

## **GCSE**

### **Further Additional Science B**

Unit **B762/02**: Modules B6, C6, P6 (Higher Tier)

General Certificate of Secondary Education

### **Mark Scheme for June 2015**

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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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Annotation	Meaning
	correct response
	incorrect response
<b>BOD</b>	benefit of the doubt
<b>NBOD</b>	benefit of the doubt <b>not</b> given
<b>ECF</b>	error carried forward
	information omitted
<b>I</b>	ignore
<b>R</b>	reject
<b>CON</b>	contradiction

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1) = separates marking points
- allow** = answers that can be accepted
- not** = answers which are not worthy of credit
- reject** = answers which are not worthy of credit
- ignore** = statements which are irrelevant
- ( ) = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
- ecf = error carried forward
- AW = alternative wording
- ora = or reverse argument

## MARK SCHEME

Question	Answer	Marks	Guidance						
1 a	<table border="1" data-bbox="376 347 1021 555"> <tr> <td data-bbox="376 347 925 411">This stage involves ligase enzymes.</td> <td data-bbox="925 347 1021 411">4</td> </tr> <tr> <td data-bbox="376 411 925 475">This stage involves restriction enzymes.</td> <td data-bbox="925 411 1021 475">3</td> </tr> <tr> <td data-bbox="376 475 925 555">Binary fission occurs in this stage.</td> <td data-bbox="925 475 1021 555">5</td> </tr> </table>	This stage involves ligase enzymes.	4	This stage involves restriction enzymes.	3	Binary fission occurs in this stage.	5	3	
This stage involves ligase enzymes.	4								
This stage involves restriction enzymes.	3								
Binary fission occurs in this stage.	5								
b	<p><b>Any one from:</b>  check / extend / improve / repeat his experiment (1)  so other scientists can learn from his work (1)  check validity / have it tested (1)</p>	1	<p><b>allow</b> carry it on  <b>ignore</b> references to claiming the discovery as theirs  <b>ignore</b> to show evidence of their work</p>						
<b>Total</b>		<b>4</b>							

Question	Answer	Marks	Guidance
2 a	<p>protease digests protein / produces amino acids (1)</p> <p>lipase digests fats / produces fatty acids and glycerol (1)</p> <p>products (will wash out as they) are soluble (1)</p>	3	<p><b>ignore</b> attaches to / removes / dissolves</p> <p><b>allow</b> breaks down</p> <p><b>allow</b> any named product is soluble</p>
b i	<p>idea that the (genetic) code is universal (1)</p> <p>so the order of amino acids is the same (1)</p>	2	<p>eg same three bases code for the same amino acid in both</p> <p><b>ignore</b> just the same bases/gene in both</p>
ii	<p>some people think it is wrong / cruel to kill (young) cows / animals (to extract the chymosin) (1)</p> <p>others think that genetic engineering may be dangerous / ethically wrong / unnatural (1)</p>	2	<p><b>allow</b> reference to vegetarians <b>allow</b> hurt or harm animals</p> <p><b>ignore</b> references to spreading diseases</p> <p><b>allow</b> don't know what the long term effects are</p> <p>It must be clear which argument is referring to which process. Allow the correct order of the arguments if the process is not stated.</p>
	<b>Total</b>	<b>7</b>	

Question	Answer	Marks	Guidance						
3 a i	less (biogas) made (1)  <b>the idea</b> that (the floating manure is exposed to air so) not anaerobic / should not be exposed to oxygen (1)	2	<b>allow</b> does not mix with the microbes / come into contact with the microbes						
ii	<table border="1" data-bbox="338 419 999 699"> <tr> <td data-bbox="338 419 943 512">70% methane / 25% carbon dioxide / 5% hydrogen</td> <td data-bbox="943 419 999 512">√</td> </tr> <tr> <td data-bbox="338 512 943 604">70% carbon dioxide / 25% methane / 5% hydrogen</td> <td data-bbox="943 512 999 604"></td> </tr> <tr> <td data-bbox="338 604 943 699">70% hydrogen / 25% carbon dioxide / 5% methane</td> <td data-bbox="943 604 999 699"></td> </tr> </table>	70% methane / 25% carbon dioxide / 5% hydrogen	√	70% carbon dioxide / 25% methane / 5% hydrogen		70% hydrogen / 25% carbon dioxide / 5% methane		1	
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b	does not contain much nitrogen (1) <b>ORA</b>  so the duckweed does not grow much (1) <b>ORA</b>	2	<b>allow</b> comparative use of figures  <b>allow</b> duckweed needs nitrogen to grow						
c	<b>any two from:</b> the earthworms will aerate the waste (1)  reduce acidity (1)  so decomposition is faster (1)  more minerals for the plants to grow (1)	2	<b>allow</b> increase the surface area of the waste / break it up    <b>ignore</b> adds minerals to the soil  <b>allow</b> increase the surface area of the waste / break it up (1) <b>not</b> just breaks it down						
d	rabbit    goat    cow	1							
	<b>Total</b>	<b>8</b>							

