

# **Additional Applied Science**

General Certificate of Secondary Education

Unit **A192/01**: Science of Materials and Production (Foundation Tier)

## **Mark Scheme for June 2013**

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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**Marking Instructions**

For answers marked by levels of response:

- a. **Read through the whole answer from start to finish**
- b. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- c. **To determine the mark within the level**, consider the following:

<b>Descriptor</b>	<b>Award mark</b>
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.

**Annotations**

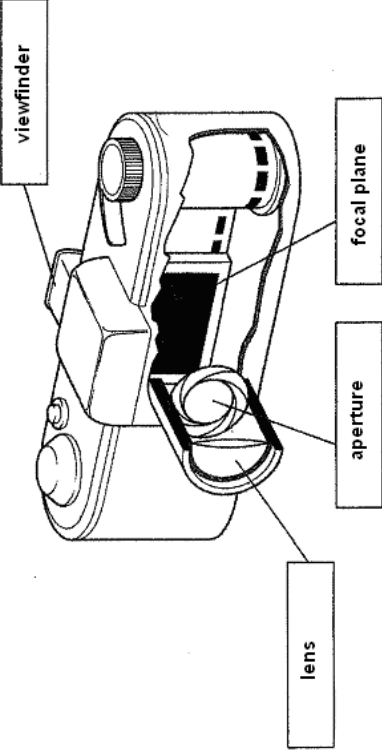
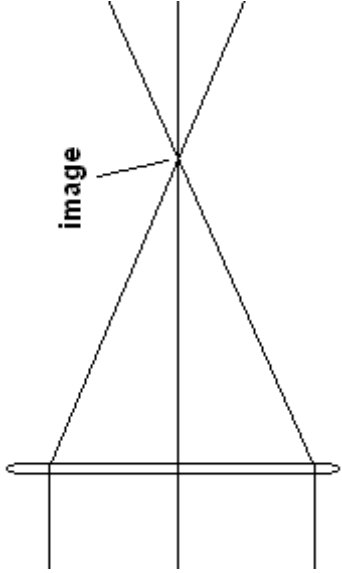
Used in the detailed Mark Scheme:

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	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
	draw attention to particular part of candidate's response
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject
	correct response
	draw attention to particular part of candidate's response
	information omitted

Question	Answer	Mark	Guidance									
1		2	straight line through (i.e. touching) two points at 100 N and 500 N [1] $16 \pm 1$ mm [1] accept 15.2 mm for [1] not a freehand line allow ecf from incorrect line (straight or freehand)									
(b) (i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">density</td> <td style="width: 50%;"></td> </tr> <tr> <td>strength</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>flexibility</td> <td></td> </tr> <tr> <td>durability</td> <td></td> </tr> </table>	density		strength	✓	flexibility		durability		1		
density												
strength	✓											
flexibility												
durability												
(ii)	so that the rope is (always) safe / won't break owttf	1	look for idea of keeping the user out of danger									
(c)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">metal</td> <td style="width: 33%; text-align: center;">very hard but brittle</td> <td style="width: 33%;"></td> </tr> <tr> <td style="text-align: center;">ceramic</td> <td style="text-align: center;">low density and high toughness</td> <td></td> </tr> <tr> <td style="text-align: center;">polymer</td> <td style="text-align: center;">high density with high strength</td> <td></td> </tr> </table>	metal	very hard but brittle		ceramic	low density and high toughness		polymer	high density with high strength		2	all three correct for [2] one or two correct for [1]
metal	very hard but brittle											
ceramic	low density and high toughness											
polymer	high density with high strength											

Question	Answer	Mark	Guidance
2 (a)	 <p>The diagram shows a camera with four labels pointing to its components: 'lens' points to the front lens, 'aperture' points to the opening in the lens, 'focal plane' points to the sensor area inside the camera body, and 'viewfinder' points to the eyepiece on the back.</p>	3	all four correct for [3] any two or three correct for [2] any one correct for [1]
(b)	C	1	
(c)	 <p>The ray diagram shows a vertical object on the left. Three rays originate from the top of the object: one parallel to the optical axis that refracts through the focal point on the right; one through the optical center that continues straight; and one through the focal point on the left that refracts parallel to the axis. These rays converge to form an inverted image on the right. The word 'image' is written next to the inverted image.</p>	2	correct pattern of rays as far as image [1] <b>accept</b> three straight lines meeting at a point on the right [1] <b>ignore</b> lines after they have crossed image label where all three rays cross [1] <b>ecf accept</b> image label where rays would have come from or gone to <b>accept</b> point / focal plane / focal point / focus as labels <b>accept</b> lines drawn without a ruler

