Chemistry (130 MARKS)

### Question 4 (52)

- (a)(i) sulfur dioxide / sulfur trioxide / nitrogen oxide (monoxide) / nitrogen dioxide (3)  
(ii) burning fossil fuels (named fossil fuel) (3)
- (b)(i) oiling / painting / galvanising / electroplating / plastic coating (3)  
(ii) iron (3)
- (c)(i) cannot be broken down by living organisms (3)  
(ii) crude oil (3)
- (d)(i) simplest form of a substance (it cannot be broken down into a simpler form) / it is made up of only one type of atom (3)  
(ii) any one of:  
**mixture:** easily separated / no new substance formed / substances not chemically combined  
**compound:** not easily separated / a new substance formed / composed of elements chemically joined (3)
- (e)(i) measuring (graduated) cylinder / pipette / burette / syringe / beaker (3)  
(ii) flows / definite mass / no definite shape / changes state when heated or cooled (3)
- (f)(i) it increases / more copper sulfate dissolves (3)  
(ii) dissolve as much solute as possible (3)
- (g)(i) copper sulfate // cobalt chloride (3)  
(ii) white // blue (3)  
[must match]
- (h)(i) **acidic:** vinegar / soda water (3)  
**basic:** baking soda / oven cleaner (3)  
**neutral:** pure water (2)  
(ii) pH meter (probe) / universal indicator (2)

**Question 5** (39)

(a)(i) B (3)

(ii) hydrogen peroxide (3)

(iii) **State or show**

metal such as zinc // calcium / alkali metal

add to named acid // add to water

[must match]

[No labelled diagram - deduct 3 marks] (2 × 3)

(iv) burns with a pop (3)

(b)(i) dissolves (3)

(ii) filtration / decanting (3)

(iii) evaporation / distillation (3)

(c)(i) hydrochloric acid (3)

(ii) calcium carbonate (3)

(iii) denser than air (3)

(iv)  $\text{CO}_2 + \text{Ca(OH)}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$  (2 × 3)

**Question 6** (39)

(a)(i) add soap (3)

shake (3)

needed most soap to make a lather / forms smallest volume of lather (3)

(ii) nicer taste / contains minerals /good for teeth (bones)  
/ good for brewing (tanning) (3)

(iii) ion exchange / boiling / add bath salts (3)

(b)(i) 11 (3)

(ii) 12 (3)

(iii) second shell with 8 electrons (3)

third shell with 1 electron (3)

(iv) alkali metals (3)

(v) ionic (3)

(vi) very reactive with oxygen (O<sub>2</sub>) and water (H<sub>2</sub>O) (3)

(vii) sodium hydroxide and hydrogen (3)

**Physics (130 MARKS)**

**Question 7** (52)

(a) correct ray diagram (3)  
 reflection (3)

(b) any two of:  
 wave, solar, tidal, geothermal, hydroelectric, biomass (2 × 3)

(c)  $V = I \times R$  /  $I = \frac{V}{R}$  /  $\frac{12}{6}$  (3)

2 A (3)

(d) electricity // heat (2 × 3)

(e)(i) balance / scales (3)

(ii) push it down (3)

(f)  $\frac{v_2 - v_1}{t}$  /  $\frac{36 - 12}{3}$  (3)

8 m s<sup>-2</sup> (3)

(g)(i) damage to hearing (3)

(ii) no medium (air) (3)

(h)(i) X (3)

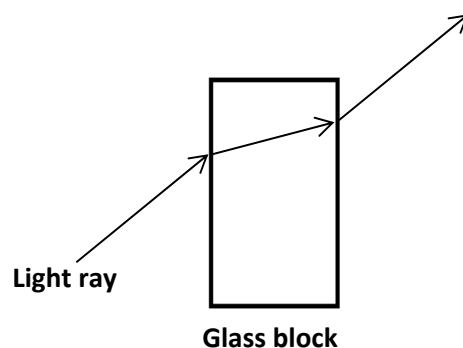
(ii) ammeter (3)

