

Cambridge Technicals Applied Science

Unit 23: Scientific research techniques

Level 3 Cambridge Technical in Applied Science
05874

Mark Scheme for January 2023

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING

TRADITIONAL















Before the Standardisation meeting you must mark at least 10 scripts from several centres. For this preliminary marking you should use **pencil** and follow the **mark scheme**. Bring these **marked scripts** to the meeting.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the traditional 40% Batch 1 and 100% Batch 2 deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or by email.
5. Work crossed out:
 - a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional lined pages if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add an annotation to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in anyway relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question

Note: Award 0 marks - for an attempt that earns no credit (including copying out the question)

8. Assistant Examiners will email a brief report on the performance of candidates to your Team Leader (Supervisor) by the end of the marking period. Your report should contain notes on particular strength displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.
9. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

10. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

11. **Subject-specific marking instructions**

PE to provide any additional information here.

Question			Answer	Marks	Guidance
1			D ✓	7	
			C ✓		
			B ✓		
			A ✓		
			D ✓		
			F ✓		
			E ✓		

Question			Answer	Marks	Guidance
2	(a)	(i)	<p>Any two from:</p> <p>breeding success/puffin population, decreases, as/because, the mass of prey loads decreases / breeding success, affected by/changes with, mass of preyloads / positive correlation ✓</p> <p>breeding success/puffin population, decreases, as/because, the mass of individual fish decreases / breeding success, affected by/changes with, mass of individual fish / positive correlation ✓</p> <p>the mass of prey loads decreases, as/because, the mass of individual fish decreases ✓</p>	2	<p>ALLOW ORA throughout for higher breeding success / mass of fish / preyloads</p> <p>ALLOW 'mass of fish' or 'mass of prey' unqualified, once</p>
2	(a)	(ii)	<p>Any three from:</p> <p>(evidence that) breeding success is only dependent on prey load ✓</p> <p>(evidence that) decreased breeding success is not due to:</p> <ul style="list-style-type: none"> • predation ✓ • pollution ✓ • climate change ✓ <p>(evidence that) there has been, a decline/change in the population of/shortage of/fewer, fish ✓</p> <p>evidence that the mass of fish to each chick is too small to ensure survival ✓</p>	3	

Question		Answer	Marks	Guidance
2	(b)	<p>Scattered data plots</p> <p>Any one from:</p> <p>correlation between two variables ✓ spread/range/variation, of data ✓ identify, outliers/anomalies ✓</p> <p>Trend lines</p> <p>pattern in data ✓ rate (of change) ✓</p>	2	ALLOW direction
		Total	7	

Question			Answer	Marks	Guidance
3	(a)	(i)	<p>valid – ammonia is, detected/collected/in the filter</p> <p>OR air samplers are placed near to where ammonia is emitted (as it only lasts a few hours) ✓</p> <p>OR check results using another, method /source ✓</p> <p>reliable – the sampler resists weather conditions / works, continuously/fully / collector does not get contaminated / resists damage / durable ✓</p> <p>repeatable – same conditions produce identical/similar results / two collectors in the same location detect the same amount of ammonia ✓</p> <p>OR same, physical environment/location ✓</p> <p>OR variables kept the same ✓</p> <p>OR written method ✓</p>	3	ALLOW ORA should read zero when placed in area known to have no ammonia
3	(a)	(ii)	<p>Any two from:</p> <p>many samplers may be needed / samplers may be in short supply ✓</p> <p>space needed for/size of, sampler / portability ✓</p> <p>cost / affordability (of samplers/filters) ✓</p> <p>the filters must be collected manually / people are needed to collect/replace filters ✓</p> <p>how often the filters must be, collected /replaced ✓</p> <p>location / accessibility (of site) ✓</p> <p>complexity (of technique)</p>	2	E.g. training needed, ease of use
3	(b)		a set of (technical) instructions/procedures/steps/rules / a description of how to prepare/analyse ✓	1	
Total				6	

