GCSE MARKING SCHEME

SUMMER 2024

GCSE
SCIENCE SUITE – PRACTICAL ASSESSMENT

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCSE SCIENCE SUITE

PRACTICAL ASSESSMENT

SUMMER 2024 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

General principles

Mark boxes

These are present in the examination papers for tables. Graphs and questions requiring extended answers, e.g. methods. Please ensure that you tick/ cross each box to correlate with the order of the marks in the mark scheme.

Tables

Do not accept abbreviations (temp, sec, etc)

If there is only 1 concentration etc in a method, then it perfectly acceptable to simply label the column as concentration.

Units should usually only be in the headings of the table.

Graphs - Common errors

1. Axes reversed – lose the label mark but nothing else
2. (0,0) not labelled on both axes at origin – lose scale mark. Accept one 0 at join of axes
3. Non-linear scales for both IV and DV, or DV only, (giving perfect straight line) – candidate can only access the label mark and 1 plotting mark – max 2
4. Non-linear scale for IV (e.g. scale is labelled 0, 20, 30 ….) – loses scale mark but can obtain all other marks (max 4)
5. Bar chart plotted – can obtain label, axes and 1 plotting mark – max 3.
   Biology – Plotting could be point to point or a *line or curve of best fit*
   Chemistry / Physics – should be line or curve of best fit.

GCSE BIOLOGY - UNIT 3

INVESTIGATING THE EFFECT OF TEMPERATURE ON CELL MEMBRANES

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>
<table>
<tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr>
<tr><td>Scalpel is <u>sharp</u></td><td>Could cut skin when cutting cylinders</td><td>Cut away from body [onto white tile]</td></tr>
<tr><td>Hot Water [can scald]</td><td>Can {scald / burn} skin when pouring water</td><td>Pour water carefully/ Wear heat proof gloves</td></tr>
</table>
Hazard = 1 mark
Risk and associated control measure = 1 mark</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (temperature, concentration) (1)
Appropriate units (°C, μg/g) included in headings (1)
Description of colour depth (1)</td><td>1
1</td><td>1

1</td><td></td><td>4</td><td>1</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>4</td><td>2</td><td>0</td><td>6</td><td>1</td><td>6</td></tr>
</table>

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Temperature	1			1		1
		(ii)		20-60 **or** 60-20 **or** 40 [°C]	1			1		1
		(iii)		Concentration [of betalain] / depth of colour	1			1		1
	(b)			Axes labelled correctly with units (1) **ecf** headings and units from the table Appropriate scales chosen so that data covers at least ½ of graph paper (1) All plots correctly plotted within < 1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit (1) Ignore point at (0,0) and only judge line between 20 and 60 °C Do not accept a thick, double, wispy line.	1 1	2 1		5	5	5
	(c)	(i)		As temperature increases, the {[betalain] concentration [in the water] / depth of colour} also increases **Or** correct description of candidate's own graph if different		1		1		1
		(ii)		Line on graph extrapolated (1) Correct value read from candidate's graph (1) Mark independently		2		2	1	2

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(d)</td><td></td><td></td><td>A random error means that {any errors are due to the person taking the measurements / results vary unpredictably from one measurement to the next} (1)
They can be reduced by taking more measurements and taking a mean (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(e)</td><td></td><td></td><td><table><tr><th>Source of inaccuracy</th><th>Improvement</th></tr><tr><td>Temperature kept changing (1)</td><td>Carry out experiment in a thermostatic water bath (1)</td></tr><tr><td>Difficult to judge depth of colour (1)</td><td>Use a colorimeter (1)</td></tr></table>Reject reference to volume</td><td></td><td>2</td><td>2</td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td>(f)</td><td></td><td></td><td>[pigment located in] vacuole / cytoplasm (1)
The cutting process damages the <u>cell</u> {membrane/ wall} (1)
[Pigment] <u>diffuses</u> [out] (1)</td><td>1</td><td>1
1</td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td>(g)</td><td></td><td></td><td>Plan at least 4 different surface areas (1)
Accept any four values [if given]
2 × control variables stated e.g. temperature / time / mass of beetroot (1)
record {colour change/ concentration} (1)
Larger surface area should show greater concentration of betalain in the water / owtte (1)</td><td></td><td></td><td>4</td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section B total</td><td>8</td><td>10</td><td>6</td><td>24</td><td>6</td><td>24</td></tr>
</table>