(iii)

Statement	Circuit X	Circuit Y	
Bulbs are brighter		✓	(2)
If one bulb is unscrewed no bulb will light	✓		(2)

**Question 8** (39)

(a)(i) emerging parallel ray as shown (3)



(ii) refraction (3)

(iii) convex lens (3)



(iv) camera / microscope / telescopes / projectors / glasses / any valid example (3)

(b)(i) joule (J) / kilojoule (kJ) (3)

(ii) chemical (3)

(iii) sound (3)

(c)(i) thermometer / temperature probe (3)

degrees Celsius / kelvin / degrees Fahrenheit (3)

(ii) hot air rises / convection (3)

(iii) any two of:  
heat is reflected by silver surfaces / silver surfaces prevent radiation //  
vacuum prevents heat loss (gain) / vacuum prevents conduction/convection //  
stopper prevents heat loss (gain) (2 × 3)

(iv) attic insulation / cavity wall / double (triple) glaze windows (doors)  
/ draught excluders / any valid example (3)

**Question 9**

(39)

(a)(i) five points correctly plotted for each girl (10 × 1)

correct line through points for each girl (2 × 1)

(ii)  $\frac{\text{distance}}{\text{time}} / \frac{100}{20}$  (3)

5 m s<sup>-1</sup> (3)

(iii) Orla (3)

straight line (3)

(b) (i)  $\frac{400 \times 2.4}{320}$  (3)

3 m (3)

(ii) force which opposes motion (movement) (3)

(iii) burn / move more slowly / stop sliding / no movement (3)

(iv) less friction / water provides lubrication (3)

### Marking Criteria for Coursework B (HL) - BIOLOGY

	<b>Guide to mark assignment</b>	<b>Mark Assignment</b>
<b>Total Marks</b>	Investigate and compare the quantitative effects of changing (a) concentration of solution, (b) type of solute used on the change in mass of a sample of potato placed in distilled water, salt solution and sugar solution.	
<b>5</b>	<p><b><u>Introduction to the investigation</u></b></p> <p><b>1 (i) Statement/identification of problem/topic to be investigated</b>  <b>1 (ii) Background research</b>  <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	<p>(2)</p> <p>(3)</p>
<b>20</b>	<p><b><u>Preparation and planning</u></b></p> <p><b>2 (i) Identify any relevant variables and necessary controls</b>  <i>Identify <u>four</u> variables (at least two compulsory) and/or indicate how some of these need to be controlled or held fixed</i></p> <p><i>Compulsory variables</i></p> <ul style="list-style-type: none"> <li>• concentration of solution</li> <li>• type of solute</li> <li>• change in mass of potato sample</li> </ul> <p><i>Other variables</i></p> <ul style="list-style-type: none"> <li>• type of potato</li> <li>• length/area/volume/mass of potato sample</li> <li>• temperature</li> <li>• volume of solution</li> <li>• time left in solution</li> <li>• type of solvent</li> </ul> <p><b>2 (ii) List of the equipment needed for the investigation</b>  <i>Identify any <u>five</u> pieces of equipment pertinent to procedure</i></p> <p><b>2 (iii) List of tasks to be carried out during the investigation</b>  <i>Identify any <u>four</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> <li>• procure potato/solutions</li> <li>• prepare different concentrations of solution</li> <li>• measure/note mass of potato sample before adding to solution</li> <li>• add potato to solution</li> <li>• measure/note mass of potato sample after removing from solution</li> <li>• repeat for different solutes</li> <li>• repeat for different concentrations</li> <li>• record <i>or</i> process <i>or</i> graph data</li> </ul>	<p>(3 + 3)</p> <p><i>any others</i> (2 + 2)</p> <p>(5 × 1)</p> <p>(1 + 1 + 1 + 2)</p>



