



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2016

Marking Scheme

Science

Ordinary 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.

TABLE FOR ASSIGNING GRADES	
GRADE	RANGE
A	510 - 600
B	420 - 509
C	330 - 419
D	240 - 329
E	150 - 239
F	60 - 149
NG	0 - 59

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 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 ngnáthráta 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

Junior Certificate Examination

SCIENCE

Ordinary Level Paper

WRITTEN EXAMINATION PAPER

Three Sections: Biology, Chemistry and Physics, *all* questions to be answered by candidates.

Biology Question 1 (52 marks); Question 2 (39 marks); Question 3 (39 marks)

Chemistry Question 4 (52 marks); Question 5 (39 marks); Question 6 (39 marks)

Physics Question 7 (52 marks); Question 8 (39 marks); Question 9 (39 marks)

COURSEWORK A

Count the number of ticked (✓) mandatory biology investigations/experiments claimed on page 5. Note this number in the box on page 5 of the Coursework booklet and enter it in the Coursework A grid on the cover page of the Coursework booklet.

Count the number of ticked (✓) mandatory chemistry investigations/experiments claimed on page 6. Note this number in the box on page 6 of the Coursework booklet and enter it in the Coursework A grid on the cover page of the Coursework booklet.

Count the number of ticked mandatory (✓) physics investigations/experiments claimed on page 7. Note this number in the box on page 7 of the Coursework booklet and enter it in the Coursework A grid on the cover page of the Coursework booklet.

Total the number of investigations / experiments claimed and award 2 marks per investigation/experiment to an amount not exceeding maximum 60 marks.

COURSEWORK B

Mark the SEC nominated investigations according to the agreed criteria. Enter the marks for each section in the Coursework B grid on the cover page of the Coursework booklet.

or

Mark the candidate nominated investigation according to the agreed criteria. Enter the marks for each section in the Coursework B grid on the cover page of the Coursework booklet.

COURSEWORK A & B

Transfer totals for MARKS awarded for Coursework A and Coursework B to grid on the cover page of the examination paper.

SCIENCE ORDINARY LEVEL 2016

Summary of Marking Scheme

BIOLOGY

- Question 1 $(7 \times 6 + 1 \times 10)$
- Question 2 (a) $(5 \times 3) + 6$
(b) (i) 3 (ii) 2×3 (iii) 3 (iv) 2×3
- Question 3 (a) $(5 \times 3) + 6$
(b) (i) 3 (ii) 3 (iii) 3 (iv) 3 (v) 3 (vi) 3

CHEMISTRY

- Question 4 $(7 \times 6 + 1 \times 10)$
- Question 5 (a) $(1 + 1 + 5 + 5)$
(b) (i) 3 (ii) 3
(c) $(5 \times 3) + 6$
- Question 6 (a) (i) 3 (ii) 3 (iii) 3×3
(b) (i) 2×3 (ii) 3
(c) $(3 \times 3) + 6$

PHYSICS

- Question 7 $(7 \times 6 + 1 \times 10)$
- Question 8 (a) (i) 3 (ii) 3×3 (iii) 2×3
(b) (i) 12 (ii) 3 (iii) 6
- Question 9 (a) (i) 3 (ii) 3 (iii) 3 (iv) 3
(b) (i) 6 (ii) 6
(c) $(3 \times 3) + 6$

BIOLOGY

Question 1

(a) (i) **B** - Vertebrate

B	Vertebrate
	Invertebrate

(ii) Any **one** correct vertebrate: human / bird / fish / snake / frog, etc

(2 + 4)

(b) Any **two** of the underlined cell structures

Nucleus Cell Wall Cytoplasm Cell membrane

(2 + 4)

(c) (i) Grass

(ii) Rabbit / Fox

(2 + 4)

(d) (i) Potato / Rice / Pasta / Bread, etc

(ii) Blue-black / Blue / Black

(2 + 4)

