

General Studies

Advanced Subsidiary GCE

Unit **F732**: The Scientific Domain

Mark Scheme for January 2013

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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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Annotations

Annotation	Meaning
	1 mark for A04
	2 marks for A04
	0 marks for A04
	Incorrect
	Development
	Example/reference
	Evaluation
	Level one
	Level two
	Level three
	Level four
	Level five
	Not answered question
	Correct point

Marking Instructions

Assessment Objectives

AO1 Demonstrate knowledge and understanding

- Demonstrate relevant knowledge and understanding applied to a range of issues, using skills from different disciplines;

AO2 Analysis and Evaluation

- Marshal evidence and draw conclusions; select, interpret, evaluate and integrate information, data concepts and opinions;

AO3 Understanding knowledge

- Demonstrate understanding of different types of knowledge, appreciating their strengths and limitations;

AO4 Communication

- Communicate clearly and accurately in a concise, logical and relevant way.

Assessment Objectives balance			
AO1	AO2	AO3	AO4
16	8		6

Question		Answer	Marks	Guidance
1	(a)	<p>The lower the mpg, the more CO₂ emitted (Good) negative correlation between the mpg and CO₂ emitted = 2 marks If candidate just states 'correlated' = 0 If candidate says 'correlated' and gives some idea of what it means = 1</p>	2	<p>Annotation: ✓ (1 mark) , or ✓✓ (2 marks)</p> <p>Award 1 mark ✓ if undeveloped/ very brief point, for example 'one goes up the other goes down'.</p> <p>Award 2 marks ✓✓ if point is developed.</p> <p>Accept reverse of statement or any other statement that suggests the correct link.</p>

Question	Answer	Marks	Guidance				
(b)	<p>Two points from the following:</p> <ul style="list-style-type: none"> • vertical axis in grams per kilogram (g/kg)(metric units) and horizontal axis in miles per gallon (mpg)(imperial units) • scale does not start at zero • grams are very small units of weight whereas miles are large units of distance • there are gaps between the groups of plotted points • the distribution of the points is unclear and not helpful in order to read the graph. • this is a small sample size • anomalies on graph eg where CO₂ = 200 • it looks like the higher the mpg the less CO₂ is emitted this is misleading as fuel consumption should be gallons used per mile. <p>The answer MUST be what IS ON the graph which is misleading – NOT what is misleading because of what is NOT there. Do not credit a response which refers to the source of the data.</p>	6	<p>4 marks + 2 AO4 marks</p> <p>Annotation: (maximum 4 ticks ✓)</p> <p>Award 1 mark ✓ for each undeveloped/very brief point. Award 2 marks ✓✓ for each developed point (max 4 ✓).</p> <p>There should be reference to both axes for a creditworthy point about units.</p> <p>The answer must relate to the diagram.</p> <p>Examiners should accept other valid points about the graph and its interpretation.</p> <p>AO4 marks (A1 – 1 mark or (A2 – 2 marks) Awarding of AO4 marks</p> <table border="1"> <tr> <td>Award 2 marks</td> <td>A2 – a clear response that communicates ideas succinctly and without technical errors.</td> </tr> <tr> <td>Award 1 mark</td> <td>A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.</td> </tr> </table>	Award 2 marks	A2 – a clear response that communicates ideas succinctly and without technical errors.	Award 1 mark	A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.
Award 2 marks	A2 – a clear response that communicates ideas succinctly and without technical errors.						
Award 1 mark	A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.						

