

# **Twenty First Century Science**

## **PILOT Examination Questions**

### **GCSE Science June 2004**

**Food matters, Material choices, Radiation and life  
(Mark Scheme)**

#### **Please note:**

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- **The style of question varies from that used for the new specifications.**
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Question		Expected Answers	Mks	Additional Guidance
1	a	3 <sup>rd</sup> box; 4 <sup>th</sup> box	1 1	3 boxes ticked = 1 max 4 boxes ticked =0
	b i	Any two from  (smaller) can be absorbed /to get through (gut) walls / to get into the blood;  (soluble) can be carried by blood/lymph;  for assimilation / to be build up to larger molecules	2	Reject 'enzymes'
	ii	starch to glucose;  protein to amino acids	1 1	Reject 2 lines from 1 box
	c	liver	1	
			<b>7</b>	

2	a		microwave;	1	Reject 'wave'
			X-ray	1	Accept 'ray'
	b	i	damage living cells/chromosomes/DNA/nucleus	1	Reject 'kills cells' Accept 'causes ionisation'
		ii	Must be comparison  examination by X-rays is <u>half</u> as risky as the radiation from flying to Spain (ora)	1	reject 'less risk' or 'safer' if without qualification.  accept 'risk from X ray is smaller'
		iii	decay happens slowly / changes would not be noticeable (in a short time)	1	note this is 2 marks on higher tier
		iv	Any one from identify problems with the teeth early / before too much damage occurs; To match risk to patient (owtte)	1	Reject 'to see if it's decayed' accept 'to discover hidden problems'
		v	comment on risk/benefit ratio;  any one of each X-ray increases exposure to X-rays; more X-rays more damage to cells; more chance of getting cancer;	1  1	reject causes/could cause cancer
				<b>8</b>	

3	a		black / 1 <sup>st</sup> box; tarry / 4 <sup>th</sup> box	1 1	
	b		hydrocarbons; refined	1 1	
	c		lubricant; petrol	1 1	
	d		a long chain molecule / 3 <sup>rd</sup> box	1	
				<b>7</b>	
4	a		the higher the melting point the greater the strength of forces (holding the atoms together)	1	Must link to forces
	b		very strong / more than very strong (owtte) / stronger than iron	1	
	c		disposal of the metal after use / 2 <sup>nd</sup> box; energy used in extracting the metal / 3 <sup>rd</sup> box	1 1	
				<b>4</b>	
5	a	i	increases	1	
		ii	more than	1	Accept 'more'
	b		4.98; (accept 5 or 5.0 do not accept 5.00) 3; (accept 3.0 or 3.00)	1 1	Mark numbers only, no mark for yes/no
	c		may not want to reduce salt  food will go bad /will not keep; food will not taste as good /nice; sales will go down / people won't buy as much;  should be made to reduce salt  improves health/reduces risk of heart attacks etc; increases life expectancy owtte; saves NHS resources/money; to prevent loss in sales due to consumer safety fears  QWC is for a clear ordered answer The candidate has attempted to answer the question using statements which are ordered in a logical way to answer the question. Generally there will be at least three statements.	4           1	Mark across both sections  1 mark max in each section for simply copying information e.g. salt is used to improve taste/preserve food or because salt increases risk of heart disease
				<b>9</b>	

6	a		<p>photosynthesis decomposing burning respiration</p>	<p>1 1 1 1</p>	
	b		<p>any two from: increased use of (fossil) fuels / named fuel from coal / oil/ gas; that release Carbon dioxide when burned;</p> <p>deforestation; leads to less photosynthesis / less CO<sub>2</sub> removed from atmosphere</p>	<p>2</p>	<p>Reject wood or charcoal as named fuel</p> <p>Accept 2 causes or 1 cause qualified.</p> <p>Reject 2 qualifications</p>
	c	i	<p>any three effects (for example): (forest) fires; crop failure; flooding; drought; people dying (from the heat); people forced to leave homes; spending more time outdoors (in Norway)..</p>	<p>3</p>	<p>Accept any effect attributable to higher temperatures</p> <p>Allow info copied directly from map</p>
		ii	<p>too soon after the event to be sure what the cause is / data needs to be analysed; need to collect more data / need to use evidence of what is going on globally / need to look over a longer timescale;</p> <p> QWC correct spelling, punctuation and grammar. The candidates can make an average of one error per sentence without penalty. A very long sentence, which should be several shorter sentences, will automatically score zero.</p>	<p>2</p>	
				<p>1</p>	
				<p><b>12</b></p>	

7	a		any two reasons using the same crops (in the same ground); minerals used up; build up of (named)disease / (named) pest; erosion	2	Reject 'nutrients' / vitamins Accept named minerals
	b		any two answers from: use of (artificial ) fertilisers; improved machinery; crop rotation; use of herbicides/pesticides/insecticides; intensive farming techniques; selective breeding / better seed; GM/better seed (if not used for selective breeding);	2	Accept named examples Reject improved technology / science/ industry/ irrigation
				<b>4</b>	
8	a	i	$\frac{33 + 34 + 33 + 34 + 36}{5}$ ; 34 (MPa)	1 1	
		ii	any two of to obtain a more reliable value; to avoid 'one off' errors / to help avoid the effect of experimental error; to identify outliers; to overcome any slight variation in the samples;	2	Reject 'to make it a fair test' 'to make it more accurate'
		iii	any one of variation in (samples of the) rubber;  variation in how test was carried out	1	Accept <i>experimental error if not given in ii</i>  Reject 'variation in vulcanisation process';
	b		the '65' result is <u>anomalous</u> ; lies well outside the range of the others (and should be ignored) / it is an outlier	1 1	
	c		tyres need to be hard; and vulcanised is harder; OR tyres should not stretch easily (have a high tensile strength); and vulcanised has higher tensile strength;	1 1	One mark for property or a conclusion  2 <sup>nd</sup> mark for linking the two mark
				<b>9</b>	
				<b>60</b>	