(e) (i) Pitfall trap

(ii) Pooter

(2 + 4)

(f) (i) Movement / Protection / Support / Shape (structure) / Blood cell production

(ii) Skull / Cranium

(2 + 4)

(g) Any **two** of:

Ear // Nose // Tongue // Skin

(2 + 4)

(h) (i) Correct line from **X** to eyepiece

(ii) Correct line from **Y** to stage

(iii) To look at cells (small things) / To magnify cell (small things)

(1 + 1 + 8)

Question 2

- (a) (i) A – Stomach

B

- (ii) B – Oesophagus

A

- (iii) C – Small intestine

C

(iv) Digest food / Breakdown food / Store food / To mix food / Produce acid /
Produce enzymes / Kill bacteria

(v) T - Molar

(vi) Chewing / Grinding

(5 × 3) + 6

(b) (i) Pump blood (3)

(ii) X - left atrium

	Right ventricle
Y	Right atrium
X	Left atrium

 (3)

Y - right atrium (3)

(iii) Exercise / Healthy diet / Low fat diet / Low salt diet / Don't smoke /
Weight control / Avoid stress / Regular health checks (3)

(iv) Red blood cells (3)

Platelets (3)

Question 3

(a) (i) Sexual

(ii) Stamen (allow anther)

Carpel (allow ovary / ovule)

(iii) Wind / Insect

(iv) No

The seeds have no water / Seeds need water to germinate

(5 × 3) + 6

(b) (i) Root (3)

(ii) It decreases (lowers / drops / falls) (3)

(iii) To stop the water evaporating / Prevent water loss (3)

(iv) Transpiration (3)

(v) Leaves (3)

(vi) Drops / Water / Liquid (3)

CHEMISTRY

Question 4

(a) (i) **B** – Covalent

(ii) **C** - Negative

	Ionic
B	Covalent
	Positive
C	Negative

(2 + 4)

(b) Any **two safety precautions**:

Tie back long hair // Wear goggles // Wear gloves // Report all accidents //
Do not enter the laboratory without permission // No eating in laboratory, etc

(2 + 4)

(c) (i) Yellow

(ii) Magnet attracts iron / magnet removes iron

(2 + 4)

(d) (i) Evaporates

(ii) Condenses

(2 + 4)

(e)

Chemical	Colour when dry	Colour when wet
Cobalt chloride	Blue	Pink

(2 + 4)

OR

Anhydrous copper sulfate	White	Blue
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(f) (i) Filtration

(ii) Any insoluble solid and liquid e.g. sand and water, etc

(2 + 4)

(g) (i) **X** – Hydrogen

(ii) **Y** – Oxygen

Y	Oxygen
X	Hydrogen
	Nitrogen

(2 + 4)

(h) (i) Increase

(ii) Solvent

(iii) Salt / Named salt / Copper sulfate / Alum, etc

(1 + 1 + 8)

Question 5

- (a) Screening
Sedimentation (Settling)
Filtration
Chlorination

(1 + 1 + 5 + 5)

(b) (i) Zn (3)

(ii) Hydrogen / allow H₂ (3)

(c) (i) L – Hydrochloric acid

L	Hydrochloric acid
	Water
	Sodium chloride
S	Calcium carbonate

(ii) S – Calcium carbonate

(iii) Compound

(iv) Turns milky (cloudy / white)

(v) It goes out / Quenches

(vi) Fire extinguisher / Photosynthesis / Fizzy drinks / Refrigeration /
Dry ice / Stage effects

(5 × 3) + 6

Question 6

(a) (i) Universal indicator / pH paper / pH meter (3)

(ii) Place into solution and observe colour / Reading on meter (3)
[marks for (ii) available only if marks for (i) awarded]

(iii) Neutral (3)

Acidic (3)

Basic (3)

(b) (i) F – Hydrogen / Carbon

F	Hydrogen
	Lithium
	Nitrogen
F	Carbon

(2 × 3)

