Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2012

Marking Scheme

Science

Ordinary Level

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 uncancelled answer.

(b) If two answers are given and neither answer is cancelled, the first answer offered only is accepted and marked accordingly.

(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.
Assistant 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 answer-booklet.

Marks should be totalled, the bonus for answering through Irish applied where relevant.

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.

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.

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.

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 total marks awarded for Coursework A and Coursework B to grid on the cover page of the examination answer-booklet.

SCIENCE ORDINARY LEVEL 2012

Summary of Marking Scheme

BIOLOGY

Question 1		(7 × 6 + 1 × 10)
Question 2	(a)	(6 + 3 × 3)
	(b)	(3)
	(c)	(6 + 3 × 3)
	(d)	(2 × 3)
Question 3	(a)	(4 × 3)
	(b)	(4 × 3)
	(c)	(2 × 3)
	(d)	(3 × 3)

CHEMISTRY

Question 4		(7 × 6 + 1 × 10)
Question 5	(a)	(3 × 3)
	(b)	(4 × 3), (3), (3)
	(c)	(4 × 3)
Question 6	(a)	(2 × 3), (3), (3),
	(b)	(2 × 3)
	(c)	(3), (6 + 3)
	(d)	(3 × 3)

PHYSICS

Question 7		(7 × 6 + 1 × 10)
Question 8	(a)	(3 × 3)
	(b)	(2 × 3)
	(c)	(4 × 3)
	(d)	(3), (3), (6)
Question 9	(a)	(2 × 3)
	(b)	(2 × 3)
	(c)	(3 × 3)
	(d)	(12), (3), (3)

BIOLOGY

Question 1

(a) A – Flower (petal) (3)

B – Root (3)

(b) Backbone (spine, vertebrae) (3)

	Mouse V

(3)

(c) Any ***two*** from

Nutrition (feeding)// excretion// reproduction// growth// movement//response (sensitivity)

(***any*** 2 × 3)

(d) A – Backbone (spine, vertebrae) (3)

Protection / support / movement / blood cell production / shape (structure) (3)

(e) Genes (3)

Eye Colour (3)

(f) Plasma (3)

Red blood cells (3)

(g) Oxygen (3)

Water (3)

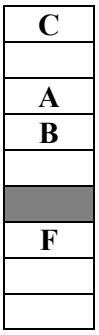
(h) Fertilisation (3)

Pill / coil / IUD (intra uterine device) / condom / diaphragm / spermicides or any correct example (3)

28 days (4)

Question 2

(a) (i) **A**: Eyepiece
B: Focus wheel
C: Lamp
F: To magnify



*(6 + 3 × 3)

(ii) Stage (3)

(b) *(6 + 3 × 3)

(i) **A**: Cell wall

(ii) **B**: Nucleus

(iii) Chloroplast / vacuole / cell wall

(iv) See parts more clearly

(c)

Cabbage (3)

Any correct example of animal competition e.g. food, mates, territory (space / shelter), water (3)

Question 3

(a) (4 × 3)

Sense			Smell		Taste
Organ		Ears		Skin	

(b) **A** – Lens (3)

B – Retina (3)

Function of C – Carry impulse (message/image) to brain (3)

Iris (3)

(c) 70 ± 2 bpm (3)

Increase (3)

(d) Atrium (3)

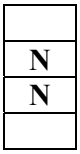
Left side has to pump blood around body / right side pumps only to lungs / pumps further (harder) (3)

Healthy diet (or qualified example) / no smoking / exercise / weight control / avoid stress / regular health checks (3)

CHEMISTRY

Question 4

(a) Nitrogen



(3)

Sulfur (3)

(b) Hydrogen (H) (3)

Oxygen (O) (3)

(c) Calcium (3)

Boiling / ion exchange / softener / distil / washing soda / bath salts (3)

(d) Sodium Chloride (NaCl) (3)

Water (H_2O) (3)

(e) Increase *(6)