Question	Answer	Marks	Guidance				
(c)	<p>Two additional pieces of information from the following:</p> <ul style="list-style-type: none"> • make and year of car • area where cars were tested • other pollutants emitted • time scale • sampling methods • fuel used • speed and acceleration • distance travelled • line of best fit. <p>Credit any other valid point.</p>	6	<p>4 marks + 2 AO4 marks</p> <p>Annotation: (maximum 4 ticks √)</p> <p>Award 1 mark for each point √ if undeveloped/very brief point.</p> <p>Award 2 marks for each developed point √√ for each developed point.</p> <p>AO4 marks (A1 – 1 mark or A2 – 2 marks)</p> <p>Awarding of AO4 marks</p> <table border="1"> <tr> <td>Award 2 marks</td> <td>A2 – a clear response that communicates ideas succinctly and without technical errors.</td> </tr> <tr> <td>Award 1 mark</td> <td>A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.</td> </tr> </table>	Award 2 marks	A2 – a clear response that communicates ideas succinctly and without technical errors.	Award 1 mark	A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.
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Award 1 mark	A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.						
(d)	<p>$49 \times 0.354 = 17.346, 17.35, 17.4, 17 \text{ km/litre.}$</p> <p>Units are not necessary for the 2 marks.</p> <p>Incorrect rounding off eg 17.3 or 17.34 award 1 mark only.</p>	2	<p>Annotation: (maximum 2 ticks √)</p> <p>Award 2 marks √√ for correct answer.</p> <p>Award 1 mark √ for correct substitution/method if answer incorrect.</p> <p>Award 0 marks x if incorrect answer and incorrect substitution/method.</p> <p>An answer of 17.346, 17.35, 17.4 or 17 kilometres per litre (km/l) is acceptable for 2 marks.</p>				

Question		Answer	Marks	Guidance
2	(a)	<p>One from the following:</p> <ul style="list-style-type: none"> the difference between the numbers goes up by an extra +1 each time adjacent numbers add up to square numbers. the difference between every 2nd number is 5, 7, 9 etc. 	2	<p>Annotation: (maximum 2 ticks ✓)</p> <p>Award 1 mark ✓ if only list of differences, 2, 3, 4, 5, 6</p> <p>Award 2 marks ✓✓ if the pattern is described in words or by explaining the differences.</p>
	(b)	<p>28, 45 and 66</p> <p>For incorrect responses:</p> <p>If the candidate has substituted '4' incorrectly, eg $(2 \times 4)^2 - 4$ then no marks.</p> <p>If the candidate has written $2 \times 4^2 - 4$ then 1 method mark (max 1 mark).</p> <p>The substitution mark is only available if the candidate has used the value of '4' correctly.</p>	3	<p>Annotation: (maximum 3 ticks ✓)</p> <p>✓ for each correct answer. X for incorrect answer. ✓ for some correct substitution shown if answers are incorrect (max 1 mark).</p>

Question	Answer	Marks	Guidance				
(c)	<p>1, 4, 9, 16, 25</p> <p>If the candidate gives all the correct answers, with no table - 9 marks</p> <p>This mark includes the AO4 mark of A2 (which you should still annotate) as the candidate has shown clearly to you what the correct answer is.</p> <p>If a candidate gives you a list of locker numbers, mark the first five numbers in the list. For example: 1, 4, 8, 16, 20, 25 This will gain a mark for '1' and a mark for '4' and 2 marks for '16'. As '25' is the 6th number they have given it cannot get credit. A candidate may give you a list of more than 5 numbers, BUT highlight which are open and which are closed, in this case mark the first five that they have labelled as open locker numbers.</p> <p>You may see this alternative approach: <i>Doors need an odd number of factors to be open for example</i> 1 = 1 4 = 1,2,4 9 = 1,3,9 16 = 1,2,4,8,16 etc</p> <p>If the candidate has gained marks from at least one answer correct then AO4 must = A1 even if there is no working out/table.</p> <p>Award A2 for three or more correct open lockers. Award A1 for less than three correct open lockers.</p>	9	<p>7 marks +2 AO4 marks</p> <p>Annotation: (maximum 7 ticks ✓)</p> <p>Award 7 marks ✓ (7 ticks) for an answer with all of the correctly numbered lockers/table.</p> <p>Award 1 mark each ✓ for each of 1,4,9 (maximum 3 marks ✓).</p> <p>Award 2 marks each ✓✓ for each of the locker numbers 16 and 25.(max 4 marks ✓).</p> <p>AO4 marks (A1 – 1 mark or A2 – 2 marks)</p> <p>Awarding of AO4 marks</p> <table border="1"> <tr> <td>Award 2 marks</td> <td>A2 – a clear response that communicates ideas succinctly and without technical errors.</td> </tr> <tr> <td>Award 1 mark</td> <td>A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.</td> </tr> </table>	Award 2 marks	A2 – a clear response that communicates ideas succinctly and without technical errors.	Award 1 mark	A1 – a response that shows a basic understanding but may contain some ambiguity and technical errors.
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Assessment Objectives balance			
AO1	AO2	AO3	AO4
8	10	6	6

