



## General Certificate of Secondary Education

# Applied Science (Double Award) 3861

*3860/2H Science for the Needs of Society*

## Mark Scheme

*2006 examination – June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

question	answers	extra information	marks
1(a)	pesticide / insecticide	do <b>not</b> accept insect killer / weed killer	1
	herbicide		1
	fungicide		1
(b)	no competition for light / minerals / nutrients (food) / water / space	do <b>not</b> accept grow better / healthier / less competition (without clarification) / weeds kill the crops / strangle crops	1
(c)(i)	P	<b>must</b> have correct symbols but ignore case	1
	K		1
(ii)	nitrogen (allow nitrate)	allow iron / calcium / sulphur / manganese / boron / copper / zinc / molybdenum	1
	magnesium	allow symbols only if correct	1
(d)(i)	manure / animal waste / dung / compost	allow crop rotation	1
(ii)	dig them up / by hand / mechanical weeder / weeding / ploughing / hoeing (owtte)		1
(iii)	use other insects to eat them / use other plants to attract insects / pheromone traps / ladybirds / marigolds / predator	ignore references to plants killing insects  allow organic pesticide  do <b>not</b> allow covering crops / greenhouse	1

question	answers	extra information	marks
1(e)(i)	<ul style="list-style-type: none"> <li>plants don't grow as fast / big</li> <li>less nutrient in soil / no artificial fertiliser / more disease / eaten by pests / more weeds etc</li> </ul>	ignore reference to cost	1 1
(ii)	52 / 2.3 = £22.61	allow 22.6/22.60 / full calculator display (22.60869561) / £23  <b>not</b> £22	1 1
(f)	any <b>three</b> from: <ul style="list-style-type: none"> <li>(high) yield / size / amount produced</li> <li>height of plant</li> <li>fast growing / growth</li> <li>taste / colour</li> <li>disease resistance / healthier</li> <li>insect resistance</li> <li>stronger plant</li> </ul>		3

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question	answers	extra information	marks
1(g)	any <b>three</b> from: <ul style="list-style-type: none"><li>• tastier crops</li><li>• more natural</li><li>• no pollution from chemicals / less environmental damage</li><li>• less chemicals in food / less residues / healthier to eat</li><li>• low set up costs for farmer</li><li>• better conditions for animals / healthier animals</li></ul>	<b>not</b> healthier crops ‘no chemicals used’ too vague	3
<b>Total</b>			<b>21</b>

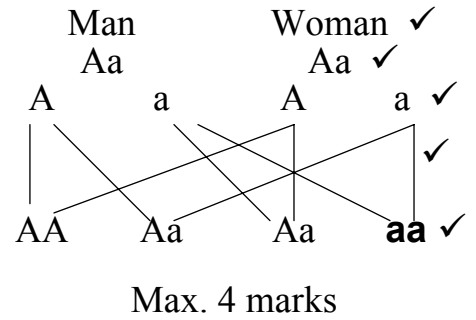
question	answers	extra information	marks
2(a)	good conductor (of electricity) / malleable / ductile / flexible		1
	<u>high</u> density / does not corrode	<b>not</b> heavy	1
	attractive appearance / shiny / resistance to corrosion / malleable / hard wearing / flexible		1
(b)(i)	copper		1
	strongest forces / bonds (of attraction between atoms)	second mark independent of first <b>not</b> just tensile strength – <b>must</b> be idea of strength of forces	1
(ii)	a sea of electrons / free electrons		1
	attraction to positive ions		1
(c)(i)	zinc makes the alloy stronger		1
	the more zinc is added the stronger it gets / higher the tensile strength	second point only = 2 marks	1
(ii)	atoms of a different size	allow ions	1
	prevent rows / layers of atoms sliding past each other		1
(d)	any <b>two</b> from:		1
	• brass is strong / harder to break	accept strength	1
	• zinc corrodes easily / (brass) does not corrode	ignore rust	
	• brass looks better / appearance	'it' = brass	