(f) Oxygen

(3)

Carbon Dioxide (3)

(g) Ions (3)

Electrons (3)

(h) **Liquid X**: Hydrochloric acid (HCl) / acid / named acid (accept chemical formulae) (3)

Solid Y: Calcium Carbonate ($CaCO_3$) / limestone / marble chips / chalk / any named carbonate or hydrogen carbonate / bread soda / washing soda (3)

Milky / cloudy / white (4)

Question 5

(a) **C**: Carbon dioxide

M: Ink

E: Iron

M
C
E

(3 × 3)

(b) **A**: Round bottomed flask (3)

B: Thermometer (3)

C: Condenser (3)

D: Beaker (3)

B
A
--
--
C
D

Distillation / evaporation & condensation (3)

Part A or Round bottomed flask (3)

(c) **State or show** (4 × 3)

Filtration	**Decanting**	**Evaporation (Distillation)**
Valid filter	Mixture in container	Mixture in container
Pour mixture	Settle (stand)	Heat
Water passes through	Pour (decant)	Evaporate (boil off)
Sand remains	Sand remains	Sand remains

Relevant labelled diagram
[Diagram must have at least <u>one</u> label – no labelled diagram – deduct [3] marks]

[Marks awarded in the context of a valid experiment.]

Question 6

(a) Any ***two*** from:

Coal // oil (oil products e.g. petrol, diesel) // natural gas (methane) // peat (turf)
(***any*** 2 × 3)

Carbon Dioxide (CO_2) (3)

Water (H_2O) (3)

(b) Crude oil (3)

Do not decompose (break down / rot / decay) (3)

(c) (i) Alkaline Earth (3)

(ii) Hydrogen (H_2) *(6 +3)

Burns (lights) with a pop (squeak / bang)

(d) Oxygen (O_2) [Accept air] (3)

Water (H_2O) / moisture (3)

Painting (varnishing) / oiling (greasing) / coating / galvanising /

electroplating / alloying (3)

PHYSICS

Question 7

(a) Freezes 0 ^{o}C (3)

Boils 100 ^{o}C (3)

F
B

(b) Light (3)

Light travels faster than sound (3)

(c) 24 (3)

m^2 (3)

(d) Does not run out / can be replenished / unlimited supply / lasts forever / can be reused (3)

	Turbine **R**

(3)

(e) It is repelled / pushed away (3)

Iron / nickel / cobalt or named alloys of these metals (3)

(f) Chemical (3)

Light / heat (3)

(g) Balance / scales (3)

Mass (3)

(h) $\frac{\text{Force (F)}}{\text{Area (A)}}$ / force ÷ area (f ÷ a) (3)

Lower (3)

Barometer / pressure gauge / manometer / blood pressure monitor (sphygmomanometer / sphygmometer) (4)

Question 8

(a) B (3)

Protection / safety / insulate / prevent shock (electrocution) (3)

Live (3)

(b) Direct (3)

Alternating (3)

(c) **A** – Battery / cell (3)

B – Switch (3)

Copper (metal) (3)

Copper is a conductor / copper completes circuit / wood is an insulator / wood doesn't complete circuit (3)

(d) 0.5 ± 0.02 (3)

Voltmeter / multimeter (3)

Proportional / both increase at same rate *(6)

[Current increases with voltage (i.e. no indication of proportionality) – 3 marks only]

Question 9

(a) **Colour A**: Red (3)

Colour B: Green (3)

(b) Nothing / card / no light / darkness (3)

Light travels in straight lines (3)

(c) Water rises [Allow water (liquids) expands] (3)

Easier to see (3)

Thermometer (3)

(d) (i) Correct line on its own / 5 points correctly plotted and join plotted points (12)

Award 2 marks for each correct point plotted
Award 2 marks for joining plotted points

(ii) 7 ± 0.2 / correct figure from candidate's graph (3)

(iii) Spring balance / Newton meter (3)