GCSE CHEMISTRY - UNIT 3

INVESTIGATING THE EFFECT OF CONCENTRATION ON THE REACTION BETWEEN AN ACID AND AN ALKALI

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>Accept any hypothesis that links concentration of alkali and volume of acid.
e.g. the higher the concentration of NaOH/ alkali the more volume of acid required
Hypothesis does not need to be correct.</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>
<table>
<tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr>
<tr><td rowspan="2">Dilute sodium hydroxide solution is an irritant</td><td>Could transfer from hands to eyes</td><td>Wear eye protection</td></tr>
<tr><td>Spill onto skin when pouring/ measuring</td><td>Wash hands / wear gloves</td></tr>
</table>
Risk and linked control measure (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (concentration of <u>NaOH</u>/ <u>alkali</u>, volume of <u>HCl</u>/ <u>acid</u>) (1)
Appropriate units (mol / dm^3, cm^3) included in headings (1)
Final volumes correctly calculated (1)</td><td>1
1</td><td>1

1</td><td></td><td>4</td><td>1</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>4</td><td>2</td><td>0</td><td>6</td><td>1</td><td>6</td></tr>
</table>

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Concentration of the {NaOH/ sodium hydroxide/ alkali}	1			1		1
		(ii)		0.04 - 0.10 **or** 0.10 - 0.04 **or** 0.06 [mol / dm^3]	1			1		1
		(iii)		Volume of the {acid/ HCl/ hydrochloric acid} [added]	1			1		1
		(iv)		Burette **and** 0.1 [cm^3] Accept 0.05 [cm^3]	1			1		1
	(b)	(i)		Neutralisation/ exothermic	1			1		1
		(ii)		Water/ H_2O		1		1		1
	(c)			Axes labelled correctly with units (1) **ecf** headings and units from the table Appropriate scales chosen that use at least ½ of graph paper (1) All plots correctly plotted within < 1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit (1) Do not accept a thick, double, wispy line	1 1	2 1		5	5	5
	(d)	(i)		The higher the concentration, the greater the volume of acid (1) at a constant rate (1) Volume is proportional to concentration = 2 marks Correct description of candidate's own graph if different = 2 marks		2		2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Correct value read from candidate's graph at 25 cm^3 [lines do not need to be shown on graph]		1		1	1	1
		(iii)		Appropriate comment regarding candidate's own value compared to the true value. e.g. My answer was close to the true value therefore it is accurate.			1	1		1
		(iv)		End point hard to judge / could overshoot the end point (1) The resolution of the measuring cylinder used to measure volume of NaOH is not good enough / only measures to the nearest cm^3 (1)		2		2		2
	(e)	(i)		25.2 [cm^3] (27.3 not used)		1		1	1	1
		(ii)		Results are precise as {most attempts/ three attempts/ attempts 2,3 and 4} are close together (1) apart from attempt 1 which is {a trial result/ a rough result/ anomalous} (1)			2	2		2
		(iii)		Potassium nitrate / KNO_3	1			1		1
		(iv)		Add {25.2 cm^3 / volume calculated in (e)(i)} of the [nitric] acid [to potassium hydroxide/ alkali] (1) without the indicator (1) [leave to] evaporate [to dryness] (1)			3	3		3
				Section B total	**8**	**10**	**6**	**24**	**7**	**24**

