

Additional Applied Science

General Certificate of Secondary Education

Unit **A192/02**: 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:

- Read through the whole answer from **start to finish**
- Decide the level that **best fits** the answer – match the quality of the answer to the closest level descriptor
- 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

- 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:

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/owt/e	alternative wording
ORA	or reverse argument

Available in scoris to annotate scripts

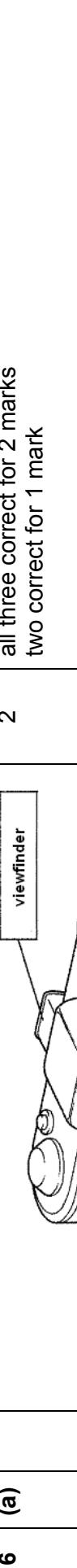
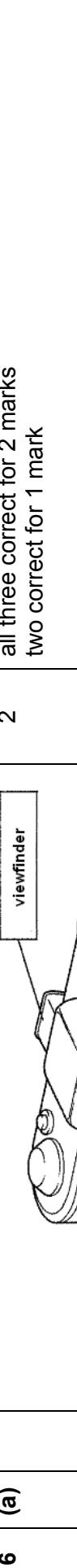
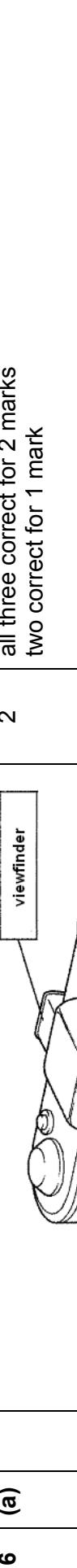
Annotation	Meaning
?	indicate uncertainty or ambiguity
[1+1]	benefit of doubt
[+1]	contradiction
X	incorrect response
[1-1]	error carried forward
O	draw attention to particular part of candidate's response
=	draw attention to particular part of candidate's response
~~~	draw attention to particular part of candidate's response
[+1]	no benefit of doubt
[1]	reject
✓	correct response
[1]	draw attention to particular part of candidate's response
[X]	information omitted

Question		Answer	Marks	Guidance
1	(a)	$\boxed{\text{CuSO}_4} + \boxed{\text{Na}_2\text{CO}_3} \rightarrow \boxed{\text{CuCO}_3} + \boxed{\text{Na}_2\text{SO}_4}$	2	reactants $\text{CuSO}_4$ and $\text{Na}_2\text{CO}_3$ , product $\text{CuCO}_3$ (1) second product $\text{Na}_2\text{SO}_4$ (1)
	(b) (i)	$920 / 115;$ $= 8 \text{ litres}$	1	correct answer with no working for [2] ecf: $(920 / 250 =) 3.7 \text{ litres for [1]}$ ecf: $(920 / 108 =) 8.5 \text{ litres for [1]}$ ecf: $(920 / 72 =) 13 \text{ litres for [1]}$ ecf: $(920 / 36 =) 26 \text{ litres for [1]}$
	(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 / outtte [3] OR 150 (g/litre) is best; because it gives a high yield; without leaving any unreacted copper sulfate [3]	3	accept between 150 and 160 g/litre

Question	Answer	Marks	Guidance
2	<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>This question is targeted at grades up to C</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>1 sound (waves) absorbed by / won't pass through fluffy surfaces / gaps in materials</li> <li>2 sound (waves) reflected by / bounce off hard / shiny / smooth surfaces</li> <li>3 sound (waves) reflected by / bounce off hard / shiny / smooth surfaces</li> <li>4 sound (waves) reflected by / bounce off hard / shiny / smooth surfaces</li> </ul>

Question	Answer	Marks	Guidance
3	<p><b>Level 3 (5–6 marks)</b> Includes at least two costs and correctly linked reasons for increase. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Includes cost linked to correct reason for increase. For the most part the information is relevant and presented in a structured and coherent format. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Includes one or more unrelated costs/reasons for increase. Answer may be simplistic. 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>relevant costs include:</b></p> <ul style="list-style-type: none"> <li>• increased demand</li> <li>• soil preparation</li> <li>• spraying with pesticides and herbicides</li> <li>• applying fertiliser</li> <li>• harvesting</li> <li>• transport</li> <li>• storage.</li> </ul> <p><b>relevant reasons for cost increase include:</b></p> <ul style="list-style-type: none"> <li>• increase in fuel price for farm machinery</li> <li>• inclement weather reducing yield</li> <li>• poor local harvest resulting in import of potatoes</li> <li>• wet weather at harvest so crop has to be dried</li> <li>• crop failure elsewhere increasing demand</li> <li>• increased losses to pests and disease.</li> <li>• lower yield therefore need to put up price to make profit</li> </ul>

Question	Answer	Marks	Guidance
4 (a)	$k = 5.0 \times 10^4 / 50\ 000 \text{ (N/m)}$ ; $x = 15 \times 10^{-3} \text{ m} / 0.015 \text{ m}$ ;	2	allow ecf from incorrect $k$ allow correct answer for (2)
(b) (i)	400 N	1	<b>allow</b> 390 - 410
(ii)	elastic materials go back to original shape/size (after being deformed/force released) plastic materials don't go back to original shape/size (after being deformed/force released)	2	
