GCSE

Science A

General Certificate of Secondary Education

Unit **A141/02:** Unit 1: Modules B1, C1, P1 (Higher Tier)

Mark Scheme for January 2012

Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not/reject	answers which are not worthy of credit
ignore	statements which are irrelevant - applies to neutral answers
allow/accept	answers that can be accepted
(words)	words which are not essential to gain credit
words	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	no benefit of doubt

R	reject
✔	correct response
L1 , L2 , L3	Allocate level of response.
⌃	information omitted

Subject-specific Marking Instructions

a.   If a candidate alters his/her response, examiners should accept the alteration.

b.   Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

Eg

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✔) in the two correct boxes.

Put ticks (✔) in the two correct boxes.

Put ticks (✔) in the two correct boxes.

This would be worth 1 mark.

This would be worth 0 marks.

This would be worth 1 mark.

c. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick boxes:

Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.
Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✔			✔	✔	✔	✔	
Manchester	✔	✗	✔	✔	✔				✔	
Paris				✔	✔		✔	✔	✔	
Southampton	✔	✗		✔		✔	✔		✔	
Score:	2	2	1	1	1	1	0	0	0	NR

e. For answers marked by levels of response:
     i.   **Read through the whole answer from start to finish**
     ii.   **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
     iii.   **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

d.   Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer	Marks	Guidance
1	(a)		<table><tr><td>memory loss</td><td>✓</td></tr><tr><td>chest infections</td><td></td></tr><tr><td>thick mucus</td><td></td></tr><tr><td>sore throat</td><td></td></tr><tr><td>clumsiness</td><td>✓</td></tr><tr><td>difficulty digesting food</td><td></td></tr></table>	2	see 12 d in the generic instructions above
	(b)	(i)	hh	1	
		(ii)	<table><tr><td></td><td colspan="2">Alesha's mother</td><td></td></tr><tr><td></td><td>h</td><td>h</td><td>(1)</td></tr><tr><td rowspan="2">Alesha's father</td><td></td><td></td><td></td></tr><tr><td>H</td><td>Hh</td><td>Hh</td></tr><tr><td>h</td><td>hh</td><td>hh</td><td>(1)</td></tr></table> 0.5 (1)	3	correct parent genotypes = 1 mark correct Punnett square = 1 mark correct probability = 1 mark ecf from parental genotypes to Punnett square, and ecf from Punnett square to probability **accept** ½ / 50% / 1:2 (**allow** ecf from their Punnett square) **accept** 2/4 for ½, 2:4 for 1:2

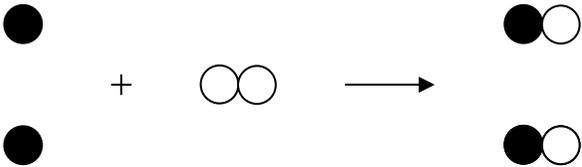| Question			Answer	Marks	Guidance
	(c)		doctor: to be able to offer advice / plan treatment / provide counselling / inform research (1); employer: to plan staffing / to assess needs of employee / health and safety issues (1)	2	reasons given must be clearly attributed to the doctor and the employer. It may be possible to infer this from what is written, e.g. 'To plan her future treatment and to plan staffing levels' are clearly addressing the two people concerned. vague ideas such as 'to help her' are not allowed unless qualified. **accept** one answer max under each heading
			Total	**8**	

Question			Answer	Marks	Guidance
2	(a)		3:2	1	do **not** credit 6:4 **allow** 'to' or '/' or '–' in place of the colon but not '.' **NOT** 2:3 or 2/3, etc. **ignore** 1.5 by itself, but accept 1.5:1
	(b)		(experiment 2 because): 3:1 is expected ratio (from two heterozygote parents) / ¼ of plants should be short/ ¾ of plants should be tall (1); ratio of experiment 2 = 19:6 or 3.17:1, which is close to this (1)	2	first mark is for calculating/ stating that the expected ratio is 3:1; the second mark is for a correct comparison with the ratio in experiment 2, for which they must have calculated the ratio or proportion in experiment 2. No mark for just stating 'experiment 2'.
	(c)		use more (parent) plants / count more offspring plants / larger sample (1)	1	do **not** credit repeat the experiment do **not** credit calculate mean
			Total	**4**	