GCSE PHYSICS - UNIT 3

INVESTIGATING THE STRENGTH OF AN ELECTROMAGNET

SECTION A

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			Accept any hypothesis that links number of turns/ coils and the mass [of pins] picked up. e.g. more turns, more pins picked up Hypothesis does not need to be correct	1			1		1
	(b)			Steel is {magnetic / attracted to a magnet} / copper is not magnetic (1) Accept it is magnetic	1			1		1
	(c)			All data recorded and logically organised (1) Suitable column headings (number of {turns/ coils}, mass [of pins]) (1) Appropriate units (g) included in headings (1) Correct calculation of means (1)	1 1	1 1		4	1	4
				Section A total	**4**	**2**	**0**	**6**	**1**	**6**

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Number of {turns / coils}	1			1		1
		(ii)		10-30 / 30-10 / 20	1			1		1
		(iii)		Mass of pins	1			1		1
		(iv)		Voltage/ current / battery (1) Because this changes the {strength of the electromagnet/ number of pins picked up} (1) **OR** Material/ thickness of wire (1) Because this changes the {current in the wire/ strength of the electromagnet/ number of pins picked up} (1) **OR** Material of the core/ same iron rod (1) because this changes the {strength of the electromagnet/ number of pins picked up} (1)	1	1		2		2
	(b)	(i)		Axes labelled correctly with units (1) **ecf** headings and units from the table. Appropriate scales chosen that use at least ½ of graph paper (1) All plots correctly plotted within < 1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit (1) Do not accept a thick, double, wispy line.	1 1	2 1		5	5	5
		(ii)		As number of turns increases the mass [picked up] increases (1) **Or** correct description of candidate's own graph if different Therefore, the stronger the electromagnet (1)		2		2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Judgement of repeatability backed up with reference to similarity of repeats (1) use of data (1)			2	2		2
		(ii)		Compare results to other groups.	1			1		1
		(iii)		**Any two inaccuracies with linked improvement** Mass only recorded to mass of whole pin (1) Use smaller pins (1) **OR** Distance to end of rod not well controlled (1) Secure in position (1) **OR** Difficult to ensure that all the turns are an equal {length/ spacing/ tightness/ owtte}/ not all turns are touching the rod (1) Measure the {length/ spacing/ owtte} of wire used/ each turn should be touching the rod (1)		2	2	4		4
	(d)	(i)		0.01 [A]	1			1		1
		(ii)		Current is double the original value (1) and force is also double the original value, so it is proportional (1) ORA		2		2	2	2
		(iii)		It is close to the true value (1) so results are <u>accurate</u> (1)			2	2		2
				Section B total	**8**	**10**	**6**	**24**	**7**	**24**

BIOLOGY – UNIT 3

SCIENCE (DOUBLE AWARD) – UNIT 7

INVESTIGATING THE EFFECT OF SWEATING ON THE RATE OF COOLING

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>Accept any hypothesis that links the sweating and dry tubes to {heat loss/ temperature change}.
e.g. the sweating tube will lose more heat than the dry tube
Hypothesis does not need to be correct.</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td><table><tr><td>Hazard</td><td>Risk</td><td>Control Measure</td></tr><tr><td>Hot water can scald</td><td>Can {scald / burn} skin when pouring water</td><td>Pour water carefully/ Wear heat proof gloves</td></tr></table>Risk and control measure (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (time, temperature, indication of type of tube) (1)
Appropriate units (°C, minutes) included in headings (1)
Accept two separate tables</td><td>1
1</td><td>1</td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Correct calculation of both temperature changes</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>4</td><td>2</td><td>0</td><td>6</td><td>1</td><td>6</td></tr>
</table>

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Temperature [change]	1			1		1
		(ii)		Answer from candidate's own data for the sweating tube [ecf from section A (c) (ii) sweating tube] Accept smallest to largest value/ largest to smallest value/ the difference between these values Ignore units	1			1		1
		(iii)		<table><tr><th>Control variable</th><th>How was this variable controlled</th></tr><tr><td>Volume of water</td><td>Used a measuring cylinder to measure 40 cm^3.</td></tr><tr><td>Time</td><td>Used a stopwatch to time 5 minutes</td></tr><tr><td>Temperature of water at the start</td><td>Water at 55-60 °C was used</td></tr></table> Any two control variables (2) with corresponding description (2)	2	2		4		4
	(b)	(i)		Axes labelled correctly with units (1) **ecf** headings and units from the table. Appropriate scales chosen that use at least ½ of graph paper (1) Accept less than half if scale could not be doubled All plots correctly plotted within < 1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit up to 5 minutes (1) Do not accept a thick, double, wispy line.	1 1	2 1		5	5	5

