OCR
RECOGNISING ACHIEVEMENT

GCSE

Science B

General Certificate of Secondary Education

Unit **B711/02:** Modules B1, C1, P1 (Higher Tier)

Mark Scheme for June 2013

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

For answers marked by levels of response:

a. **Read through the whole answer from start to finish**
b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
c. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

d. Use the **L1**, **L2**, **L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

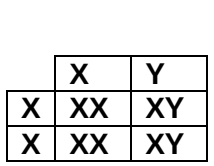
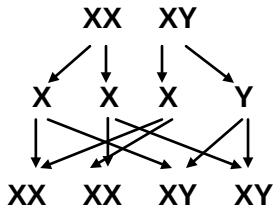
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Annotations

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
L1	Level 1
L2	Level 2
L3	Level 3

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

Question			Answer	Marks	Guidance
1	(a)	(i)	35 (pairs) (1)	1	
		(ii)	XY (1)	1	either order **allow** X and Y or Y and X (1)
	(b)		XX **and** XY seen as the **parent** genotypes (1) XX **and** XX **and** XY **and** XY seen as **offspring** genotypes (1)	2	**allow** genetic diagrams e.g.  (2)  (2) **ignore** incorrect labelling of parents e.g. XX male
	(c)		**any two from:** has monocular vision / does not have binocular vision (1) (brain) cannot compare **images** (from both eyes) (1) images from both eyes need to be similar / cannot judge distance when object is seen with only one eye / cannot judge distance when object is on one side of his head (1)	2	 **allow** eyes are not forward facing / eyes are on the sides of his head / cannot see straight ahead / cannot see what is in front of them (1) **allow** the two images do not meet / the two images do not overlap / images do not meet up / (idea that) brain cannot compare the two pictures (1)
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		<u>blood</u> sugar (levels) (1)	1	**allow** <u>blood</u> glucose (levels) / amount of sugar in the <u>blood</u> / amount of glucose in the <u>blood</u> (1) **ignore** just amount of sugar (levels) **ignore** just amount of glucose (levels)

Question	Answer	Marks	Guidance
(b)	**[Level 3]** **Linked explanation of the usefulness of the food pyramid** **AND** **Linked information about Type 1 diabetes** Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **[Level 2]** **Explanation of the usefulness of the food pyramid** **AND** **Information about Type 1 diabetes** Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **[Level 1]** **Explanation of the usefulness of the food pyramid** **OR** **Information about Type 1 diabetes** 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:** **At level 3** **Linked explanation of the usefulness of the food pyramid may include:** • should eat mainly from the bottom of the pyramid **to** prevent overeating of sugar • should eat less from top of pyramid **to** avoid over eating sugar • should eat some from the top **to** make sure they have sugar in diet • diabetics can use the food pyramid **to** balance or reduce the amount of sugar eaten **Information about Type 1 diabetes may include:** • Type 1 diabetes can be managed by diet **but** also needs injections of insulin • eating more sugary food **means** they will need to inject more insulin **At level 1 and 2** **Explanation of the usefulness of the food pyramid may include:** • shows how much of each food is best • diabetics should eat more from bottom / named food(s) • diabetics should eat less from top / named food(s) **allow** sugary foods / glucose as alternatives for sweets **Information about Type 1 diabetes may include:**

					• **blood** sugar level not controlled or too high • none or little insulin produced by body • insulin controls **blood** sugar levels / stops hypo(glycaemic) or hyper(glycaemic) effects • Type 1 diabetes needs injections of insulin **Use the L1, L2, L3 annotations in scoris, do not use ticks.**
	(c)		**any two from:** (contains) receptors (1) to detect light / to see light (1) to detect colours / to see colours (1) changes light (energy) into electrical (energy) / AW (1)	2	**allow** (contains) rods / (contains) cones (1) **allow** light sensitive / photosensitive / absorb light (1) **allow** photoreceptors (2) **allow** colour receptors (2) **allow** light sensitive cells (2) **ignore** reflects light / refracts light **ignore** allows light into the eye / focuses light **ignore** controls light / controls colour (that enters the eye)
			Total	**9**	

