OCR
RECOGNISING ACHIEVEMENT

GCSE

Science B

General Certificate of Secondary Education

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

Mark Scheme for January 2012

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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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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

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
	benefit of the doubt
	benefit of the doubt **not** given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

Subject-specific Marking Instructions

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

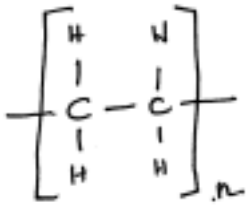
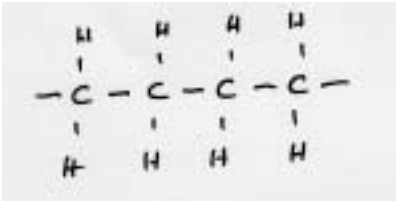
Question			Answer	Marks	Guidance
1	(a)		18 (ml) (1)	1	
	(b)	(i)	90 (min) (1)	1	**allow** 1 hour 30 min (1) **allow** 1.5 hours (1) **ignore** 1.3 / 1.30
		(ii)	(Billy) has different mass or weight or size (than average adult) (1) **ecf** if answer to (i) > 120, (Billy) has different mass or weight or size (than average adult) (1)	1	**allow** liver not working properly / liver damaged / smaller liver than normal (1) **allow** cirrhosis (1) **allow** (Billy) is a child / (Billy) is younger / (Billy) is smaller (1) **allow** idea that (Billy) is different from the average mass or weight or size (1) **ignore** slower metabolism / lower tolerance (to alcohol) **allow** (Billy) is bigger (1) **allow** idea that (Billy) is different from the average mass or weight or size (1) **ecf** if answer to (i) = 120, there is no creditworthy answer to this question
	(c)		(brand) **E** (1) calculation showing that unit:volume ratio is highest for **E**, eg units per ml for **E** = 0.0052 **or** (100 / 330) x 1.7 **or** 0.52 or 0.51 or 0.5 (1)	2	**if E not correct, scores 0** **allow** correct description (1) **allow** 0.005 or 0.0051 (1) **allow** 1.7 / 330 or 1.7 / 33 (1) **allow** 330 / 1.7 or 194.1 (1)
	(d)		(act on) synapse (1) by (depressant) binding with receptor molecules / by blocking receptor site (1)	2	**allow** synaptic cleft **allow** less (neuro)transmitter (released) (1) **allow** less named neurotransmitters eg Ach / acetylcholine (released) (1) **allow** slows down the **release** of the (neuro)transmitter **ignore** no transmitter / less transmission / slow(er) transmission
			Total	**7**	

Question			Answer	Marks	Guidance
2	(a)	(i)	**any one from:** lose weight / keep weight down (1) less stress (1) stop / reduce smoking (1) stop / reduce alcohol (1)	1	**allow** reduce salt / keep salt low (1) **allow** eat less (saturated) fats / eat less cholesterol (1) **allow** medication or tablets e.g. beta blockers / diuretics (1) **allow** drink more water (1) **ignore** sleep more **ignore** healthier diet
		(ii)	**one mark for reason <u>and</u> one mark for valid explanation:** age (1) e.g. teenagers need more energy or more protein (1) OR activity (1) e.g. sports people need more energy (1) OR diabetes (1) need control sugar or glucose intake (1) OR allergy / example of allergy (1) need to avoid allergen (1) OR gender (1) men (on average) need more energy as bigger (1) OR size (1) bigger people need more energy or more protein / ora (1)	2	**explanation mark is dependent on reason mark to get 2 marks, answers must be correctly linked** **allow** any valid medical condition: eg coeliac or gluten intolerant (1) need gluten-free or wheat free diet (1) eg lactose intolerant (1) need dairy or lactose free diet (1) eg anaemic (1) need diet rich in iron or red meat (1) **ignore** so need more sugar / glucose **allow** allergy /example of allergy (1) need to get nutrition from another food (1) **ignore** non-medical reasons: religion / personal choice / culture / cost

Question			Answer	Marks	Guidance
	(b)		evaporation (1) maintain body temperature or lose (extra) heat (1)	2	**allow** changes liquid water to water vapour **allow** lowers body temperature or cools body (1) **allow** higher level answers eg energy needed to provide latent heat or homeostasis or stop overheating (1)
	(c)	(i)	skin / foot (1)	1	**allow** nerve endings in skin / toes / foot (1)
		(ii)	(leg) **muscle** (1)	1	**allow** (foot) muscle (1)
			Total	**7**	