Question			Answer	Marks	Guidance
3	(a)		**[Level 3]** Recognises that Thomas and James have identical genes. Describes and explains at least one difference due to environmental effects. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** States that Thomas and James inherit the same genes from both parents, but may confuse identical and non-identical twins. Links at least one difference to environmental effects, even if the word 'environment' is not used. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** May identify only similarities or differences between Thomas and James, possibly without explanation. May refer to genes/DNA but probably not related to the boys' similarities; may refer to similarities to one or other parent. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to C** **Indicative scientific points at Level 3 may include:** • correct use of the terms gene and embryo • genes are identical • same genetic information • describes one hereditable factor • twins came from same original embryo (one egg and one sperm) which split • genetic features include eye colour, nose shape • some features are controlled by the environment • influence of environment is different for each person • environmental features include hairstyle, scar, weight • suggested lifestyle differences responsible for these differences **Indicative scientific points at Level 2 may include:** • some genes from father, some from mother • genetic features include eye colour, nose shape • features inherited from either father or mother • embryos produced by paternal sperm and maternal egg • uses the term 'environmental' for the relevant factor(s) • influence of environment is different for each person • environmental features include hairstyle, scar, weight **Indicative scientific points at Level 1 may include:** • some features inherited from parents • recognises an (environmental) difference **accept** hair colour as either genetic or environmental. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question	Answer	Marks	Guidance
3 (b)	<table><tr><td>Each body cell in a human…</td><td></td></tr><tr><td>A gene on the X chromosome…</td><td></td></tr><tr><td>The sex-determining gene…</td><td></td></tr><tr><td>a gene on the Y chromosome…</td><td>✓</td></tr><tr><td>each body cell in a human female…</td><td>✓</td></tr><tr><td>the sex-determining gene triggers…</td><td>✓</td></tr></table>	2	two marks for all boxes correct (3 correct ticks and 3 empty boxes) one mark for 3 correct ticks and one other tick one mark for 2 correct ticks and at most one other tick one mark for 1 correct tick and at most one other tick
	Total	**8**	

	Question		Answer	Marks	Guidance
4	(a)	(i)	1200 x 2.1 (= 2520)	1	**accept** explanation in words provided that multiplication is clear. 2520 kg is in the question: this question is about the logic. **accept** reverse working, i.e. 2520/2.1 = 1200
		(ii)	16000 x 90 (= 1440000 (g)) (1); = 1440000/ 1000 = 1440 kg 2520 – 1440 = 1080kg (1)	2	if you see 1440000 or 1440, you can award the first mark, which is for multiplying the mass of CO_2 per km by the distance correct numerical answer of 1080 gets both marks even with no working. no ecf from incorrect mass in first calculation.
	(b)		set legal limits / laws / lowering congestion or charges / raise public awareness of advantages / subsidise road tax or insurance or price of hybrids (1)	1	**allow** other reasonable suggestions, e.g. subsidy for hybrid cars ('make them cheaper') / increase of petrol tax or prices/advertising hybrid cars/ scrappage scheme
	(c)		**any two from:** 1. limited range 2. lower speed 3. quiet and so dangerous to pedestrians 4. problems with charging points 5. problems with pollution 6. economic problems 7. problems with batteries/electrical supply	2	credit alternative valid problems. **some examples of points 4 to 7**: 4. eg not many around, expensive to install 5. eg during manufacture/ disposal/ from power stations instead, cost of safe disposal 6. eg costs of manufacturing, effect on petroleum industry 7. eg expensive, heavy, long time to charge, more power stations needed ('need a lot of electricity'), scarce raw materials
			Total	**6**	

Question			Answer	Marks	Guidance
5	(a)			1	for 1 mark, needs to have: • a black blob on the left hand side separate from the one already there; • two separate 'molecules' of a black blob joined to a white blob on the right hand side and no other particles drawn, unless they are crossed out.