Question	Answer	Marks	Guidance
4	<p><b>[Level 3]</b> Answer links two named events to increases in cholera cases <b>and</b> provides detailed explanations for two of the increases</p> <p>Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p><b>[Level 2]</b> Answer links any of the events to increases in cholera cases <b>and</b> provides an explanation for the increase in cases</p> <p>Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>[Level 1]</b> Answer links any of the three events to increases in cholera cases <b>and</b> provides a limited explanation for the increase in cases</p> <p>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>This question is targeted up to grade A</p> <p><b>Indicative scientific points at Level 3 may include:</b></p> <ul style="list-style-type: none"> <li>• earthquake may rupture sewage pipes so sewage released</li> <li>• water pipes may be ruptured so lack of clean drinking water</li> <li>• storm may cause flooding and so spread contaminated water about</li> <li>• rioting makes it difficult for medical services to get to people to treat them / vice versa or people cannot reach clean water supplies</li> </ul> <p><b>Indicative scientific points at Level 2 may include:</b></p> <ul style="list-style-type: none"> <li>• natural disasters increase the spread of contaminated water</li> <li>• natural disasters will result in lack of clean drinking water</li> <li>• hamper medical services</li> </ul> <p><b>Indicative scientific points at Level 1 may include:</b></p> <ul style="list-style-type: none"> <li>• cholera is spread by water</li> </ul> <p><b>if candidate fails to mention increase in cholera then max level 2</b></p> <p><b>Use the L1, L2, L3 annotations in Scoris. Do not use ticks.</b></p>
<b>Total</b>		<b>6</b>	


Question	Answer	Marks	Guidance
5 a	unsaturated because it contains a double bond/C=C	1	<b>ignore</b> references to C=O bond <b>not</b> molecules
5 b	turns (from orange/red/brown) to colourless / decolorises	1	<b>ignore</b> becomes clear / transparent
5 c	<b>any two from;</b>  Bromine only reacts with (C to C) double bond / an addition reaction takes place (at C to C double bond) (1)  the <b>product</b> /dibromo compound is colourless (1)	2	<b>allow</b> answer from diagram
<b>Total</b>		<b>4</b>	

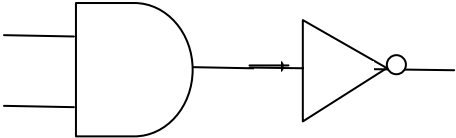
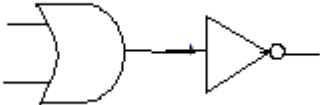
Question	Answer	Marks	Guidance
6 a	$\text{Mg} + \text{ZnCl}_2 \rightarrow \text{MgCl}_2 + \text{Zn}$	1	<b>allow</b> reactants and/or products in reverse order
6 b	Magnesium is oxidised(1)  Magnesium (atoms) lose electrons (1)  Zinc <u>ions</u> are reduced (1)  Zinc <u>ions</u> gain electrons (1)	4	must be zinc ions. <b>not</b> zinc chloride gains electrons  <b>not</b> zinc gains electrons.  if no other marks gained allow one mark for the idea of oxidation is loss of electrons and reduction is gain (1)
<b>Total</b>		<b>5</b>	