BIOLOGY – Marking Criteria for Coursework B

		Guide to mark assignment	
SECTION **Aims**	**Total Mark**	**Investigate named seeds, chosen by you, to examine the effects of (a) placing the seeds in a fridge for a few days before sowing, (b) placing the seeds in a hot press for a few days before sowing on (i) the percentage of seeds that germinate, (ii) the speed of germination of the seeds.**	**O.L.**
Introduction Clear statement of the problem / topic to be investigated, background research undertaken in preparation for the investigation: people, books, websites, etc. as sources of relevant information.	**5**	**Statement / identification of problem / topic to be investigated:** **Research:** Any reference to book / internet (web) / person consulted etc / evidence of research	(3) (2)

Preparation and planning
 	
Identification of variables and controls
List of equipment needed for the investigation
List of tasks to be carried out during the investigation
	20	**Variables / Controls:**
		Identify ***four*** variables, any **two essential** variables and any **two other variables**, and/or indicate how some of these need to be controlled or held fixed.
		
		<u>Essential Variables</u>:
		Location (temperature) of seeds // percentage (number) of seeds that germinate // speed of germination of seeds
		
		<u>Other Variables / Controls</u>:
		Same seed type //same number of seeds // same time // same volume of water // same growth containers // same growth medium // same germination conditions (similar environment) // seeds at room temperature
		
		Equipment needed: Identify any ***five*** pieces of equipment used:
		Named seeds // water // growth containers // growth medium (cotton wool, filter paper, soil etc.) // graduated cylinder // thermometer (temp. sensor) // hot press (incubator) // fridge // forceps // labels // droppers // any valid piece of equipment pertinent to procedure (except safety equipment)
		
		List of tasks: Identify any ***three*** tasks carried out in investigation:
		Procure seeds // leave seeds in fridge (hot press) // prepare growth medium // plant seeds // leave seeds to germinate // monitor for germination // record data // reference to calculations
			(3 + 3)
			
			(2 + 2)
			
			(5 × 1)
			
			(2 + 2+ 1)

Procedure Procedure, apparatus, safety, data collection /observations ▪ Safety precautions required for this investigation ▪ Procedures followed in the investigation Recorded data/observations	**20**	**Safety:** Identify any ***two*** **specific** safety precautions followed in conducting the investigation **Procedure: <u>State *or* Show</u>** Identify any ***five*** steps taken in conducting investigation: Select (obtain) seeds // store set in fridge // store set in hot press // store set at room temperature // store for same time interval before sowing // put growth medium in growth container // measure volume of water // add water to growth medium // count seeds // add seeds to growth medium // label // leave seeds in same environment // monitor // record data // repeat to verify data // calculate speed of germination // calculate % germination // present data (graph) **Recorded Data / Observations:** [Table presentation likely] Identify any **two** points related to method used: Number of fridge seeds that germinate and time Number of hot press seeds that germinate and time [Allow 3 marks only for number of seeds in fridge and hot press but no reference to time]	(3 + 2) (3 + 3 + 2 + 1 + 1) (3 + 2)
Analysis & Conclusions Analysis ▪ Calculations/data analysis ▪ Conclusion(s) and evaluation of results(s)	**20**	**Calculations / Data analysis:** ***One*** relevant comment analysing data ***or*** calculation ***or*** graph Limited manipulation of data ***OR*** Good manipulation of data ***OR*** Excellent manipulation of data **Conclusion:** ***One*** relevant conclusion drawn **and** evaluation of results obtained Limited treatment ***OR*** Good treatment ***OR*** Excellent treatment	(4) (7) (10) (4) (7) (10)
Comment Comments (e.g. refinements, extensions, sources of error etc.)	**10**	***One*** comment (e.g. **refinement / extension / source of error etc.**) reliability of data / how process could be improved / sources of error /possible reason for unexpected result /possible extension of the investigation / application of knowledge Limited comprehension ***OR*** Good comprehension ***OR*** Excellent comprehension	(4) (7) (10)