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Line on graph extended to 6 minutes(1) Correct value read from candidate's graph (1)		2		2	1	2
	(c)	(i)		{Sweating/ wet} tube has a greater {temperature loss/ change}/ ORA/ answer linked to candidate's own data.		1		1		1
		(ii)		{Sweat/ liquid} <u>evaporates</u> [from the surface of the skin] (1) Uses {heat/ energy} / Increasing {heat/ energy} loss (1)	2			2		2
	(d)	(i)		<table><tr><td>Inaccuracy</td><td>Improvement</td></tr><tr><td>Measuring cylinder was only accurate to the nearest cm^3.</td><td>Use measuring cylinder with a {higher/ smaller*/ greater/ better} resolution/ Use measuring cylinder with smaller* scale divisions/ use a burette (1) *Accept smaller but not lower or bigger</td></tr></table>			1	1		1
		(ii)		Sweat is usually warm/ sweat is {body temperature/ 37 °C}/ sweat contains other substances also.			1	1		1
	(e)	(i)		14 + 15 = 29 (1) $\frac{29}{2}$ = 14.5 or 15 (1) Award two marks for correct answer without any working shown.		2		2	2	2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		[Repeating results] allowed them to identify which result was {anomalous/ owtte} (1) So it {can be ignored/ not be included in calculation} (1)			2	2		2
		(iii)		The results {are close together/ within a narrow range/ similar} (1) Relevant use of data to support this comment (1)			2	2		2
				Section B total	**8**	**10**	**6**	**24**	**8**	**24**

CHEMISTRY – UNIT 3

SCIENCE (DOUBLE AWARD) – UNIT 7

APPLIED SCIENCE (DOUBLE AWARD) – UNIT 5

INVESTIGATING EXOTHERMIC REACTIONS

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>Accept any hypothesis that links temperature with time
e.g. as the time increases the temperature also increases
accept ‘hotter’ as meaning the same as temperature increase
Accept reference to heat energy release instead of temperature change.
Hypothesis does not need to be correct.</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>
<table>
<tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr>
<tr><td rowspan="2">Dilute copper(II) sulfate solution is an irritant</td><td>Could transfer from hands to eyes</td><td>Wear eye protection</td></tr>
<tr><td>Spill onto skin when pouring</td><td>Wash hands / wear gloves</td></tr>
</table>
Risk and associated control measure (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (time / temperature [of mixture]) (1)
Appropriate units (s/ seconds, °C) included in headings (1)
Correct calculation of mean temperature (1)</td><td>1
1</td><td>1

1</td><td></td><td>4</td><td>1</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>4</td><td>2</td><td>0</td><td>6</td><td>1</td><td>6</td></tr>
</table>

SECTION B

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td></td><td>Time</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Temperature</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>
<table>
<tr><th>Control variable</th><th>How it was controlled</th></tr>
<tr><td>Volume [of copper sulfate solution]</td><td>25 cm^3 – using a measuring cylinder</td></tr>
<tr><td>Concentration [of the copper sulfate solution]</td><td>0.5 mol/dm^3 solution used for {each/ every} result</td></tr>
<tr><td>Mass [of zinc]</td><td>2.5 g for each sample – using a {balance/ preweighed}</td></tr>
</table>
Any control variable (1)
with corresponding description (1)</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Axes labelled correctly with units (1) ecf headings and units from table
Appropriate scales chosen that use at least ½ of graph paper (1)
All plots correctly plotted with <1 small square tolerance (2)
1 error (1) >1 error (0)
Appropriate line of best fit (1)
Do not accept a thick, double, wispy line.</td><td>1
1</td><td>2
1</td><td></td><td>5</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>I</td><td>Maximum temperature correctly identified from graph.</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td>II</td><td>Calculation of temperature change (ecf from values selected)</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Correct substitution of values (1) ecf Correct answer (1) Award two marks for correct answer only	1	1		2	2	2
		(iv)	I	As time increases, the temperature increases and then decreases. **Or** correct description of candidate's own graph if different		1		1		1
			II	**Any two (x1) from** • When the temperature is rising the <u>reaction</u> is taking place (1) • At {given/ highest} {temperature/ time} the <u>reaction</u> is complete (1) • The temperature {decreases/ stays the same} {once the {reaction/ displacement} is complete/ when no more energy is being released} (1) Accept for 2nd mp if candidate data supports Reaction has not completed as the temperature is still rising	2			2		2
		(v)		Value between 18 °C and 23 °C – because would return to {starting/ room} temperature Accept candidate's answer from 0 seconds.		1		1		1