Question	Answer	Marks	Guidance
7 a	D	1	
7 b	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	1	
7 c	<p>fuel cell may contain poisonous <u>catalysts</u> that have to be disposed of /</p> <p>fossil fuels may have been used / carbon dioxide may have been released to make hydrogen and/or oxygen/</p> <p>fossil fuels may have been used / carbon dioxide may have been released to make the fuel cells</p>	1	<p><b>not</b> just disposing of them releases harmful gases</p> <p><b>allow</b> a named fossil fuel</p> <p><b>allow</b> a named fossil fuel</p>
7 d	<p><b>any two from</b></p> <p>crude oil / fossil fuels / petrol / diesel are non-renewable limited amounts available / finite / running out ORA (1)</p> <p>reduce / do not release carbon dioxide emissions ORA(1)</p> <p>reduces / do not release <math>\text{NO}_x</math> / <math>\text{SO}_2</math> emissions ORA(1)</p> <p>reduces / do not release hydrocarbon / unburnt fuel / particulates / carbon emissions ORA(1)</p> <p>hydrogen can be made from water (which is abundant) (1)</p>	2	<p>'it' = fuel cells</p> <p><b>not</b> reusable</p> <p><b>ignore</b> greenhouse gases / carbon neutral</p> <p><b>allow</b> does not cause acid rain</p>
	<b>Total</b>	<b>6</b>	

Question	Answer	Marks	Guidance
8 a	<p>points plotted correctly (1)</p> <p>suitable <b>curved</b> line of best fit (1)</p>	2	<p><b>allow</b> extrapolation      <b>not</b> double lines or sketchy lines</p>
8 b	<p>idea that after 1987 the ozone goes down because (chlorine) radicals / CFCs remain in atmosphere / take a long time to break down/ be removed (1)</p> <p>idea that after 2005 ozone starts to go up because amounts of (chlorine) radicals / CFCs in the atmosphere is decreasing / CFCs are breaking down (1)</p> <p>if the graph / trend / figures in table continues at the same rate then it will get back to 1985 level by 2025 (AW) (1)</p>	3	<p>eg curve of best fit shows that this true</p>
	<b>Total</b>	<b>5</b>	

Question	Answer	Marks	Guidance
<p><b>9</b> </p>	<p><b>Level 3</b> gives a full explanation of how detergent works <b>AND</b> gives a reason for using low temperatures</p> <p>Quality of communication does not impede communication of science at this level. (5-6 marks)</p> <p><b>Level 2</b> gives a partial explanation of how detergent works <b>and</b> gives a reason for using low temperatures <b>OR</b> gives a full explanation of how detergent works</p> <p>Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p><b>Level 1</b> gives a partial explanation of how detergent works <b>OR</b> suggests a reason for using a low temperature</p> <p>Quality of 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 grade</b></p> <p><b>Indicative scientific points could include:</b></p> <p><b>How the shirt is cleaned</b></p> <ul style="list-style-type: none"> <li>• detergent has a hydrophilic head and a hydrophobic tail</li> <li>• hydrophobic tail forms strong intermolecular forces with grease</li> <li>• hydrophilic head forms strong intermolecular forces with water</li> </ul> <p><b>Advantages of low temperature</b></p> <ul style="list-style-type: none"> <li>• the material the shirt is made of may be damaged by high temperatures</li> <li>• high temperatures may shrink shirt</li> <li>• washing at low temperatures reduces the amount of energy needed to heat the water</li> <li>• enzymes can be active</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris, do not use ticks</b></p>
	<b>Total</b>	<b>6</b>	

Question	Answer	Marks	Guidance																														
10 a i	less (resistance) [1]	1	<p><b>not</b> stays the same / higher  <b>allow</b> correct calculation                      e.g. 1.05 or 20/19 [1]</p> <p><b>ignore</b> incorrect calculation if answer of less (resistance) given</p>																														
ii	1.05 ( $\Omega$ ) <b>or</b> 1.1 ( $\Omega$ ) or 1 [2]  <b>but</b> 20/19 <b>or</b> 10/9.5 <b>or</b> 1/0.95 <b>or</b> 1.0 <b>or</b> 1.054 <b>or</b> 1.052 [1]	2	<p><b>allow</b> 1.053 / 1.0526 etc [2]</p>																														
b	<p><b>OR</b> table all 4 correct [1]</p> <p><b>AND</b> table all 3 correct [1]</p>	2	<table border="1" data-bbox="1323 659 1832 836"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr> <td>(0)</td> <td>(0)</td> <td>0</td> </tr> <tr> <td>(0)</td> <td>(1)</td> <td>1</td> </tr> <tr> <td>(1)</td> <td>(0)</td> <td>1</td> </tr> <tr> <td>(1)</td> <td>(1)</td> <td>1</td> </tr> </tbody> </table> <table border="1" data-bbox="1323 874 1832 1051"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr> <td>(0)</td> <td>(0)</td> <td>(0)</td> </tr> <tr> <td>(0)</td> <td>1</td> <td>(0)</td> </tr> <tr> <td>(1)</td> <td>(0)</td> <td>(0)</td> </tr> <tr> <td>1</td> <td>1</td> <td>(1)</td> </tr> </tbody> </table>	(Input A)	(Input B)	(Output P)	(0)	(0)	0	(0)	(1)	1	(1)	(0)	1	(1)	(1)	1	(Input A)	(Input B)	(Output P)	(0)	(0)	(0)	(0)	1	(0)	(1)	(0)	(0)	1	1	(1)
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c i	 <p>[1]</p>	1	<p><b>not</b></p> 																														

