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 2016

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

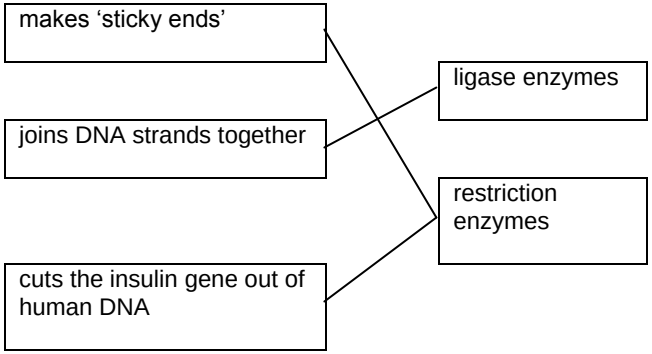
Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	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 i	flagella (1)	1	**ignore** tail
ii		2	3 correct = 2 marks, 2 correct = 1 mark, 1 correct = 0
b i	2 000 000 (2) but $\frac{10\,000}{0.0025}$ = 4 000 000 = (1) or $\frac{10}{0.0025}$ = 4 000 = (1) or $\frac{5\,000}{0.0025}$ but incorrect answer = (1)	2	

Question	Answer	Marks	Guidance
ii	genetic engineering can produce (much) more insulin ORA / treat (many) more people (1) one pig could only supply enough to treat 20 people (per day) (1) would need 200 000 pigs to make the same amount (as made by one batch) / 10kg (2) 100 000 pigs **per day** to make the same amount / 100 000 pigs to treat the 2000000 people / the same amount of people (2)	2	
iii	do not have to separate insulin from the cells / do not need to break open the cells to get the insulin (1)	1	**allow** no further extraction needed / easier to extract / easier to extract from the solution (than from the cells)(1) **ignore** insulin does not need to be extracted from fermenter / solution
		8	

Question	Answer	Marks	Guidance
2 a	idea that Calumet has a low(est) volume of water flowing down ORA (1) calculation to show that Fox river is the higher polluter / 4472 v 706.8 micrograms (2)	3	 **allow** identifies Fox river as causing higher / the most pollution (1)
b i	fertiliser / sewage (1)	1	**allow** nitrates / phosphates / detergent / ammonium compounds **ignore** ammonia / ammonium (1)
ii	high percentage of methane allows it to be burnt in a controlled way / as fuel (1) a low percentage of methane may be explosive (1)	2	**allow** any percentage equal to or above 50% **ignore** high percentage will burn easily **allow** any percentage equal to or less than 20%
iii	PCBs break down very slowly (1) PCBs will gradually build up in larger animals (1)	2	**allow** persistent (1) **ignore** reference to solubility or rate of PCBs leaving water or remains a long time **allow** bioaccumulation (1)
		8	

Question	Answer	Marks	Guidance
3	**[Level 3]** Answer fully explains the two changes in death rates between the death rates in the two hospitals in terms of the transmission of bacteria. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer links the two changes in death rates in the hospital to changes in the practices. No bacteria explanation is given. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Links one change in death rate to a change in practice. **OR** Simply describes the patterns shown in the graph 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 up to grade C** **Indicative scientific points linking change in practice to death rates at level 2 and 3:** • death rate increases because doctors transfer bacteria from dead bodies to women • death rate drops because washing hands kills / removes the bacteria / prevents bacterial transfer **Indicative scientific points about change in practices at level 1 and 2:** • increase in death rate coincides with doctors training starting • decrease in death rate linked to doctors washing their hands. **Indicative scientific points about comparisons at level 1:** • similar death rates in both hospitals up to 1823 • from 1823 to 1847 death rates are higher in Semmelweis' hospital • after 1847 death rates are similar again.

Question	Answer	Marks	Guidance
b i	idea that he did his work before Pasteur (1) idea that Pasteur developed the germ theory (of disease)(1)	2	**allow** lived before Pasteur (1) **allow** did his work before the germ theory was discovered (1) **allow** idea that Pasteur found out what causes diseases (1) **ignore** just reference to Pasteur showing that there are microbes in the air **ignore** references to other scientists
ii	always complete the dose of any antibiotic that is prescribed (1)	1	
	Total	**9**	

Question	Answer	Marks	Guidance
4 a	**any two from** **sugar** (for fermentation) is grown/comes from plants(1) the plants can grow again / sugar can be made again (1) in a reasonable length of time / quickly (1)	2	 **allow** example of a plant / plant product eg grapes **allow** grow more plants **ignore** just 'plants grow' **allow** idea of carbon dioxide being recycled
b	(if the temperature is too high) the enzymes in yeast are denatured(1) (absence of air) prevents formation of ethanoic acid / prevents oxidation/ prevents aerobic respiration (1)	2	**allow** enzymes change shape / distort / destroyed **not** enzymes killed **allow** yeast dies **not** yeast denatured **allow** needs to be anaerobic **allow** prevents entry of oxygen
	Total	**4**	