Question	Answer	Mark	Guidance
3 (a)	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">copper sulfate</div> <div style="font-size: 2em;">+</div> <div style="border: 1px solid black; padding: 2px; text-align: center;">sodium carbonate</div> <div style="font-size: 2em;">→</div> <div style="border: 1px solid black; padding: 2px; text-align: center;">copper carbonate</div> <div style="font-size: 2em;">+</div> <div style="border: 1px solid black; padding: 2px; text-align: center;">sodium sulfate</div> </div>	2	correct reactants in any order [1] correct products in any order [1] <b>accept</b> correct formulae instead of words
(b)	(i) 920 / 115; = 8 litres	1 1	correct answer with no working for [2] <b>ecf:</b> (920 / 250 =) 3.7 litres for [1] <b>ecf:</b> (920 / 108 =) 8.5 litres for [1] <b>ecf:</b> (920 / 72 =) 13 litres for [1] <b>ecf:</b> (920 / 36 =) 26 litres for [1]
(ii)	EITHER yes because it gives highest / best yield (at 115 g/litre) [1]; OR 200 (g/litre) is best / as good; because it still gives 115 (g/litre) / same yield [2]; OR 200 (g/litre) is best / as good; because it still gives 115 (g/litre); for less copper sulfate / expense / owtte [3] OR 150 (g/litre) is best; because it gives a high yield; without leaving any unreacted copper sulfate [3]	3	<b>accept</b> between 150 and 160 g/litre



Question	Answer	Mark	Guidance
4	<p><b>Level 3 (5–6 marks)</b> Suggests design features <b>and</b> explains them with relevant science. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Suggests a design feature <b>and</b> explains it with relevant science. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> <b>Either</b> suggests a design feature <b>or</b> provides some relevant science. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>relevant design features include:</b></p> <ul style="list-style-type: none"> <li>• carpets on the floor</li> <li>• double glazed windows</li> <li>• acoustic ceiling tiles</li> <li>• cavity walls between flats</li> <li>• solid floors / ceilings</li> <li>• solid external doors</li> <li>• sound insulation / proofing</li> <li>• brick instead of flimsy material</li> <li>• thicker walls</li> <li>• soft materials e.g. foams</li> </ul> <p><b>relevant science includes:</b></p> <ul style="list-style-type: none"> <li>• sound (waves) absorbed by / won't pass through</li> <li>• fluffy surfaces / gaps in materials</li> <li>• sound (waves) reflected by / bounce off</li> <li>• hard / shiny / smooth surfaces</li> </ul>

Question	Answer	Mark	Guidance
5	<p><b>Level 3 (5–6 marks)</b> Compares some organic and non-organic features. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Compares an organic feature with a non-organic feature. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> States <b>either</b> an organic feature <b>or</b> a non-organic feature. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to E</b></p> <p><b>organic features include:</b></p> <ul style="list-style-type: none"> <li>• manure (instead of chemical fertiliser)</li> <li>• no herbicide (chemicals)</li> <li>• no pesticide (chemicals)</li> <li>• no fungicide (chemicals)</li> <li>• reduced yield</li> <li>• uses crop rotation</li> <li>• keep grazing animals</li> <li>• friendly to wildlife</li> </ul> <p><b>non-organic features include:</b></p> <ul style="list-style-type: none"> <li>• chemical fertiliser</li> <li>• herbicides</li> <li>• pesticides</li> <li>• fungicides</li> <li>• increased yield</li> <li>• no need to rotate crops</li> <li>• no need to keep grazing animals</li> <li>• low biodiversity</li> </ul> <p><b>look for type of farming associated with each feature</b> <b>ignore</b> references to wheat quality, cost of production, health issues, GM crops</p>

Question	Answer	Mark	Guidance
6 (a)	EITHER highest strength (70 MPa); so won't break (easily); OR highest density (7000 kg/m <sup>3</sup> ); so makes a heavy axe-head;	1 1	<b>ignore</b> bending/cutting/stiffness in justification <b>accept</b> both properties with no justification for [2] a list of two correct properties and one incorrect [1] a list of all four properties [0]
(b)	polymer; lowest (thermal) conductivity (0.3 W/mK);	1 1	<b>accept</b> poor conductor / good insulator
(c) (i)	a mix of materials which is biodegradable sheets of different materials fastened together fibres of two different materials knotted together fibres of one material in a matrix of another ... ✓	1	
(ii)	fibreglass / carbon fibre / wood	1	<b>accept</b> any composite material suitable for a handle <b>not</b> rubber, plastic
7 (a)	any one of beer, cheese, yogurt, bread, mycoprotein, cider	1	<b>not</b> wine or spirits <b>accept</b> cake
(b)	sugar → alcohol + carbon dioxide	2	all three correct for [2] one or two correct for [1] <b>accept</b> products in any order
(c) (i)	8;	1	
(ii)	idea that concentration doubles every 5 hours; 25 hours;	1 1	method [1] correct answer [1]
(iii)	wash it / sterilise it / boil water in it before wine added;	1	<b>accept</b> any chemical which will kill bacteria e.g. disinfectant, sodium metabisulfite, camden tablets ... <b>ignore</b> cooling / freezing / heating <b>accept</b> clean the bottle <b>ignore</b> use a clean bottle

Question	Answer	Mark	Guidance
8	<p><b>Level 3 (5–6 marks)</b> Describes a procedure which would make large pure crystals. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Describes a procedure which would make pure crystals, with a significant error or omission. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Describes <b>either</b> combining the reactants <b>or</b> filtering the products <b>or</b> making crystals. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Procedure includes:</b></p> <ul style="list-style-type: none"> <li>• add solid to acid</li> <li>• stir / heat</li> <li>• until no more solid dissolves</li> <li>• pass mixture through filter (paper)</li> <li>• heat solution to evaporate some water</li> <li>• leave somewhere cool</li> <li>• for a long time</li> <li>• until there are dry crystals</li> </ul>

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