CHEMISTRY – Marking Criteria for Coursework B

		Guide to mark assignment	
SECTION **Aims**	**Total Mark**	**Investigate the effects on the amount of carbon dioxide dissolved in a fizzy drink when it is stored in (a) an open container (b) a closed container, at different conditions of (i) temperature (ii) stirring or shaking (iii) time elapsed.**	**O.L.**
Introduction Clear statement of the problem/topic to be investigated, background research undertaken in preparation for the investigation: people, books, websites, etc. as sources of relevant information.	**5**	**Statement / identification of problem / topic to be investigated:** **Research:** Any reference to book / internet (web) / person consulted etc /evidence of research	(3) (2)

Preparation and planning
 	
Identification of variables and controls
List of equipment needed for the investigation
List of tasks to be carried out during the investigation
	20	**Variables / Controls:**
		Identify ***four*** variables, any **two essential** variables and any **two other variables**, and/or indicate how some of these need to be controlled or held fixed.
		
		<u>Essential Variables</u>:
		Container open or closed // temperature // stirring (shaking) // time elapsed // amount of carbon dioxide (change in mass of container) (pH change) (pressure change)
		
		Depending on variable student changes, essential variables can become other variables
		
		<u>Other Variables</u>:
		Same type of drink // same type of container // same volume // same temperature // same stirring (shaking) rate // same time // same method of measurement of carbon dioxide (balance) (pH meter / sensor / paper) (CO_2 sensor) (pressure sensor)
		
		Equipment needed: Identify any ***five*** pieces of equipment used:
		Fizzy drink *or* example // containers // lids (covers) // hotplate (Bunsen burner) // water bath // graduated cylinder // balance // thermometer (temp. sensor) // stirrer // stop clock (watch / timer) // pH meter (sensor / paper) // CO_2 sensor // pressure sensor // any valid piece of equipment pertinent to procedure (except safety equipment)
		
		List of tasks: Identify any ***three*** tasks carried out in investigation:
		Procure fizzy drink // measure volume // leave containers open (closed) // vary (set) temperature of drink // vary (set) stirring (shaking) rate of drink // vary (set) time drink is left // measure CO_2 (mass) (pH) (pressure) // record data // reference to calculations
			(3 + 3)
			
			(2 + 2)
			
			(5 × 1)
			
			(2 + 2 + 1)

Procedure Procedure, apparatus, safety, data collection /observations ▪ Safety precautions required for this investigation ▪ Procedures followed in the investigation Recorded data/observations	**20**	**Safety:** Identify any ***two*** **specific** safety precautions followed in conducting the investigation **Procedure: <u>State *or* Show</u>** Identify any ***six*** steps taken in conducting these investigations, ***<u>three steps common to the 3 experiments</u>*** ***AND*** ***<u>one step pertinent to each experiment.</u>*** **Common Steps:** Select (obtain) fizzy drink // measure volume fizzy drink // place in open container // measure **initial** CO_2 *or* mass *or* pH *or* pressure // repeat measurement at regular intervals // repeat with closed container // record data // reference to calculation // present data (table, graph) *(i)* **Temperature:** heat drink // measure temperature // repeat at different temperatures *(ii)* **Stirring (shaking) rate**: measure without stirring (shaking) // stir (shake) // repeat for different durations of stirring (shaking) *(iii)* **Time elapsed**: measure (set) time period // start timer // repeat at different time intervals **Recorded Data / Observations: :** [Table presentation likely] **Temperature** *versus* **amount of CO_2 (mass / pH / pressure)** **Stirring (shaking) rate** *versus* **amount of CO_2 (mass / pH / pressure)** **Time** *versus* **amount of CO_2 (mass / pH / pressure)**	(3 + 2) *(2 + 2 + 1) *(2 + 2 + 1) *(2 + 2 + 1)
Analysis & Conclusions Analysis ▪ Calculations / data analysis ▪ Conclusion(s) and evaluation of results(s)	**20**	**Calculations / Data analysis:** ***One*** relevant comment analysing data ***or*** calculation ***or*** graph Limited manipulation of data ***OR*** Good manipulation of data ***OR*** Excellent manipulation of data **Conclusion:** ***One*** relevant conclusion drawn **and** evaluation of results obtained Limited treatment ***OR*** Good treatment ***OR*** Excellent treatment	(4) (7) (10) (4) (7) (10)
Comment Comments (e.g. refinements, extensions, sources of error etc.)	**10**	***One*** comment (e.g. **refinement / extension / source of error etc.**) reliability of data / how process could be improved / sources of error / possible reason for unexpected result / possible extension of the investigation / application of knowledge Limited comprehension ***OR*** Good comprehension ***OR*** Excellent comprehension	(4) (7) (10)

