



GCSE

Science B

General Certificate of Secondary Education

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

Mark Scheme for June 2016

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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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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

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MARK SCHEME

Question	Answer	Marks	Guidance
1 a	in the blood (1)	1	allow veins / arteries / capillaries / blood vessels / blood system (1) not (red) blood cells / haemoglobin
b	idea that carbohydrates are sugar / glucose or made of sugar / glucose (molecules) (1) idea of insulin controls / lowers / regulates (blood) sugar or glucose levels / AW (1)	2	allow he will be eating more sugar / glucose (1) allow his (blood) sugar / glucose level will go up (1) ignore other named sugars e.g. sucrose ignore references to energy / fat not protein allow idea of need to control / lower / regulate (blood) sugar or glucose levels by injecting insulin (1) ignore just 'needs to inject insulin' not insulin increases blood sugar levels allow Type 1 is insulin dependent (1)
c	any two from stored in the liver (1) (stored) as glycogen (1) (excess converted to) fat (1)	2	allow in muscle but not around muscle (1) allow liver converts the carbohydrates (1) but e.g. liver converts the carbohydrates to glycogen (2) ignore references to blood not transported as glycogen / stored as glucose not glucogon or glucogen ignore regions of fat storage

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Question	Answer		Marks	Guidance
d	genotype	phenotype	2	all correct equals two marks one or two correct equals one mark ignore dominant / recessive / heterozygous / homozygous allow no, no, yes (2) allow not inherited, not inherited, inherited (2) if candidate answers in terms of diabetes then no marks
	FF	idea that they do not have cystic fibrosis		
	Ff	idea that they do not have cystic fibrosis or they are a carrier		
	ff	idea that they do have cystic fibrosis		
Total		7		

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Question	Answer	Marks	Guidance
2 a	any three from alcohol is a depressant (1) idea that it affects synapse (1) binds with receptor (molecules in membrane) (1) idea that blocks the transmission of the impulse (across synapse) (1)	3	ignore slows down your reactions allow blocks the receptor (1) allow blocks the nerve impulses (1) allow stops the chemical that crosses the synapse (2) ignore slows the transmission / slows down chemicals
b	7(units) (2) but if answer incorrect 21 (units drunk) (1)	2	
c	20 -29 year olds reduce the risk of a accident by 30 times if they ... <input checked="" type="checkbox"/> Only those aged 18 – 19 will have an accident with a blood... <input type="checkbox"/> People over 30 are 20 times better drivers than people in other age groups. <input type="checkbox"/> People with a blood alcohol level of 150 mg/100ml are at least 200 <input checked="" type="checkbox"/> The lower the blood alcohol level the more likely you are to have an accident. <input type="checkbox"/>	2	each correct tick = 1 mark three ticks but one correct and two wrong = 1 mark three ticks but two correct and one wrong = 1 mark more than three ticks = 0 marks
Total		7	

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Question	Answer	Marks	Guidance
3	<p>Level 3 Complete explanation of how vaccines work that includes correct reference to terms antibodies, antigens and idea of memory cells AND makes a valid conclusion using data. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 Incomplete explanation of how vaccines work, which includes correct reference to either antibodies OR antigens OR idea of memory cells AND makes a valid conclusion using data. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>Level 1 Incomplete explanation of how vaccines work, without reference to either antibodies or antigens OR makes a valid conclusion using data. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A*</p> <p>Indicative scientific points on vaccine at level 2 and 3 include:</p> <ul style="list-style-type: none"> • idea that vaccine contains antigen • antigens trigger immune response • (white blood cells) produce antibodies • antibodies link to antigens • antibodies destroy pathogens • idea of memory cells / faster response if infected (by actual pathogen) / idea of active immunity <p>not white blood cells produce antigens</p> <p>Indicative scientific points on vaccine at level 1 may include:</p> <ul style="list-style-type: none"> • harmless or inactive or dead pathogen / virus given (allow part of the virus or pathogen but not just pathogen or virus given) • vaccine triggers immune response • individual is immune (to polio) <p>Indicative scientific points on conclusion may include:</p> <ul style="list-style-type: none"> • vaccination programme is working as number of cases falls after 1988 or after start of campaign • vaccination programme is working as recent cases are below 1000 • vaccination programme not completely successful as polio cases still occurring in 2004 • data only goes to 2004 so final outcome not known <p>answers that just state ' the number of cases went down from 1984 to 2004' should be awarded the lower mark at the relevant level</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> <p>Make sure you look at the additional answer space</p>
	Total	6	