(ii) Any **one** of:

Coal / Oil / Named oil product e.g. petrol, diesel / Turf (peat) /
Natural gas (methane) (3)

(c) (i) Oxygen / O₂

(ii) To stop oxygen (O₂ / air) entering

(iii) No

Paint keeps out oxygen (O₂ / air) / Paint keeps out water (H₂O)

(3 × 3) + 6

PHYSICS

Question 7

- (a) (i) Metal
(ii) Conductor / Not an insulator
[marks for (ii) available only if marks for (i) awarded] (2 + 4)
- (b) Any **two of**:
Tidal // Geothermal // Solar // Wind // Wave // Hydroelectric (2 + 4)
- (c) (i) **C**
(ii) Fuse / Earth wire / Plastic casing / Cable grips / Earth pin longer/
Insulated wires (2 + 4)
- (d) (i) Metal / Any named metal / Copper / Graphite
(ii) It is a conductor
[marks for (ii) available only if marks for (i) awarded] (2 + 4)
- (e) (i) Gravity
(ii) Newton (2 + 4)
- (f) (i) **A**
(ii) **B** (2 + 4)
- (g) (i) Sound is a form of energy / Sound is caused by vibrations /
Sound makes air vibrate
(ii) Wear ear plugs (protection) / Any valid answer (2 + 4)
- (h) (i) Prism
(ii) Glass / Plastic / Perspex
(iii) Red / Orange / Yellow / Green / Blue / Indigo / Violet (1 + 1 + 8)

Question 8

(a) (i) Balance (scales) (3)

(ii) **State or show:**

Water in overflow can / water in graduated cylinder (3)

[vessel must be named or labelled in diagram]

Add stone (3)

Note the volume of water collected (displaced) (3)

(iii) **D** – 3

X – g/cm³

	80
D	3
X	g/cm³
	J

(3)

(3)

(b) (i) Points correctly plotted and joined / Correct line on its own (12)

Note: Award 2 marks for each correct point plotted

Award 2 marks for joining plotted points

(ii) 50 ± 2 m (3)

(iii) 10 *(6)

[If correct operation shown, e.g. 20 ÷ 2 and no answer or incorrect answer given, award (6) and deduct (1)]

Question 9

- (a) (i) Rises (3)
- (ii) Expand / Volume increases (3)
- (iii) Falls (3)
- (iv) Contract / Volume decreases (3)
-
- (b) (i) Chemical into Heat or Light / Heat into Light (6)
- (ii) Light into Electrical or Heat / Electrical into Heat (6)
-
- (c) (i) Torch / lamp / any valid source of light
- (ii) Needle (string) through holes
[Allow 'align identical cards with hole in same position in each' or
'line up cards and put a hole in all three at once'.]
- (iii) Blu tac / Retort stands / Held in hands, etc
- (iv) To stop the light affecting the results / To see result clearly