Question			Answer	Marks	Guidance
3	(a)		(harmless pathogen carries) **antigens** (1) (white blood cells produce) **antibodies** (1) memory cells remain / ability to produce antibodies more quickly in future (1)	3	 **allow** idea that vaccines can contain antibodies (1) **ignore** you already have the antibodies (to fight the disease) **ignore** body or cells remember the antibodies
	(b)		idea that benefits outweigh any risks (1)	1	**allow** examples e.g. best to immunise because any slight side effects could be treated rather than get the disease, which would kill the baby (1)
	(c)		(diseases) not caused by bacteria / are caused by viruses or fungi / antibiotics only work against bacteria (1)	1	**allow** (viruses or fungi are) resistant to antibiotics (1) **allow** they are not bacteria (1) **ignore** they are immune to antibiotics **ignore** they do not work, unless qualified
			Total	**5**	

Question			Answer	Marks	Guidance
4			**[Level 3]** **Describes results <u>and</u> explains why untreated seedlings grow towards the light but treated seedlings do not. The role of auxin is clearly explained.** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Describes results <u>and</u> explains either why untreated seedlings grow taller or why they grow towards light**. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Describes results for the seedlings.** 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/A*.** **Ignore** geotropism at all levels **Indicative scientific points at level 3 may include:** • most of the points at levels 1 and 2 plus • removing tip removes the source of auxin and so stops growth • auxin collects on shaded side • auxin causes (more) (cell) elongation on shaded side • elongation of one side causes the shoot to bend (towards the light) • advantage to plant as light is needed for photosynthesis **Indicative scientific points at level 2 may include:** • (untreated) seedlings show (positive) phototropism • auxin or plant hormone made / present in tip • removing tip removes source of auxin **Indicative scientific points at level 1 may include:** • removing tip stops growth • untreated seedlings grow taller / ora • untreated seedlings grow towards light / ora
			Total	**6**	

Question			Answer	Marks	Guidance
5	(a)		**A** (1)	1	**allow** C_2H_4 **allow** correct answer ticked, circled or underlined if answer line is blank
	(b)		C_3H_8 (1)	1	**not** C3H8 / C^3H^8 **allow** H_8C_3
	(c)			1	(square) brackets required bonds at the sides must be present, but do not need to pass through the brackets **allow** formula without 'n' **allow** formula drawn with at least 4 carbon atoms e.g. 
	(d)		contains only (carbon to carbon) single bonds / **ora** (1)	1	**allow** does not contain double bonds (1) **ignore** contains single bonds **ignore** is an alkane
			Total	**4**	

Question			Answer	Marks	Guidance
6	(a)	(i)	because **A** and **C** are biodegradable (1) because **B** and **D** are soluble in petrol (1)	2	**allow** 1 mark for idea that plastics must not dissolve in petrol or water **and** must not biodegrade without identifying specific polymers **allow** because **A** and **B** are soluble in water (1)
		(ii)	flexible / able to be bent round corners (1)	1	**allow** non-rigid (1) **allow** non-flammable / flammability (1) **allow** easy to mould (1) **ignore** stretchy / durable / strong / waterproof
	(b)		because holes in PTFE are too small for (liquid) water to pass through (1) but holes are big enough to allow water **vapour** through (1)	2	**allow** rain for (liquid) water **ignore** water molecules or water particles **not** water for water vapour **not** just sweat **allow** big enough to let sweat or water **evaporate** (1) **allow** the (liquid) water does not pass through but water **vapour** does (2)
			Total	**5**	

Question			Answer	Marks	Guidance
7	(a)		**[Level 3]** **Comprehensive analysis of shortfalls <u>and</u> excesses of fractions. Comprehensive description of cracking. Relevant word or symbol equation included.** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Some analysis of shortfalls <u>and</u> excesses of fractions. Limited description of cracking. May attempt to write a word or symbol equation.** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Simple analysis of shortfall <u>and</u> excess of fractions, and/or rudimentary description of cracking.** 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/A*.** **ignore** references to fractional distillation at all levels. **allow** chains as idea of molecules for levels 1 and 2. **Indicative scientific points at level 3 may include:** • some of the points from level 2 plus • fuel oil, paraffin and naphtha exceed demand • insufficient petrol and gases to meet demand • cracking helps the oil refinery match supply of useful products (petrol) with the demand for them. • correctly balanced equation e.g. $C_{12}H_{26} \rightarrow C_8H_{18} + C_4H_8$ **Indicative scientific points at level 2 may include:** • fuel oil /paraffin /naphtha exceed demand • petrol / gases not sufficient to meet demand • cracking converts large alkane molecules into smaller (alkane and alkene) molecules – this may be illustrated with an equation • cracking makes useful (smaller) alkene molecules (which can be used to make polymers) • if no cracking then fuel oil would need to be stored. **Indicative scientific points at level 1 may include:** • idea that there is too much of some fractions • idea that there is not enough of other fractions • cracking makes more petrol • idea that cracking breaks large molecules to small molecules • cracking needs a high temperature / catalyst

