OCR
Oxford Cambridge and RSA

GCSE

Further Additional Science B

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

General Certificate of Secondary Education

Mark Scheme for June 2017

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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.

Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
R	reject
CON	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

<table>
<tr><th colspan="2">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td>number of new varieties approved for testing:

increased up until 2002 (1)
decreased after 2002 (1)</td><td>2</td><td>

allow it increase up to 1995 (1)

1 mark for description with no data</td></tr>
<tr><td></td><td>b</td><td>Clare (1)

because the graph is (only) about testing (1)</td><td>2</td><td>If name other than Clare then zero for question</td></tr>
<tr><td></td><td>c i</td><td>resistance to pests and infections (1)</td><td>1</td><td>allow other unambiguous indication, e.g. underlining
more than one answer = 0 marks</td></tr>
<tr><td></td><td>ii</td><td>(totals add up to) 27(%) /

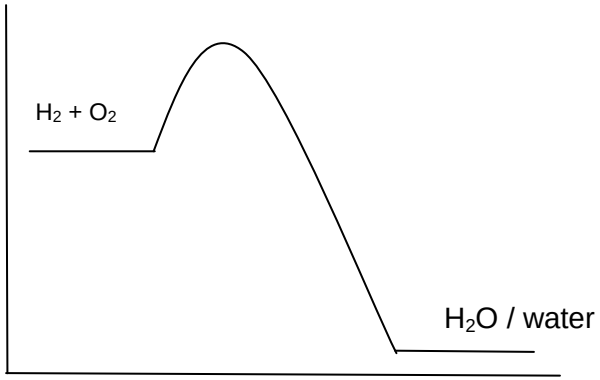
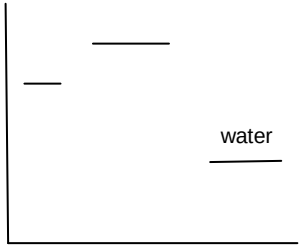
(17 +1 + 4 + 5 =) 27(%) (1)</td><td>1</td><td>allow reference to all the resistance figures adding up to more than the herbicide tolerance / 24%
allow idea that the total of theresistance figures is the largest percentage</td></tr>
<tr><td></td><td>d</td><td><table><tr><td>3</td><td>cut open the DNA of a new plant</td></tr><tr><td>(1)</td><td>identify the desired gene in a plant</td></tr><tr><td>4</td><td>insert the desired gene into the DNA</td></tr><tr><td>2</td><td>remove the desired gene from the DNA</td></tr><tr><td>(5)</td><td>the desired gene works in the new plant</td></tr></table>
all correct (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
2 a	(springtail population) will increase (1) **plus any one from** more fungi to eat / beetles are not eating the fungi (1) no / less predation / AW (1)	2	If answer is decrease then zero for question **ignore** less food for them **allow** increase because beetles feed on the springtails (2)
b	**any two from** many different ways of feeding (1) idea that they can consume many different foods / have different energy sources (1) they can make their own food / can photosynthesise (1) they can tolerate wide temperature variations / are extremophiles / tolerates extreme conditions (1)	2	 **ignore** nutrients **ignore** nutrients **ignore** can live in a wide range of conditions **allow** they can evolve / adapt quickly (1) **ignore** they can reproduce quickly
c i	he was (now) a famous author / idea that he was (now) a respected scientist / people had enjoyed his previous book(s) / idea that it was a more useful book for many people (had a practical use) / it is a less complex topic / idea that it is a less controversial topic (1)	1	 **ignore** it was more interesting **ignore** more people could read

ii	**[Level 3]** Description **AND** explanation of at least two activities. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Description **AND** explanation one activity. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Description of at least one activity. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **description of what earthworms do** • bury dead material • break material into smaller pieces • aerate / drain soil • mix up soil layers • neutralise acid soil **explanation of why their actions are so important** • burying dead material means it can add minerals / nutrients as it decays • breaking down the material into small pieces allows it to decay faster • aerating / draining soil means that oxygen can get to soil organisms and plant roots for respiration • mixing up soil layers spreads minerals / nutrients / means the depth of fertile soil increases • neutralising acid soil means more plants can grow **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**11**	

Question	Answer	Marks	Guidance
3	(biological) washing powder contains protease/enzyme (1) protease/enzyme digests egg white / protein (1) protease/enzyme works best in water / in B (1) the protease/enzyme is denatured by acid/alkali / C / D (1) **but** the protease/enzyme is denatured more by the acid than the alkali / more in C than in D (2)	4	 **allows** breaks down / breaks up (1) **allow**low / high pH but if linked to a tube this must be correct **allow**more by low pH than high pH
	Total	**4**	

Question	Answer	Marks	Guidance
4 a	virus injects / inserts its DNA / genetic material (1) idea that the virus uses the bacterial cell to make new viruses (1)	2	**ignore** virus enters the cell **ignore** just reproduces inside the cell
b	idea of preventing the development of bacterial resistance (1)	1	**allow** idea thatparticular bacteria may already be resistant **allow** idea that patient may be recovering on their own **allow** patient may be allergic to antibiotic treatment **allow** antibiotics / they can increase the number of resistant bacteria **ignore** immune
	Total	**3**	