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>
<table>
<tr><td>Inaccuracy</td><td>Improvement</td></tr>
<tr><td>Heat loss</td><td>Wrap the {cup/ glass beaker} in cotton wool/ increase insulation/ use two cups/ use lid [on the cup] (1)</td></tr>
<tr><td>The measuring cylinder {only measures to the nearest cm^3/ is not precise/ has a low resolution/ owtte } (1)</td><td>Use a burette/ pipette to measure the volume of copper(II) sulfate solution</td></tr>
</table>
</td><td></td><td>1</td><td>1</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td></td><td>Correct order of reactivity –
Magnesium/ Mg > Zinc/ Zn > Iron/ Fe
Accept correct symbols.</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Good [precision] for zinc and magnesium (1)
because the results are close together (1)
OR
Poor [precision] for iron (1)
because the results are not close together (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Use of data e.g. 11 is just as far from 15 as 19 / all results are equally spread apart / owtte (1)
so {either / any} could be anomalous (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section B total</td><td>8</td><td>10</td><td>6</td><td>24</td><td>9</td><td>24</td></tr>
</table>

PHYSICS – UNIT 3

SCIENCE (Double Award) – UNIT 7

INVESTIGATING THE MOTION OF A FALLING OBJECT

SECTION A

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			Accept any hypothesis that links {distance/ [drop] height} and {speed / time} e.g. As height increases, speed / time increases Hypothesis does not need to be correct.	1			1		1
	(b)			<table><tr><td>HAZARD</td><td>RISK</td><td>CONTROL MEASURE</td></tr><tr><td></td><td></td><td></td></tr></table> No significant risk/ OWTTE seen in any column. Accept for 1 mark Hazard = Pointer is <u>sharp</u>	1			1		1
	(c)			All data recorded and logically organised (1) Suitable column headings (height/distance, time, mean time) (1) Appropriate units (cm, seconds/s) included in headings (1) Correct calculation of mean time (1)	1 1	1 1		4	1	4
				Section A total	**4**	**2**	**0**	**6**	**1**	**6**

SECTION B

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td></td><td>Distance
Accept height</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Time [taken to drop/ fall]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>150 – 50 or 50 – 150 or 100 [cm]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iv)</td><td></td><td>0.01 [s]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(v)</td><td></td><td><table><tr><td>Control variable</td><td>Why was it controlled?</td></tr><tr><td>Area of the case</td><td>Changing the area changes the {air resistance/ drag/ time/ speed} (1)</td></tr></table></td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Axes labelled correctly with units (1) ecf headings and units from table.
Appropriate scales chosen that use at least ½ of graph paper (1)
All plots correctly plotted with <1 small square tolerance (2)
1 error (1) >1 error (0)
Appropriate line of best fit (1)
Do not accept a thick, double, wispy line</td><td>1
1</td><td>2
1</td><td></td><td>5</td><td>5</td><td>5</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		As distance increases, the time increases (1) at a constant rate (1) **OR** correct description of candidate's own graph if different = 2 marks If distance doubles, time doubles = 2 marks time is proportional to distance = 2 marks		2		2		2
	(c)	(i)		All speeds correct (2) Two speeds correct = 1 mark Unit – cm/s (1)		3		3	3	3
		(ii)		Similar speeds [indicate terminal speed]/ ORA (1) Correct use of data to compare speeds for different heights (1) Only award 2nd mp if 1st mp awarded			2	2		2
	(d)	(i)		Substitution of correct values (1) Correct answer (1) Award two marks for correct answer only	1	1		2	2	2
		(ii)		**Any 2 (×1) from:** – {Record/ video/ use} {camera/ phone} – Use light gates – Increase the {drop/ release} heights.			2	2		2
		(iii)		**Comment on repeatability = 1 mark** e.g. they are repeatable as readings are {[very] similar/ close together} / ORA (1) no mark for reference to yes/ no only **Justification = 1 mark** **Either** numerical data (from table) e.g. all within 0.1 s **or** uncertainty value in d(i) (1)			2	2		2
		(iv)		Compare results to other groups	1			1		1
				Section B total	**8**	**10**	**6**	**24**	**10**	**24**