(3 × 3) + 6

Marking Criteria for Coursework B (OL) - BIOLOGY

Guide to mark assignment		
Total Marks		Mark Assignment
5	<p>Investigate and compare the quantitative effects of changing (a) the duration of light physical exercise, and (b) the time elapsed since the exercise stopped, on the pulse rate of a person.</p> <p><u>Introduction to the investigation</u></p> <p>1 (i) Statement / identification of problem / topic to be investigated (2)</p> <p>1 (ii) Background research (3) <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	
20	<p><u>Preparation and planning</u></p> <p>2 (i) Identify any relevant variables and necessary controls <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"> • duration of the light physical exercise • time elapsed since the exercise stopped • pulse rate [allow heart rate] <p><i>Other variables</i></p> <ul style="list-style-type: none"> • type of exercise • rate (intensity) of exercise • method / duration of resting after exercise / initial (rest) pulse rate • individual being tested • temperature of surroundings <i>or</i> time of day <i>or</i> clothing worn • location of pulse (radial, finger, etc) <i>or</i> method of measuring pulse rate • frequency of reading of pulse rate <p>2 (ii) List of the equipment needed for the investigation <i>Identify any <u>three</u> pieces of equipment pertinent to procedure</i> (2 + 2 + 1)</p> <p>2 (iii) List of tasks to be carried out during the investigation <i>Identify any <u>three</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> • select method to measure pulse <i>or</i> prepare for measuring pulse • measure (note) resting pulse rate • exercise • measure (note) pulse rate • repeat for different durations of exercise • measure pulse rate at suitable time intervals after stopping the exercise • record <i>or</i> graph data 	<p>(3 + 3)</p> <p>(2 + 2)</p> <p>(2 + 2 + 1)</p> <p>(2 + 2 + 1)</p>
20	<p><u>Procedure, Apparatus, Safety, Data Collection / Observations</u></p> <p>3 (i) Safety precautions <i>Identify any <u>two</u> specific safety precautions followed</i></p>	(3 + 2)

	<p>3 (ii) & (iii) Procedure followed in the investigation (<i>state or show</i>)</p> <p><i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> • reference to method of measuring pulse rate • measure (note) resting pulse rate of individual <i>or</i> self • repeat and calculate average resting pulse rate • light exercise carried out • record (note) duration of exercise • pulse rate recorded at end of exercise period • allow pulse rate to return to rest rate • repeat exercise for different time durations • starting with a pulse rate elevated by exercise, read pulse rate at intervals after exercise has stopped • record (note) time(s) elapsed since exercise stopped • repeat to verify data • record <i>or</i> graph data <p>3 (iv) Recorded Data / Observations</p> <p><i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> • effect of duration of exercise on pulse rate • effect of time elapsed after exercise on pulse rate 	<p>(2 + 2 + 2) + (1 + 1 + 1 + 1)</p> <p>(3 + 2)</p>
20	<p><u>Analysis</u></p> <p>4 (i) Calculations / Data analysis</p> <p><i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> • Excellent manipulation of two data sets with at least 2 data points in each set <i>using</i> accurate graphs / correct calculations / clear statements of analysis of data • Good manipulation of two data sets with at least 2 data points in each set <i>using</i> incomplete graphs / calculations / statements of analysis of data • Limited manipulation of one data set of with at least 2 data points <i>using</i> graphs / calculations / statement of analysis of data <p>4 (ii) Conclusion(s) and Evaluation of Result(s)</p> <p><i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> • Excellent treatment (clear, supported statements about both sets of data) • Good treatment (statements about both sets of data, not fully clear <i>or</i> not fully supported) • Limited treatment (clear, supported statements about one set of data only) 	<p>(10)</p> <p>(7)</p> <p>(4)</p> <p>Only if 3(iv) and/or 4(i) attempted</p> <p>(10)</p> <p>(7)</p> <p>(4)</p>
10	<p><u>Comments</u></p> <p><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"> • Excellent comprehension • Good comprehension 	<p>(5) } × 2 (3) }</p>