Question			Answer	Marks	Guidance
3	(a)	(i)	**any two from:** stop smoking / reduce smoking / avoid passive smoke / avoid cigarette fumes (1) eat foods rich in antioxidants (1) avoid (exposure to) harmful gases (not associated with smoking) / dust / chemicals (1)	2	 **allow** use filters on cigarettes / avoid smoke filled areas (1) **allow** eat (plenty of) fruit and vegetables / take beta carotene supplement (if you are a heavy smoker) (1) **allow** avoid areas with high background radiation or radon / avoid area near named harmful substances e.g. asbestos (1) **allow** wear face masks in polluted areas (1)
		(ii)	male cases: deaths ratio **any one from:** 558 : 138 (1) 93 : 23 (1) 4 : 1 (1) female cases: deaths ratio **any one from:** 1596 : 216 (1) 133 : 18 (1) 7 : 1 (1)	2	 **allow** 4.04 : 1 (1) **allow** one mark for any correct ratio **allow** 7.39 : 1 (1) **allow** 7.4 : 1 (1) **allow** 7.3 : 1 (1) **allow** one mark for any correct ratio **allow** 1 in 4 and 1 in 7 (1) **allow** one mark if both ratios calculated correctly

Question			Answer	Marks	Guidance
					but written the wrong way round e.g. 1 : 4 **and** 1 : 7 (1)
		(iii)	males (no mark) because the ratio (of cases : deaths) is small(er) (1)	1	**allow** ecf from 3(a)(ii) **allow** males (no mark) because for the same number of cases there are more deaths (1) **allow** males (no mark) because a higher percentage of cases die (1)
	(b)		**any two from:** his results needed a new way of thinking to explain them (1) his work was used by others to develop new lines of approach for research (into cancer treatment) (1) his research was recognised as being a ground breaking discovery (in an area covered by a Nobel Prize award) (1)	2	**DO NOT AWARD MARKS FOR REPEATING INFORMATION FROM ARTICLE** **allow** he did not give up when the results were not as expected **but** tried to explain them (1) **ignore** just his work saved many lives
			Total	**7**	

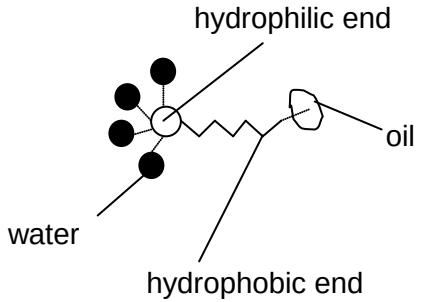
Question			Answer	Marks	Guidance
4	(a)		2 hours / 120 minutes (1)	1	**allow** + / - 5 minutes
	(b)		oxyhaemoglobin forms (1) **but** oxyhaemoglobin forms more readily than carbon monoxide combines with haemoglobin (2) **or** carbon monoxide combines with haemoglobin during poisoning (1) (idea that high concentration of) oxygen will replace this carbon monoxide (and so oxygenate the blood again) (1)	2	**allow** high oxygen concentration will cause the carbon monoxide to dissociate from haemoglobin (1) **allow** carbon monoxide reacts with haemoglobin (1)
			Total	**3**	

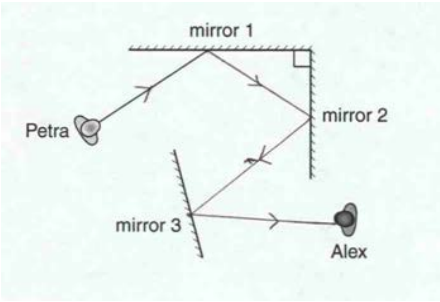
Question			Answer	Marks	Guidance
5	(a)		170 (1)	1	unit not needed **allow** any value between 160 and 180 (1) **allow** 160 – 180 (1) **ignore** 160 - 250
	(b)		petrol has a **smaller** molecular size / ora (1) petrol has **weaker** intermolecular forces / petrol has **weaker** forces between molecules / ora (1)	2	**BOTH MARKING POINTS MUST INCLUDE A COMPARISON** **assume it refers to petrol in the answer** **allow** petrol has **fewer** C atoms / **smaller** hydrocarbon chain (1) **allow** petrol has **weaker** van der Waals' forces / petrol has **weaker** intermolecular bonds (1) **not** petrol has weaker bonds / petrol has weaker covalent bonds
	(c)		**large molecules** that are in **low demand** are cracked (1) cracking produces **small molecules** that are in **high demand** (1) **but** correct example (scores 2 marks) e.g. naphtha is cracked to make petrol or LPG / bitumen is cracked to make paraffin / bitumen is cracked to make petrol or LPG (2)	2	**maximum two marks** **ignore** more useful **if any incorrect examples maximum one mark** **not** bitumen cracked to make diesel or naphtha – this is not supported by the data **not** diesel is cracked to give naphtha – this is not supported by the data **not** cracking paraffin or petrol – they are in demand
			Total	**5**	