Question	Answer	Marks	Guidance
5 a	$2H_2 + O_2 \rightarrow 2H_2O$ correct formulae (1) balancing - conditional on correct formulae (1)	2	**allow** any correct multiple including fractions e.g. $4H_2 + 2O_2 \rightarrow 4H_2O$ (2) **allow** = or ⇌ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. 2h2 + $O^2 \rightarrow 2H_2o$ (1)
b	 graph rises initially (to show activation energy) (1) graph levels off at a lower energy than $H_2 + O_2$ and this energy level is labelled with water (1)	2	**Allow** (2) 

c	**any two from:** (fuel cell) may contain **poisonous**catalysts that have to be disposed of (1) fossil fuels may have been used to make hydrogen and/or oxygen / carbon dioxide may have been released to make hydrogen and/or oxygen(1) fossil fuels may have been used / carbon dioxide may have been released to make the fuel cells (1)	2	**not** just disposing of them releases harmful gases **allow** a named fossil fuel **allow** a named fossil fuel
	Total	**6**	

Question	Answer	Marks	Guidance
6 a	**C** (1) removes stain and does not damage clothes (1)	2	incorrect letter then zero for question
b	**A** and **E** (1) they / enzymes remove food/ egg /blood stains (1)	2	**both** required explanation mark is **dependent** on correct identification of detergents **allow** breaks down / digests **ignore** dissolves **allow** reference to protease / enzymes digesting proteins in egg / blood **allow**reference to lipase and oils if referring to E
c	uses a solvent (1) does not involve water (1) idea that removes stains that are insoluble in water (1)	2	
	Total	**6**	

Question	Answer	Marks	Guidance
7 a	idea that solid has ions which cannot move (1) idea that ions in liquid can move (1)	2	**not** electrons cannot move in a solid **not** electrons can move in a liquid
b	$2H^+ + 2e^- \rightarrow H_2$ correct symbols (1) balancing – dependent on correct formulae and electrons (1)	2	**allow** any correct multiple including fractions e.g. $4H^+ + 4e^- \rightarrow 2H_2$ (2) **allow** = or ⇌ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. 2H+ + $2e^- \rightarrow h_2$ (1) **allow** $2H^+ \rightarrow H_2 - 2e^-$(2)
c	idea that $H^+$is preferentially discharged / H^+ discharged before Na^+(1)	1	**'it' = hydrogen** **allow** H^+ is less reactive / Na^+ is more reactive (1) **allow** needs less energy to discharge the hydrogen (1)
	Total	**5**	

Question	Answer	Marks	Guidance
8 a	saponification (1)	1	**allow** hydrolysis / **ignore**soaponification (1)
b	fat + sodium hydroxide →**soap** + **glycerol** (1)	1	**both** required **allow** propane-1,2,3-triol for glycerol
	Total	**2**	

Question	Answer	Marks	Guidance
9	**Level 3** Applies knowledge to identify, with explanations, the type of hardness in all of the samples **AND** writes a correct equation for the thermal decomposition of calcium hydrogencarbonate. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** Applies knowledge to identify, with explanations, the type of hardness in at all of the samples **OR** Applies knowledge to identify, with an explanation, the type of hardness in two of the samples **and** writes an equation for the thermal decomposition of calcium**hydrogencarbonate.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** Applies knowledge to identify, with an explanation, the type of hardness in one of the samples **OR** writes an equation for the thermal decomposition of calcium hydrogencarbonate. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science (0marks)	6	**This question is targeted at grades up to A/A*.** **Indicative scientific points may include:** **Types of hardness and explanations** • sample **A** contains temporary hardness • as it is completely softened (by boiling) / volume of soap (after boiling) is the same as distilled water / $3cm^3$ • sample **B** contains both temporary and permanent hardness • as it is partly softened (by boiling) / volume of soap decreases (after boiling) but is still more than distilled water • sample **C** contains only permanent hardness • as it is not softened (by boiling) / volume of soap does not change (after boiling) • sample **D** contains temporary hardness • as it is completely softened (by boiling)/ volume of soap (after boiling) is the same as distilled water / $3cm^3$ **Equation** $Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2$ **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
		6	

Question	Answer	Marks	Guidance
10 a i	A (1)	1	
ii	A (1)	1	
b	57.1 (Ω) (2) **If answer is incorrect or incomplete then:** **Either** 7/400 scores / 0.0175 (1) **Or** 400/7 (1)	2	**Allow** any correct rounded number from 57.14285714
	Total	**4**	