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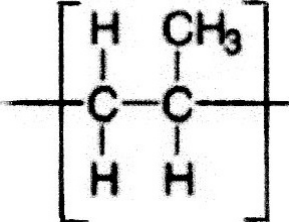
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Question	Answer	Marks	Guidance
4 a	relay (1) effector (1)	2	allow intermediate / interneuron / association neuron / connector neuron / local circuit neuron (1) ignore reflex allow muscle (1) ignore receiver / brain / gland / response not effector
b	cell body (1)	1	allow dendrites / dendron (1) allow phonetic spelling
c	any two from transmission will be slower (1) missing the sheath or myelin (1) sheath insulates (the axon) (1) sheath speeds up the impulse (1)	2	allow slower impulses / impulses take longer (1) ignore messages or information allow idea of impulse leaks / becomes fainter / fewer impulses received (1) allow axon or sheath or myelin or fatty layer damaged (1) ignore wall or membrane or outer layer is damaged allow impulse could pass from one axon to another (1)
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Question	Answer	Marks	Guidance
5 a	C (1) because it contains oxygen / does not contain carbon and hydrogen only (1)	2	second marking point is dependent on the first allow has O in the formula (1) allow C and H for carbon and hydrogen (1) not contains an oxygen molecule (in the formula) not is not a mixture of carbon and hydrogen only not does not contain carbon and hydrogen molecules or compounds only not does not contain carbon and hydro only
b	C ₂ H ₆ O (1)	1	allow elements in any order (1) allow C ₂ H ₆ O ₁ / C ₂ H ₅ OH (1) not C ₂ H ₆ O / C ² H ⁶ O not C ₂ +H ₆ +O
c	contains a double bond (between carbon atoms) (1)	1	not double bond between carbon molecules or compounds ignore it is an alkene
d	 (1)	1	allow CH ₃ group drawn in any position allow CH ₃ group drawn showing bonds between C and H atoms allow round brackets allow without bracket allow with or without n after the brackets not a double bond drawn between carbon atoms must have bonds on either side of carbon atoms
	Total	5	

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Question	Answer	Marks	Guidance
6 a	<p>any two from</p> <p>they are no longer being made (1)</p> <p>limited supply (1)</p> <p>they are being made very slowly (1)</p> <p>they are used (up) faster than they are being made (1)</p>	2	<p>allow never made again (1)</p> <p>allow it will run out / when it's gone it's gone (1)</p> <p>allow there is only a fixed amount of the fuel (1)</p> <p>allow takes thousands or millions (but not hundreds) of years to make / can't be made very quickly (1)</p> <p>ignore just 'they will be used up' unless qualified e.g. they will be used up so there are none left (1)</p> <p>ignore there isn't much of it, unless qualified</p> <p>ignore it can't be remade</p> <p>ignore it can't be used again</p> <p>ignore takes a long time to form</p>

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Question	Answer	Marks	Guidance
b	<p>any two from</p> <p>(oil spills) damage to bird's feathers / kills birds / kills fish / kills animals / kills wildlife</p> <p>because bird is no longer buoyant or can't fly or feathers no longer waterproof</p> <p>or</p> <p>because poisons them / destroys their food</p> <p>or damages fish gills</p> <p>or idea of loss of income for fishermen (1)</p> <p>(oil spills) damages beaches / habitats because oil spills get washed up (1)</p> <p>idea that detergents used in clean up of oil spills are harmful to wildlife or damages wildlife (1)</p>	2	<p>2 examples with explanation for each = 2 marks</p> <p>1 or 2 examples with only one explanation = 1 mark</p> <p>2 examples no explanation = 1 mark</p> <p>e.g. oil spills damages beaches and wildlife (1)</p> <p>1 example no explanation = 0 marks</p> <p>allow environmental problems related to emissions from engine of oil tanker e.g. carbon dioxide released (from tankers) because it causes climate change / global warming (1)</p> <p>ignore just 'carbon dioxide or emissions or oil causes pollution'</p>
c i	LPG and diesel (1)	1	<p>either order</p> <p>allow correct answers ticked, circled or underlined in table if answer line is blank</p>
c ii	<p>cracking</p> <p>or description of cracking (1)</p> <p>uses named fraction in excess (paraffin / fuel oil / bitumen) produces more petrol (1)</p>	2	<p>allow crack (1)</p> <p>e.g. large molecules changed into smaller molecules (1)</p> <p>allow idea of using a fraction that they have excess of or a fraction that has only a small demand (1)</p>
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Question	Answer	Marks	Guidance
7 a	$C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4CO_2 + 5H_2O$ formulae (1) balancing (1)	2	allow any correct multiple, including fractions allow = / \rightleftharpoons instead of \rightarrow not and / & balancing mark is dependent on the correct formulae but allow 1 mark for a balanced equation with a minor error in e.g. $C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow 4CO_2 + 5H_2O$
b	carbon dioxide / CO_2 (1)	1	not CO_2 / CO^2