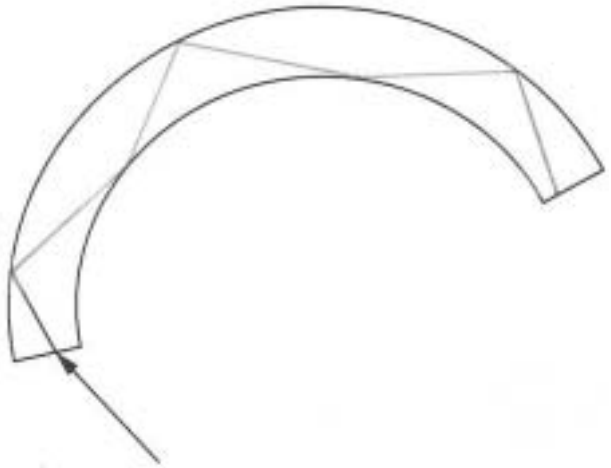
Question			Answer	Marks	Guidance
	(b)		**any two from** idea that UK **dependent** on oil supplies from politically unstable countries or other countries (1) idea that this means that future supply is not secure (because of regime change or countries at war) (1) idea that environmental problems happen (1) idea that these environmental problems can be politically damaging or costly for governments (1)	2	**ignore** UK needs oil from other countries (in stem of question) **allow** idea that countries can charge a high price for oil (1) **allow** specific examples of environmental damage (1) **ignore** cost to oil companies unless linked to government action
			Total	**8**	

Question			Answer	Marks	Guidance
8	(a)		**any <u>two</u> from the advantages** because it is the cheapest (1) because it has high energy value (1) because it has (good) availability (1) because it has longest supply (1) **and the disadvantage** because it is (the most) polluting (1)	3	**allow** it is cheap (1) **allow** it has an energy value of 8950(kJ) / it has a good energy value (1) **allow** it has a long supply / last a long time / lasts 50 years (1) **ignore** it is a solid **allow** gives off sulfur dioxide (1) **ignore** bad for the environment
	(b)		$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ correct formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae **allow** any correct multiple eg $2CH_4 + 4O_2 \rightarrow 2CO_2 + 4H_2O$ (2) **allow** = or ⇆ for arrow **not** 'and' or & for + **allow** one mark for correct balanced equation with incorrect use of upper and lower case formulae eg $Ch_4 + 2O^2 \rightarrow CO_2 + 2H2O$
			Total	**5**	

Question			Answer	Marks	Guidance
9	(a)		denaturing / denaturation (1)	1	**allow** thermal decomposition (1) **ignore** denurturing
	(b)		because cell walls rupture (resulting in loss of rigid structure) (1) and starch (grains) swell or starch (grains) spread out (1)	2	**allow** cell wall breaks (down) (1) **allow** cellulose breaks down (1) **allow** starch (grains) expand (1)
			Total	**3**	

Question			Answer	Marks	Guidance
10	(a)		ultraviolet (1)	1	**allow** UV / UVA / UVB / UVC (1) if more than one type of radiation then scores 0, eg UV and IR
	(b)		(use of) CFCs (1)	1	**allow** named CFC (1) **ignore** spray cans, a chemical in aerosols if more than one named pollutant then scores 0 but **ignore** general references to pollution
	(c)		**any one from** idea that it may prevent enough sunlight or UV reaching the skin (1) less vitamin D produced (1) so cause rickets (1)	1	 **allow** ora for each marking point
			Total	**3**	

Question			Answer	Marks	Guidance
11	(a)			2	**allow** explanation of intense and coherent together, but do not allow incorrect descriptions, eg intense and coherent means in phase (1) but intense means in phase (0)
			intense **any one from** small divergence (1) (idea of) lots of energy in a small area (1)		**allow** less spreading or do not spread out or concentrated in one place (1) **allow** more concentrated (1) **ignore** rays are closer together
			coherent **any one from** monochromatic (1) same frequency (1) in phase (1) so peaks line up with other peaks or troughs line up with other troughs (1)		**allow** same colour (1) **ignore** fixed phase difference

