

## A21: Scientific Method, Investigation, Analysis and Evaluation

### Task 1: Essay

Centre No:		Candidate No:		
Section	Mark criteria	Marks Awarded	Mark Range	AO
Title/ Introduction	A comprehensive knowledge of most key concepts, interpretations, issues and technical terms relevant to the scientific investigation.		[7-9]	AO1 [9]
	A satisfactory knowledge of most key concepts, interpretations, issues and technical terms relevant to the scientific investigation		[4-6]	
	A basic knowledge of some information relevant to the scientific investigation.		[1-3]	
Main Section	An excellent understanding of all the scientific ideas, processes, techniques and procedures relevant to the scientific investigation.		[7-9]	AO1 [9]
	A satisfactory understanding of most of the scientific ideas, processes, techniques and procedures relevant to the scientific investigation.		[4-6]	
	A basic understanding of scientific ideas, processes, techniques and/or procedures, with limited relevance to the scientific investigation		[1-3]	
		<b>Total Mark divided by 2</b>		
Conclusion	A logical and clear argument is presented. Results, scientific information, evidence, issues and ideas have been analysed and interpreted in a rigorous way with evaluations leading to refinements. The conclusion is concise and thoroughly supported with evidence. Spelling, punctuation and grammar, form and style of writing, and use of scientific terminology are always of an excellent standard		[3]	AO3 [6]
	A satisfactory attempt has been made to present an argument and to evaluate, analyse and interpret results, issues and scientific information to reach an adequately supported conclusion. Spelling, punctuation and grammar form and style of writing and use of scientific terminology are of satisfactory standard.		[2]	
	A basic attempt has been made to present an argument and to analyse information to reach a conclusion. Spelling, punctuation and grammar form and style of writing and use of scientific terminology are of limited standard.		[1]	
References	All information and sources have been referenced (at least ten) using the Harvard referencing system.		[3]	
	A satisfactory attempt to reference information and sources using the Harvard referencing system is used.		[2]	
	An attempt to reference sources is made.		[1]	
		<b>Total Mark</b>	<b>/15</b>	
<b>Award [0] for any element of the task not worthy of credit</b>				

## Task 2: Plan & Lab Book

Centre No:		Candidate No:		
Section	Mark criteria	Marks Awarded	Mark Range	AO
Draft Plan & Trial	An excellent understanding of all the scientific ideas, processes, techniques, issues and procedures relevant to the scientific investigation. An excellent project plan has been developed showing a thorough understanding of most of the investigation design principles.		[4]	AO1 [4]
	A satisfactory understanding of most of the scientific ideas, processes, techniques, issues and procedures relevant to the scientific investigation. A satisfactory project plan has been developed showing satisfactory understanding of most of the investigation design principles.		[2]–[3]	
	A basic understanding of scientific ideas, processes, techniques, issues and/or procedures, with limited relevance to the scientific investigation. An action plan has been produced with limited knowledge demonstrated of the investigation design principles.		[1]	
Record of experimental work	A comprehensive application of knowledge and understanding of a wide range of scientific ideas, processes, techniques and procedures: • to practical contexts; and • when handling qualitative and quantitative data. Recording of work and refinements is comprehensive.		[5]–[6]	AO2 [6]
	A satisfactory application of knowledge and understanding of some scientific ideas, processes, techniques and procedures: • to practical contexts; and • when handling qualitative and/or quantitative data. Recording of work and refinements is of a satisfactory standard.		[3]–[4]	
	A limited application of knowledge of scientific ideas, processes, techniques and/or procedures was attempted Recording of work in the lab book is of a basic standard.		[1]–[2]	
Refinements	The project plan is refined as required, based on the outcomes of all experimental work.		[4]	AO3 [10]
	A satisfactory attempt is made to refine the project plan based on the outcomes of the experimental work.		[2]–[3]	
	A limited attempt has been made to amend the action plan based on outcomes from the scientific investigation.		[1]	
Project Plan	The project plan is implemented fully and on schedule taking into account all refinement required. A thorough assessment is made of possible errors and health and safety hazards. An excellent evaluation of aspects of the investigation is included, where appropriate.		[6]	
	The project plan is mostly implemented on schedule, taking into consideration some refinement required. A satisfactory assessment is made of possible errors and health and safety hazards A satisfactory evaluation of aspects of the investigation is included, where appropriate.		[4]–[5]	
	The action plan is implemented at a basic level. A limited assessment is made of possible errors and/or safety hazards.		[1]–[3]	
<b>Total Mark</b>		<b>/20</b>		
<b>Award [0] for any element of the task not worthy of credit.</b>				

