

**GCSE**

**Additional Applied Science**

Unit **A192/02**: Science of Materials and Production  
(Higher Tier)

General Certificate of Secondary Education

**Mark Scheme for June 2016**

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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.

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## Annotations

Used in the detailed Mark Scheme:

Annotation	Meaning
/	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 RM Assessor 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

**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.

E.g.

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

Put ticks (✓) in the two correct boxes.

✗
✗

This would be worth 1 mark.

Put ticks (✓) in the two correct boxes.

✓
✗

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

✗
✗
✓
✓

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

<b>Edinburgh</b>	
<b>Manchester</b>	
<b>Paris</b>	
<b>Southampton</b>	

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

<b>Edinburgh</b>			✓			✓	✓	✓	✓	
<b>Manchester</b>	✓	x	✓	✓	✓				✓	
<b>Paris</b>				✓	✓		✓	✓	✓	
<b>Southampton</b>	✓	x		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

## MARK SCHEME:

Question		Answer	Mark	Guidance
1	a	two sensible reasons in context of tennis racket; (Stiff) so it doesn't bend/change shape (low density) so that it is easy to carry (strong)so that it does not break	2	Eg: (stiffness) so it doesn't bend, (density) so it isn't too heavy, (strength) so it doesn't break easily
	b	any three of the following points, [1] each: aluminium is <ul style="list-style-type: none"> <li>• almost the stiffest;</li> <li>• almost the strongest;</li> <li>• but the heaviest / most dense;</li> </ul> carbon fibre is <ul style="list-style-type: none"> <li>• better choice than aluminium</li> <li>• the stiffest</li> <li>• the strongest</li> <li>• less dense / lighter than aluminium</li> </ul>	3	no mark for an unjustified yes/no  nothing for repeating data from table without comparison
	c	Handle will feel warm; As heat from hand won't flow(easily)to frame/handle;	1 1	

Question	Answer	Mark	Guidance
2	<p><b>[Level 3]</b> Describes a procedure which would work AND explains each step of the procedure AND names a food product. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Describes and explains part of a procedure which would work AND names a food product. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes part of a procedure which would work AND names a food product. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to C.</b></p> <p><b>Indicative science points may include:</b></p> <p><b>food products</b></p> <ul style="list-style-type: none"> <li>• cheese</li> <li>• yogurt</li> </ul> <p><b>explained steps in production</b></p> <ul style="list-style-type: none"> <li>• heating of milk to sterilise it</li> <li>• addition of culture to introduce bacteria</li> <li>• keeping milk warm for bacterial growth</li> <li>• cover milk to keep out other bacteria</li> <li>• bacteria feed on lactose / sugar in milk</li> <li>• by anaerobic respiration to make lactic acid</li> <li>• waste products thicken/clot milk</li> </ul>

Question		Answer	Mark	Guidance
3	a	any two of the following, [1] each: <ul style="list-style-type: none"> <li>• more efficient;</li> <li>• used to make other chemicals;</li> <li>• which are widely used/high requirement;</li> <li>• cheaper/more cost effective;</li> <li>• for fertilisers / cleaning products / health products;</li> </ul>	2	
	b	air and water (and methane); sulfur and air and water; sodium chloride and water;	1 1 1	reactants in any order
	c	$2\text{NH}_4\text{OH} + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4 + 2\text{H}_2\text{O}$ ;	2	$(\text{NH}_4)_2\text{SO}_4$ [1] $2\text{H}_2\text{O}$ [1]

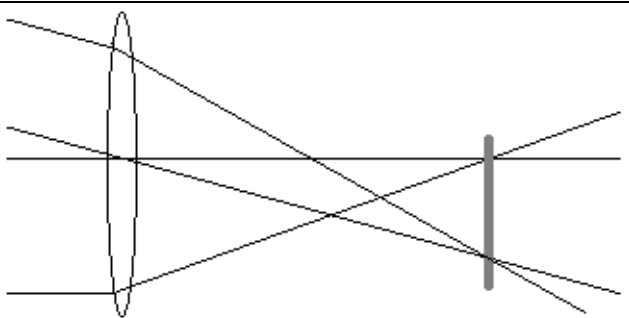
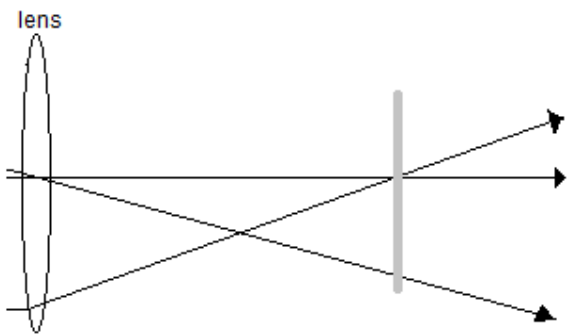
Question		Answer	Mark	Guidance
4	a	5 N extra extends cord by $255 - 240 = 15$ mm;  10 N extra extends cord by 30 mm so final length = $255 + 30 = 285$ mm;	1  1	method i.e. use of $F = kx$ and calculation of extension [1] correct answer [1]
	b	extension at 25 N is 0.075 m; energy is $0.5 \times 25 \times 0.075 = 0.9375$ J;	1 1	Accept value between 0.074 – 0.076m Accept correct calculation from 0.074/0.075/0.076 Accept 0.9 provided method is clear
	c	elastic behaviour because graph is a straight line	1	need both behaviour and reason for [1]

