OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced GCE **G642**

Science and Human Activity

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Question			Expected Answer	Mark	Rationale/Additional Guidance
1	a	i	Alpha helix correctly labelled ✓ Beta sheet correctly labelled ✓	2	**NOT** Helix alone
		ii	N connected to C ✓ Correct valencies 3 for N 4 for C ✓ Water molecule produced ✓	3	Correct peptide bond gets 2 marks H_2O shown (anywhere) gets 3rd mark. No mark for word water
	b	i	All nine points plotted correctly ✓ ✓ Line of best fit must be a smooth curve ✓	3	1 mark if one point incorrectly plotted 0 marks if more than one point incorrectly plotted -1 if Y axis not labelled Do not penalise leaving pH 6 value off L.O.B.F Do not give mark if ruler used to connect consecutive points
		ii	Between 50 – 55 (but see graph) ✓	1	**ALLOW** ecf from graph.
	c	i	The 3D structure (fold) of the (functional) protein ✓ As determined by the protein's primary structure ✓	2	2nd mark can be awarded for mention of bonds that hold 3D structure e.g. H or S-S Shape implies 3D structure
		ii	Low activity at extremes of pH ✓ Enzyme denatured (by amino acids changed) ✓ Effecting lock and key mech. ✓ Disrupting intermolecular forces holding protein together ✓ Inactive 3D structure ✓ **QWC** for linking evidence (from data) with theory (mention of graph)✓	6	**OR** same argument relating to high and low pH effecting active site of enzyme by disruption intermolecular forces Disrupting lock and key mechanism of enzyme substrate complex. There must be a specific mention of the data
			Total	17	

Question			Expected Answer	Mark	Rationale/Additional Guidance
2	a	i	Gaseous particles are in constant (random motion) ✓ Pressure caused by particulate collisions between particles and vessel wall ✓	2	Must mention particles hitting container wall for 2nd mark
		ii	$P=N/m^2$ rearranged to $N= P \times m^2$ ✓ 100 000 x 0.5 = 50 000 ✓ Newtons (N) ✓	3	50 000 N gets all 3 Equation in triangle scores 0
		iii	Pressure increases ✓ As temp rises particles gain more kinetic energy AW move about faster (average K.E. increases) ✓ Thus particulate collisions with the container have greater energy AW ✓	3	
	b	i	Heat energy from sun (radiation) causes (indirectly) air molecules to increase their kinetic energy(move faster) ✓ Faster moving particles occupy a larger volume and thus the air becomes less dense and rises AW ✓	2	2nd mark must refer to larger volume or lower density
		ii	As warm air rises it cools ✓ Thus water vapour condenses (clouds form) which can lead to rain ✓	2	Formation of clouds must be related to air cooling
			Total	**12**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
3	a	i	+4 in SO_2 ✓	1	
		ii	Increase in oxidation number / oxygen is added ✓	1	
		iii	ZnO is being reduced ✓ Because oxygen is being removed ✓	2	**ACCEPT** Zn is reduced as it goes from +2 to 0 oxid number (Do not accept just Zn is reduced)
	b	i	H_2O ✓	1	
		ii	H^+ ✓ **2**H^+ ✓	2	H_2^+ gets 0 H_2^{2+} = 0
	c		Acid rain can acidify soils causing reduced plant growth ✓ Soil can be neutralised (using lime) ✓ Lakes can be acidified causing damage to aquatic life ✓ Lakes can be neutralised (lime etc.) ✓ Limestone buildings can be corroded by acid rain ✓ Surfaces can be, treated/sealed, to prevent corrosion ✓	6	3 marks max if only effects given without suggested solutions to counteract problem. **ALLOW** 1 standalone mark for general reason leading to acid rain reduction e.g.: use fewer cars
			Total	13	

Question			Expected Answer	Mark	Rationale/Additional Guidance
4	a	i	A chemical reaction initiated by (sun) light ✓	1	
		ii	200nm = 2.0 x 10^{-7} m ✓ f = c/λ ✓ f = 3.0 x 10^{8}/ 2.0 x 10^{-7} = 1.5 x 10^{15} ✓ Hz (s^{-1}) ✓	4	1.5 x 10^{15} Hz (s^{-1}) gets all 4
	b	i	A species (atom or group of atoms) with an **unpaired** electron ✓	1	
		ii	Cl• or $CFCl_2$• ✓	1	**NOT** anything generated by C-F bond fission Radical must show explicit dot (unpaired e)
	c	i	Substance that speeds up the rate of a chemical reaction ✓ But does not get used up in the reaction ✓	2	Lowers E_a(1) Provides alternative reaction pathway (1) If enzyme described -1
		ii	NO is oxidised (used) in first step, to form NO_2 ✓ But reduced back to NO (regenerated in second step) so that it can be used again ✓	2	NO is not used up = 1 mark only If equations combined to show NO use cancelling out give 2
			Total	11	