question	answers	extra information	marks
2(e)	suitable test device		1
	any <b>two</b> from:		
	<ul style="list-style-type: none"> <li>variation of load</li> <li>repeat for three materials</li> <li>repeat experiment and take an average</li> </ul>	no marks for heating or melting	2
<b>Total</b>			<b>16</b>
3(a)(i)	sweating gives cooling effect		1
	due to evaporation of water		1
(ii)	(cooling caused by)		
	larger diameter	accept converse	1
	more blood to surface	change in diameter linked to blood flow = 1 mark	1
(b)(i)	recessive		1
(ii)	identification of homozygous recessive aa		1
	then <b>three</b> from:		
	<ul style="list-style-type: none"> <li>parental genotypes identified as Aa Aa</li> <li>gametes identified as A a</li> <li>parent or gamete correctly labelled</li> <li>correct identification of combination</li> </ul>		3
	(see sample Punnet squares and F <sub>1</sub> diagrams on next page)		

Question 3(a)(ii) – Samples for marking

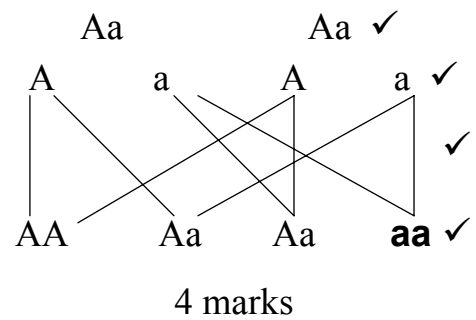
Parents ✓      Aa   Aa ✓

	A	a ✓	
A	AA	Aa ✓	
a	Aa	<b>aa</b> ✓	Max. 4 marks

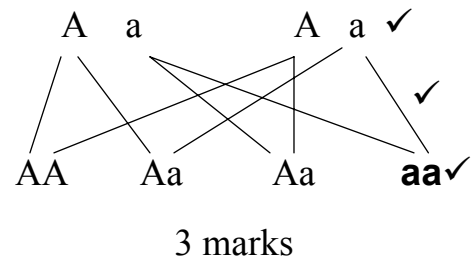


Father

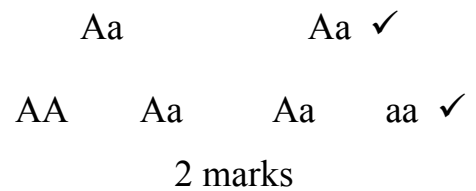
		Mother ✓	
	A	A	a ✓
A	AA	Aa	
a	Aa	<b>aa</b> ✓	4 marks



	A	a ✓	
A	AA	Aa ✓	
a	Aa	<b>aa</b> ✓	3 marks

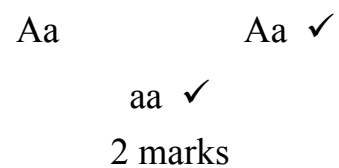


	A	a ✓	
A	AA	Aa ✓	
a	Aa	aa	2 marks



Parents ✓    Aa      Aa ✓

**aa** ✓      3 marks



**aa**      1 mark

question	answers	extra information	marks
3(b)(iii)	$\frac{1}{4}$ / 0.25 / 25% / 1:3 / one in four	(do <b>not</b> accept: 1:4 / 3:1 / 1/3)	1
(c)	chromosomes / gene	<b>not</b> 'jean'	1
(d)	<p><b>A</b> DNA / chromosome removed (from cell)</p> <p><b>B</b> <u>gene</u> selected / removed / cut out</p> <p><b>C</b> any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• plasmid taken from bacterium / plasmid taken from cell</li> <li>• plasmid / DNA from bacterium broken open</li> <li>• gene put into plasmid / DNA from bacterium</li> </ul> <p><b>D</b> any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• gene put into plasmid / DNA from bacterium</li> <li>• plasmid put into bacterium / cell</li> </ul> <p><b>E</b> bacteria reproduce / cells reproduce</p>	<p>credit only once (see <b>D</b>)</p> <p>do <b>not</b> accept this point if made in <b>C</b></p> <p>accept divide / reproduces</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
(e)	mitosis	correct spelling only	1