Question			Answer	Marks	Guidance
6	(a)		sulfur dioxide (causes acid rain) (1) **but** (idea of) more sulfur dioxide near volcano / ora (2)	2	**not** if more than one gas named from the table e.g. sulfur dioxide and hydrogen sulfide (0) **for second marking point there needs to be a clear comparison e.g.** near a volcano it is 1500 and in city it is **only** 200 (1)
	(b)		$2NO + O_2 \rightarrow 2NO_2$ correct reactants and products (1) balancing – dependent on correct formulae (1)	2	**allow** any correct multiple including fractions **allow** = instead of → **not** & or and instead of + **allow** one mark for correct balanced equation with minor errors of case or subscript eg 2No + O2 → 2NO2
			Total	**4**	

Question			Answer	Marks	Guidance
7			**[Level 3]** **Advantage** **AND** **Disadvantage** **AND** **Two symbol equations for different combustion reactions, one of which is balanced.** Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **[Level 2]** **One advantage OR one disadvantage** **AND** **An attempt at two word equations for different combustion reactions OR an attempt at one symbol equation.** Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **[Level 1]** **One advantage** **OR** **One disadvantage** **OR** **An attempt at a word equation or symbol equation for a combustion reaction.** Quality of written 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)**	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** **Advantage for complete combustion** • does not make a poisonous gas • produces carbon dioxide • does not make soot • gives more energy than incomplete • gives a hotter flame **allow** complete combustion has a plentiful oxygen supply **Disadvantage for incomplete combustion** • makes poisonous gas • produces carbon monoxide • makes soot or a yellow smoky flame • gives less energy than complete combustion • gives a cooler flame **Possible equations include** • butane + oxygen → carbon dioxide + water • butane + oxygen → carbon monoxide + water • butane + oxygen → carbon + water • $C_4H_{10} + 6½O_2 \rightarrow 4CO_2 + 5H_2O$ • $C_4H_{10} + 4½O_2 \rightarrow 4CO + 5H_2O$ • $C_4H_{10} + 2½O_2 \rightarrow 4C + 5H_2O$ **allow** hydrocarbon for butane **Use the L1, L2, L3 annotations in scoris, do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
8	(a)		**any one from:** **less** litter (1) **less** need for land-fill (sites) / AW (1) new uses for polymers can be developed (1)	1	**ignore** environmentally friendly / helps the environment / less pollution **ignore** easy to dispose of **allow** specific use of a biodegradable polymer or a polymer which dissolves in water e.g. (to make a new type of) shopping bags / stitches that dissolve (1)
	(b)		contains oxygen (atom) / has more than just hydrogen and carbon (1)	1	**allow** hydrocarbons have hydrogen and carbon (atoms) only (1) **not** contains an oxygen molecule
	(c)		**any two from:** results can be checked (1) so that further evidence can be collected (1) to provide information to other scientists or public or other organisations / AW (1) so he can get recognition for his work (1)	2	**allow** peer-review / results can be evaluated (1) **allow** work can be developed further (1) **allow** so other scientists cannot take credit (1)
	(d)		**any two from:** (colourless so you) can see through it (1) (hard so it) cannot be scratched (1) (strong so it) does not break easily / (strong) so it is not be broken by a stone / AW (1) (not biodegradable so) will not naturally decay / AW (1)	2	any reference for the need of a high density award a **maximum** of **one** mark
			Total	**6**	

Question			Answer	Marks	Guidance
9	(a)		idea that emulsifier has a **hydrophilic** end and a **hydrophobic** end (1) idea that hydrophilic end is attracted / bonded to water **and** idea that hydrophobic end is attracted / bonded to oil (1)	2	**allow** answers that **only** refer to water loving end attracted to water and water hating end attracted to oil (1) **allow** both marks from a labelled diagram. for second marking point the diagram must indicate attraction / bonding of emulsifier to water and oil e.g.  (2)
	(b)		**any two from:** cell walls rupture / cell walls break / cells lose rigid structure (1) so enzymes can easily come into contact with starch (inside the cell) (1) starch grains swell up / starch grains spread out / AW (1)	2	**ignore** breaking cell membrane **allow** has a softer texture / ora if no other marking point has been awarded (1)
			Total	**4**	

Question			Answer	Marks	Guidance
10	(a)	(i)	change in the speed / change in wavelength (1)	1	**allow** different (optical) densities (1) **allow** the light ray is not at 90^0 to medium 2 / light ray enters medium 2 at an angle / light ray is at an angle (1)
		(ii)	ray with correct reflection between Petra and Alex (1)	1	**allow** ray from Alex to mirror 3 to mirror 2 to mirror 1 to Petra (1) **ignore** arrows on rays  (1)