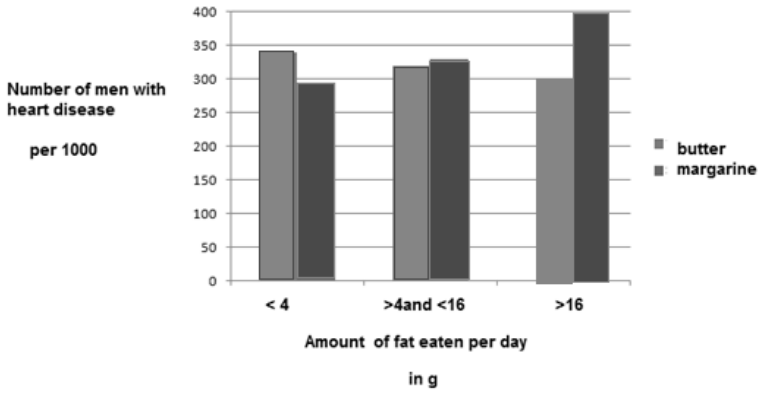
Question	Answer	Marks	Guidance
11	Attempts 2 and 5 (1) Attempt 2: doubling the turns = double voltage / 20V **and**speed doubles = double voltage / 20V so both together = 4x voltage / gives 40V (1) Attempt 5: speed quadruples = 4x voltage / 40V (1)	3	both required for the mark
	Total	**3**	

Question	Answer	Marks	Guidance
12 a	when the temperature is low, resistance of thermistor is high ORA (1) high resistance leads to a high voltage (across T) ORA (1) high voltage / low temperature / high resistancegenerates a '1'(1) low voltage / high temperature / low resistance / generates '0' (1)	4	**allow** switches gate on **ignore** sends a signal to the gate **allow** gate is not switched on / gate is switched off **ignore** references to current
b	Column D: 0,0,0,0,0,0,1,1 (1) Column E: 0,1,0,1,0,1,0,1 (1) Column F: 0,0,0,0,0,0,0,1 (1)	3	
	Total	**7**	

Question	Answer	Marks	Guidance
13 a	**Level 3: 5-6 marks** Two correct calculations AND anexplanation of the power loss in the cables Quality of written communication does not impede communication of science at this level. **Level 2: 3-4 marks** Two correct calculations **OR** An explanation of the power loss in the cables Quality of written communication partly impedes communication of science at this level. **Level 1: 1-2 marks** One correct power loss calculation **Or** Qualitative comment on the power loss in the cables. Quality of written communication impedes the communication of science at this level **Level 0: 0 marks** Insufficient or irrelevant science. Not worthy of credit.	6	This question is targeted up to A* Indicative scientific points may include (but are not limited to) the following: **Level 3** 480 watts and 4.8 watts Decreasing current by a factor of 10 decreases power loss by a factor of 100 / high voltage means lower current so less energy is lost (as heat) **Level 2** 480 watts and 4.8 watts **or** Decreasing current by a factor of 10 decreases power loss by a factor of 100 / high voltage means lower current so less energy is lost (as heat) **Level 1** 480 watts **or** 4.8 watts **or** higher currents/lower voltages means more energy lost (as heat) lower currents/higher voltages means less energy lost (as heat)
b	**Any two from:** idea that resistance is caused by collision of electrons	2	

	with atoms / ions (1) increase in temperature means increase in KE of atoms / ions / increase in temperature means atoms/ ions vibrate faster / more (1) causing an increase in collisions (1)		
	Total	**8**	

Question	Answer	Marks	Guidance
14 a	voltage AND current decrease (1) **but** voltage and current decrease quickly(immediately after connecting the conductor across them) (2)	2	**allow** they decrease (1) **allow** rate of decrease slows (2)
b	**any one from:** smoothing of electrical supply (1) store of **charge** (1) (short term back-up) power supply (1)	1	 **allow** smoothing of current / voltage **ignore** store of voltage / current / electricity **allow** store of electrons **ignore** acts as a battery
	Total	**3**	

Question	Answer	Marks	Guidance
15 a i	bars plotted correctly for both butter and margarine with some indication as to which bar is which (1)	1	 **line graph= 0**
a ii	29.5 (%) (2) **but if incorrect or incomplete then** 295 x 100 1000 (1)	2	**allow**30 (%) (2) **allow**29 (%) (1)
a iii	**any two from:** (No) only very small differences between butter and margarine for **> 4 and <16**(1) >4 and <16 / >4 / >16 shows butter is healthier but <4 it is margarine so contradicts(1) data only refers to heart disease not other medical conditions (1) only data for men / no mention of women (1)	2	

			allow one mark for a yes answer Yes - because it shows that eating butter is more healthy because eating >4 and <16 / >4 / >16 of fat eating butter results in less men with heart disease **allow** reference to total number with butter being lower or Yes because it shows the idea that when eating **less** than 4g of fat eating margarine results in less men with heart disease /ora (1) **ignore** references to other lifestyle factors / dietary factors
a iv	**any three from:** 832 is a small sample size(1) only small age range(1) does not take into account other lifestyle factors / other dietary factors (1) maybe genetic reasons for heart disease(1)	3	**ignore** tested 832 men not 1000 men **allowonly** tested 832 men **allow** they might not be 45 -64 **allow** examples such as smoking or salt intake **allow** different ethnic groups
b	**any two from:** deaths increasing as levels of margarine increase (1) deaths decreasing as levels of margarine decrease (1) both were highest / at around the same time (1) when margarine levels low then deaths are low (1)	**2**	**If no other marks allow** both graphs are the same shape (1)
	Total	**10**	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553