Question	Answer	Marks	Guidance																																																												
ii	<p>NAND table all correct [1]</p>	1	<p>any of the following are correct</p> <table border="1" data-bbox="1310 304 1818 483"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr><td>(0)</td><td>0</td><td>1</td></tr> <tr><td>(0)</td><td>1</td><td>1</td></tr> <tr><td>(1)</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td></tr> </tbody> </table> <table border="1" data-bbox="1310 507 1818 686"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr><td>(0)</td><td>1</td><td>1</td></tr> <tr><td>(0)</td><td>0</td><td>1</td></tr> <tr><td>(1)</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td></tr> </tbody> </table> <table border="1" data-bbox="1310 710 1818 888"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr><td>(0)</td><td>0</td><td>1</td></tr> <tr><td>(0)</td><td>1</td><td>1</td></tr> <tr><td>(1)</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> </tbody> </table> <table border="1" data-bbox="1310 912 1818 1091"> <thead> <tr> <th>(Input A)</th> <th>(Input B)</th> <th>(Output P)</th> </tr> </thead> <tbody> <tr><td>(0)</td><td>1</td><td>1</td></tr> <tr><td>(0)</td><td>0</td><td>1</td></tr> <tr><td>(1)</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td></tr> </tbody> </table>	(Input A)	(Input B)	(Output P)	(0)	0	1	(0)	1	1	(1)	0	1	1	1	0	(Input A)	(Input B)	(Output P)	(0)	1	1	(0)	0	1	(1)	0	1	1	1	0	(Input A)	(Input B)	(Output P)	(0)	0	1	(0)	1	1	(1)	1	0	1	0	1	(Input A)	(Input B)	(Output P)	(0)	1	1	(0)	0	1	(1)	1	0	1	0	1
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Question	Answer	Marks	Guidance
11 a	<p><b>for</b>  <b>any one from</b>  reduces labour costs /  reach inaccessible places /  less damage to crops /  better management of crops or animals /  quicker / save time /  creating jobs (by maintaining the robots) [1]</p> <p><b>against</b>  <b>any one from</b>  (spraying) less control over dispersal /  cannot make 'intelligent' decisions /  robots may damage / disturb wildlife /  noise /  risk of a person/animal getting sprayed /  idea of spying / lack of privacy for locals /  risk of flying into electrical wires /  loss of jobs (because the robots have taken over labour  or farming tasks) /  dangers of crashing [1]</p>	2	<p><b>ignore</b> gets a better crop yield</p> <p><b>allow</b> increases efficiency <b>ignore</b> less fertiliser used</p> <p><b>ignore</b> pollution unless qualified</p>
	<b>Total</b>	<b>2</b>	

Question	Answer	Marks	Guidance
12 a	<p>(range is) 2.8 (<math>\Omega</math>) <b>and</b> 'no' [4]</p> <p><b>but</b></p> <p>2.8 (<math>\Omega</math>) (on its own) / range (on its own) e.g. 2 to 4.8 / correct range but 'yes' / 2 (<math>\Omega</math>) <b>and</b> 4.8 (<math>\Omega</math>) plus no [3]</p> <p><b>but</b></p> <p>2 (<math>\Omega</math>) <b>and</b> 4.8 (<math>\Omega</math>) [2]</p> <p><b>but</b></p> <p>either (at 4V) 2 (<math>\Omega</math>) <b>or</b> (at 12V) 4.8 (<math>\Omega</math>) [1]</p>	4	<b>allow</b> range e.g. 2 to 4.8 <b>and</b> 'no' [4]

