OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced Subsidiary GCE

Unit **G642:** Science and Human Activity

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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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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Question			Expected Answers	Marks	Additional Guidance
1			Troposphere	1	
			Expand	1	Allow rises for second mark
			Rises	1	No alternative
			Condenses	1	
			Wet	1	(not warm)
			High Low	1	**Both high and low needed for this mark**
			Clockwise	1	
			Total	7	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	A bonding pair labelled A non bonding pair labelled	1 1	
		(ii)	O is more electronegative than H Thus is δ- w.r.t. H δ+	1 1	
		(iii)	Water molecule is "V" shaped There is a greater share of the electrons at the O end of the molecule (as predicted by electronegativity difference)	1 1	Any correct indication of O- and H+ (1)
	(b)		Water's high specific heat capacity means that it "holds" a lot of energy/is slow to heat up And so slow to cool down As a liquid (convection) currents allow heat energy to be transferred around the earth Heat energy is dispersed around the Earth	1 1 1 1 Any 3	credit heat transferred to atmosphere
	(c)		Ammonia has a permanent dipole (Due to shape of molecule) Ammonia can form H bonds Can H bond with water molecules thus is soluble	1 1 1	**Any indication of H bonds between water and ammonia on diagram should gain credit.**
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	O_2	1	Not 2O
		(ii)	2 and 2	1	Both needed for the mark
		(iii)	H_2O	1	
	(b)	(i)	Metal ions have a positive charge Attracted to the surface of clay which has a negative charge H^+ ions from acid exchange with the metal ions releasing (into solution)	1 1 1	Any examples shown Ca^{2+} Al^{3+} etc First 2 marks can be awarded from a clear diagram Can be shown on the diagram.
		(ii)	Exchange may remove nutrients from soil (eg Ca and Mg ions) These ions needed for healthy plant growth Exchange can release toxic ions from soil (eg Al^{3+} or Pb^{2+} As a result these ions can be absorbed by plant and hinder plant growth	1 1 1 1	+ve ions must be indicated as metals Metal ions released gets (1)
	(c)	(i)	Two reliability issues highlighted such as no repeats or clear anomaly of result 2 Unclear when sample was taken at location	1 1 1 Any 2	Consider other viable options

Question			Expected Answers	Marks	Additional Guidance
		(ii)	Repeat experiments at locations 1-5 This would improve reliability Ensure surface area of 1g of limestone in each sample is controlled Would improve validity on conclusion (ensure fair test) Increase number of locations tested Improves reliability Measure masses of limestone at start and end of experiment with greater precision	**1** **+1** **1** **+1** **1** **+1** **1**	Improvement 1 + reason 1 More than 4 suggested improvements but no reasons given scores maximum of 4/8 Allow leave samples for longer Credit idea of increasing precision of apparatus (1)
			Improves accuracy Make more precise (or frequent) time interval measurements Improves reliability	**+1** **1** **+1** **Max 8**	
			Total	**20**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	-3	1	
		(ii)	+1	1	
	(b)	(i)	2200-2250 cm^{-1}	1	
		(ii)	Choice of c=fλ AND correctly rearranged $3.0 \times 10^{8} / 4.5 \times 10^{-5} = 6.67 \times 10^{12}$	1 1	**Accept** equation in triangle
		(iii)	$E = 6.67 \times 10^{12} \times (6.63 \times 10^{-34}) = 4.42 \times 10^{-21}$ Joules (J)	1 1	e.c.f using answer from part i
	(c)	(i)	2 N_2O, 1O_2 and 4NO.	1	All must be correct for this mark,
		(ii)	An atom (or group of atoms) with an unpaired electron	1	
	(d)		More intensive land use means using more fertilizers Fertilizers contain nitrogen (ammonia or nitrates) As a results nitrogen fixing bacteria will flourish and return more N to the atmosphere in the form of N_2O More N_2O in stratosphere produces more NO which catalyses the decomposition of O_3	1 1 1 1	Do not credit argument for acid rain
			Total	13	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	Methionine- Lycine-Cysteine-Glycine-Alanine-Tyrosine	**2**	1 mistake =1 more than 1=0
		(ii)	1. Tyrosine	**1**	
			2. Cysteine forms S-S bonds between cysteine residues in protein Mutation to tyrosine means S-S bond cannot form S-S bonds important in tertiary /active structure of protein thus proper 3D structure cannot (may not) form	**1** **1** **1**	No mention of S-S bond loses only (1)
	(b)		Non competitive inhibition is substance binding protein (enzyme) away from active site Binding causes (conformational) change in binding site Thus normal substrate cannot bind to active site Lead ions may form ionic interactions with amino acids away from active site Thus distort the normal substrate binding site Non competitive inhibition not dependent upon concentration	**1** **1** **1** **1** **1** **1** **Any 5**	
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
6			Alpha source	1	Apparatus marks
			Gold leaf foil	1	
			Screen (ZnS) for counting flashes	1	Award marks from diagram
			Screen is moveable around the gold foil	1	
			Most particles pass straight through	1	
			Some are deflected/very few bounce back	1	Observation marks
			Most of the atom is empty space	1	
			Nearly all of mass of atom concentrated in centre (nucleus)	1	Conclusion marks
			Nucleus must be positively charged because like charges repel	1	
			Any mention of “plum pudding model” being inconsistent with results from exp.	1	
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	β^{0}_{-1}	1 1	**Accept** e^{-}
		(ii)	Radiation of sufficient energy (high energy) To remove electrons from other atoms	1 1	
		(iii)	Isotopes have the same electronic structure (configuration) It is electronic configuration that determines chemical properties	1 1	Accept same **number** of electrons for 1
		(iv)	40.1/8.02 = 5 half lives Half 60mg 5 times = 1.875 (1.88mg)	1 1	
	(b)		Trace amounts mean exposure is low Alpha particles have low penetrating power Thus unlikely to penetrate the rock to do damage	1 1 1	
			Total	11	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		One cycle correctly shown on diagram	1	
	(b)	(i)	W=IxV correctly chosen AND rearranged 1400/240= 5.833	1 1	Accept triangle
		(ii)	V=IR correctly chosen AND rearranged R= 240/5.833 = 41 Ohms (Ω)	1 1 1	Accept triangle
	(c)	(i)	**Nuclei** split Resulting in release of energy	1 1	
		(ii)	Advantages: No CO_2 production Supply of fissile material more reliable Resources of fissile material will last longer Disadvantages: Disposal of waste is still an unresolved problem Supply of fissile material arguably as insecure as fossil fuels Fissile material also a non renewable resource Potential terrorist threat Other renewable need to be explored	 1 1 1 1 1 1 1 1 Any 6	 Making concrete has carbon footprint.
		(iii)	Temperatures required for fusion are extremely high Reaction takes in more energy than it produces **OR** very difficult to control	1 1	
			Total	16	

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