GCSE APPLIED SCIENCE (DOUBLE AWARD) - UNIT 5

INVESTIGATING HEAT RADIATION

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>Accept any hypothesis that links colour of container with {temperature/ heat}.
e.g. the temperature of the air will increase more in the black container than in the silver container
Hypothesis does not need to be correct.</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>
<table>
<tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr>
<tr><td rowspan="2">Hot lamp [can burn]</td><td>Can burn skin [fingers] when moving the lamp.</td><td>Move the lamp by the base only.
Allow lamp to cool before moving.</td></tr>
<tr><td>Can burn skin [fingers] if touched when taking measurements</td><td>Take care when taking measurements</td></tr>
</table>
Hazard (1)
Risk and control measure (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (time, temperature, reference to colour) (1)
Appropriate units (minutes, °C) included in headings (1)</td><td>1
1</td><td>1</td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>5</td><td>1</td><td>0</td><td>6</td><td>0</td><td>6</td></tr>
</table>

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Colour of container Accept time	1			1		1
		(ii)		Correct range of temperatures in **black** container (from candidate's results)	1			1		1
		(iii)		Controlled variable (1) and how it was controlled (1) For example: Distance [from lamp] (1), measured with a <u>ruler</u> to be <u>5 cm</u> (1) Size/ shape of container (1), two <u>identical</u> containers used/ owtte (1) [Heating] time (1), {each container heated/ timed} for <u>10 minutes</u> measured using a <u>stopwatch</u> (1)	1	1		2		2
	(b)			Axes labelled correctly with units (1) **ecf** headings and units from table. Appropriate scales chosen that use at least ½ of graph paper (1) Accept less than half if scale could not be doubled All plots correctly plotted with <1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit (1) Do not accept a thick, double, wispy line.	1 1	2 1		5	5	5
	(c)			As time increases, the temperature increases (1) at a constant rate/ at an increasing rate/ at a decreasing rate/ levels off (1) Correct statement that matches candidate's own data = 2 marks		2		2		2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		Carry out the experiment more times [and compare the results to see if they are similar]	1			1		1
		(ii)		Both groups got similar results (1) use of data (1)			2	2		2
		(iii)		Black container = 6 [°C] (1) Container wrapped in aluminium foil = 3 [°C] (1)		2		2		2
		(iv)		$[\frac{6}{10}]$ = 0.6 [°C / min] (1) ecf		1		1	1	1
		(v)		Black surfaces are better absorbers [of infra-red radiation] (1) Accept black absorbs and silver reflects			1	1		1
	(e)	(i)		Substitution: 100 × 600 (1) Energy transfer = 60 000 [J] (1) Award two marks for correct answer only Award one mark for an answer of 1 000 [J]	1	1		2		2
		(ii)		Some is {absorbed by/ transferred to/ owtte} {the plastic container/ the [surrounding] air}.		1		1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)			• At least two control variables stated, e.g equal volumes of hot water/ same size mug/ same time/ same start temperature (1) • Brief description of method, e.g. measure temperature, start stopwatch, measure temperature again after xx mins (1) • Clear statement as to how the results would be analysed e.g. calculate change in temperature for each mug/ see which one has the biggest temperature drop (1)			3	3		3
				Section B total	**7**	**11**	**6**	**24**	**6**	**24**

