Cambridge Technicals Applied Science

Unit 23: Scientific Research Techniques

Level 3 Cambridge Technical in Applied Science
05847 - 05849/05874/05879

Mark Scheme for January 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.

Annotations available in RM Assessor

Annotation	Meaning
✔	Correct response
✖	Incorrect response
⌃	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives

- the question paper

- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Mark	Guidance
1	(a)		to retest/test the Gambian-derived hypothesis/correlation (that early life exposures correlated with season of birth predict later patterns of mortality) ✓	1	**ALLOW** confirm / establish
	(b)	(i)	the season of birth/seasonality predicts later patterns of mortality ✓	1	**ALLOW** season of birth affects immune function
		(ii)	no correlation ✓	1	
	(c)		<table><tr><td>data from large demographic surveys are / are not more reliable</td><td></td></tr><tr><td>infectious disease is / is not the main cause of death in rural areas</td><td></td></tr><tr><td>lack of food does / does not affect immune function</td><td></td></tr><tr><td>exposure to infectious disease in rural Gambia and the Matlab are / are not similar</td><td>✓</td></tr><tr><td>the season of birth does / does not affect mortality</td><td>✓</td></tr></table>	2	
	(d)	(i)	large sample size ✓ "data from a large demographic survey" ✓	2	
		(ii)	both studies are in rural areas / named areas / areas with similar seasonality ✓	1	**ALLOW** information is given about where the studies were
		(iii)	**Any one from:** it gives the information needed to locate the study (in either the journal or online) ✓ it allows others to find out more details about the research study ✓	1	
			Total	9	

Question			Answer	Mark	Guidance
2	(a)		reference to identical points on each ball ✓ measure the **vertical** distance (between these points) ✓	2	**ALLOW** both marks from a diagram
	(b)	(i)	46 mm / 4.6 cm✓ ± 0.5 (mm) / ± 0.05 (cm) ✓	2	**ALLOW** ± 1.0 (mm) / 0.01 (cm)
		(ii)	**Any one from:** ruler not calibrated correctly ✓ (construction) lines are not perpendicular ✓ distance from top of point A to bottom of point B is measured / error in determining centre of each point ✓	1	**IGNORE** "measured wrong" unqualified **ALLOW** other detail of incorrect measuring points
			Total	5	

Question			Answer	Mark	Guidance
3	(a)	(i)	published scientific research / scientific websites / (named) relevant scientific research institutions ✓	1	
		(ii)	**Any three from:** use of relevant search terms ✓ use of special academic/scientific search engines ✓ use a method of referencing ✓ avoid duplication of different sources referring to the same research finding✓ keep a short summary/record of data found from each source ✓ use a table/grid to compare data summaries to note similarities or conflicting findings/conclusions ✓	3	**ALLOW** scientific search sites
	(b)		<table><tr><td>the different wavelengths of infrared that were observed by IRAS</td><td>✓</td></tr><tr><td>the duration of the IRAS mission</td><td></td></tr><tr><td>the equation that shows the relationship between wavelength and temperature</td><td>✓</td></tr><tr><td>the percentage of infrared absorbed by the Earth's atmosphere</td><td></td></tr><tr><td>the percentage of the night sky that was mapped by IRAS</td><td></td></tr></table>	2	
			Total	6	

Question			Answer	Mark	Guidance
4	(a)	(i)	activates PPARD ✓	1	**ALLOW** to change the expression of (975) genes (in a major muscle of mice) **ALLOW** it improves endurance
		(ii)	PPARD prevents glucose being used as an energy source in muscle during exercise / PPARD suppresses sugar metabolism ✓	1	
		(iii)	**Any two from:** Mice run for, longer/270 mins compared to 160 mins, before exhaustion /AW ✓ 270 is 70% more than 160 ✓ calculation to support the conclusion e.g. 160 + (160 x 0.7) = 272 ✓	2	
	(b)	(i)	**Any two from:** the mice were observed to stop exercising at this value **OR** a standard procedure/protocol defines this value as exhaustion ✓ 70 mg/dL is the **lower** limit of the normal range for blood glucose ✓ readily available source of data / measurement (other than ventilation rate or lactic acid build up in muscles etc.) ✓	2	**ALLOW** blood glucose is classed as low (source B) / the lowest level that blood glucose can drop to
		(ii)	the data collected is valid/reliable ✓ the experiment is reproducible ✓	2	**ALLOW** idea that exhaustion cannot be observed consistently in a qualitative way **ALLOW** repeatable
	(c)		paragraph 5 states that blood glucose decreased (in both groups) / low glucose is a cause of fatigue ✓ paragraph 6 states that PPARD **prevents glucose** being used ✓	2	**ALLOW** for 1 mark the idea that it is the use of glucose that is being contradicted.