20	<p><b>Procedure, Apparatus, Safety, Data Collection / Observations</b></p> <p><b>3 (i) Safety precautions</b>  <i>Identify any <u>two</u> specific safety precautions followed</i></p> <p><b>3 (ii) &amp; (iii) Procedure followed in the investigation (state or show)</b>  <i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> <li>• measure/note mass of solute</li> <li>• measure/note volume of solvent</li> <li>• mix solute and solvent</li> <li>• select known volume of solution</li> <li>• peel potato</li> <li>• cut/grate potato</li> <li>• measure/note mass of potato sample before adding to solution</li> <li>• add potato sample to solution</li> <li>• measure/note time</li> <li>• remove potato sample from solution</li> <li>• remove excess solution from potato sample</li> <li>• measure/note mass of potato sample after removing from solution</li> <li>• repeat to verify data</li> <li>• repeat for different solutes</li> <li>• repeat for different concentrations</li> <li>• record <i>or</i> process <i>or</i> graph data</li> </ul> <p><b>3 (iv) Recorded Data / Observations</b>  <i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> <li>• change in mass of potato sample for different concentrations (3 non-zero concentrations of salt/sugar solution)</li> <li>• change in mass of potato sample for 3 solutions (water, salt, sugar)</li> </ul>	<p>(2 + 3)</p> <p>(1 + 1 + 1 + 1) + (2 + 2 + 2)</p> <p>(2 + 3)</p>
20	<p><b>Analysis</b></p> <p><b>4 (i) Calculations / Data analysis</b>  <i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> manipulation of both data sets, with at least 3 data points in each set, using accurate graphs / correct calculations / clear statements of analysis (10)</li> <li>• <b>Good</b> manipulation of both data sets, with at least 3 data points in each set, using graphs / calculations / statements of analysis (7)</li> <li>• <b>Limited</b> manipulation of either data set with at least 3 data points in the set, using graphs / calculations / statement of analysis (4)</li> </ul> <p><b>4 (ii) Conclusion(s) and Evaluation of Result(s)</b>  <i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> treatment (clear, supported statements about both data sets) (10)</li> <li>• <b>Good</b> treatment (statements about both data sets, not fully clear or not fully supported) (7)</li> <li>• <b>Limited</b> treatment (clear, supported statement about one data set only) (4)</li> </ul>	<p>(10)</p> <p>(7)</p> <p>(4)</p> <p><i>Only if 3(iv) and/or 4(i) attempted</i></p> <p>(10)</p> <p>(7)</p> <p>(4)</p>
10	<p><b>Comments</b>  <i>Any <u>two</u> comments on refinement or improvement or extension or possible application or source of error, etc.</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> comprehension</li> <li>• <b>Good</b> comprehension</li> </ul>	<p>(5) } × 2 (3) }</p>

### Marking Criteria for Coursework B (HL) - CHEMISTRY

	<b>Guide to mark assignment</b>	
<b>Total Marks</b>	Investigate and compare the quantitative effects of changing (a) applied voltage, (b) concentration of sulfuric acid on the rate of production of either hydrogen <i>or</i> oxygen gas during the electrolysis of acidified water.	<b>Mark Assignment</b>
<b>5</b>	<p><b><u>Introduction to the investigation</u></b></p> <p><b>1 (i) Statement/identification of problem/topic to be investigated</b>  <b>1 (ii) Background research</b>  <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	<p>(2)</p> <p>(3)</p>
<b>20</b>	<p><b><u>Preparation and planning</u></b></p> <p><b>2 (i) Identify any relevant variables and necessary controls</b>  <i>Identify <u>four</u> variables (at least two compulsory) and/or indicate how some of these need to be controlled or held fixed</i></p> <p><i>Compulsory variables</i></p> <ul style="list-style-type: none"> <li>• voltage</li> <li>• concentration of acid</li> <li>• rate of production of gas (time for fixed volume <i>or</i> volume in fixed time)</li> </ul> <p><i>Other variables</i></p> <ul style="list-style-type: none"> <li>• volume of solution</li> <li>• mass/area of electrodes</li> <li>• type of electrodes</li> <li>• time for gas production <i>or</i> volume of gas produced (<i>unless awarded marks above</i>)</li> <li>• source of water</li> <li>• atmospheric pressure</li> <li>• temperature</li> <li>• resistance in the circuit</li> </ul> <p><b>2 (ii) List of the equipment needed for the investigation</b>  <i>Identify any <u>five</u> pieces of equipment pertinent to procedure</i></p> <p><b>2 (iii) List of tasks to be carried out during the investigation</b>  <i>Identify any <u>four</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> <li>• procure water/sulfuric acid</li> <li>• dilute sulfuric acid</li> <li>• set up circuit</li> <li>• set/measure/note voltage</li> <li>• measure/note rate of production of gas</li> <li>• repeat for different voltages</li> <li>• repeat for different concentrations of sulfuric acid</li> <li>• record <i>or</i> process <i>or</i> graph data</li> </ul>	<p>(3 + 3)</p> <p><i>any others</i> (2 + 2)</p> <p>(5 × 1)</p> <p>(1 + 1 + 1 + 2)</p>