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question	answers	extra information	marks
3(f)	any <b>two</b> from: <ul style="list-style-type: none"><li>• improve shelf life</li><li>• disease resistance / to cure disease</li><li>• produce (other) drugs / medicines</li><li>• change animals / plants</li></ul>	2 marks if two <u>inherited</u> diseases named  2 marks for two specific examples allow cloning	2
<b>Total</b>			<b>19</b>

question	answers	extra information	marks
4(a)	$3 \times 8$		1
	$= 24$		1
(b)	$24 \times 7$		1
	$= 168$	allow £1.68 if correct symbol used	1
(c)	power = 3000 watts		1
	current = power / voltage		1
	$3000 / 240$		1
	$= 12.5$ (amps)		1
(d)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• conduction / heats the air</li> <li>• convection / hot air rises / air movement</li> <li>• radiation / waves</li> </ul>		2
(e)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• cavity wall (insulation)</li> <li>• roof insulation / loft insulation</li> <li>• carpet</li> <li>• double glazing</li> <li>• draught proofing / fill the gaps</li> <li>• curtains</li> <li>• keep door closed / window closed</li> <li>• silver foil behind radiator</li> </ul>	insulation alone = 1 mark	2

question	answers	extra information	marks
4(f)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• water may boil / freeze</li> <li>• oil has higher boiling point / water may evaporate</li> <li>• less corrosion / rust</li> <li>• higher heat capacity / holds more heat / stays hotter longer</li> </ul>	ignore reference to relative rates of heat transfer	1
<b>Total</b>			<b>13</b>
5(a)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• clean fuel / little soot / less pollution</li> <li>• easy to light / easy to control</li> <li>• contains large amount of energy / gives plenty of heat</li> <li>• inexpensive / cheap</li> <li>• supply through pipeline</li> </ul>		2
(b)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• contains carbon</li> <li>• derived from living material / (owtte)</li> </ul>	ignore hydrogen	1
(c)(i)	carbon and hydrogen	do <b>not</b> accept C and H	1
(ii)	2		1
(iii)	carbon dioxide / carbon oxide	<b>not</b> carbon monoxide	1
	water / hydrogen oxide	do <b>not</b> accept CO <sub>2</sub> and H <sub>2</sub> O	1

question	answers	extra information	marks
5(iv)	combustion		1
	exothermic		1
(v)	3338 – 2640		1
	= 698		1
	<b>or</b> 2640 – 3338		
	= -698		
<b>Total</b>			<b>11</b>
6(a)(i)	any <b>three</b> from: <ul style="list-style-type: none"> <li>• measured volume of solution</li> <li>• (heat to) evaporate / in evaporating basin</li> <li>• mass of container before</li> <li>• mass of container plus solid after</li> </ul>	only allow heat / boil / use evaporating basin if solid is formed	3
(ii)	130/2		1
	= 65 mg		1
	<b>or</b>	2 marks for correct answer	
	136.2/2		
	= 68.1 mg		

question	answers	extra information	marks
6(b)(i)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• ionic</li> <li>• transfer of electrons from Na to Cl</li> <li>• to form <math>\text{Na}^+\text{Cl}^-</math> / to form positive and negative ions</li> <li>• attraction between positive and negative (ions)</li> </ul>		2
(ii)	strong force of attraction between ions / particles	allow strong bonds	1
(iii)	one mark for name one mark for correct formula	<b>must</b> take from list (but accept $\text{MgCO}_3$ and $\text{CaCO}_3$ ) <b>must</b> be of named compound	1 1
<b>Total</b>			<b>10</b>
			<b>Overall mark = 90</b>