OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced Subsidiary GCE

Unit **G642:** Science and Human Activity

Mark Scheme for January 2011

Oxford Cambridge and RSA Examinations

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Question			Answer	Mark	Guidance
1	a		*Any **two** from:* Sun's rays are more concentrated in North (because of Earth's tilt) ✓ Thus more energy per unit area ✓ Day is longer in North ✓ North is exposed to more sunlight ✓ Thus less time to lose heat (at night) ✓	2	**Accept** north is closer to the sun
	b		P=F/A correctly chosen **AND** rearranged to F=P*A ✓ F= 2.56 x 10^7 ✓ Newtons (N) ✓	3	Award mark if F=P*A shown or values of P and A multiplied (Award even if P not converted to Pa)
	c	i	Volume increases/AW ✓ Air particles gain more (Kinetic) energy ✓ Thus move about more quickly and take up more space/AW ✓	3	**REJECT** particles get hotter
		ii	At **A** atmospheric pressure is low ✓ Weather is (hot and) wet ✓ Hot air rises (creating low pressure) and as it cools water condenses and can fall as rain ✓ At **B** pressure is high ✓ Weather is (hot and) dry ✓ Cooler air is more dense and descends creating high pressure ✓	6	Explanation must imply rain is due to cold air resulting in condensation Mark annotations on diagram
			Total	14	

Question			Answer	Mark	Guidance
2	a		**P** = North Atlantic drift ✓ **Q** = Gulf stream ✓ **R** = Norwegian current ✓	3	
	b		Any indication of use of Q = mcΘ ✓ Mass of water = 100 x 1000 = 1 x 10^5 kg ✓ Heat loss = 1 x 10^5 x 4.18 x 4 = 1.67(2) x 10^6 ✓ kJ ✓	4	16 720 MJ (16.7 GJ)
	c	i	Water gets colder OR has high salinity due to evaporation as current passed warmer parts of the globe ✓ As a result water in current is denser and so sinks ✓	2	**ACCEPT** either reason for water getting denser
		ii	Melting of polar ice caps results in more fresh (pure) water entering oceans ✓ This will cause salt water to be diluted and thus reduce its density ✓ Refer to table to show higher density of salt water (or lower of pure water) ✓ As a result the salt water current will not drop (descend) and thus cycle may stop ✓	4	
			Total	13	

Question			Answer	Mark	Guidance
3	a	i	1,1 and 2 ✓	1	If 1 and 1 values left blank assume 1 is implied and award mark. Accept multiples e.g. 2,2 and 4
		ii	2,1 and 2 ✓	1	See above for 1 value
	b		$HNO_3 \rightarrow H^+ + NO_3^-$ ✓✓	2	1 mark for H^+ ion (as product) 2 marks if completely correct
	c	i	NO is used up in reaction 1 but put back in step 2 ✓ Thus not consumed in the reaction ✓	2	
		ii	Reactants and products shown on diagram ✓ Exothermic reaction profile ✓ Catalysed reaction clearly indicated with lower activation energy ✓ Activation energy E_a and ΔH labelled for at least 1 reaction profile ✓	4	
	d	i	(+)1 ✓	1	**ACCEPT** 1 (i.e. + implied)
		ii	*Any **seven** from:* Greenhouse effect involves the trapping of solar energy ✓ Energy absorbed by the Earth's surface and re-emitted as IR radiation ✓ N_2O absorbs IR radiation ✓ Preventing it escaping into space ✓ As a result (average) global temperature is rising ✓ Leading to melting of polar ice caps ✓ Disruption of weather patterns (egs) ✓ Changes in biodiversity ✓ Rising sea levels ✓	7	
			Total	18	

Question			Answer	Mark	Guidance
4	a	i	CUCAAAUCUUUGUAA ✓	2	1 mistake gets 1 mark. More than 1 gets 0
		ii	5 ✓	1	
		iii	Ribosome ✓	1	
	b	i	COOH circled ✓ NH_2 circled ✓	2	If NH and C=O only circled (1)
		ii.1	Tertiary is the (precise) 3D structure of the protein ✓ Which is determined by the (specific) amino acid sequence ✓	2	
		ii.2	Cysteine amino acids can form S-S covalent bonds ✓ With other cysteine amino acids (only) ✓ These (strong) bonds are important in maintaining the protein's 3D structure ✓	3	
			Total	11	

Question			Answer	Mark	Guidance
5	a	i	56 **and** 55 (both required) ✓	1	
		ii	Ethanol = 55.5 ✓ Hexane = 63 ✓	2	Accept 56 to 2 s.f. for ethanol
		iii	Some indication of use of mcΔΘ ✓ 50 x 4.18 x 55 = 11495 for ethanol (55.5) **AND** 50 x 4.18 x 63 = 13167 for hexane ✓ Correct unit used J (or kJ if converted) ✓ Correct division by 0.5g to get mass per gram ✓ Ethanol = 22.99 kJ g^{-1} **AND** Hexane = 26.33 kJ g^{-1} ✓	5	**Both** mcΔΘ must be correct for 1 mark If mass of fuel used in calculation instead of mass of water then MAX 2 for whole question If both values are correct award all 5 If sig. fig. are correct for both **but** wrong decimal place due incorrect unit conversion award 3
		iv	Not all heat transferred to water in calorimeter / s.h.c of calorimeter not taken into account ✓	1	
	b		Both experimental values for ethanol are close together (55 &56) whereas those for hexane are 55 & 71 / Consistency (closeness) of results is evidence of reliability ✓	1	

Question			Answer	Mark	Guidance
5	c		Hexane has a greater energy density per gram than ethanol and on this basis is a better fuel ✓ Hexane comes from crude oil ✓ Thus is a non-renewable resource ✓ Both fuels produce CO_2 ✓ Ethanol may have a lower energy density but is a renewable resource ✓ Produced by fermentation (of biomass) ✓ And thus has a smaller carbon footprint/AW ✓ However, use of land for biofuel has an impact on land usage for food ✓	8	
			Total	**18**	

Question			Answer	Mark	Guidance
6			Isotopes ✓ Decay ✓ Electrons ✓ Nucleus ✓ Mass ✓ Number ✓ Temperatures ✓ Heavier ✓	8	
			Total	**8**	

Question			Answer	Mark	Guidance
7	a	i	Alternating current ✓ Changing direction ✓ 100 times a second (50 cycles/s) ✓	3	
		ii	W = I x V rearranged to I = W/V ✓ 3kW = 3000 W ✓ I = 3000/240 = 12.5 ✓ Amps (A) ✓	4	
		iii	Either $W = I^2R$ or V=IR correctly rearranged ✓ $R = 3000/(12.5)^2 = 19.2$ ✓ Ohms (Ω) ✓	3	
	b		To minimise power loss current can be decreased and voltage increased (voltage stepped up) ✓ This means less energy is lost as heat ✓ Power loss = I^2R thus resistance should be minimised ✓ Using electricity transmission cables with low resistance (i.e. Al has high conductivity) ✓	4	
	c		**advantages** Wind turbines do not produce CO_2 ✓ Not reliant on, gas/oil, etc. from overseas ✓ **disadvantages** Wind source unreliable ✓ Cannot supply sufficient energy ✓ Turbines an eyesore ✓	4	2 marks max for advantage 2 marks max for disadvantage
			Total	18	

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