20	<p><b>Procedure, Apparatus, Safety, Data Collection / Observations</b></p> <p><b>3 (i) Safety precautions</b>  <i>Identify any <u>two</u> specific safety precautions followed</i></p> <p><b>3 (ii) &amp; (iii) Procedure followed in the investigation (state or show)</b>  <i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> <li>• measure/note volume of water</li> <li>• measure/note volume of sulfuric acid</li> <li>• mix sulfuric acid and water</li> <li>• add solution to voltameter</li> <li>• connect power supply across electrodes</li> <li>• connect voltmeter across electrodes</li> <li>• switch on circuit</li> <li>• set/measure/note voltage</li> <li>• measure/note time</li> <li>• measure/note volume of gas produced</li> <li>• repeat to verify data</li> <li>• repeat for different voltages</li> <li>• repeat for different concentrations</li> <li>• record or process or graph data</li> </ul> <p><b>3 (iv) Recorded Data / Observations</b>  <i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> <li>• effect of voltage on rate of production of gas (3 voltages)</li> <li>• effect of concentration of sulfuric acid on rate of production of gas (3 concentrations)</li> </ul>	<p>(2 + 3)</p> <p>(1 + 1 + 1 + 1) + (2 + 2 + 2)</p> <p>(2 + 3)</p>
20	<p><b>Analysis</b></p> <p><b>4 (i) Calculations / Data analysis</b>  <i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> manipulation of both data sets, with at least 3 data points in each set, using accurate graphs / correct calculations / clear statements of analysis</li> <li>• <b>Good</b> manipulation of both data sets, with at least 3 data points in each set, using graphs / calculations / statements of analysis</li> <li>• <b>Limited</b> manipulation of either data set with at least 3 data points in the set, using graphs / calculations / statement of analysis</li> </ul> <p><b>4 (ii) Conclusion(s) and Evaluation of Result(s)</b>  <i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> treatment (clear, supported statements about both data sets)</li> <li>• <b>Good</b> treatment (statements about both data sets, not fully clear or not fully supported)</li> <li>• <b>Limited</b> treatment (clear, supported statement about one data set only)</li> </ul>	<p>(10)</p> <p>(7)</p> <p>(4)</p> <p><i>Only if 3(iv) and/or 4(i) attempted</i> (10)</p> <p>(7)</p> <p>(4)</p>
10	<p><b>Comments</b>  <i>Any <u>two</u> comments on refinement or improvement or extension or possible application or source of error, etc.</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> comprehension</li> <li>• <b>Good</b> comprehension</li> </ul>	<p>(5) } × 2 (3) }</p>