Question	Answer	Marks	Guidance
5 a	alkanes / HFC / hydrofluorocarbon (1)	1	**allow** any suitable named alkane or HFC eg butane / compressed air
b	**any two from** there are many old fridges / old aerosol that still contain CFCs (1) they release CFCs when old fridges **are** scrapped (1) chlorine radicals regenerate / idea that a chain reaction takes place (1) CFCs do not break down (1) CFCs are still used in some countries (1)	2	 **ignore** CFCs were released in the past **ignore** just 'remain for a long time' **allow** CFCs are unreactive
	Total	**3**	

Question	Answer	Marks	Guidance
6 a	Birmingham(1)	1	
b	(no) **any three from** limescale / temporary hardness depends on the difference between results before and after (1) Birmingham has the least difference (between results before and after) / **only** deceases by 3 (1) Birmingham has the least amount of temporary hardness / limescale (1) Bristol forms the most limescale or temporary hardness / Bristol forms 56 / Bristol has the largest difference (1)	3	**ignore** units throughout **ignore** Birmingham does not have the most temporary hardness / limescale
	Total	**4**	

Question	Answer	Marks	Guidance
7 a	C (1) it is the most effective at low temperatures/ good at removing (food) stains (1)	2	**any other letter then zero for question** **ignore** references to other properties **ignore** enzymes only work low temperatures
b	**any two from:** idea that garments are not very soft (1) idea that it is not the most economical (1) there is insufficient difference between results (1) results are subjective/matter of opinion(1) results are not checked / no repeats (1) used on different clothes(1) used on different stains/dirt (1) size of sample not given/comment about sample size too small (1) may produce allergies (1)	2	**allow** not the cheaper **ignore** the most expensive
	Total	**4**	

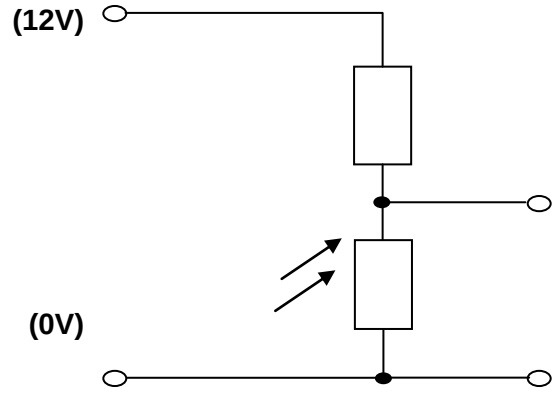
Question	Answer	Marks	Guidance
8 a	$4\ OH^- - 4e^- \rightarrow O_2 + 2H_2O$ or $4\ OH^{-}\ ^{-} \rightarrow O_2 + 2H_2O + 4e^-$ (2) correct formulae including electron (1) balancing (conditional on correct formulae) (1)	2	**allow** e instead of e^- **allow** any correct multiple, including fractions **allow =** instead of → **not** and or & instead of + balancing mark is dependent on the correct formulae but **allow** 1 mark for a balanced equation with a minor error in subscripts or case
b	7200 (cm^3) (2)	2	**allow** 60 x 2 **or** 120 x 60 **or** 60 x 60 (1)
	Total	**4**	

Question	Answer	Marks	Guidance
9	**[Level 3]** Candidates give a detailed explanation of how both galvanising and tin plating works. They choose a more effective process (can be either) and give a reason for their choice. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Candidates give a simple explanation of how both galvanising and tin plating work **OR** gives a simple explanation of how one works and chooses a more effective process (can be either) with a reason. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Candidates give a simple explanation of how galvanising **or** tin plating works **or** gives a reason why the method should be used. Quality of communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. (0 marks)		**This question is targeted at grades A* - C** **Indicative marking points include;** **Detailed explanation of how galvanising works at level 3:** • zinc is more reactive than iron • zinc acts as sacrificial metal • zinc will lose electrons in preference to iron. **Simple explanation of how galvanising works at level 1/2:** • iron covered with zinc • zinc excludes air/water from surface of iron **Detailed explanation of how tin plating works at level 3:** • prevents oxygen reacting with iron / stops oxidation • tin does not react with oxygen / does not oxidise **Simple explanation of how tin plating works at level 1/2:** • tin acts as a barrier / tin does not react • tin excludes air/water from surface of iron **Reasons for choice:** • tin is less likely to react with food/acids • zinc is reactive so is more likely to react with food / acids / zinc (ions) will get into the food. • when tin is scratched, air/water can reach the surface of the iron • when scratched iron will lose electrons in preference to tin • when scratched, iron rusts faster with tin than on its own
	Total	**6**	