### Task 3: Written Report

Centre No:		Candidate No:		
Section	Mark criteria	Marks Awarded	Mark Range	AO
Title	An appropriate and concise title which clearly indicates to the reader what the investigation is about. Scientific terminology is used appropriately.		[2]	AO1 AO2 [2]
	The title mostly explains what the investigation is about.		[1]	
Aim/ Hypothesis	The aim is a concise statement and outlines clearly the purpose of the investigation. The hypothesis explains suggested solutions based on what is already known. It can be supported or disproved through experimentation or observation. Comprehensive explanation of principles, definitions, experimental techniques, theories and laws are given, as appropriate.		[5-6]	AO1 AO2 AO3 [6]
	The aim is a statement which outlines with some clarity the purpose of the investigation. The hypothesis explains at least one suggested solution based on what is already known. A satisfactory explanation of principles, definitions, experimental techniques, theories and laws are given, as appropriate.		[3-4]	
	The aim is a statement which outlines with limited clarity the purpose of the investigation. There is an attempt in the hypothesis to explain a suggested solution. A basic explanation of principles, definitions, experimental techniques, theories and/or laws are given.		[1-2]	
Materials & Apparatus	The materials and apparatus list is comprehensive and accurate. Scientifically labelled diagram (s) of the appropriate materials and apparatus, accurately and independently set-up are included.		[3]	AO1 AO2 [3]
	The materials and apparatus list is mostly complete and accurate. Labelled diagram (s) of the materials and apparatus, set-up some with teacher/technician support, are included.		[2]	
	A materials and apparatus list is provided with some omissions. Significant teacher/technician support is required.		[1]	
Risk Assessment	A good risk assessment including identification of all of the safety hazards and a brief statement of the potential hazardous outcomes		[3]	AO3 [3]
	A satisfactory risk assessment including identification of most of the safety hazards and a brief statement of at least one potential hazardous outcome		[2]	
	A basic risk assessment including limited identification of safety hazards and may include identification of a potential hazardous outcome.		[1]	
Method	All parts of the investigation are carried out independently, displaying a very good level of technical skills. The method used is always appropriate. Measurements are accurate. The method is detailed in full and accurately recorded. There is a thorough explanation of the method used. Health and safety issues are considered throughout and appropriate precautions are taken at all times.		[6-8]	AO2 AO3 [8]
	Most parts of the investigation are carried out independently, displaying a satisfactory level of technical skills. The method used is mostly appropriate. Measurements are mostly accurate. Most steps of the method are recorded and accurate.		[3-5]	

	There is a satisfactory explanation of the method used. Health and safety issues are considered and appropriate precautions are taken most of the time.			
	The investigation is carried out with limited independence, displaying a basic level of technical skills. The method is sometimes appropriate. Measurements are sometimes accurate. A limited method is recorded displaying gaps in knowledge and understanding There is a basic explanation of the method used. Health and safety issues are sometimes considered and precautions are sometimes taken.		<b>[1-2]</b>	
<b>Results</b>	A complete set of quantitative results and qualitative observations have been recorded in appropriate tabular and/or graphical format using appropriate headings and units. Calculations are also included and accurate to two decimal places.		<b>[6-8]</b>	<b>AO2 AO3 [8]</b>
	Some quantitative results and/or qualitative observations have been recorded in tabular and/or graphical format using headings and units which are sometimes accurate. Calculations are also included and accurate.		<b>[3-5]</b>	
	Quantitative results and/or qualitative observations have been recorded. The format is not always the most appropriate and headings and units are sometimes inaccurate. Basic calculations are also included.		<b>[1-2]</b>	
<b>Conclusion/ Evaluation</b>	An accurate and concise conclusion that answers the objective of the investigation is provided. A thorough error analysis has been carried out with identification of the sources of error. An excellent evaluation of the experiment has been done, including limitations with explanations. Suggestions have been included identifying refinement of the experimental techniques used. Use of appropriate scientific terminology is of an excellent standard. The spelling, punctuation and grammar are of an excellent standard and the form and style of writing is highly appropriate.		<b>[8-10]</b>	<b>AO3 [10]</b>
	A statement that answers the objective of the investigation is included. An error analysis has been carried out with identification of some of the sources of error. An evaluation of the experiment has been done, including some limitations with explanations. Use of appropriate scientific terminology is of a good standard. The spelling, punctuation and grammar are of a good standard and the form and style of writing is mostly appropriate.		<b>[4-7]</b>	
	A statement of conclusion is provided. There may be identification of at least one source of error. There may be a basic evaluation of the experiment with little/no use of scientific terminology. The spelling, punctuation and grammar are of a limited standard and the form and style of writing is basic		<b>[1-3]</b>	
<b>Appendices/ References</b>	All information and sources have been referenced (at least ten) using the Harvard referencing system. Appropriate appendices have been included and enhance the report.		<b>[4-5]</b>	<b>AO3 [5]</b>
	A satisfactory attempt to reference information and sources using the Harvard referencing system is used. Some appendices have been included and are mostly appropriate.		<b>[2-3]</b>	
	An attempt to reference sources is made. There may be some appendices included.		<b>[1]</b>	
<b>Total Mark</b>		<b>/45</b>		
<b>Award [0] for any element of the task not worthy of credit.</b>				