Question		Answer	Marks	Guidance
4	(a)	<p>Source A. Any three from: report of the results/conclusions, of work done by others / uses secondary data ✓</p> <p>no, data/results, are provided ✓</p> <p>not subject to peer review/academic scrutiny ✓</p> <p>refers to original sources/authors (so claims can be checked) ✓</p> <p>AVP ✓</p> <p>Source B. Any three from: report (of the method/results/conclusions) of work done by the authors / primary data ✓</p> <p>subject to peer review/academic scrutiny / from, academic publication/scientific journal ✓</p> <p>methodology is described ✓</p> <p>results are used to justify conclusions ✓</p>	6	<p>E. g. qualitative data / not quantitative data</p> <p>ALLOW fact-checked</p>
4	(b)	<p>Any two from weight loss can be explained by going to the toilet ✓</p> <p>weight gain can be explained by, gaining muscle, eating ✓</p> <p>ketones, are produced by/correlate with, burning fat ✓</p> <p>'weight can go up or down during the day but this won't tell us if we are actually burning body fat' ✓</p>	2	

Question		Answer	Marks	Guidance
4	(c)	<p>Any seven from:</p> <p>columns or rows for:</p> <ul style="list-style-type: none"> • tabulated data (e.g. lines to indicate rows and columns) ✓ • volunteer ID (e.g. 1, 2, Male1, Female 4) ✓ • BMI ✓ • weight /mass ✓ • (breath) propanone (level) ✓ • (units for BPL) ppm v/v ✓ • week 1 to 4 / days 1 - 28 ✓ • impedance and urine ketones ✓ • use of a table key e.g. BMI or BAL ✓ 	7	ALLOW clear indication of rows and columns
4	(d)	<p>A - People with, diabetes/insulin dependence, should consult/be monitored by, their doctor or consultant ✓</p> <p>B - Approval by a Human Study Review Board/HSRB / chose healthy individuals ✓</p>	2	ALLOW text copied directly from the source material, without further explanation.
4	(e)	(Source B states) no correlation of urine ketones to ... weight loss' ✓	1	
4	(f)	R ² /correlation, high/linear/0.94/0.96 ✓ compared to, gas/liquid, chromatography/GC/LC ✓	2	
Total			20	

Question		Answer	Marks	Guidance
5	Report	<p>Levels of Response</p> <p>Level 3</p> <ul style="list-style-type: none"> • Provides a detailed justification of the focus of the research • Detailed information and evidence generated which is clearly relevant and applicable to the area of focus • Information is interpreted and used effectively, justifying the findings reported • Detailed evaluation of methods and sources used and evidence generated • Detailed conclusions based on the sources used and evidence generated • Clear consideration of the validity, reliability and generalizability of the research undertaken • Implications of the findings are well thought through and clearly presented. • Provides clear proposals of possible areas for further research which are relevant to the focus/theme and are feasible. • Well-structured and clear reporting with correct terminology used • Many points are developed <p style="text-align: right;">[16 – 20 marks]</p>	20	<p>Valid points</p> <ul style="list-style-type: none"> • Explanation of area of focus <ul style="list-style-type: none"> ○ is clear and concise ○ may be expressed as question(s) to explore ○ related to the pre-released material ○ may be oppositional ○ may be a different slant • Justification <ul style="list-style-type: none"> ○ in relation to the pre-release ○ in relation to own personal interest in the theme ○ in relation to another specific source ○ in relation to current/contemporary issues linked to the pre-release • Reporting of findings taking into consideration: <ul style="list-style-type: none"> ○ appropriate use of information/data ○ comparing and contrasting methods, results or findings ○ relevance and appropriateness of findings from information gathered ○ clear link and relevance to area of focus being researched <ul style="list-style-type: none"> ○ acknowledgement of sources ○ avoidance of plagiarism ○ consideration of any relevant ethical issues • Evaluation of research should aim to assess validity, reliability and generalizability related to the following:

Question	Answer	Marks	Guidance
	<p>Level 2</p> <ul style="list-style-type: none"> • Provides a sound justification of the focus of the research. • Detailed information and evidence generated which is of some relevance to the area of focus • Information is interpreted and used effectively at times • Some evaluation of research conducted but may only focus on some of methods used, sources used and evidence generated • Reasonable conclusions based on the sources used and evidence generated • Some consideration of the validity, reliability and generalizability of the research undertaken but may be more general than in relation to specific aspects such as methodology. • Implications of the findings are provided but may be quite general in nature. • Provides a reasonable proposal for possible areas for further research which has some relevance to the focus/theme and are feasible. • Reasonably clear reporting of findings, using correct terminology • Some points are developed <p style="text-align: right;">[9 – 15 marks]</p>		<p>Method(s) chosen</p> <ul style="list-style-type: none"> ○ quantitative and/or qualitative ○ primary and/or secondary ○ details of methods (e.g. survey, questionnaire, interview, literature review, etc...) ○ participants (where applicable) ○ ethical considerations <p>Evidence generated</p> <ul style="list-style-type: none"> ○ notes and records ○ types of data ○ selecting/collecting/interpreting relevant data, graphs and tables ○ analysis of results (e.g. compilation of data, results and findings, use of methods of analysis valid for data collected, including triangulation, use of percentages, use of statistical averages) ○ appropriate referencing and acknowledgement of sources ○ advanced search tools and refining search data <p>Source material(s) used</p> <ul style="list-style-type: none"> ○ Identifying secondary sources: <ul style="list-style-type: none"> ▪ Library search carried out ▪ Lists the key terms used ○ Selecting secondary sources <ul style="list-style-type: none"> ▪ Appropriate ▪ Relevant ▪ Complimentary ▪ Trustworthy ▪ identifies possible bias ▪ strengths or limitations of research methods used ▪ ethics of the research ▪ representativeness of samples

Question	Answer	Marks	Guidance
	<p>Level 1</p> <ul style="list-style-type: none"> • Provides a basic description of the focus of the research • Basic information and evidence generated which is not always relevant to the area of focus • Findings are basic; information gathered is used with limited effectiveness • Some description of methods used, sources used and evidence generated • Limited consideration of the impact on the validity and reliability but may be more general than in relation to specific aspects such as methodology • Some more developed points made • Some basic conclusions drawn but may not always clearly relate to the evidence generated • Limited consideration of the validity, reliability and generalizability of the research undertaken • Some implications of the findings may be suggested • Proposes some possible areas for further research which show some relevance to the focus/theme but may be unrealistic • Reporting is limited in terms of style, structure and use of terminology (list-like answers should be placed in this level) • Very few, if any, developed points <p style="text-align: right;">[1 - 8 marks]</p> <p>Level 0</p> <p>Candidate includes fewer than two valid points.</p> <p style="text-align: right;">[0 marks]</p>		<ul style="list-style-type: none"> • Conclusions will bring together your key findings, your evaluation and relate them back to your focus and should: <ul style="list-style-type: none"> ○ be in relation to the area of focus/research question/hypothesis ○ make judgements on evidence/findings ○ use the information gathered ○ consider the validity, reliability and generalizability of the research conducted • Answer may assess implications of findings for: <ul style="list-style-type: none"> ○ Individuals ○ groups ○ practitioners/professionals ○ practice ○ private, public, voluntary sectors ○ areas of policy ○ those who carry out research ○ particular areas of sport science and sport studies • Proposals for relevant areas for further research may include: <ul style="list-style-type: none"> ○ questions that have not been answered ○ areas where further evidence is needed ○ alternative research methods that could be used • Proposals should: <ul style="list-style-type: none"> ○ be plausible and realistic ○ build on current knowledge ○ relate to the focus and/or theme ○ be linked to limitations identified
	Total	20	

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