(iii)	area under graph = $0.5 \times 400 \times 20 = 4000$ for (1) energy = $0.5 \times 400 \text{ N} \times 0.02 \text{ m} = 4 \text{ J}$ for (2)	2	If no units max 1
5 (a)	<b>any two</b> of the following: strong - so that it doesn't bend/break (1) hard - so that it keeps a cutting edge/doesn't dent(1) stiff - so that it doesn't change shape when loaded (1) tough/not brittle - so that it doesn't break (1) durable - so that it lasts a long time (1)	2	
(b)	handle poor conductor of heat/good thermal insulator (1) metal conducts heat quicker/better (1)	2	
(c)	named fibre eg carbon in carbon fibre, glass in GRC; named matrix eg resin/glue in carbon fibre and GRC;	2	

Question	Answer	Marks	Guidance
6 (a)	 <p>Diagram of a camera showing internal components:</p> <ul style="list-style-type: none"> <li>lens</li> <li>aperture / shutter</li> <li>focal plane</li> <li>viewfinder</li> </ul>	2	<p>all three correct for 2 marks two correct for 1 mark</p> <p><b>allow</b> iris for aperture</p>
(b)	<p>converging lens</p>  <p>Diagram showing a converging lens forming a real image. Parallel rays from the left converge through the lens to form an inverted image on the focal plane.</p> <p>focal plane</p> <p>image</p>	2	<p>two rays from lens meeting at image point (1)</p> <p>two parallel rays to the left of lens at the correct angle by eye (1)</p> <p><b>accept</b> straight lines drawn by hand</p>
(c)	<p>move lens away from focal plane/film; to keep the image in focus;</p>  <p>Diagram showing a diverging lens forming a virtual image. Diverging rays from the left appear to come from behind the lens, forming an upright image on the focal plane.</p> <p>image</p>	2	<p><b>accept</b> move lens towards object/away from image</p>

Question	Answer	Marks	Guidance
7	<p><b>Level 3 (5–6 marks)</b>            Discusses most of the relevant points. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b>            Discusses some of the relevant points. For the most part the information is relevant and presented in a structured and coherent format. Quality of written communication partly impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b>            Discusses a few of the relevant points. Answer may be simplistic. 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>relevant points include:</b></p> <ul style="list-style-type: none"> <li>• is it a continuous or batch process?</li> <li>• design of vessel for reacting chemicals</li> <li>• how to measure out reactants</li> <li>• how to mix reactants</li> <li>• how to warm reactants</li> <li>• recycling of excess solid</li> <li>• separating out excess solid</li> <li>• method of heating solution</li> <li>• method of separating crystals from solution</li> <li>• how to monitor the flow of reactants/temperature.</li> </ul> <p>must be related to manufacture of copper sulfate</p>

Question	Answer	Marks	Guidance
8 (a)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	2	second product $CO_2$ for 1 mark equation balanced for 1 mark i.e. $2CO_2$
(b) (i)	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="border: 1px solid black; padding: 2px;">alcohol</div> <span style="margin: 0 10px;">+</span> <div style="border: 1px solid black; padding: 2px;">oxygen</div> <span style="margin: 0 10px;">$\rightarrow$</span> <div style="border: 1px solid black; padding: 2px;">acetic acid</div> <span style="margin: 0 10px;">+</span> <div style="border: 1px solid black; padding: 2px;">water</div> </div>	1	accept reactants in any order accept ethanol for alcohol accept ethanoic acid for acetic acid
(ii)	numbers increase rapidly (exponential phase) as they consume food; numbers level off and fall (senescence) as food runs out	2	
(iii)	<p>Keep the wine above room temperature.      Filter the wine as it goes into the bottle.      Wash the bottle before filling it with wine.      Make sure that air can't get past the cork.      Boil the wine before it goes into the bottle.</p> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	1	both correct for (1)

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