Question	Answer	Marks	Guidance
3	<p>This question involves:</p> <ul style="list-style-type: none"> choice of area of research outlining two advantages of increasing funding outlining two disadvantages of increasing funding. <p>Indicative content:</p> <p>Advantages of increasing funding include:</p> <ul style="list-style-type: none"> further developments may become available through more research, eg more cures, space exploration developments, organ transplantation more difficult and lengthy processes may be improved the future of our population may become more secure. <p>Disadvantages of increasing funding include:</p> <ul style="list-style-type: none"> there may be other more immediate problems which need financing eg areas suffering from natural disasters money should be spent on prevention of problems governments may not be able to sustain involvement. <p>Credit any other valid point relevant to their choice of research.</p>	30	<p>Annotation: ✓ for each advantage and disadvantage. Use DEV, EG, EVAL, or NAQ as appropriate. Insert L1, L2, L3, L4 or L5 at end of response to identify Level.</p> <p>Levels of response:</p> <p>Level 5 (25–30 marks) These answers will include two very good, well developed advantages and two very good, well developed disadvantages (AO1 and AO2). There will be a clear understanding of their choice of scientific research, there will be some reference to funding and answers will include developed material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured and written with facility.</p> <p>Level 4 (19–24 marks) These answers will include two good advantages and two good disadvantages. Two of the four will be well developed (AO1 and AO2). There will be understanding of their choice of scientific research, some reference to funding and answers will include material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured.</p>

Question	Answer	Marks	Guidance
			<p>Level 3 (13–18 marks) These answers will describe two advantages and two disadvantages more briefly. Two of the four will be developed (AO1 and AO2). There will be some understanding of their choice of scientific research, but there will be little or no reference to funding and answers will include some material linked to AO3 e.g. examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear but contain some errors of spelling punctuation and grammar and a modest structure.</p> <p>Level 2 (7–12 marks) These answers will offer three of the four advantages and disadvantages in brief or outline form (AO1 and AO2). There will be limited evidence of AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) the clarity of these answers will be insecure and command of spelling, punctuation and grammar as well as structure will be limited and inaccurate.</p> <p>Level 1 (0–6 marks) These answers will describe two of the advantages and disadvantages (AO1 and AO2) and will include very limited fragments of material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be unclear with poor sentence structure and errors of grammar and spelling.</p>