Question			Answer	Marks	Guidance
(b)			**[Level 3]** Answer includes an understanding of what is formed from both gases, how oxygen is involved, how this involves oxidation and reduction. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer includes a description of oxidation of carbon monoxide by addition of oxygen to form carbon dioxide OR a description of reduction of nitrogen monoxide by loss of oxygen OR a partial description of both. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer gives some correct idea of what happens to the carbon monoxide and nitrogen monoxide, e.g. turned into less harmful gases. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A/A*** **Points relevant to carbon monoxide may include:** • carbon monoxide is converted to carbon dioxide • this involves addition of oxygen - this could be shown by a molecule diagram, by a word equation (carbon + oxygen → carbon dioxide), by a partial symbol equation ($CO + O \rightarrow CO_2$) or by a complete symbol equation ($2CO + O_2 \rightarrow 2CO_2$) • this is called oxidation **Points relevant to nitrogen monoxide may include:** • nitrogen monoxide is converted to nitrogen • this involves removal/loss of oxygen - this could be shown by a molecule diagram, by a word equation (nitrogen monoxide → nitrogen + oxygen), by a partial symbol equation ($NO \rightarrow N + O$) or by a complete symbol equation ($2NO \rightarrow N_2 + O_2$) • this is called reduction **Other relevant points may include:** • catalyst increases rate of reaction(s) • oxygen moves from nitrogen dioxide to carbon monoxide • overall reaction is $2CO + 2NO \rightarrow N_2 + 2CO_2$ • carbon + nitrogen → nitrogen + carbon monoxide monoxide dioxide **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	7	

Question			Answer	Marks	Guidance
6	(a)	(i)	rises slowly at first then quickly	1	**accept** use of dates needs increase in rate: not just 'positive correlation'
		(ii)		1	

As the amount of coal burned increases, the...	✓
Between 1990 and 2005…	
More power stations are built…	
Burning coal has no effect…	
Modern power stations…	

Question			Answer	Marks	Guidance
		(iii)	**marking points for values from 29(+):** (value for 2010 could be anomalous), so follow earlier (exponential) trend (1); increase in (coal fired) power stations/ more coal being burnt (1); which makes more sulfur dioxide (1); **marking points for values 28 – 30:** (value for 2005 could be anomalous), so follow earlier (linear) trend of 2 – 3 per five years (1); (even though coal usage is increasing) modern power stations are getting better at removing SO_2 (1); **marking points for values from 20 – 28:** trend is for smaller increase in SO_2 each year (1); removal of sulfur dioxide from the flue gases of coal burning power stations (1); which puts less sulfur dioxide into the air (1)	2	no mark is given for the amount of SO_2. if the coal graph has been used instead of the SO_2 graph, no marks — you will see a value of 800+ (millions of tons) the first set of marking points is based on an increasing (exponential) trend in the data, inferred from the coal graph. the second set of marking points is based on the increases in the SO_2 graph increases being linear, with one anomalous point the third set of marking points is based on the improvement in removal of SO_2 **allow** one mark based on the data in the graph, and one mark for the chemistry or both marks for the chemistry.

Question			Answer	Marks	Guidance
	(b)	(i)	Wednesday (**accept** 38) Thursday (**accept** 15)	1	must be in the right order.
		(ii)	SO_2 is soluble in water (1) low power output **means** less coal burned (1)	2	mark independently of **(b)(i)** answer given not just 'low power output' or 'low power output so less sulfur dioxide'
			Total	7	