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Question	Answer	Marks	Guidance
<p> c</p>	<p>[Level 3] Makes a justified choice as to which fuel is the most sensible answer, evaluating information to explain at least two advantages AND at least one disadvantage of the chosen fuel. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer evaluates information to explain at least one advantage AND at least one disadvantage of methane OR Answer evaluates information to explain at least one advantage AND at least one disadvantage of coal. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer evaluates information to explain at least one advantage OR at least one disadvantage of methane OR coal. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A must make a justified choice to be in level three Indicative scientific points may include: Advantages of methane:</p> <ul style="list-style-type: none"> • good availability • (reasonably) low cost • high energy value • gas so can be piped to factory / idea that there is no need to store • produces less CO₂ (than coal) <p>Disadvantages of methane:</p> <ul style="list-style-type: none"> • CO₂ produced • more expensive than coal • highly flammable (if leaks occur) <p>Advantages of coal:</p> <ul style="list-style-type: none"> • good availability • low cost • easy to store / easier to transport <p>ignore solid at room temperature</p> <p>Disadvantages of coal:</p> <ul style="list-style-type: none"> • more CO₂ produced than methane • (relatively) low energy value • solid so takes up lots of storage space • needs to be delivered by train / lorry • is more difficult to light • gives more sulfur dioxide when it burns • is a 'dirtier' fuel • makes a solid waste • is more labour intensive <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	9	

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Question	Answer	Marks	Guidance
8 a	<p>insoluble in water</p> <p>so the perfume cannot be washed off easily</p> <p>so Helen is not poisoned</p> <p>does not react with water</p> <p>so Helen can put the perfume directly onto her skin</p> <p>non-irritant</p> <p>so that the perfume does not react with perspiration</p>	2	all 3 correct = 2 marks 1 or 2 correct = 1 mark
b	<p>any two from</p> <p>there are weak attractions between particles (in perfume) or weak intermolecular forces (1)</p> <p>particles gain energy / particles with lots of energy escape (from the liquid) (1)</p> <p>forces or attractions between the particles (in the liquid) are overcome or weakened or broken (1)</p>	2	<p>allow molecules instead of particles</p> <p>allow bonds instead of forces, if clear the bonds are between particles</p> <p>not covalent bonds</p> <p>allow particles move faster (1)</p> <p>ignore particles gain heat</p> <p>ignore energy gets stronger</p> <p>ignore references to particles becoming more spread out or separated</p> <p>ignore references to diffusion</p>
Total		4	

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Question	Answer	Marks	Guidance
9 a i	infrared (1)	1	allow IR (1)
ii	radio (1)	1	
b	2 (cm) (1)	1	
c	<p>any two from</p> <p>idea of reduce the distance (the signal travels) or use more transmitters (1)</p> <p>idea of increase the height of the transmitter / put transmitters on buildings (1)</p> <p>idea of line of sight (1)</p>	2	<p>ignore boost or amplify the signal</p> <p>ignore personal solutions: e.g. phone from another place / go outside the building</p> <p>allow pylons / masts / mobile phone towers / stations for transmitters</p> <p>ignore satellites / receivers /receptors for transmitters</p> <p>ignore signals</p> <p>allow idea of no obstacles in between e.g. on high place so doesn't get blocked by buildings (2)</p>
	Total	5	

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Question	Answer	Marks	Guidance
10	<p>[Level 3] Explains in detail why noise is easier to remove from digital signals AND Explains how one property of digital signals has been used in the switch to digital. Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] Gives a simple explanation about why noise is easier to remove from digital signals AND states at least one property of digital signals. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] Gives a simple explanation about why noise is easier to remove from digital signals OR states at least one property of digital signals. Quality of written communication impedes communication of the science at this level (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A. Indicative scientific points may include:</p> <p>Level 3 why it is easier to remove noise from digital may include:</p> <ul style="list-style-type: none"> • easier with digital as only looking for 0 and 1 values rather than range or varying or continuously moving values for analogue • noise adds extra random information that is different to a digital signal but similar to an analogue signal • less interference in final signal or with other broadcasts <p>properties of digital signals which have been used to switch to digital may include:</p> <ul style="list-style-type: none"> • explanation of what multiplexing means / several signals transmitted at the same time • so you can have, more stations / more broadcasts / less bandwidth / more or wider range of programmes • no need for a carrier wave <p>Level 1 and 2 noise easier to remove may include:</p> <ul style="list-style-type: none"> • noise is analogue / noise is not digital • easy to see the noise on a digital signal • noise only affects some or flat part of digital signal • less interference / less noise / less disturbance / less interruptions <p>properties of digital signals may include:</p> <ul style="list-style-type: none"> • digital signals can be multiplexed • 0 and 1 / pulses / high and low / on and off • square shape on diagram <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks</p>
Total		6	