### Marking Criteria for Coursework B (HL) - PHYSICS

<b>Guide to mark assignment</b>		
<b>Total Marks</b>		<b>Mark Assignment</b>
<b>5</b>	<p><b>Investigate and compare the quantitative effects of changing (a) hair colour, (b) the usage of shampoo or similar commercial hair treatments on the tensile strength of hair taken from the human head.</b></p> <p><b><u>Introduction to the investigation</u></b></p> <p><b>1 (i) Statement/identification of problem/topic to be investigated</b>  <b>1 (ii) Background research</b>  <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	<p>(2)</p> <p>(3)</p>
<b>20</b>	<p><b><u>Preparation and planning</u></b></p> <p><b>2 (i) Identify any relevant variables and necessary controls</b>  <i>Identify <u>four</u> variables (at least two compulsory) and/or indicate how some of these need to be controlled or held fixed</i></p> <p><i>Compulsory variables</i></p> <ul style="list-style-type: none"> <li>• hair colour</li> <li>• hair treatment</li> <li>• tensile strength (e.g. force/weight/mass)</li> </ul> <p><i>Other variables</i></p> <ul style="list-style-type: none"> <li>• length of hair</li> <li>• thickness of hair</li> <li>• source of hair (e.g. part of head, hair donor etc.)</li> <li>• factor(s) indicative of extent of hair treatment (e.g. time, temperature, volume, concentration etc.)</li> <li>• part of hair strand</li> <li>• hair treatment other than that being investigated</li> <li>• room temperature</li> <li>• room humidity</li> </ul> <p><b>2 (ii) List of the equipment needed for the investigation</b>  <i>Identify any <u>five</u> pieces of equipment pertinent to procedure</i></p> <p><b>2 (iii) List of tasks to be carried out during the investigation</b>  <i>Identify any <u>four</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> <li>• procure hairs/treatments</li> <li>• treat hair</li> <li>• tie/fix hair in apparatus</li> <li>• apply force to hair</li> <li>• measure/note/add force to break hair</li> <li>• repeat for different hair colours</li> <li>• repeat for different treatments</li> <li>• record <i>or</i> process <i>or</i> graph data</li> </ul>	<p>(3 + 3)</p> <p><i>any others</i> (2 + 2)</p> <p>(5 × 1)</p> <p>(1 + 1 + 1 + 2)</p>

20	<p><b>Procedure, Apparatus, Safety, Data Collection / Observations</b></p> <p><b>3 (i) Safety precautions</b>  <i>Identify any <u>two</u> specific safety precautions followed</i></p> <p><b>3 (ii) &amp; (iii) Procedure followed in the investigation (state or show)</b>  <i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> <li>• source hairs</li> <li>• cut hair or measure/note length of hair</li> <li>• measure/note colour of hair</li> <li>• prepare hair treatment</li> <li>• apply treatment to hair</li> <li>• measure/note factor indicative of extent of hair treatment  <i>(e.g. time, temperature, concentration etc.)</i></li> <li>• fix/tie hair in apparatus</li> <li>• fix/tie e.g. hook/pan to hair</li> <li>• apply initial force to hair</li> <li>• apply increasing force to hair until it breaks</li> <li>• measure/note breaking force</li> <li>• repeat to verify data</li> <li>• repeat for different hair colours</li> <li>• repeat for different treatments</li> <li>• record or process or graph data</li> </ul> <p><b>3 (iv) Recorded Data / Observations</b>  <i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> <li>• effect of colour on tensile strength of hair (3 colours)</li> <li>• effect of treatment on tensile strength of hair</li> </ul>	<p>(2 + 3)</p> <p>(1 + 1 + 1 + 1)  +  (2 + 2 + 2)</p> <p>(2 + 3)</p>
20	<p><b>Analysis</b></p> <p><b>4 (i) Calculations / Data analysis</b>  <i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> manipulation of both data sets, with at least 3 colours and 2 treatments, using accurate graphs / correct calculations / clear statements of analysis</li> <li>• <b>Good</b> manipulation of both data sets with at least 3 colours and 2 treatments, using graphs / calculations / statements of analysis</li> <li>• <b>Limited</b> manipulation of either data set, with at least 3 colours or 2 treatments, using graphs / calculations / statement of analysis</li> </ul> <p><b>4 (ii) Conclusion(s) and Evaluation of Result(s)</b>  <i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> treatment (clear, supported statements about both data sets)</li> <li>• <b>Good</b> treatment (statements about both data sets, not fully clear or not fully supported)</li> <li>• <b>Limited</b> treatment (clear, supported statements about one data set only)</li> </ul>	<p>(10)</p> <p>(7)</p> <p>(4)</p> <p><i>Only if 3(iv) and/or 4(i) attempted</i>  (10)</p> <p>(7)</p> <p>(4)</p>
10	<p><b>Comments</b>  <i>Any <u>two</u> comments on refinement or improvement or extension or possible application or source of error, etc.</i></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> comprehension</li> <li>• <b>Good</b> comprehension</li> </ul>	<p>(5) } × 2  (3) }</p>