Question			Answer	Marks	Guidance
	(b)		any one correct reflection at surface (1) no more than 5 reflections at the upper surface (1) 	2	 for second mark ray MUST be continuous and touch surface(s) each time, ie no gaps, and reach other end of fibre reflections may all be just at upper surface **allow** reflections drawn that do not reach the other end of the fibre, but if next reflection had been drawn this would have been the case (2)
	(c)		**health risks** **any one from** (microwaves cause) heating **brain** / may heat or cook **brain** (1) (microwaves may) damage cells or tissues (1) (microwaves cause) cancer or tumours (1) **risks limited** **any one from** limit or reduce use / AW (1) use remote earpiece / use handsfree / use loudspeaker (1) bluetooth / AW (1)	2	**ignore** reference to type of radiation **allow** can effect the brain or can damage the brain or cause brain problems (1) **ignore** damages ear drum or hearing **allow** risk of accident if using mobile phone while driving (1) **allow** texting instead of phoning (1) **ignore** hold further from your ear or body **ignore** changes to the microwaves used
			Total	**6**	

Question			Answer	Marks	Guidance
12			**[Level 3]** **Describes and explains how the design of double glazed windows reduces energy transfer. Describes detailed trend(s) in the data.** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **Describes and gives a limited explanation of how the design of double glazed windows reduces energy transfer. Recognises general trend(s) in the data.** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **Attempts to describe how the design of double glazed windows reduces energy transfer <u>or</u> uses the data to recognise general trend(s).** 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.** **ignore** vacuum for air gap at all levels **Indicative scientific points at level 3 may include:** • most of the relevant points from levels 1 and 2 plus must have both description and reference to the data • description of general trends e.g. as air gap increases savings increase up to16mm then level off / increasing the size of the gap beyond 16mm is not effective • doubling the gap from 4mm to 8mm saves twice as much as doubling from 8mm to 16mm • inverse relationship between increase in saving and gap size **Indicative scientific points at level 2 may include:** • trapped air reduces conduction / convection (currents) • reducing convection reduces energy transfer • increasing the size of the air gap decreases the energy transfer / increases the saving / decrease cost (up to 20mm) **allow** correct description of convection or conduction in terms of particle model up to level 2 **allow** stops conduction and convection up to level 2 **ignore** references to heat particles up to level 2 **Indicative scientific points at level 1 may include:** • glass or air is a poor conductor / good insulator • air (in the air gap) is trapped • idea that increasing the size of the air gap decreases the energy transfer
			Total	**6**	

Question			Answer	Marks	Guidance
13	(a)		because energy is being used to break the forces or bonds (between molecules) (1)	1	**ignore** references to breaking covalent bonds or intramolecular bonds
	(b)	(i)	24600 (J) (2) **but if answer incorrect** 0.4 x 4100 x 15 (1) **or** 0.4 x 4100 x (20 – 5) (1)	2	**allow** 24.6 **KJ** (2) **allow** 0.4 x 4100 x 20 or 32800 (1)
		(ii)	0.0745 / 0.075 (kg) (2) **but if answer incorrect** $\frac{24600}{330000}$ (1)	2	**allow** ecf from (i), eg 32800 ÷ 330000 (1) but 0.099 or 0.1 (2) **allow** 0.09 (1) **allow** 0.07 (kg) (2) **allow** 0.074 (kg) (1) **allow** 74.5 g (2)
			Total	**5**	

Question			Answer	Marks	Guidance
14	(a)		X-rays ultraviolet / UV infrared / IR radio (2)	2	all correct order (2) any two in correct box eg X-rays ultraviolet radio infrared (1)
	(b)	(i)	idea that microwaves and/or radio waves can be diffracted (to reach **A**) (1) **but** only radio waves can be diffracted enough (to reach **B**) **because** the wavelength of radio waves is larger (than the wavelength of microwaves) / ora (2)	2	**ignore** idea of reflection from ionosphere **allow** wavelength of radio waves is similar in size to the gap between the buildings / ora (1) **allow** direct comparisons eg microwaves are about 10cm in length and radio waves are about 100m in length (1)
		(ii)	idea that the new building could block or restrict waves or signals or waves are reflected **and** **any one solution from** move the transmitter to the top of the new building (1) increase the height of the transmitter / put transmitter on tallest building (1) use relay transmitters on other buildings (1) move the transmitter so that it is not in the line of sight of the new building / aw (1)	1	**answer must have both effect and suggested solution for the mark** **allow** radio waves cannot be diffracted by that much **ignore** interference **allow** change the angle of the transmitter **allow** change the site of the new building / do not build it at position **X** **allow** have a smaller building **ignore** use a signal booster
			Total	**5**	

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