

Twenty First Century Science

PILOT Examination Questions

GCSE Science Jan 2005

**Air quality, You and your genes, Earth in the Universe
(Mark Scheme)**

Please note:

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- The style of question varies from that used for the new specifications.
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1(a)(i)	purple and green leaves; purple stem; identical; to parent;	2	<u>Exactly</u> same NOT copy accept 10 cm tall
(ii)	Any two from: grown in <u>different</u> conditions/environment; Different: water; sun; minerals; nutrients; temperature; will affect growth rate/photosynthesis;	2	not food
(b)(i)	all chromosomes/genetic information/genes in each cell;	1	not DNA
(ii)	some cells are unspecialised; can develop into any type of plant cell;	2	For one mark only: chromosomes/genes carry <u>all the</u> <u>information</u> (for the plant to develop all parts); (accept DNA)
		7	

2	OCO→carbon dioxide→formed by complete burning CO→carbon monoxide→formed when fuels do not burn completely OSO→sulfur dioxide→ formed when coal or oil containing sulfur burns LHS 3 correct = 2; 2 or 1 correct = 1 RHS 3 correct = 2; 2 or 1 correct = 1	4	
		4	

3 (a)	(C) B E A D B somewhere before E; E somewhere before A; A somewhere before D;	3	
(b)(i)	comet; asteroid/meteor/meteorite;	2	accept moon/satellites reject dust
(ii)	gravity	1	
(c)	distance ; travelled by light in one year;	2	2 marks for 10 ¹⁰ km or 10 ¹³ m

(d)	Any two: it was closer together/in one place; began with a 'big bang'; material flung outwards/Universe is expanding;	2	
		10	

4 (a)	to ensure result is reliable/in case you get an odd result/outlier/anomaly; difficult to maintain constant conditions/exhaust does not come out smoothly; human error/mistake;	2	not <u>accurate</u> ; fair test;
(b)	$(119+126+113+122)/4$ <u>OR</u> $(119 + 126 + 122)/3$ = 120 (ppb) = 122/122.3 (ppb)	2	method & substitution✓ evaluation✓
(c)	113 → 126/14 or 13; <u>OR</u> 119 → 126/8 or 7;	1	
(d)	The chemistry teacher's car definitely produces more NO _x (first row)	1	
(e)	combines with/reacts with <u>water</u> /dissolves in <u>water</u> ; acid rain; kills plants/fish/damages buildings; makes asthma symptoms worse/may cause breathing problems; contributes to smog;	2	any 2 'causes asthma attack' but <u>not</u> 'causes asthma' <u>not</u> pollution
		8	

5(a)	Each baby/person has own (different) set of chromosomes/genes; (inherited) from both parents;	2	might be a boy not enough
(b)(i)	X; X or Y; (any order) sperm; X and X;	4	
(ii)	XX XY XX XY	1	
(iii)	all correct = 1 50 (%)	1	not half
		8	

6(a)	BEAD scores 3 marks B somewhere before E ; E somewhere before A ; A somewhere before D ;	3	
(b)	FOR: stop people having the disease/less stress on rest of family; AGAINST: unnatural/wrong/may harm embryo/against religion; DO NOT allow 'may go wrong'; not cost	2	cure/prevent/save cheaper than treating disease
		5	

7(a)	calcium carbonate → (accept =) calcium oxide + carbon dioxide	1	correct symbol equation ignore chalk and lime
(b)	soot/ashes/chalk/grinding cement/cement powder;	1	any one NOT just cement
(c)	reacts; with oxygen and water (vapour); acid rain/sulfuric acid/sulfurous acid;	2	any two not just air
(d)	sample from each site; repeat samples; practical method for sampling; standardisation of sample (size/time/distance); method of measuring results; One mark will be for a clear, ordered answer. At least two correct steps in logical order	3	any three e.g. sellotape draw up air through filter
		+1	
		8	

8 (a)	4500 million years	1	
(b)(i)	information about families in the bible	1	not just the bible
(ii)	information came from the bible; believed bible to be true/would not challenge Church/Archbishop; unaware of other ideas;	2	any two
(c)	Hadrian's wall has not eroded much <u>in 1000 years</u> ; erosion is a slow process; erosion elsewhere could not have happened in 5000 years;	2	any two
(d)	new observations/data/evidence; imagination/creative thought; new theory accounts for observations/data/evidence; theories tested by experiment/more measurements;	3	any 3
	QWC spelling punctuation and grammar	1	
		10	