Question	Answer	Marks	Guidance
b	<p><b>[Level 3]</b>  <b>answer describe the graph in terms of resistance and give a full kinetic explanation related to increasing resistance.</b>            Quality of written communication does not impede communication of the science at this level.            (5–6 marks)</p> <p><b>[Level 2]</b>  <b>answer gives a kinetic explanation related to resistance.</b>            Quality of written communication partly impedes communication of the science at this level.            (3–4 marks)</p> <p><b>[Level 1]</b>  <b>answer explains the shape of the graph referring to change in resistance</b>  <b>or</b>  <b>makes a comment about the implications of increased collisions</b>            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 scientific points may include at level 3:</b></p> <ul style="list-style-type: none"> <li>• gradient decreases so resistance increases</li> <li>• resistance increases with increasing voltage / current</li> </ul> <p><b>linked to</b></p> <ul style="list-style-type: none"> <li>• <b>more</b> electrons collide with atoms (ions)</li> <li>• leading to greater vibration of atoms (ions)</li> <li>• so electrons find it more difficult to move between atoms</li> </ul> <p><b>Indicative scientific points may include at level 1 or 2:</b></p> <ul style="list-style-type: none"> <li>• resistance increases with voltage / current</li> </ul> <p><b>linked to</b></p> <ul style="list-style-type: none"> <li>• greater vibrations of atoms / ions <b>or</b> more collisions of electron with atoms</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p>
<b>Total</b>		<b>10</b>	



Question	Answer	Marks	Guidance
13 a	<p><b>any two from</b></p> <p>coil cuts magnetic field / coil moves within magnetic field [1]</p> <p>voltage is induced / a current flows [1]</p> <p>current alternates (every half turn) [1]</p> <p><b>and then</b></p> <p><b>slip rings:</b> complete circuit / allow current to flow / prevent wires tangling [1]</p>	3	<p><b>not</b> coil is made to move by the magnetic field</p> <p>induces an alternating current = 2</p>
b	<p>greater current / greater voltage / greater pd [1]</p> <p>voltage or current direction changes more frequently / AW [1]</p> <p>magnetic field lines cuts more frequently / AW [1]</p>	3	<p><b>allow</b> magnetic flux changes <b>allow</b> it increases</p> <p><b>allow</b> more electrons flow</p> <p><b>ignore</b> speed of electrons</p> <p><b>ignore</b> increases the strength of the magnetic field</p>
<b>Total</b>		<b>6</b>	

Question	Answer	Marks	Guidance
14 a	Denmark Germany UK and Netherlands (all have register system 1) (1)  idea that lower percentages of the population are on the donor list / indicate system 1. (1)	2	<b>ignore</b> Sweden
b i	40 (2)  but $\frac{500}{1249} \times 100$ (1)	2	<b>allow</b> 40.032026 and any correct rounding of this number (1)
b ii	<b>any three from:</b>  <b>yes</b> for 'not all organ transplants are on the increase' but <b>no</b> for 'the organ transplant that has increased in actual numbers the most is the lung' (1)  pancreas transplants are on the decrease / not increasing (1)  lungs have the highest <b>percentage</b> increase / do not have the highest actual number increase (1)  cornea / liver / kidney has a higher increase in actual number (1)	3	<b>allow</b> cornea transplants show rise of 1133 / liver 151 / kidney 500 <b>and</b> lung transplants a rise of 72(1)
c i	idea that one donor will donate many organs <b>OR</b> more than one transplant per donor takes place (1)	1	<b>allow</b> reference to artificial / animal part transplants

Question	Answer	Marks	Guidance
c ii	<p><b>any two from:</b></p> <p>it / opt out system / system 2 means there will be more donors (1)</p> <p>there are not enough donors / transplants / need more donors / the number of donors is not increasing / there are more people waiting than transplants / donors(1)</p> <p>the number of people needing transplants is still rising (1)</p> <p>any correct use of actual data from either graph (1)</p>	2	<p>gap between people waiting and transplants / donors is increasing = 2</p> <p><b>e.g.</b> compares the number of donors in the UK to those in France  <b>e.g.</b> identifies the fact that there were 7500 people waiting for transplants in 2008 but only 2500 transplants took place.  <b>eg</b> opt out countries have nearly 100% of people on donor list</p>
	<b>Total</b>	<b>10</b>	

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