APPLIED SCIENCE (DOUBLE AWARD) – UNIT 5

APPLIED SCIENCE (SINGLE AWARD) – UNIT 4

INVESTIGATING THE VITAMIN C CONTENT OF FRUIT JUICES

SECTION A

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			<table><tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr><tr><td></td><td></td><td></td></tr></table> No significant risk/ DCPIP currently not classified as hazardous seen anywhere	1			1		1
	(b)			To keep healthy/ to have a balanced diet/ ensure we avoid deficiency diseases Accept scurvy	1			1		
	(c)			All data recorded and logically organised (1) Suitable column headings ([name of] juice, number of drops [needed to decolourise DCPIP]) (1) Appropriate units for dependent variable (drops) included in headings. No unit for independent variable (1) Correct calculation of means (1)	1 1	1 1		4	1	4
				Section A total	**4**	**2**	**0**	**6**	**1**	**5**

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		{Type / flavour} of juice	1			1		1
		(ii)		[Number of] drops [of juice needed to decolourise DCPIP]	1			1		1
		(iii)		<table><tr><th>Control variable</th><th>How it was controlled</th></tr><tr><td>Volume of DCPIP (1)</td><td>1 cm^3 measured using a syringe (1)</td></tr><tr><td>Concentration of DCPIP (1)</td><td>Kept at 0.01 % (1)</td></tr></table>	2	2		4		4
		(iv)		0.1[cm^3]	1			1		1
	(b)	(i)		Axes labelled correctly with units (1) Appropriate scales chosen that use at least ½ of graph paper (1) All plots correctly plotted with <1 small square tolerance (2) 1 error (1) >1 error (0) Appropriate line of best fit (1) Do not accept a thick, double, wispy line.	1 1	2 1		5	5	5
		(ii)		Correct calculation of vitamin C content for orange juice from candidate's graph i.e. expected answer 0.25 [mg/cm^3]		1		1	1	1
	(c)	(i)		[Results {partially/ do not} support the hypothesis] Orange has a {higher concentration/ fewer drops} than pineapple (1) and {a lower concentration/ more drops} than grapefruit (1) **ecf** from (b)(ii)			2	2		2

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Good [repeatability] for orange and pineapple (1)
because the results are close together (1)
OR
Poor [repeatability] for grapefruit (1)
because the results are not close together (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Did not compare with another group</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(d)</td><td></td><td></td><td><table><tr><th>Inaccuracy</th><th>Improvement</th></tr><tr><td>Drops of juice not all the same {size/ volume}/ more than one drop added (1)</td><td>Use a {burette/ graduated pipette} [to deliver a fixed volume] (1)</td></tr><tr><td>Difficult to judge end point (1)</td><td>Use a colour chart/ colorimeter/ keep first tube as a comparison/ use white {tile/ background} (1)</td></tr></table></td><td></td><td>2</td><td>2</td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td>(e)</td><td></td><td></td><td>$\frac{40}{0.84}$ (1)
= 47.62 or 47.6 or 48 [cm^3] (1)
Correct answer only award 2 marks</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section B total</td><td>8</td><td>10</td><td>6</td><td>24</td><td>8</td><td>24</td></tr>
</table>