PHYSICS – Marking Criteria for Coursework B

		Guide to mark assignment	
SECTION **Aims**	**Total Mark**	**Investigate the factors that determine the rate at which heat is lost from different types of drinking cups that contain hot liquid.**	**O.L.**
Introduction Clear statement of the problem/topic to be investigated, background research undertaken in preparation for the investigation: people, books, websites, etc. as sources of relevant information.	**5**	**Statement / identification of problem / topic to be investigated:** **Research:** Any reference to book / internet (web) / person consulted etc /evidence of research	(3) (2)

Preparation and planning
 	
Identification of variables and controls
List of equipment needed for the investigation
List of tasks to be carried out during the investigation
	20	**Variables / Controls:**
		Identify ***four*** variables, any **two essential** variables and any **two other variables**, and/or indicate how some of these need to be controlled or held fixed.
		
		<u>Essential Variables</u>:
		Type of cup // volume of liquid // type of liquid // colour of cup // size of cup (surface area) // thickness of cup // presence or absence of lid (surface area exposed) // initial temperature liquid // external temperature (surroundings) // air movements // insulation // any valid variable // heat loss (drop in temperature)
		
		Depending on variable student changes, essential variables can become other variables
		
		<u>Other Variables</u>:
		Same type of cup // same volume of liquid // same type of liquid // same colour of cup // same size cup (surface area) //same thickness // presence or absence of lid (surface area exposed) // same initial temperature liquid // place in similar surroundings // same air flow // same insulation // any valid fixed variable //same thermometer (temp. sensor) // same time interval
		
		Equipment needed: Identify any ***five*** pieces of equipment used:
		Named types of cup // lids (covers) // thermometer (temp. sensor) // liquids // paint // kettle (Bunsen , hotplate) // graduated cylinder // stop clock (watch, timer) // insulation // fan (hairdryer) // any valid piece of equipment pertinent to procedure (except safety equipment)
		
		List of tasks: Identify any ***three*** tasks carried out in investigation:
		Procure cups // set (vary) factor 1 // set (vary) factor 2 // heat liquid // measure volume // add hot liquid // monitor temperature over time // record data // reference to calculations
			(3 + 3)
			
			(2 + 2)
			
			(5 × 1)
			
			(2 + 2 + 1)