2	a		damage living cells/chromosomes/DNA/nucleus	1	Reject 'kills cells' Accept 'causes ionisation'
	b		Must be comparison examination by X-rays is <u>half</u> as risky as the radiation from flying to Spain (ora)	1	reject 'less risk' or 'safer' if without qualification.  accept 'risk from X ray is smaller'
	c		decay happens slowly ; changes would not be noticeable (in a short time)	2	
	d		any one of identify problems with the teeth early / before too much damage occurs; To match risk to patient (owtte)	1	Reject 'to see if it's decayed' accept ' to discover hidden problems'
	e		comment on risk/benefit ratio;  any one of each X-ray increases exposure to X-rays; more X-rays more damage to cells; more chance of getting cancer;	1  1	reject causes/could cause cancer
	f		any two from people worry about X-rays but not about the risk from radiation of flying;  flying is a familiar activity;  puts the X-ray risk into perspective/allows extent of risk to be assessed;  gives another source of radiation for comparison	2	quality of response
				<b>9</b>	



3	a	i	$\frac{33 + 34 + 33 + 34 + 36}{5} ;$ 34 (MPa)	1 1	correct answer but no working =2 marks
		ii	any two of to obtain a more reliable value;  to avoid 'one off' errors / to help avoid the effect of experimental error;  to identify outliers;  to overcome any slight variation in the samples;	2	Reject  'to make it a fair test'  'to make it more accurate'
		iii	any one of variation in (samples of the) rubber;  variation in how test was carried out	1	<i>Accept experimental error if not given in ii</i>  Reject 'variation in vulcanisation process';
	b		the '65' result is <u>anomalous</u> ;  lies well outside the range of the others (and should be ignored) / it is an outlier	1 1	
	c		tyres need to be hard; and vulcanised is harder;  OR  tyres should not stretch easily (have a high tensile strength); and vulcanised has higher tensile strength;	1 1	One mark for a property or a conclusion.  2 <sup>nd</sup> mark is for linking the two
				<b>9</b>	

4	a		Idea of (named) minerals/ required chemicals in ash	1	Accept 'acts as a fertilizer'  Reject 'fertilises the soil' 'nutrients' / vitamins
	b		any two answers use of (artificial ) fertilisers; improved machinery; crop rotation; use of herbicides/pesticides/insecticides; intensive farming techniques; selective breeding / better seed; GM/better seed (if not used for selective breeding);	2	Accept named examples Reject improved technology / science/ industry/ irrigation
				<b>3</b>	
5	a		<b>A</b> photosynthesis / production of starch/sugar/glucose; decrease as carbon dioxide taken in (from the atmosphere);  <b>B</b> plant material decomposes; respiring producing increase in carbon dioxide;  <b>C</b> fossil fuels burn; releasing CO <sub>2</sub> into atmosphere and hence increase	2  2  2	
	b		any two from increased use of (fossil) fuels / named fuel from coal / oil/ gas;  that release Carbon dioxide when burned; deforestation;  leads to less photosynthesis / less CO <sub>2</sub> removed from atmosphere	2	Reject wood or charcoal as named fuel  Accept 2 causes or 1 cause qualified.  Reject 2 qualifications
	c	i	higher than normal temperatures in a number of countries suggests world wide effect;  serious flooding suggests higher rainfall;  forest fires suggest drought / high temperatures crop failures suggest drought;  OR  Location, what's happened and why unusual for that location; X3	3	need both evidence and what it implies  award on quality of response

ii		<p>too soon after the event to be sure what the cause is / data needs to be analysed;          need to collect more data / need to use evidence of what is going on globally / need to look over a longer timescale;</p> <p> QWC correct spelling, punctuation and grammar.          The candidates can make an average of one error per sentence without penalty. A very long sentence, which should be several shorter sentences, will automatically score zero.</p>	2	
			1	
			<b>14</b>	
6 a i		it is not to feed people/get more food / simply for looks/sport / monopoly / gene transfer to other grasses or plants / modified grass may spread	1	
ii		<p>Any two from          produce own insecticide/nitrates;</p> <p>more resistance to rot/temp extremes/salinity/drought/bad weather;</p> <p>higher yield/better quality product;</p>	2	<p>reject animal references</p> <p>Accept 'produce nutritional supplements'</p>
b		so that scientific arguments can be studied/ prevent damaging different environment/ ensure public/government are informed/allow public debate	1	
c i		<p>Any three from          identify gene;</p> <p>(desired) gene removed;</p> <p>from DNA/chromosome;</p> <p>by enzymes;</p> <p>placed in bacterial DNA/plasmid</p>	3	
ii		New/different/more genes/alleles/DNA	1	accept resistant to weedkiller
			<b>8</b>	

7	a		Hydrocarbon(s)	1	
	b		small molecules/monomers join together; to make large molecules/polymer	1 1	
	c		any two from crude oil (is a complex mixture) with few uses;  (splitting it up) provides fuels, lubricants and raw materials for the chemical industry / provides a number of products;  which have lots of uses;  refined products have a higher value;	2	
	d		A is longer/larger than B;  there are more forces of attraction between molecules;  which will need more energy to overcome; (and hence a higher boiling point)	1 1 1	Accept 'more atoms' Reject mention of cross-linking
	e		any two from  environmental impacts of making a product from crude oil;  using the product;  disposal of the product	2	
				<b>10</b>	
				<b>60</b>	