Question			Expected Answer	Mark	Rationale/Additional Guidance
5	a		**1**. Nucleus **2**. Triplet **3**. Hydrogen **4**. Guanine **5**. Uracil **6**. Translated **7**. Ribosome	7	
	b		**Method** - *max **three** from:* Start with a hypothesis ✓ Set up some sort of epidemiological research method/case control study ✓ Idea of a control group ✓ Larger group sizes give more **reliable** evidence ✓ Longer period of case study gives more reliable evidence ✓ Possible cohort studies where GM food is already available ✓ **Evidence** - *max **three** from:* Evidence will be statistical ✓ There should be a statistically significant difference between control and test group(s) ✓ Evidence should be, reproducible/validated ✓ Difficulty of controlling all variables ✓ **Ethical issues** - *max **two** from:* Case control study method raises issues of who should be the test group? ✓ Ethics of a placebo group? ✓ Longer period of testing could be scientifically desirable but could expose test group to greater risk ✓ **plus** **QWC** mark for logical sequencing of investigation ✓	9	Any mention of animal/controlled testing (1) Any mention of tests being repeated (1) Raising issue of a suitable time period (1 year or more) (1) Any mention of a blind test (1) Any attempt to quantify or represent data e.g.graph(1) Mention of peer review (1) If repetition not in method credit (1) if mentioned here Ethical issues must relate to the eating of tomatoes and not growing Credit issues of religious belief (1) **QWC** mark will only be awarded if method contains some indication of Hypothesis- Experiment-Analysis sequence.
			Total	16	

Question			Expected Answer	Mark	Rationale/Additional Guidance
6	a		Isotopes are atoms of the same element/same atomic number ✓ With different neutron numbers (in the nucleus) ✓	2	Molecules or substances loses 1 **ACCEPT** different, mass/nucleon numbers
	b	i	P=15 ✓ N=16 ✓ E=15 ✓	3	
		ii	Mass number=32 ✓ Atomic number=16 ✓	2	
		iii	$6.25 \times 10^{-2} = 0.0625$ ✓ 1 to 0.625 = 4 half lives ✓ 4 x 14.3 days = 57.2 days ✓	3	
		iv	^{32}P releases beta particles <u>which are ionising</u> ✓ Ionising radiation can cause burns / damage, biological tissue/DNA ✓ Leading to mutations (possible cancers) ✓ Samples should be kept in suitable containers e.g. lead lined (sufficient to stop beta radiation) ✓	4	
			Total	**14**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
7	a		Any energy source that is, constantly replenished/not a finite resource ✓	1	**NOT** 'its not a fossil fuel'
	b		**Solar power** ***advantages*** constant supply in sunny countries (named eg). Technology exists/works. CO_2 neutral, low risk (cf nuclear) ***disadvantages*** dependent on sun (ie not suitable for certain climates) Technology expensive/ cells can be unreliable **Wind power** ***advantages*** technology tried and tested. CO_2 neutral, low risk ***disadvantages*** dependent upon wind/ unreliable supply. Wind farms unsightly, low level noise nearby **Wave power** ***advantages*** regular supply, CO_2 neutral, low risk. ***disadvantages*** not suitable for land locked countries, new technology **Tidal power** ***advantages*** regular/continuous supply, CO_2 neutral ***disadvantages*** new technology not suitable for landlocked countries	6	Must give one advantage **and** one disadvantage for each method chosen. **DO NOT CREDIT '**produces a lot of energy' for advantage mark.

Question			Expected Answer	Mark	Rationale/Additional Guidance
7	c	i	**Fusion**: Joining together/combining ✓ Of atomic nuclei (releasing energy) ✓ **Fission**: splitting apart ✓ Of atomic (unstable)nuclei (releasing energy) ✓	4	**DO NOT ACCEPT** 'forcing together'
		ii	(Electromagnetic) Radiation ✓	1	**ACCEPT** specific radiation such as visible or UV **ACCEPT** light
		iii	Types of ionising radiation ✓ Can cause damage to living systems ✓	2	
		iv	The (gases in the) atmosphere / the Earth's magnetic field ✓	1	**NOT** ozone layer **ACCEPT** stratosphere
		v	Atomic mass = 3 ✓ Atomic number = 1 ✓	2	
			Total	17	

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