**Marking Criteria for Coursework B (HL) – OWN INVESTIGATION**

<b>10</b>	<p><b><u>Introduction to the investigation</u></b></p> <p><b>1 (i) Statement/identification of problem/topic to be investigated</b></p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> treatment (6)</li> <li>• <b>Good</b> treatment (4)</li> <li>• <b>Limited</b> treatment (2)</li> </ul> <p><b>1 (ii) Background research</b></p> <p>Any <u>two</u> references to book or internet or person consulted or evidence of research (2 + 2)</p>	
<b>40</b>	<p><b><u>Preparation and planning</u></b></p> <p><b>2 (i) Identify any relevant variables and necessary controls</b></p> <p>Identify <u>eight</u> variables (<u>two</u> compulsory variables – which refer to the investigation title – and any <u>six</u> other variables) and/or indicate how some of these need to be controlled or held fixed (2 × 4)          [If variables/controls are not relevant to the type of investigation, allow 6 marks for stating so, then re-adjust equipment to (8 × 2) and tasks to (6 × 3)] (6 × 2)</p> <p><b>2 (ii) List of the equipment needed for the investigation</b></p> <p>Identify any <u>eight</u> pieces of equipment pertinent to procedure (8 × 1)</p> <p><b>2 (iii) List of tasks to be carried out during the investigation</b></p> <p>Identify any <u>six</u> tasks carried out in investigation (6 × 2)</p>	
<b>40</b>	<p><b><u>Procedure, Apparatus, Safety, Data Collection/Observations</u></b></p> <p><b>3 (i) Safety precautions</b></p> <p>Identify any <u>four</u> specific safety precautions followed (4 × 2)</p> <p><b>3 (ii) &amp; (iii) Procedure followed in the investigation (state or show)</b></p> <p>Identify any <u>twelve</u> steps taken in conducting investigation (4 × 1) + (4 × 2) + (4 × 3)</p> <p><b>3 (iv) Recorded Data / Observations</b></p> <p>Identify <u>eight</u> data points (8 × 1)</p>	
<b>40</b>	<p><b><u>Analysis</u></b></p> <p><b>4 (i) Calculations / Data analysis</b></p> <p><u>Two</u> relevant analyses of data or calculations or graph(s)</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> manipulation of data (10)</li> <li>• <b>Good</b> manipulation of data (7)</li> <li>• <b>Limited</b> manipulation of data (4)</li> </ul> <p>(10) (7) (4) } × 2</p> <p><b>4 (ii) Conclusion(s) and Evaluation of Result(s)</b></p> <p><u>Two</u> relevant conclusions drawn and evaluation of results</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> treatment (10)</li> <li>• <b>Good</b> treatment (7)</li> <li>• <b>Limited</b> treatment (4)</li> </ul> <p>(10) (7) (4) } × 2</p> <p><i>Only if 3(iv) and/or 4(i) attempted</i></p>	
<b>20</b>	<p><b><u>Comments</u></b></p> <p>Any <u>four</u> comments on refinement or improvement or extension or possible application or source of error, etc.</p> <ul style="list-style-type: none"> <li>• <b>Excellent</b> comprehension (5)</li> <li>• <b>Good</b> comprehension (3)</li> </ul> <p>(5) (3) } × 4</p>	