Question	Answer	Marks	Guidance
10 a	**any two from:** resistance increases (1) current decreases (1) so brightness decreases (1)	2	 **ignore** reference to voltage **ignore** current is lost
b	**any three from** more voltage causes the **electrons** to move faster / increased current so greater flow of electrons (1) higher the voltage or the higher the current then **more** collisions between **electrons** and atoms / ions (1) so atoms / ions vibrate **more** (therefore the resistance increases) (1) electrons / atoms / ions have **more** kinetic energy (1)	3	 **allow** increased current so more electrons **allow** higher the voltage or the higher the current then more electrons hitting atoms **ignore** reference to electrons hitting each other **allow** particles have more kinetic energy
c i	(yes) **any one from** resistance is constant / AW (1) current proportional to voltage /ora (1)	1	**if answer is no = 0 marks** **allow** graph is a straight line **allow** gradient is constant / AW (1)

Question	Answer	Marks	Guidance
ii	**X** = 5 (Ω) **and Y** = 10 (Ω) (2) **but** **X** has a lower resistance (than **Y),** ORA (1) **X** has half the resistance of **Y** ORA (2)	2	
	Total	**8**	

Question	Answer	Marks	Guidance
11 a	**any two from:** (idea of) changes direction of current (1) every half turn (1) (idea of) maintains correct direction of force (1)	2	must be correctly linked to first marking point
b	**Level 3: (5 – 6 marks)** Answer recognises the effect of doubling the turns **and** that the effect of halving the current compensates for this. Quality of written communication does not impede communication of the science at this level. **Level 2: (3 – 4 marks)** Answer recognises the effect of more turns **and** the effect of reducing or increasing the current. Quality of written communication partly impedes communication of the science at this level. **Level 1: (1 – 2 marks)** Answer recognises the effect of more turns **or** changing the current. Quality of written communication impedes communication of the science at this level. **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted up to grade C** **Indicative scientific points may include:** **Level 3:** • doubling the number of turns doubles the speed • to keep the speed the same he must have halved the current • changes cancel each other out. **Level 2 or Level 1:** **Effect of changing the number of turns** • more turns = more speed **Effect of changing the current** • Matt must have reduced the current • reducing current = less speed • increasing current = more speed. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**8**	

Question	Answer	Marks	Guidance
12 a	range is 3V (3) **but if answer incorrect** 6V output (for 500Ω) (1) 9V output (for 1500Ω) (1)	3	**allow** range is 6V to 9V (3) **allow** ecf for calculation of range from candidates values of voltage for 500Ω and 1500Ω e.g. 6V and 8V gives a range of 2V (2) eg. 10V and 20V gives a range of 10V (1)
b	change a resistor with an LDR (1)	3	**allow** diagram showing a resistor replaced by an LDR (1) **ignore** just stating a LDR is put in **allow** LDR as the top resistor or the bottom variable resistor e.g.  (1) If correct symbol is **not** used then it must be labelled to get this 1st marking point.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>higher the light intensity the lower the resistance / lower the light intensity the higher the resistance (1)

so the output voltage will change with brightness (1)</td><td></td><td>allow night for low light intensity and day for high light intensity

allow either direction as the idea of change(1)</td></tr>
<tr><td>c</td><td><table><tr><th>(U)</th><th>(V)</th><th>(W)</th><th>(X)</th></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>
columns U and column V correct (1)

column W correct (1)

column X correct (1)</td><td>3</td><td></td></tr>
<tr><td></td><td>Total</td><td>9</td><td></td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>13 a i</td><td>two calculations of total energy divided by population ie 7.54 v 3.45 (2)

but one correct calculation (1)</td><td>2</td><td>allow 7.5374 etc and 3.4490 etc but rounding must be correct</td></tr>
<tr><td>ii</td><td>any three from:

<table>
<tr><td>NA or SA</td><td>uses more bioethanol than biodiesel ORA (1)</td></tr>
<tr><td>NA</td><td>Uses less biodiesel than SA (1)</td></tr>
<tr><td>NA</td><td>Uses more bioethanol than SA (1)</td></tr>
<tr><td>NA</td><td>Total biofuel use higher ORA (1)</td></tr>
<tr><td></td><td>28.2 in NA v 15.9 in SA (1)</td></tr>
<tr><td>NA</td><td>uses a higher proportion of bioethanol to biodiesel ORA (1)</td></tr>
<tr><td>NA</td><td>biofuels provide a lower % of their energy than in S.A. ORA(1)</td></tr>
<tr><td></td><td>calculation of percentage of fuel that is biofuel for each area (1)</td></tr>
</table></td><td>3</td><td>NA uses 12.3 more than SA (2)

NA 1.27% v SA 2.79%</td></tr>
<tr><td>b</td><td>300 years (1)</td><td>1</td><td></td></tr>
<tr><td>c i</td><td>growing sugar beet is better (no mark)

growing sugar beet = 40 unit saving (1)

grassland takes up 30 units (1)</td><td>2</td><td>If answer states that grassland is better then zero marks

sugar beet saves 10 units more than grassland takes in (2)
allow answers that refer to greater than 10 saving due to the need to burn fossil fuels rather than biofuels.</td></tr>
<tr><td>ii</td><td>forests take up larger amounts of carbon dioxide than biofuels save (1)

calculation to back up argument ie tropical forests take up 180 / non-topical take up 90 (1)</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>10</td><td></td></tr>
</table>

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

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553