APPLIED SCIENCE (SINGLE AWARD) – UNIT 4

INVESTIGATING THE EFFECT OF CONCENTRATION ON THE BREAKDOWN OF HYDROGEN PEROXIDE

SECTION A

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td></td><td>Accept any hypothesis that links concentration [of hydrogen peroxide] and height of foam.
e.g. As the {concentration/ strength} of the hydrogen peroxide increases the {height / volume} of the {contents of the measuring cylinder/ foam} increases
Accept rate of reaction as an alternative or height/ volume of foam
Hypothesis does not need to be correct.</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td><table><tr><th>HAZARD</th><th>RISK</th><th>CONTROL MEASURE</th></tr><tr><td rowspan="2">Dilute hydrogen peroxide solution is an irritant</td><td>Could transfer from hands to eyes</td><td>Wear eye protection</td></tr><tr><td>Spill onto skin when pouring</td><td>Wash hands/ wear gloves</td></tr></table>Risk and control measure (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>All data recorded and logically organised (1)
Suitable column headings (concentration [of hydrogen peroxide], volume) (1)
Appropriate units (vol, cm^3) included in headings (1)
Calculation of means (1)</td><td>
1
1</td><td>1

1</td><td></td><td>4</td><td>1</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Section A total</td><td>4</td><td>2</td><td>0</td><td>6</td><td>1</td><td>6</td></tr>
</table>

SECTION B

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td></td><td>Concentration [of hydrogen peroxide]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>4 – 20 or 20 – 4 or 16 [vol]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Height / volume [of foam]</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iv)</td><td></td><td><table><tr><th>Control variable</th><th>How it was controlled</th></tr><tr><td>Volume of hydrogen peroxide</td><td>Measured 10 cm^3 in a measuring cylinder</td></tr><tr><td>Time</td><td>Measured 30 seconds with a stopwatch</td></tr><tr><td>Quantity of manganese dioxide</td><td>Used {the tip of a/ 1} spatula</td></tr><tr><td>Volume of washing up liquid</td><td>Measured 0.5 cm^3 with a pipette</td></tr></table>Any 2 control variables (2)
With corresponding controls (2)</td><td>2</td><td>2</td><td></td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>Axes labelled correctly with units (1) ecf headings and units from the table.
Appropriate scales chosen that use at least ½ of graph paper (1)
All plots correctly plotted within <1 small square tolerance (2)
1 error (1) >1 error (0)
Appropriate line of best fit (1)
Do not accept a thick, double, wispy line.</td><td>1
1</td><td>2
1</td><td></td><td>5</td><td>5</td><td>5</td></tr>
</table>

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>As the concentration of hydrogen peroxide increases the {height / volume} [of the foam] increases
Or correct description of candidate's own graph if different</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td></td><td>[A catalyst] {speeds up a reaction/ lowers the activation energy}</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Adding manganese dioxide causes the {decomposition/ reaction} to happen much more quickly/ Adding manganese dioxide speeds up the reaction
or
Manganese dioxide is still there at the end/ no manganese dioxide is used up</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(e)</td><td></td><td></td><td>Any 1 suitable inaccuracy (1)
+ linked improvement (1)
<table><tr><th>Inaccuracy</th><th>Improvement</th></tr><tr><td>Used a spatula to measure manganese dioxide</td><td>Weigh the manganese dioxide/ use given mass</td></tr><tr><td>{Washing up liquid / manganese dioxide} {isn't all at the bottom of the measuring cylinder/ sticks to the side}</td><td>Put pipette deeper into the measuring cylinder / use a funnel</td></tr><tr><td>Temperature [of the room] was not controlled</td><td>Use a water bath</td></tr></table></td><td></td><td>1</td><td>1</td><td>2</td><td></td><td>2</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)	(i)		The data is reproducible in [as far as] the same trend is seen in Group A and Group B (1) The values for each concentration are [very] different between groups and show poor reproducibility/ are not reproducible (1)			2	2		2
		(ii)		Selection of correct values i.e. 24 and 20(1) $\frac{24-20}{2}$ = 2 [cm^3] (1) Correct answer only award 2 marks		2		2	2	2
	(g)			**Any three (×1) from:** • 2 controlled variables – e.g. concentration of H_2O_2 / volume of H_2O_2 **/** manganese dioxide**/** washing up liquid. • Method of temperature control – e.g. water bath. • Suitable range of temperatures – at least 4 temperatures, at least 5 °C apart, in range 0-100 °C. • Method of analysing results – compare volume of foam at different temperatures/ owtte			3	3		3
				Section B total	**8**	**10**	**6**	**24**	**7**	**24**