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Question	Answer	Marks	Guidance
11 a	no (no mark) idea that the general trend of the graph is downwards (1) OR yes (no mark) idea that there are no lower recorded readings / general trend of graph since 1997 is upwards (1)	1	allow graph goes up and down over the years so may still go down again (1) allow because we have banned CFCs / idea of rules relating to disposal of CFCs (1) allow 1997 or 295 is the lowest reading (on the graph)(1)
b i	idea that as ozone increases the UV decreases / ora (1)	1	allow any correct inverse relationship e.g. when graph 1 goes up graph 2 goes down /ora (1) e.g. in 1997 the UV index was the highest with the lowest amount of ozone (1) allow graphs are mirror images of each other (1)
ii	any one from (ozone) protects from UV (1) (ozone) absorbs UV (1) (ozone) reduces UV / stops UV (1)	1	allow so UV (level) does not increase (1) allow (ozone) reduces risk of skin cancer or cataracts (from UV exposure) (1)

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Question	Answer	Marks	Guidance
c	<p>any two from</p> <p>idea that single country reducing CFC use would not make a difference / need to work together to make a difference (1)</p> <p>the reduction in (the level of CFCs) would be faster (1)</p> <p>idea that it is a serious problem (so need to work together) (1)</p> <p>(idea of that a problem is) skin cancer or cataracts (1)</p>	2	<p>allow everyone needs to stop using it in order for CFC to not damage the atmosphere (1)</p> <p>allow if more countries work together ozone rate of depletion will be slower (1)</p> <p>allow (needs international agreement) as it affects everyone on earth (1)</p> <p>allow it would reduce the incidence of skin cancer or cataracts (1)</p>
	Total	5	

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Question	Answer	Marks	Guidance
12 a	<p>any two from</p> <p>double glazed (windows) or small windows correctly linked to convection or conduction (1)</p> <p>loft insulation correctly linked to convection or conduction (1)</p> <p>windows allow (passive) solar heating by radiation (1)</p>	2	<p>If no reference to convection, conduction or radiation then no marks.</p> <p>allow idea that loft insulation has a reflective surface correctly linked to radiation (1)</p>

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Question	Answer	Marks	Guidance
b i	payback time is 3.5 years (2) or payback time = $\frac{1400}{400}$ (1) or payback time is less than 5 years / or state a value less than 5 (1)	2	check calculations next to and in table allow (5 x (£)400) = (£)2000 or (you save) (£)2000 (1) allow idea that (£)2000 is more than (£)1400 (2) allow (in 5 years) you save (£)600 (2)
ii	cavity wall insulation and cavity wall insulation saves (£)2000 (1) low energy bulbs and a thermostat saves (£)550 (1) BUT cavity wall insulation saves (£)1450 more (2)	2	low energy light bulbs / thermostat given = 0 marks check calculations next to and in table ignore incorrect subtraction ignore idea that cavity wall saves more per year than low energy light bulbs and a thermostat allow overall cavity wall saves (£) 600 (2) allow low energy light bulbs and a thermostat saves (£) 495 (2)
Total		6	

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Question	Answer	Marks	Guidance
13	<p>max two from similarities diffraction after barrier / change in wave direction after barrier / waves curve or bend after barrier (1)</p> <p>wave speed stays the same (1)</p> <p>wavelength stays the same / distance between the lines stays the same (1)</p> <p>max two from differences B has less diffraction / A has more diffraction (1)</p> <p>(as) gap is different size (1)</p>	3	<p>allow both waves are rounded after barrier (1)</p> <p>allow A is more curved / more bent / more rounded / ora (1)</p> <p>allow one with smaller gap diffracts or bends more / ora (2)</p> <p>allow more diffraction seen with pattern A as the gap size is of the same order as the wavelength / ora (2)</p>
	Total	3	

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