Question			Answer	Mark	Guidance
	(d)		**Innovation** **Both** sources describe a drug that offers the benefits of exercise to people who are unable to exercise ✓ **Bias** Only source B ✓ suggests any negative consequences of the exercise pill ✓ **Regulation** **Any two from***: (Source B): banned by WADA for use by athletes ✓ regulatory approval unlikely due to uncertainty of long term use ✓ Source A does not refer to regulation ✓	5	**ALLOW** source A does not describe negative consequences of taking the exercise pill – 2 marks
	(e)		**Any five from:** methodology ✓ time frame ✓ equipment needed ✓ risk assessment ✓ data collection / data recording ✓ appropriate ethical issue ✓ appropriate moral issue ✓ cost ✓	5	**ALLOW** e.g., sample size / dose
			Total	20	

Question		Answer	Mark	Guidance

5	Report	**Levels of Response**
		
		Level 3
		• 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
		 [16 – 20 marks]
		Level 2
		• 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
			20	**Valid points**
				
				• **Explanation** of area of focus
				  o is clear and concise
				
				  o may be expressed as question(s) to explore
				
				  o related to the pre-released material
				
				  o may be oppositional
				
				  o may be a different slant
				
				• **Justification**
				  o in relation to the pre-release
				
				  o in relation to own personal interest in the theme
				
				  o in relation to another specific source
				
				  o in relation to current/contemporary issues linked to the pre-release
				
				• **Reporting** of findings taking into consideration:
				  o appropriate use of information/data
				
				  o comparing and contrasting methods, results or findings
				
				  o relevance and appropriateness of findings from information gathered
				
				  o clear link and relevance to area of focus being researched o acknowledgement of sources
				
				  o avoidance of plagiarism
				
				  o consideration of any relevant ethical issues

Question	Answer	Mark	Guidance
	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 **[9 – 15 marks]** **Level 1** • 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		• **Evaluation** of research should aim to assess validity, reliability and generalizability related to the following: Method(s) chosen o quantitative and/or qualitative o primary and/or secondary o details of methods (e.g. survey, questionnaire, interview, literature review, etc…) o participants (where applicable) o ethical considerations Evidence generated o notes and records o types of data o selecting/collecting/interpreting relevant data, graphs and tables o 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) o appropriate referencing and acknowledgement of sources o advanced search tools and refining search data Source material(s) used o Identifying secondary sources:

Question	Answer	Mark	Guidance
	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 **[1 - 8 marks]** **Level 0** Candidate includes fewer than two valid points. **[0 marks]**		▪ Library search carried out ▪ Lists the key terms used ○ Selecting secondary sources ▪ Appropriate ▪ Relevant ▪ Complimentary ▪ Trustworthy ▪ identifies possible bias ▪ strengths or limitations of research methods used ▪ ethics of the research ▪ representativeness of samples • **Conclusions** will bring together your key findings, your evaluation and relate them back to your focus and should: ○ 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: ○ Individuals

Question		Answer	Mark	Guidance
				o groups
				o practitioners/professionals
				o practice
				o private, public, voluntary sectors
				o areas of policy
				o those who carry out research
				o particular areas of sport science and sport studies
				• Proposals for relevant areas for further research may include: o questions that have not been answered
				o areas where further evidence is needed
				o alternative research methods that could be used
				• Proposals should: o be plausible and realistic
				o build on current knowledge
				o relate to the focus and/or theme
				o be linked to limitations identified
		Total	**60**	

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