Question			Answer	Marks	Guidance
	(b)		waves have the same frequency / waves have the same wavelength / waves are in phase (with each other) (1) waves have low divergence / AW (1)	2	**allow** correct diagram for wave in phase e.g.  (1) **allow** concentrated / focussed / narrow beam / do not spread out (over the distance of the laser light show) / highly amplified (1) **ignore** bright / straight
	(c)	(i)	**any two from:** pulses of light / flashes of light / AW (1) dash or line or – using long pulse or flash / dot or . using short pulse or flash / AW (1) message relayed or amplified between stations or people (to cover long distances) (1)	2	**ignore** reference to sound **allow** by switching a torch or light on and off (1) **allow** by using digital signals (1) **allow** light with long and short pulses / AW (2)

Question			Answer	Marks	Guidance
		(ii)	**any one from:** (idea of) longer distance possible (between amplifiers) (1) higher data carrying capacity / can be multiplexed (1) less degradation / less signal loss (1) lower power required (1) (idea of) no 'crosstalk' when run in parallel with other data lines (1) can be used in area of high electromagnetic interference (1)	1	**allow** optical fibres are thinner / lightweight (1) **allow** less interference (with nearby data lines) (1)
	(d)		to separate the signal (into several outputs) / to decode (the (multiplexed) signals (1)	1	**allow** separates the signal into 4 signals / separates the signal into the original signals (1) **ignore** to spread the signal(s) / sort out the signals
			Total	**8**	

Question			Answer	Marks	Guidance
11			**[Level 3]** **Estimated time with IR and reason given including mention of conduction** **AND** **Estimated time with microwaves and reason given including mention of more fat and/or water content or less conduction** Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **[Level 2]** **Estimated time quoted with IR and reason given** **AND** **Estimated time quoted with microwaves and reason given** Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **[Level 1]** **Estimated time with IR and reason given** **OR** **Estimated time with microwaves and reason given** **OR** **Estimated time for IR and estimated time for microwave cooking quoted** **OR** **One reason each for IR and microwave time increasing** 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 C.** **Indicative scientific points may include:** **IR/oven heating estimate** • suitable estimate of more than 5 minutes / 10 -15 minutes **reason** • surface of pizza approximately the same size or slightly larger because of increased depth • only surface(s) heated • energy must be **conducted** through the pizza • idea that water or fat content not important in this method of heating **microwave heating estimate** • suitable estimate of more than 1.5 minutes **reason** • surface of pizza approximately the same size or slightly larger because of increased depth • idea that microwaves penetrate more than 7mm • so less **conduction** needed (compared to IR) • idea of **more water and/or fat content** so time for cooking is reduced compared to IR • idea that water or fat content important in this method of heating **accept** higher level answers in terms of KE transfer between particles during conduction **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
12	(a)		1.5×10^{10} (Hz) (3) **or** 15000000000 (Hz) (3) **but if answer incorrect** 1.5 with incorrect power of 10 (2) **or** 1.5 (2) **or** $3 \times 10^{8} / 2 \times 10^{-2}$ (1) **or** $3 \times 10^{8} / 0.02$ (1) **or** 300000000 / 2×10^{-2} (1) **or** 300000000 / 0.02 (1)	3	**allow** 15 or 15 followed by incorrect number of 0s (2) **allow** 1.5^{10} (1)

Question			Answer	Marks	Guidance
	(b)	**(i)**	as frequency increases the energy increases / as frequency decreases the energy decreases / AW (1)	1	**allow** the higher the frequency the higher the energy / the lower the frequency the lower the energy / positive correlation (1)
		(ii)	**B** has higher frequency **/ B** has more energy / ora for A (1) **B** potentially more dangerous / **B** causes more burning / **B** causes more skin damage / ora for **A** (1)	2	
			Total	**6**	

Question			Answer	Marks	Guidance
13	**(a)**	**(i)**	yes (no mark) **and any one from:** darker skins absorb **more** (ultraviolet radiation) / ora (1) darker skin contains **more** melanin or pigment / ora (1) in darker skin **less** (ultraviolet radiation) reaches (living) **cells** or **tissues** / ora (1)	1	**MUST BE YES FOR MARKS TO BE AWARDED** **allow** phonetic spellings for melanin **not** melamine
		(ii)	test **C** (1) **then one from:** repeat the test (for the result that does not fit the pattern) (1) carry out more tests (1)	2	**allow** identification of 10 and 15 as conflicting evidence (1)
	(b)		**more** (UV) radiation reaches the Earth (1) (so) potential danger to human health **increases** (1)	2	**BOTH MARKING POINTS MUST INCLUDE A COMPARISON** **allow more** UVA / **more** UVB / **more** UVC (1) **allow** examples of increased risk e.g. **more** damage to eyes / **more** (risk of) skin cancer / **more** damage to skin (1) **ignore** harm / kills humans / more damage
			Total	**5**	

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