

**GCE**

**Science**

Unit **G642**: Science and Human Activity

Advanced Subsidiary GCE

**Mark Scheme for June 2017**

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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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Annotations: the following annotations are available on SCORIS.

✓	= correct response
✗	= incorrect response
bod	= benefit of the doubt
nbod	= benefit of the doubt <b>not</b> given
ECF	= error carried forward
^	= information omitted
I	= ignore
R	= reject

Question			Expected Answers	Marks	Additional Guidance
1	a	i	Water (collects) in the high lake water flows downhill through turbine Turbine drives <u>electrical</u> generator	1 1 1	AW potential energy is converted to kinetic energy; AW kinetic energy is converted into electrical energy
		ii	Advantage no CO <sub>2</sub> emitted Disadvantage: dependent on rainfall / only possible in mountainous regions AW	1 1	Accept CO <sub>2</sub> neutral / low carbon footprint
	b	i	Field lines <u>further apart</u> so field strength is weaker	1	Must refer to field strength
		ii	Field strength <u>arrows</u> point in opposite direction	1	Must refer to direction of arrows
	c		$W = V \times I$	1	
			$W = 2 \times 12 = 24 \text{ W}$	1	
			$W = \text{J/s, so } J = W \times s$	1	
			$J = 24 \times 10 \times 60 = 14,400 \text{ J (14.4 kJ)}$	1	
		<b>total</b>		<b>11</b>	

Question		Expected Answers	Marks	Additional Guidance	
2	a	Electronegativity <u>difference</u> (between O and H)	1	<b>AW O is more electronegative than H</b> <b>Can be scored from labels on diagram</b> AW centre of negative charge is not in same place as centre of positive charge	
		So oxygen negative and hydrogen is positive	1		
		Molecule is not (completely) symmetrical	1		
	b	i	Hydrogen bond	1	
		ii	As water molecules are closer together So have greater density	1 1	
	c	Total mass = 690 (kg)	1	<b>Ecf from incorrect mass. 985 scores 2</b>	
		Density = mass/volume	1		
		$690/0.675 = 1022 \text{ (kgm}^{-3}\text{)}$	1		
	d	Water has evaporated travelling North (from equator)	1		
		Thus salinity of water increases and thus density increases	1		
		Colder at northern latitude	1		
		Water becomes denser	1		
	e	Water's high s.h.c means that it retains heat energy/slow to warm slow to cool	1		
		Movement of water currents distributes heat energy from Tropics to North Atlantic	1		
		Moderates (especially maritime) climates/ prevents extremes of temperature change	1		
		<b>total</b>	<b>16</b>		

Question		Expected Answers	Marks	Additional Guidance
3	a	Shows ozone concentration values of 33 and 311 times greater	1 1	ALLOW 2-4 and 32-34 ecf from values outside tolerance
	b	i	1	<b>ALLOW unpaired electrons</b>
		ii	1 1 1 1	
		iii	1	
	c	i	1	Accept NO is regenerated
		ii	1 1	<b>ALLOW incorrect value for o.n. increase</b>
		iii	1 1	
	d	i	1	Ignore reference to shape
		ii	1 1	<b>REJECT low toxicity</b>
		<b>total</b>	<b>16</b>	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	7.8 ALLOW 7.7-7.9	1	
		ii	OH <sup>-</sup> ion conc increases at higher pH OR Less H <sup>+</sup> ions/ Affects pattern of bonding in enzyme / active site AW affects charges on groups in enzyme / active site Alters tertiary structure AW shape of active site Prevents substrate from binding to / fitting into <u>active site</u>	1  1 1 1	ALLOW denatures enzyme
		iii	Enzymes have different optimum pHs Different parts of the body have different pH values	1 1	
	b		Structural Act as enzymes Membrane channels Antibodies Hormones ANY 3	1 1 1	IGNORE growth and repair
			<b>total</b>	<b>10</b>	

