

**Cambridge Technicals
Applied Science**

Unit 23: Scientific research techniques

Level 3 Cambridge Technical in Applied Science
05874

Mark Scheme for June 2022

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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**

PE to update subject specific - insert details in table for annotation to mark your paper

Annotation	Meaning

10. **Subject-specific marking instructions**

PE to provide any additional information here.

Question	Answer	Mark	Guidance
1	D ✓ C ✓ A ✓ E ✓ B ✓	5	
	Total	5	

Question			Answer	Mark	Guidance
2	(a)	(i)	(increased) glyphosate use correlates with (increased) incidences of coeliac disease / positive correlation ✓	1	ALLOW does (more) glyphosate use cause (more) coeliac disease?
		(ii)	<p><i>Any three from:</i></p> <p>is there a mechanism/an explanation, of how (glyphosate causes coeliac) ✓</p> <p>is / how much glyphosate is present in the wheat when it is consumed ✓</p> <p>is glyphosate present at (scientifically agreed) harmful levels ✓</p> <p>is most wheat treated with glyphosate ✓</p> <p>is there a high probability that most of the new cases have been exposed to glyphosate ✓</p> <p>have coeliac cases increased in countries that do not use glyphosate on wheat ✓</p> <p>was coeliac disease harder to diagnose in earlier years ✓</p>	3	ALLOW other realistic suggestions
	(b)		<p>line graph shows, weight/glyphosate, is continuously variable (with time) / indicates the overall trend in the data</p> <p>bar graph shows incidence is discretely variable / discontinuous (data) (with time)</p>	2	<p>ALLOW line graph shows it/weight can have any value</p> <p>ALLOW bar graph shows incidence can only have whole number/integer values</p> <p>ALLOW because incidence/new cases is a category (of total cases) OR each year is a different category</p> <p>If no other mark:</p> <p>ALLOW 1 mark for reference to line graph and bar graph/chart</p> <p>OR to show the trend in the data</p> <p>IGNORE compare</p>
			Total	6	

Question		Answer	Mark	Guidance
3	(a)	<p><i>Any three from:</i></p> <ul style="list-style-type: none"> valid / reliable data ✓ not hazardous / safe ✓ cost /cheap ✓ easy to use / not, complicated/time consuming / portability ✓ repeatable ✓ reliability of equipment ✓ accurate ✓ readily available ✓ 	3	
	(b)	<p><i>Any five from:</i></p> <ul style="list-style-type: none"> what type/texture of soil she has ✓ how much water to put in / how to set tensiometer up ✓ how to calibrate it ✓ how often to recalibrate it ✓ where (in the field) to put it / how far away from it to water ✓ how to protect it from damage ✓ how long to leave in soil before taking a reading ✓ how deep it should be in the ground ✓ the optimum readings for particular crops/soil types ✓ 	max.5	<p>ALLOW other realistic suggestions</p> <p>IGNORE how to use it, unqualified</p>

Question		Answer	Mark	Guidance
		<p>how often to take readings ✓</p> <p>how it is likely to respond at different stages of crop growth ✓</p> <p>how it is likely to respond to changing weather conditions ✓</p> <p>cleaning / maintenance ✓</p>		
3	(c)	<p><i>Any one from:</i></p> <p>risk of it being struck by machinery – put a cage around it / remove it / only use when no machinery in use ✓</p> <p>risk of it being lost as the crops get bigger – put a flagpole on it ✓</p> <p>risk of the water in the tube freezing – bring it in in cold weather ✓</p> <p>risk of the ceramic tip breaking – drill a hole in the ground first ✓</p> <p>risk of the ceramic tip being contaminated with oil/grease – don't touch it with bare hands ✓</p>	1	ALLOW other realistic suggestions
		Total	9	

Question			Answer	Mark	Guidance
4	(a)	(i)	similar age / 35-70 year olds ✓	1	
		(ii)	(total) mortality and cardiovascular disease ✓	1	ALLOW dietary intake / different eating habits /the differences in the % of energy provided (to each individual) by carbohydrates, fats and proteins
		(iii)	<i>timescale</i> – (more than) 10 years / for a long period of time / Jan 1, 2003, and March 31, 2013 ✓ <i>follow up</i> – (median) 7.4 years / 5.3 – 9.3 years ✓	2	
		(iv)	<i>Any two from:</i> to make associations/links between different dietary factors/behaviours, and (disease/mortality) outcomes ✓ with an associated hazard ratio / confidence interval / level of confidence ✓ to, produce/reconsider, dietary guidelines / educate public ✓	2	ALLOW correct quotes from the insert to support the use of data e.g. high carbohydrate intake was associated with higher risk of total mortality / high fat does not increase CVD/
	(b)		<i>method</i> - (validated food frequency) questionnaire ✓ <i>explanation</i> - <i>any two from</i> (valid and reliable because): the content (of the questionnaire) is relevant to the study ✓ it has been compared with other valid methods ✓ is academically rigorous ✓ similar results whenever the questionnaire is repeated ✓	3	ALLOW the questionnaire measures what it is supposed to measure, e.e. asks what people eat and how much IGNORE all used same questionnaire ALLOW peer reviewed ALLOW not subjective

Question			Answer	Mark	Guidance
4	(c)	(i)	increased risk of <u>total</u> mortality ✓ not associated with risk of cardiovascular disease ✓	2	
		(ii)	Source A - eat less carbohydrates / high carbohydrate diet caused increase in total mortality , but source B recommends, high(er) consumption of carbohydrates/55 - 60% of calories from carbohydrates ✓	1	
	(d)	(i)	no (significant) risk of, myocardial infarction/CVD death ✓ lower risk of stroke ✓	2	ALLOW related to lower (total) mortality
		(ii)	<i>either</i> diets low in saturated fats protect against heart disease ✓ <i>or</i> LA Veterans' Study of 1969, showed that a low-saturated fat diet reduced incidence of heart disease ✓ <i>and</i> Minnesota Coronary Experiment - people with the lowest cholesterol levels twice as likely to die as those with the highest cholesterol ✓	1 1	ALLOW reverse argument ALLOW LA Veteran's Study ALLOW Minnesota Coronary Experiment
	(e)	(i)	<i>Perspective</i> health and wellbeing / journalistic / popular science / historic / media / in the public interest ✓ <i>Purpose</i> either to explain the history of the association between fat and heart disease ✓ or to explain how the conclusions were based on flawed science/bias ✓	2	AW ALLOW any realistic suggestion, based on Article B ALLOW think critically about conclusions of scientific studies

Question		Answer	Mark	Guidance
(e)	(ii)	<p><i>Any two from:</i></p> <p>The author wrote a best-seller in 1959 based on his hypothesis before the publication of the study in 1978 ✓</p> <p>The AHA published guidelines in 1961 and 1977 based on the hypothesis before the publication of the study ✓</p> <p>Keys selected groups/areas e.g. Cretans for his study that would support his hypothesis ✓</p> <p>Keys selected specific time period / Lent ✓</p> <p>Keys (and colleagues) had vested interests in the hypothesis being correct but they were also able to influence which research or researchers received funding ✓</p>	max. 2	
		Total	20	

Question		Answer	Mark	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 ○ 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	Mark	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

Question	Answer	Mark	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>		<ul style="list-style-type: none"> ▪ strengths or limitations of research methods used ▪ ethics of the research ▪ representativeness of samples <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

Question		Answer	Mark	Guidance
		<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"> • 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	
		Overall paper total	60	

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