Assessment Objectives balance			
AO1	AO2	AO3	AO4
8	10	6	6

Question	Answer	Marks	Guidance
4	<p>This question involves:</p> <ul style="list-style-type: none"> • recognition of the issue of polluted water • two problems caused by water pollution • two ways in which each problem may be reduced in the future. <p>Indicative content:</p> <p>Problems:</p> <ul style="list-style-type: none"> • health problems • seepage of chemicals into agricultural land • effects on animals and their products • loss of marine life • problems of waste disposal. <p>Ways:</p> <ul style="list-style-type: none"> • fines for industries who pollute water • more funding for research into more environmental issues • rely more on GM crops which do not need chemicals spraying on them • more funding available for cleaning the water • more education and public spending. 	30	<p>Annotation: ✓ for each problem and for each way it could be reduced. Use DEV, EG, EVAL or NAQ as appropriate. Insert L1, L2, L3, L4 or L5 at the end of response to identify Level.</p> <p>Levels of response:</p> <p>Level 5 (25–30 marks) These answers will include two outlined problems caused by water pollution and two very good, well developed ways in which each problem may be reduced (AO1 and AO2). There will be a clear understanding of pollution and answers will include developed material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured and written with facility.</p> <p>Level 4 (19–24 marks) These answers will include two outlined problems caused by water pollution and two ways in which each problem may be reduced. Three of the four ways will be developed (AO1 and AO2). There will be understanding of pollution and answers will include developed material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured.</p>

Question	Answer	Marks	Guidance
			<p>Level 3 (13–18 marks) These answers will include two problems caused by water pollution and two ways in which each problem may be reduced. Two of the four ways will be developed (AO1 and AO2). There will be some understanding of pollution and answers will include some material linked to AO3 e.g. examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear but contain some errors of spelling punctuation and grammar and a modest structure.</p> <p>Level 2 (7–12 marks) These answers will include problems caused by water pollution or ways in which each problem may be reduced in brief or outline form with only fragments of supporting evidence or analysis (AO1 and AO2). There will be limited evidence of AO3 e.g. examples, personal experience or discussion of definitions. In terms of AO4 (communication) clarity of these answers will be insecure and the command of spelling, punctuation and grammar as well as structure will be limited and inaccurate.</p> <p>Level 1 (0–6 marks) These answers will describe problems and ways in fragmentary terms. This will include very limited fragments of evidence of AO3 e.g. examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be unclear with poor sentence structure and errors of grammar and spelling.</p>

Assessment Objectives balance			
AO1	AO2	AO3	AO4
8	10	6	6

Question	Answer	Marks	Guidance
5	<p>This question involves:</p> <ul style="list-style-type: none"> recognition of the overall problem of conserving energy and supplies of food recognition of three environmental problems. <p>Indicative content:</p> <p>Three possible problems:</p> <ul style="list-style-type: none"> increased demand for food may cause farmers to cultivate marginal land which might be vulnerable to erosion there may be a depletion of marine resources we may reach our limits of water supply a possibility of more pesticides being used which are harmful to the environment increased demand for energy may cause more pollution on the environment from its transport increased demand for energy may cause suppliers to exploit hazardous areas to extract fuel resources more people may mean more cars and more pollution for example CO₂ Global warming – but this point must not be the focus of the response. 	30	<p>Annotation: √ for each problem. Use DEV, EG, EVAL or NAQ as appropriate. Insert L1, L2, L3, L4 or L5 at the end of the response to identify Level.</p> <p>Levels of response:</p> <p>Level 5 (25–30 marks) These answers will include three well developed accounts of the problems (AO1 and AO2). There will be a clear understanding of the effects on the environment and answers will include developed material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured and written with facility.</p> <p>Level 4 (19–24 marks) These answers will include three accounts of the problems. Two of the three will be developed and will be supported with analysis and evidence (AO1 and AO2). There will be an understanding of the effects on the environment and answers will include developed material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear and well structured.</p>

Question	Answer	Marks	Guidance
			<p>Level 3 (13–18 marks) These answers will include three accounts of the problems. One of the three will be developed (AO1 and AO2). There will be some understanding of the effects on the environment and answers will include some material linked to AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be clear but contain some errors of spelling punctuation and grammar and a modest structure.</p> <p>Level 2 (7–12 marks) These answers will offer problems in brief or outline form with only fragments of supporting evidence or analysis (AO1 and AO2). There will be very limited evidence of AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) the clarity of these answers will be insecure and their command of spelling, punctuation and grammar as well as structure will be limited and inaccurate.</p> <p>Level 1 (0–6 marks) These answers will describe problems in fragmentary terms and this will be supported with very limited evidence (AO1 and AO2) There will be very limited evidence of AO3 eg examples, personal experience or discussion of definitions. In terms of AO4 (communication) these answers will be unclear with poor sentence structure and errors of grammar and spelling.</p>