1(a)	information came from the bible; believed bible to be truth/would not challenge Church; poor communication/unaware of other ideas;	2	any two
(b)	Hadrian's wall has not eroded much <u>in 1000 years</u> ; erosion is a slow process; erosion elsewhere could not have happened in 5000 years;	2	any two
(c)	radioactive rocks within the Earth (continue to generate heat); so cooling cannot happen as quickly as Thompson calculated;	2	
(d)	new observations/data/evidence; imagination/creative thought; new theory accounts for observations/data/evidence; theories tested by experiment/more measurements;	3	any 3
		9	
2(a)	calcium carbonate → calcium oxide + carbon dioxide	1	correct symbol equation
(b)	soot/ashes/chalk/grinding cement/cement powder;	1	any one NOT just cement
(c)	reacts; with oxygen and water (vapour); acid rain/sulfuric acid/sulfurous acid	2	any two
(d)	sample from each site; repeat samples; practical method for sampling; standardisation of sample (size/time/distance); method of measuring results;	3	any three
	One mark will be for a clear, ordered answer.	+1	
		8	

3ai	chromosomes/nucleus of cells;	1	
aii	<i>Determine characteristics;</i> <i>genes provide instructions for the cells;</i> <i>describe how to make proteins;</i>	2	Not 'causing disease'
bi	<i>Any one from:</i> <i>Huntington's disease (chorea); cystic fibrosis;</i> <i>haemophilia;</i>	1	accept sickle cell anaemia, colour blindness
bii	Huntington's disease: Any two from: disease shows when patient is approx. 30 – 40 years old; brain cells degenerate/ damage to nervous system; patient makes clumsy, jerky movements; moody/depressed ; affects memory; eventually become totally disabled/loss of speech; cystic fibrosis: Any two from: produce thick/ sticky mucus; mucus blocks air passages / difficulty in breathing; mucus gets into digestive system/difficulty absorbing (digesting)food; more prone to lung infections; infection damages lungs; haemophilia: Any two from: blood does not clot; bruise easily; prolonged bleeding; body does not make Factor 8; usually affects males; females are carriers;; sickle cell: Any two from severe pain; fatigue/weak; prone to tissue damage colour blindness cannot distinguish between colours; usually affects males	2	
ci	Any one from To look for trends/correlations; To identify causes; To estimate cost of provision; To find the number of people with diseases	1	

cii	<p>for: employers will understand the medical conditions/ requirements of their staff;(eg health and safety) insurance companies can assess risk/ appropriate premium; a greater understanding might reduce prejudice;</p> <p>against; may prevent people gaining jobs; may increase insurance payments; may not be able to gain insurance; confidential/invasion of privacy;</p> <p style="text-align: right;">Total</p>	4	at least one advantage and one disadvantage for full marks
		11	
4a	4 (water); 3 (carbon dioxide);	2	
bi	0.6 tonnes of LPG produces $0.6 \times 3 = 1.8$ tonnes CO ₂ ;	1	
ii	$3.0 - 1.8 = 1.2$ tonnes;	1	
c	6 p per mile	1	
di	$12000 \times 3p = 36000 p / \text{£}360$	1	
ii	$\text{£}1800 / \text{£} 360/\text{year} = 5$ years	1	
e	<p>advantages lower fuel costs; less pollution/specific examples;</p> <p>disadvantages less luggage space; LPG fuel not readily available;</p>	4	at least one advantage and one disadvantage for full marks accept 'cheaper' not 'harmful'
		11	
5(a)	T; A; All correct = 2 marks G; 3 correct = 1 mark C;	2	
b	Proteins are made up of amino acids; each protein has amino acids in a particular order; order of bases determines the specific protein/triplet code determines the specific amino acid; DNA instructs the cell to join the amino acid together in the correct order;	3	any three
	Total	5	

6 (a)	<p>A cloud of dust and gases; 5000m years ago; cloud collapsed; heated up; gravity caused material to clump together; gravity caused planet formation; The planets orbit the Sun; Fusion of H nuclei provide energy source; The Sun runs out of fuel/ forming a red giant; In 5000 m years time; Any correct stage after this (white dwarf, black dwarf)</p> <p style="text-align: right;">QWC Clear, ordered answer</p>	5	any five
(b)	<p>The light reaching our eyes set off 600 years ago; so we are seeing the star as it was 600 years ago;</p>	2	
(c)	<p>Galaxies are moving away from us; further away the quicker they are moving; space/Universe is expanding; began with a 'big bang'; began in a central place;</p>	3	any 3
11			

7(a)	<p>BEAD scores 3 marks B somewhere before E; E somewhere before A; A somewhere before D;</p> <p>FOR: stop people having the disease/less stress on rest of family; AGAINST: unnatural/wrong/may harm embryo/against religion; DO NOT allow 'may go wrong'</p>	3	
b		2	cure/prevent/save cheaper than treating disease
		5	

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