Procedure Procedure, apparatus, safety, data collection /observations ▪ Safety precautions required for this investigation ▪ Procedures followed in the investigation Recorded data/observations	**20**	**Safety:** Identify any ***two*** **specific** safety precautions followed in conducting the investigation **Procedure: <u>State *or* Show</u>** Identify any ***five*** steps taken in conducting investigation: Select (obtain) cups // heat liquid // measure volume // add hot liquid to different types of cup // note initial temperature // record temperature drop over time // record data // repeat to verify data // reference to calculations // present data (graph) ***Repeat:*** for different volumes of liquid // different types of liquid // different colour cups // different size of cup (surface area) // different thickness of cup // cups with (without) lid (exposed surface area) // different start temperatures of liquid // cups in different environments // cups in different airflow // cups with different insulation // any other valid variable **Recorded Data / Observations:** [Table presentation likely] Identify any two points related to method used: **Factor 1: temperature drop** and **time** **Factor 2 :temperature drop** and **time** [Allow 3 marks only for temperature drop for two factors but no reference to time]	(3 + 2) (3 + 3+ 2 + 1 + 1) (3 + 2)
Analysis & Conclusions Analysis ▪ Calculations/data analysis ▪ Conclusion(s) and evaluation of results(s)	**20**	**Calculations / Data analysis:** ***One*** relevant comment analysing data ***or*** calculation ***or*** graph Limited manipulation of data ***OR*** Good manipulation of data ***OR*** Excellent manipulation of data **Conclusion:** ***One*** relevant conclusion drawn **and** evaluation of results obtained Limited treatment ***OR*** Good treatment ***OR*** Excellent treatment	(4) (7) (10) (4) (7) (10)
Comment Comments (e.g. refinements, extensions, sources of error etc.)	**10**	***One*** comment (e.g. **refinement / extension / source of error etc.**) reliability of data / how process could be improved / sources of error / possible reason for unexpected result / possible extension of the investigation / application of knowledge Limited comprehension ***OR*** Good comprehension ***OR*** Excellent comprehension	(4) (7) (10)

OWN INVESTIGATION – Marking Criteria for Coursework B

Guide to mark assignment				
Section	**Aims**		**Total Mark**	**O.L.**
Introduction	Clear statement of the problem/topic to be investigated, background research undertaken in preparation for the investigation: people, books, websites, etc. as sources of relevant information.	10	**Statement / identification of problem / hypothesis statement / topic to be investigated:** (must elaborate on title) **Research:** Any ***two*** references to book / web / person consulted etc (must qualify why this person was a suitable consultant) / evidence of research	(6) (2 × 2)
Preparation and planning	Identification of variables and controls List of equipment needed for the investigation List of tasks to be carried out during the investigation	40	**Variables & Controls*:** Identify any ***five*** variables / controls: Must include **two** essential variables with respect to title. Any **three** other relevant variables /control **Equipment needed:** Identify any ***six*** pieces of equipment used **List of tasks:** Identify any ***four*** tasks carried out in investigation * If variables / controls not relevant to the type of investigation undertaken allow **8** marks for stating so and then readjust equipment to **(6 × 2)** and tasks to **(4 × 5)**	 (2 × 4) (3 × 4) (6 × 1) (4 + 4 + 3 + 3)
Procedure	Procedure, apparatus, safety, data collection / observations ▪ Safety precautions required for this investigation ▪ Procedures followed in the investigation ▪ Recorded data /observations	40	**Safety:** Identify any ***two*** safety precautions followed in conducting the investigation **Procedure:** State <u>or</u> Show Identify any ***eight*** steps taken in conducting investigation **Recorded Data / Observations:** Identify any ***two*** points related to method used [Table presentation likely]	(2 × 3) (8 × 3) (2 × 5)
Analysis & Conclusions	Analysis ▪ Calculations/data analysis ▪ Conclusion(s) and evaluation of results(s)	40	**Calculations / Data analysis:** ***Two*** relevant comments analysing data **or** calculation **or** graph Limited manipulation of data ***OR*** Good manipulation of data ***OR*** Excellent manipulation of data **Conclusion:** ***Two*** relevant conclusions drawn **or** evaluation of results obtained Limited treatment ***OR*** Good treatment ***OR*** Excellent treatment	 (4) (7) (10) } × 2 (4) (7) (10) } × 2
Comment	Comments (e.g. refinements, extensions, sources of error etc.)	20	***Four*** comments (e.g. **refinements / extensions / sources of error etc.**) What was learnt* / reliability of data / how process could be improved / sources of error / extension of investigation / possible reason for unexpected result / application of knowledge * Other than conclusions already stated	 (5 + 5 + 5 +5)