OCR
Oxford Cambridge and RSA

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.

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	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** gl**u**cogon or gl**u**cogen **ignore** regions of fat storage

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>d</td><td>
<table>
<tr><th>genotype</th><th>phenotype</th></tr>
<tr><td>FF</td><td>idea that they do not have cystic fibrosis</td></tr>
<tr><td>Ff</td><td>idea that they do not have cystic fibrosis

or they are a carrier</td></tr>
<tr><td>ff</td><td>idea that they do have cystic fibrosis</td></tr>
</table>
</td><td>2</td><td>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</td></tr>
<tr><td></td><td>Total</td><td>7</td><td></td></tr>
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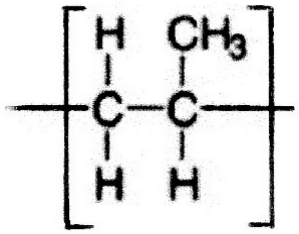
Question	Answer	Marks	Guidance
2 a	**any three from** alcohol is a **depressant** (1) idea that it affects **synapse** (1) binds with receptor (molecules in membrane) (1) idea that blocks the transmission of the impulse (across synapse) (1)	3	**ignore** slows down your reactions **allow** blocks the 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 ... ✓ Only those aged 18 – 19 will have an accident with a blood... ☐ People over 30 are 20 times better drivers than people in other age groups. ☐ People with a blood alcohol level of 150 mg/100ml are at least 200 ..... ✓ The lower the blood alcohol level the more likely you are to have an accident. ☐	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**	

Question	Answer	Marks	Guidance
3	**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) **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) **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) **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 on vaccine at level 2 and 3 include:** • 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 **not** white blood cells produce antigens **Indicative scientific points on vaccine at level 1 may include:** • 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) **Indicative scientific points on conclusion may include:** • 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 **answers that just state ' the number of cases went down from 1984 to 2004' should be awarded the lower mark at the relevant level** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Make sure you look at the additional answer space**
	Total	**6**	

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** affector
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)
	Total	**5**	

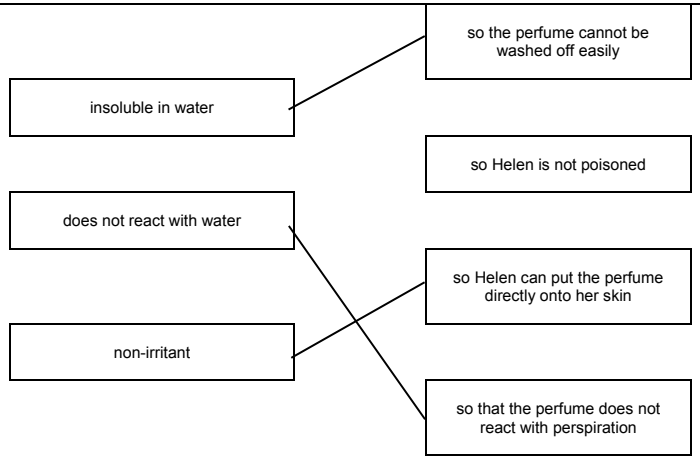
Question	Answer	Marks	Guidance
5 a	**C** (1) because it contains oxygen / does not contain carbon and hydrogen **only** (1)	2	second marking point is dependent on the first **allow** has O in the formula (1) **allow** C and H for carbon and hydrogen (1) **not** contains an oxygen **molecule (** in the 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_2H_6O (1)	1	**allow** elements in any order (1) **allow** $C_2H_6O_1$ / C_2H_5OH (1) **not** C2H6O / C^2H^6O **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**	

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

Question	Answer	Marks	Guidance
b	**any two from** (oil spills) damage to bird's feathers / kills birds / kills fish / kills animals / kills wildlife because **bird** is no longer buoyant or can't fly or feathers no longer waterproof **or** because poisons them / destroys their food **or** damages fish gills **or** idea of loss of income for fishermen (1) (oil spills) damages beaches / habitats because oil spills get washed up (1) idea that **detergents** used in clean up of oil spills are harmful to wildlife or damages wildlife (1)	2	2 examples with explanation for each = 2 marks 1 or 2 examples with only one explanation = 1 mark 2 examples no explanation = 1 mark e.g. oil spills damages beaches and wildlife (1) 1 example no explanation = 0 marks **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) **ignore** just 'carbon dioxide or emissions or oil causes pollution'
c i	LPG **and** diesel (1)	1	**either order** **allow** correct answers ticked, circled or underlined in table if answer line is blank
c ii	cracking or description of cracking (1) **uses** named fraction in excess (paraffin / fuel oil / bitumen) produces more petrol (1)	2	**allow** crack (1) e.g. large **molecules** changed into smaller **molecules** (1) **allow** idea of **using** a fraction that they have excess of or a fraction that has only a small demand (1)
	Total	**7**	

Question	Answer	Marks	Guidance
7 a	$C_4H_{10} + 6½O_2 \rightarrow 4CO_2 + 5H_2O$ formulae (1) balancing (1)	2	**allow** any correct multiple, including fractions **allow** = / ⇌ instead of → **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. $C_4H10 + 6½O2 \rightarrow 4CO2 + 5H_2O$
b	carbon dioxide / CO_2 (1)	1	**not** CO2 / CO^2

Question	Answer	Marks	Guidance
c	**[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) **[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) **[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) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**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:** • 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 CO_2 (than coal) **Disadvantages of methane:** • CO_2 produced • more expensive than coal • highly flammable (if leaks occur) **Advantages of coal:** • good availability • low cost • easy to store / easier to transport **ignore** solid at room temperature **Disadvantages of coal:** • more CO_2 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 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**9**	

Question	Answer	Marks	Guidance
8 a		2	all 3 correct = 2 marks 1 or 2 correct = 1 mark
b	**any two from** there are weak attractions between particles (in perfume) or weak intermolecular forces (1) particles gain energy / particles with lots of energy escape (from the liquid) (1) forces or attractions between the particles (in the liquid) are overcome or weakened or broken (1)	2	**allow** molecules instead of particles **allow** bonds instead of forces, if clear the bonds are between particles **not** covalent bonds **allow** particles move faster (1) **ignore** particles gain heat **ignore** energy gets stronger **ignore** references to particles becoming more spread out or separated **ignore** references to diffusion
	Total	**4**	

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

Question	Answer	Marks	Guidance
10	**[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) **[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) **[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) **[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:** **Level 3** **why it is easier to remove noise from digital may include:** • 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 **properties of digital signals which have been used to switch to digital may include:** • 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 **Level 1 and 2** **noise easier to remove may include:** • 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 **properties of digital signals may include:** • digital signals can be multiplexed • 0 and 1 / pulses / high and low / on and off • square shape on diagram **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks**
	Total	**6**	

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)

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

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

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**	

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

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