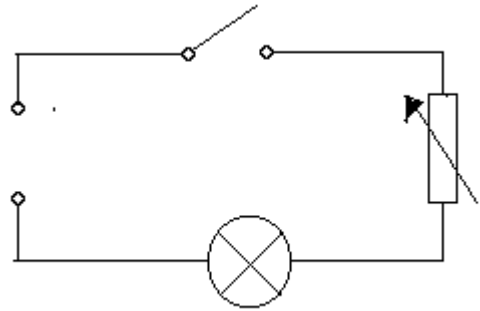


Question	Answer	Mark	Guidance
5	<p><b>[Level 3]</b> Describes some explained aspects from each of the stages. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> EITHER describes an explained aspect from each of the stages OR describes some explained aspects from some of the stages. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Describes a couple of explained aspects. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to B.</b></p> <p><b>Indicative science points may include these explained stages:</b></p> <p><b>preparation</b></p> <ul style="list-style-type: none"> <li>• ploughing to break up the soil</li> <li>• fertilizing to provide nutrients for crop</li> <li>• sowing to put the seed in the ground</li> <li>• select best seed type to give maximum yield</li> </ul> <p><b>growing</b></p> <ul style="list-style-type: none"> <li>• controlling weeds to prevent competition</li> <li>• controlling pests to prevent crop being eaten</li> <li>• fertilizing to provide nutrients for crop</li> </ul> <p><b>harvesting</b></p> <ul style="list-style-type: none"> <li>• separation of edible grain from inedible stalk/chaff</li> <li>• drying to prevent growth of mould/fungi</li> <li>• storing to keep safe from pests</li> <li>• to sell wheat</li> <li>• to make suitable (named) product</li> </ul> <p><b>Look for correct explanation for each action.</b></p>

Question	Answer	Mark	Guidance
6	<p><b>[Level 3]</b> Describes some aspects of all stages AND shows most calculations. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Shows a calculation AND describes some aspects of some stages. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Shows a calculation OR describes some aspect of some stages. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p><b>This question is targeted at grades up to A</b></p> <p><b>Indicative science points may include :</b></p> <p><b>calculations</b></p> <ul style="list-style-type: none"> <li>• 1 l = 4 x 250 ml (units conversion)</li> </ul> <p>EITHER</p> <ul style="list-style-type: none"> <li>• 117 / 4 = 29.25 g (for 250 ml)</li> <li>• 1.5 / 0.25 = six times</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• 117 x 1.5 = 175.5 g ( for 1.5 l)</li> <li>• (1.5 -0.25)/0.25 = five rinsings from flask</li> </ul> <p><b>measuring salt</b></p> <ul style="list-style-type: none"> <li>• place <u>beaker</u> on <u>scales</u></li> <li>• tare scales</li> <li>• add calculated mass of salt</li> </ul> <p><b>dissolving</b></p> <ul style="list-style-type: none"> <li>• add some water to beaker</li> <li>• stir</li> <li>• warm to speed up the process</li> </ul> <p><b>transferring</b></p> <ul style="list-style-type: none"> <li>• place <u>funnel</u> on flask and pour solution into <u>flask</u></li> <li>• rinse out beaker with water and pour it into flask</li> <li>• repeat last stage a few times until almost to 250 ml mark</li> </ul> <p><b>measuring water</b></p> <ul style="list-style-type: none"> <li>• use a dropper to add water to the mark</li> <li>• stopper the flask and turn upside down a few times</li> <li>• pour into 1.5 l flask and repeat five more times</li> </ul>

Question		Answer	Mark	Guidance
7	a	body is opaque; lens is transparent;	1 1	<b>accept</b> refracting / refraction
	b	<b>precaution</b> <ul style="list-style-type: none"> <li>• limit exposure time</li> <li>• stop people touching lamp</li> <li>• stop people staring at lamp</li> <li>• keep (flammable) material away from lamp</li> </ul> <b>reason</b> <ul style="list-style-type: none"> <li>• lamp emit infrared radiation</li> <li>• lamp gets hot</li> <li>• lamp heats up/ burns people/material;</li> <li>• prevent damage to eye/retina</li> </ul>	2	any precaution [1] any reason [1]  <b>not</b> keep people away from lamp
	c	i	1	vertical line through point where rays from feet cross
		ii	1	approaches top half of lens parallel to other ray from head, crossing that ray at the focal plane (no ecf from (i))
		iii	1	Allow zooms out



Question		Answer	Mark	Guidance
8	a		2	correct circuit symbols [1] series circuit [1]
	b	i	1  1	
		ii	1  1	98000 = 2marks

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