Marking Criteria for Coursework B (OL) - CHEMISTRY

Guide to mark assignment		
Total Marks		Mark Assignment
	Investigate and compare the quantitative effects of changing (a) the rhubarb surface area, and (b) the temperature of solution, on the rate of reaction (measured by noting time for decolourisation of solution) between the oxalic acid in rhubarb and dilute potassium permanganate solution (acidified with sulfuric acid).	
5	<p><u>Introduction to the investigation</u></p> <p>1 (i) Statement / identification of problem / topic to be investigated (2)</p> <p>1 (ii) Background research (3) <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	
20	<p><u>Preparation and planning</u></p> <p>2 (i) Identify any relevant variables and necessary controls <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"> • rhubarb surface area (3 + 3) • temperature of solution • rate of reaction <i>or</i> time for decolourisation of reaction mixture <p><i>Other variables</i></p> <ul style="list-style-type: none"> • amount (mass, volume, length of pieces) of rhubarb used • concentration of potassium permanganate solution • volume of potassium permanganate solution (2 + 2) • acidity of potassium permanganate solution • method of stirring <i>or</i> amount of stirring • source of rhubarb <i>or</i> method of storing rhubarb before use • temperature of surroundings (laboratory) <i>or</i> air currents <i>or</i> room temperature <p>2 (ii) List of the equipment needed for the investigation <i>Identify any <u>five</u> pieces of equipment pertinent to procedure</i> (1 + 1 + 1 + 1 + 1)</p> <p>2 (iii) List of tasks to be carried out during the investigation <i>Identify <u>first</u> task and any <u>two other</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> • use rhubarb* (2) • procure potassium permanganate solution • mix rhubarb and potassium permanganate solution <i>or</i> vice versa • note time for decolourisation • repeat with different surface areas of rhubarb (2 + 1) • repeat at different temperatures • record <i>or</i> graph data 	
20	<p><u>Procedure, Apparatus, Safety, Data Collection/Observations</u></p> <p>3 (i) Safety precautions (3 + 2) <i>Identify any <u>two</u> specific safety precautions followed</i></p>	

	<p>3 (ii) & (iii) Procedure followed in the investigation (<i>state or show</i>)</p> <p><i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> • measure out portions of rhubarb of known mass (volume, length) • expose certain surface area by cutting or chopping or peeling • prepare acidified potassium permanganate <i>or</i> measure known volume of potassium permanganate solution • add potassium permanganate to rhubarb <i>or</i> vice versa • start timer • stir or mix • measure (note) time for decolourisation of potassium permanganate solution • repeat with different surface areas of rhubarb • using water baths or otherwise to obtain different temperatures of solution • repeat at different temperatures • repeat to verify data • record <i>or</i> graph data <p>3 (iv) Recorded Data / Observations</p> <p><i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> • effect of changing rhubarb surface area on rate of reaction • effect of changing temperature of reaction mixture on rate of reaction 	<p>(2 + 2 + 2) + (1 + 1 + 1 + 1)</p> <p>(3 + 2)</p>
20	<p><u>Analysis</u></p> <p>4 (i) Calculations / Data analysis</p> <p><i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> • Excellent manipulation of two data sets with at least 2 data points in each set <i>using</i> accurate graphs / correct calculations / clear statements of analysis of data • Good manipulation of two data sets with at least 2 data points in each set <i>using</i> incomplete graphs / calculations / statements of analysis of data • Limited manipulation of one data set of with at least 2 data points <i>using</i> graphs / calculations / statement of analysis of data <p>4 (ii) Conclusion(s) and Evaluation of Result(s)</p> <p><i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> • Excellent treatment (clear, supported statements about both sets of data) • Good treatment (statements about both sets of data, not fully clear <i>or</i> not fully supported) • Limited treatment (clear, supported statements about one set of data only) 	<p>(10)</p> <p>(7)</p> <p>(4)</p> <p>Only if 3(iv) and/or 4(i) attempted</p> <p>(10)</p> <p>(7)</p> <p>(4)</p>
10	<p><u>Comments</u></p> <p><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"> • Excellent comprehension • Good comprehension 	<p>(5) } × 2 (3) }</p>