APPENDIX 1

Assessment Objective Weighting

	AO1	AO2	AO3	AO4
Marks	8	10	6	6

Generic Mark Scheme for Questions with 30 marks

Level 5

AO1	<ul style="list-style-type: none"> select, use and integrate a very good range of relevant knowledge show a good understanding of the concepts involved 	25–30
AO2	<ul style="list-style-type: none"> interpret and analyse issues and problems well and evaluates them appropriately use evidence to develop complex reasoned arguments and draw sound conclusions on the evidence 	
AO3	<ul style="list-style-type: none"> demonstrate very good awareness of the differences between types of knowledge have a very good appreciation of the strengths and limitations of the different types of knowledge 	
AO4	<ul style="list-style-type: none"> communicate complex ideas clearly and accurately, using specialist vocabulary where appropriate, in a concise, logical and relevant way use a wide range of the rules of grammar, punctuation and spelling with accuracy and facility. 	

Level 4

AO1	<ul style="list-style-type: none"> select, use and integrate a good range of relevant knowledge show an understanding of the concepts involved 	19–24
AO2	<ul style="list-style-type: none"> interpret and analyse issues and problems well and evaluates them competently use evidence to develop reasoned arguments and draw sound conclusions on the evidence 	
AO3	<ul style="list-style-type: none"> demonstrate good awareness of the differences between types of knowledge have a good appreciation of the strengths and limitations of the different types of knowledge 	
AO4	<ul style="list-style-type: none"> communicate ideas clearly and accurately, using specialist vocabulary where appropriate, in a concise, logical and relevant way use a range of the rules of grammar, punctuation and spelling with accuracy and facility. 	

Level 3

AO1	<ul style="list-style-type: none"> select, use and integrate a range of relevant knowledge show an adequate understanding of the concepts involved 	13–18
AO2	<ul style="list-style-type: none"> undertake some interpretation and analysis of issues and problems and make a superficial evaluation use evidence to develop arguments and draw conclusions 	
AO3	<ul style="list-style-type: none"> demonstrate awareness of the differences between types of knowledge have an appreciation of the strengths and limitations of the different types of knowledge 	
AO4	<ul style="list-style-type: none"> communicate clearly, using some specialist vocabulary with facility use some of the rules of grammar, punctuation and spelling with facility. 	

Level 2

AO1	<ul style="list-style-type: none"> select, use and integrate a limited range of relevant knowledge show a modest understanding of the concepts involved 	7–12
AO2	<ul style="list-style-type: none"> demonstrate limited interpretation and analysis of issues and problems with limited evaluation use evidence to develop limited arguments and draw limited conclusions 	
AO3	<ul style="list-style-type: none"> demonstrate limited awareness of the differences between types of knowledge have a restricted appreciation of the strengths and limitations of the different types of knowledge 	
AO4	<ul style="list-style-type: none"> communicate ideas with limited clarity, using some specialist vocabulary use some rules of grammar, punctuation and spelling. 	

Level 1

AO1	<ul style="list-style-type: none"> select, use and integrate some knowledge which may not be accurate show a restricted understanding of the concepts involved 	0–6
AO2	<ul style="list-style-type: none"> demonstrate poor interpretation and analysis of issues, problems and evaluation recognise arguments and conclusions 	
AO3	<ul style="list-style-type: none"> demonstrate very limited awareness of the differences between types of knowledge have a very restricted appreciation of the strengths and limitations of the different types of knowledge 	
AO4	<ul style="list-style-type: none"> communicate with little clarity using occasional specialist terms use poor grammar and punctuation, and inaccurate spelling. 	

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