Question			Expected Answers		
5	a	i	Burning in oxygen / reaction with oxygen	1	
		ii	Exothermic means releasing heat (to surroundings) Breaking bonds requires energy (endothermic) Forming new bonds is exothermic More energy released than required	1 1 1 1	Answer may refer to specific bonds broken from a) (i)  "More energy released <b>in forming bonds</b> than needed to <b>break bonds</b> " scores 3
	b		Visible light /UV from Sun light absorbed by Earths surface Earths surface heats up Emits as longer wavelength / IR radiation Greenhouse gases (such as CO <sub>2</sub> ) absorb IR radiation Less energy escapes into space AW some energy re-emitted back to Earth AW energy passed onto other molecules in the atmosphere Combustion of methane produces CO <sub>2</sub> More CO <sub>2</sub> in atmosphere means more energy trapped AW ANY 6	1 1 1 1 1 1 1	ALLOW "traps IR"
			<b>total</b>	<b>11</b>	



<b>6</b>	<b>a</b>	Proton Neutron	1	
	<b>b</b>	A = 89 Z = 36	1 1	
	<b>c</b>	<b>i</b>	1	
		Time taken for radioactive count (isotope) / uranium 235 To decay to half its original value	1	
		<b>ii</b>	1	
		3 half lives 3 x 11.5 = 34.5 seconds	1	34.5s gets both marks
		<b>total</b>	<b>7</b>	

Question		Expected Answers		Marks	Additional Guidance
7	a	Adenosine	A structure within a cell composed of RNA and protein	1	All correct = 5 marks 1 or 2 incorrect = 3 marks 3 or 4 incorrect 2 marks  2 correct = 1 mark Less than 2 correct = 0
		Plasmid	A base found only in RNA	1	
		Restriction enzyme	The observable characteristics of an organism		
		Ribosome	Can be used as a vector in genetic manipulation.	1	
		Uracil	A base found in DNA <b>and</b> RNA	1	
		Gene	A protein that binds to a specific DNA sequence and cuts it	1	
		Phenotype	A sequence of nucleotides coding for a protein	1	
				Max 5	

	<b>b</b>	<b>i</b>	Identify gene from donor organism remove gene using restriction enzyme put into a vector / plasmid / virus check that gene has been transferred successfully using marker characteristics AW produce whole plant from cells	1 1 1 1 1 Any 4	
		<b>ii</b>	<b>Benefits</b> Potentially cheaper foods / better yields Pest resistant crops / disease resistant / drought resistant crops Plants can be modified to produce other substances e.g. medicines / nutrients etc  <b>Hazards</b> Genetic material may be transferred to other crops / weeds May be unforeseen consequences in long term May reduce genetic variety Toxic / allergic reactions / cancer causing chemicals	1 1 1 1 1 1 1 Any 6	NOT just "has not been tested"
			<b>total</b>	<b>15</b>	

Question			Expected Answers	Marks	Additional Guidance
8	a	i	Burette	1	
		ii	(Volumetric) pipette	1	
		iii	<b>Indicator</b> To determine point of neutralisation (end point) <b>White tile</b> So that change in indicator colour can be seen	1 1	
b	i	25.85, 24.40, 0.65, 24.40,	1 1	all correct = 2 marks 1 incorrect = 1 mark more than 1 incorrect = 0 marks	
		ii	Indicates titrations 2,3 and 5 Correct ave = 24.383 To correct d.p.= 24.38	1 1 1	If titration 1 and/ or titration 4 used in average max 2 marks Accept ecf from (b)(i)
c	i	Acidifies <u>soil</u> impacting on crops / trees Acidifies <u>lakes / rivers</u> affecting plants and aquatic animals <u>Reacts</u> with stonework causing damage / corrosion	1 1 1	ACCEPT examples	
		ii	Choose non sulphur containing fuel / remove S from fuel before use Capture the SO <sub>2</sub> produced before it is released to environment Use catalytic converters to convert NO <sub>x</sub> into (nitrogen / safer substances) Alter temperature in engines / industrial processes to form less NO <sub>x</sub> Use alternative sources of energy that do not produce NO <sub>x</sub> or SO <sub>x</sub> / gives example e.g wind power etc ANY 2		Must be linked to correct pollutant
<b>total</b>				<b>14</b>	

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