Marking Criteria for Coursework B (OL) - PHYSICS

Guide to mark assignment		
Total Marks		Mark Assignment
5	<p><u>Introduction to the investigation</u></p> <p>1 (i) Statement / identification of problem / topic to be investigated (2)</p> <p>1 (ii) Background research (3) <i>Any <u>one</u> reference to book or internet or person consulted or evidence of research</i></p>	
20	<p><u>Preparation and planning</u></p> <p>2 (i) Identify any relevant variables and necessary controls <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"> • length of pendulum [allow length of string] • mass of bob [allow weight][allow mass/weight of pendulum] • period <i>or</i> time of oscillation(s) <p style="text-align: right;">(3 + 3)</p> <p><i>Other variables</i></p> <ul style="list-style-type: none"> • number of oscillations counted • string used • bob <i>or</i> shape of bob <i>or</i> volume of bob • angle of oscillation • method of attaching string to bob <i>or</i> method of attaching string to point of suspension of bob • method of release of bob • temperature <i>or</i> air currents <i>or</i> room conditions <i>or</i> gravity <p style="text-align: right;">(2 + 2)</p> <p>2 (ii) List of the equipment needed for the investigation <i>Identify any <u>five</u> pieces of equipment pertinent to procedure</i></p> <p style="text-align: right;">(1 + 1 + 1 + 1 + 1)</p> <p>2 (iii) List of tasks to be carried out during the investigation <i>Identify any <u>three</u> tasks carried out in investigation</i></p> <ul style="list-style-type: none"> • procure pendulum • suspend string <i>or</i> pendulum from fixed point • set pendulum in oscillation • measure time for oscillation(s) • repeat for different lengths of pendulum • repeat for different masses of bob • record <i>or</i> graph data <p style="text-align: right;">(2 + 2 + 1)</p>	
20	<p><u>Procedure, Apparatus, Safety, Data Collection/Observations</u></p> <p>3 (i) Safety precautions <i>Identify any <u>two</u> specific safety precautions followed</i></p> <p style="text-align: right;">(3 + 2)</p>	

	<p>3 (ii) & (iii) Procedure followed in the investigation (<i>state or show</i>)</p> <p><i>Identify any <u>seven</u> steps taken in conducting investigation</i></p> <ul style="list-style-type: none"> • string attached to bob • pendulum suspended from a fixed point • measure (note) length of pendulum • measure (note) mass of bob • measure (note) angle of release <i>or</i> keep angle of release small • pendulum set in oscillation • take time for known number of oscillations using stopwatch (timer) <i>or</i> take time(s) for one oscillation using electronic light gates or similar • note (calculate) average time for one oscillation • repeat with different pendulum lengths • repeat with bobs of different masses • repeat to verify data • record <i>or</i> graph data <p>3 (iv) Recorded Data / Observations</p> <p><i>Identify <u>two</u> data sets</i></p> <ul style="list-style-type: none"> • effect of changing length of pendulum on period (time of oscillation) • effect of changing mass of bob on period (time for oscillation) 	<p>(2 + 2 + 2) + (1 + 1 + 1 + 1)</p> <p>(3 + 2)</p>
20	<p><u>Analysis</u></p> <p>4 (i) Calculations / Data analysis</p> <p><i>Relevant analysis of data or calculations or graph(s)</i></p> <ul style="list-style-type: none"> • Excellent manipulation of two data sets with at least 2 data points in each set <i>using</i> accurate graphs / all calculations correct / clear statements of analysis of data (10) • Good manipulation of two data sets with at least 2 data points in each set <i>using</i> incomplete graphs / calculations / statements of analysis of data (7) • Limited manipulation of one data set of with at least 2 data points <i>using</i> graphs / calculations / statement of analysis of data (4) <p>4 (ii) Conclusion(s) and Evaluation of Result(s)</p> <p><i>Relevant conclusion(s) drawn and evaluation of result(s)</i></p> <ul style="list-style-type: none"> • Excellent treatment (clear, supported statements about both sets of data) (10) • Good treatment (statements about both sets of data, not fully clear <i>or</i> not fully supported) (7) • Limited treatment (clear, supported statements about one set of data only) (4) 	<p>Only if 3(iv) and/or 4(i) attempted</p> <p>(10)</p> <p>(7)</p> <p>(4)</p>
10	<p><u>Comments</u></p> <p><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"> • Excellent comprehension • Good comprehension 	<p>(5) } × 2 (3) }</p>

Marking Criteria for Coursework B (OL) – OWN INVESTIGATION

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