Question			Answer	Marks	Guidance
7	(a)		any indication of oscillations perpendicular to the direction of propagation of the wave	1	answer may be in a diagram Minimum diagram is a sinusoidal wave shape with **either** direction of travel **or** direction of oscillation indicated e.g. ∿∿ or ↕∿∿
	(b)	(i)	t = 150 – 50 = 100 s (1); speed = d/t = 560 km/ 100 s = 5.6 km/s (1)	2	award 2 marks for correct numerical answer of 5.6 km/s if you see 100 (s), the first marking point has been met
		(ii)	the time between the two would increase **because** the S-wave is slower and so will fall further and further behind / the further you go, the greater the lag.	1	need the reason for the time lag being greater at greater distances.
	(c)		frequency = 40/5 = 8 (Hz); (1) wavelength = speed/frequency = 3.7/8 = 0.463 (1) **OR** distance moved in 5 s = 3.7 x 5 = 18.5 km (1); this has 40 waves, so wavelength = 18.5 /40 = 0.463 km (1)	2	**allow** ecf from frequency if you see 8 (Hz), the first marking point has been met **allow** ecf from distance moved in 5 s if you see 18.5 (km), the first marking point has been met accept any number of significant figures
			Total	6	
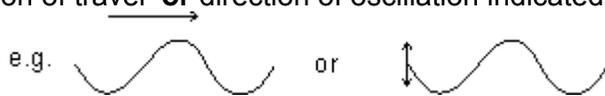
Question	Answer	Marks	Guidance
8	**[Level 3]** Clear explanation of earthquakes and mountain building in terms of plate movement in more than one direction and these are correctly described. May recognise volcanoes are associated with subduction (may not use the term), mountain building or seafloor spreading. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes more than one direction of tectonic plate movement, and can relate movement to earthquakes and/or mountain building. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes tectonic plate movement, but is unclear about direction. Likely to repeat the question stem with respect to these events occurring at the edges of plates. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points at Level 3 may include:** • tectonic plates move slowly • caused by movements in the mantle • correct use of constructive / destructive/ conservative with regard to plate boundaries • subduction/plates moving under each other occurs when plates move together (destructive boundary) • volcanoes produced during subduction/plates moving under each other • seafloor spreading/plates moving apart (constructive boundary) associated with volcanoes/outwelling magma • Mountain formation occurs when plates move together • earthquakes are caused when plates move suddenly **Indicative scientific points at Level 2 may include:** • tectonic plates fit like a jigsaw • tectonic plates move sideway/together / apart • plates scrape against/crash into each other • earthquakes are caused when plates move (suddenly) • mountains caused by when plates collide head on **Indicative scientific points at Level 1 may include:** • the Earth's crust has tectonic plates in it • these plates move • earthquakes are caused when plates move • mountains happen where plates meet **accept** diagrams showing any of the above **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	6	

Question			Answer	Marks	Guidance
9	(a)		galaxies that are further away are moving (away) faster / distance and speed are positively correlated (1)	1	either approach direction of correlation must be explicit
	(b)		realises that not all the data has been used / recognises the outlier (1); **either** (YES because) reason for exclusion e.g. it gives a value for **B** that fits the pattern on the graph / the 6.6 is very different from other values **or** (NO because) there is no valid reason for excluding it / data needed further investigation (1)	2	
	(c)		<table><tr><td>1500 km/s is greater…</td><td></td></tr><tr><td>The distance to the distant galaxies is difficult...</td><td>✓</td></tr><tr><td>The relationship may not be a straight line...</td><td>✓</td></tr><tr><td>70 million years is greater…</td><td></td></tr><tr><td>All galaxies show redshift</td><td></td></tr></table>	2	
			Total	5	

Question	Answer	Marks	Guidance
10 (a)	<table><tr><td>Ann</td><td>✓</td></tr><tr><td>Ben</td><td></td></tr><tr><td>Colin</td><td>✓</td></tr><tr><td>Diana</td><td></td></tr></table>	1	**both** needed for the mark
(b)	<table><tr><td>Ann</td><td></td></tr><tr><td>Ben</td><td></td></tr><tr><td>Colin</td><td>✓</td></tr><tr><td>Diana</td><td></td></tr></table>	1	
(c)	<table><tr><td>Ann</td><td></td></tr><tr><td>Ben</td><td>✓</td></tr><tr><td>Colin</td><td></td></tr><tr><td>Diana</td><td></td></tr></table>	1	
	Total	**3**	

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