OCR
RECOGNISING ACHIEVEMENT

GCE

Science

Advanced GCE **A2 7885**

Advanced Subsidiary GCE **AS 3885**

Mark Schemes for the Units

June 2008

3885/7885/MS/R/08

Oxford Cambridge and RSA Examinations

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Advanced Subsidiary GCE Science (3885)

MARK SCHEMES FOR THE UNITS

2841 Science and the Natural Environment

Question			Expected Answers	Marks	Additional Guidance
1	a		A= Cell wall; B= Cell membrane; C= Nucleus;		
	b	i	Site of **respiration;** Energy released/ ATP production/ Glucose oxidised;	1 1	ACCEPT provides energy (1) Store energy is CON
		ii	Site of (bio) synthesis; Protein and/or Lipid synthesis;	1 1	Accept making macro/big molecules
	c		1. cell wall 2. Chloroplasts 3. (Large) vacuole	All 3 = 2 marks, 2 = 1 mark Only 1 or 0 = 0 marks.	
	d	i	Cell membrane too fragile/ thin AW Difficult to image with light microscope	1	NOT "too small"
		ii	Membrane consists of lipids (with embedded protein channels) (small) molecules diffuse through lipids; molecules can also diffuse through protein channels; diffusion occurs down a concentration gradient AW from high to low concentration	1 1 1 1 ANY 3 points	Any reference to lipid structure of membrane NOT active processes NOT large gaps in membrane

	e	**i**	Plant cell: unlight/photons; Animal cell: food (energy)chemical energy/ glucose;	1 1	
		ii	Chemical energy is converted into heat energy ; Movement energy/ muscle contraction/ active transport eg ion pump; Exported as chemical energy in form of molecules lost from cell;	1 1 1	NOT respiration alone (unless heat loss mentioned) ONLY ACCEPT kinetic energy if linked to a specific process ACCEPT "as chemical energy"
			Total	**18**	

Question			**Expected Answers**	**Marks**	**Additional Guidance**
2	**a**		Distance measured/ shown between two successive peaks/crests; Clearly shown on diagram;	2	MUST BE A REASONABLY ACCURATE ATTEMPT AT SHOWING COMPLETE WAVELENGTH
	b		Camera can use different sensors/ filters;	1	
	c	**i**	False colour;	1	
		ii	White/pale blue;	1	
		iii	Deep red/red;	1	
		iv	Purple/Maroon;	1	
	d		Deforestation/ land usage eg crop type/flooding / weather patterns / surface temperatures / sediments in water	Any 2	OVP Needs to be related to an actual use i.e not "weather" or "temperature" alone
			Total	**9**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	Helium; nucleus; AW Made from 2 protons; and 2 neutrons; Emitted from nuclear decay/nucleus;	 2 1	 Must state that emission is from the nucleus (from atom is CON)
		ii	Time; For activity/mass of radioactive isotope to reach half; Of starting activity/initial mass;	1 1 1	ACCEPT “how long it takes” Needs to be linked to a valid property ACCEPT to fall by a half
	b	i	Alpha particles have low penetrating power; cannot escape human body;	1 1	
		ii	Alpha particles are ionising/ can ionise	 1	Must mention ionising – no credit for description of physiological effect
	c		208 upper case ; 84 lower case;	1 1	
	d	i	Method showing on graph $A_0/2$; Calculated as 2.9 +/- 0.2 years / 1060 +/- 70 days;	1 1	ALLOW ECF FROM GRAPH
		ii	Curve falling more steeply; Half life shown as 0.4 years +/- 0.2;	1 1	Any line steeper than original line By inspection is half-life not shown explicitly
	d	iii	40% +/- 5% ecf from graph;	1	

	e	**i**	Radiation damages cells (owtte)	1	Alpha radiation ionising/ mutations / cancer etc.
		ii	Low concentration/amounts means relatively low risk;	1	
			Total	**18**	

Question			Expected Answers	Marks	Additional Guidance
4	**a**		System must have at least one decomposer / a decay chain; to ensure nutrient recycling;	1 1	IGNORE any reference to food / energy etc.
	b	**i**	Nutrient depletion in system ;	1	ACCEPT plants would die ACCEPT causes eutrophication (in a neighbouring aquatic ecosystem)
		ii	Deforestation/ overhunting/introduction of new species	1	
		iii	Increased nutrient input leads to rapid growth of producers; which absorb more nutrients making less available for other organisms; OR depleted nutrient levels result in more trees dying; thus more decomposition making more nutrients available.	1 1	Must be related to processes occurring in a forest ecosystem
		iv	Any increase in variable would generate a further acceleration of outcome.	1	ACCEPT any correct specific example / eg increased soil exposure/erosion leads to less plant growth leading to even more soil erosion etc ACCEPT any change causes accelerated change.
	c				

			Evolution occurs by means of natural selection; i.e. fittest survive to reproduce (owtte); any mention of greater competition for resources in non stable environment; changes to ecosystem means that more individuals will not survive; Rate of mutation is NOT different in the two different systems; mutations (may) give individuals advantageous characteristics; In an unchanging ecosystem all organisms well adapted; No further changes occur mutations unlikely to be an advantage / advantageous mutation less likely in stable environment; QWC: 2: Coherent language, well organised AND at least two technical terms used in correct context and spelt correctly 1: Generally coherent with some organisation AND at least one technical terms used in correct context and spelt correctly 0: Poorly organised AND no technical terms **(Natural) selection;** **Mutation;** **Niche(s);** **Advantage / advantageous** **Adaptation / adapt** **Characteristic(s)**	1 1 1 1 1 1 1 1 1 1 2	**Any 6 from 8** **2 (QWC)**
			Total	**15**	

2842 Science and Human Activity

Question			Expected Answers	Marks	Additional Guidance
1	a		Amino acid (residue)	1	
	b	i	(alpha) helix AW secondary structure	1	
		ii	Reaction occurs here Substrate binds to active site AW enzyme-substrate complex forms; Active site and substrate have complementary shapes AW substrate fits into active site;	1 1 1	Enzyme reacts (alone) is CON Accept "locks onto" CON if enzyme fits into substrate! NOT lock and key alone
	c	i	Smaller than a protein molecule; Have the general formula $C_n(H_2O)_n$	1 1	-1 for every extra tick above 2
		ii	Takes part in respiration AW soluble transport ; To provide energy / ATP	1 1	IGNORE store. Award first mark for an explanation of glucose reacting / breaking down in some way to produce (a different form of) energy.Transport mark relies on a realisation that glucose dissolves in e.g. cell sap or blood NOT just source / provides
	d	i	(long chain) made up of many sugar molecules / monosaccharide units	1	NOT just "several" or "a number" without further amplication e.g. reference to long chain
		ii	Starch / glycogen / amylopectin / amylose	1	NOT amylase
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	Nitrogen and oxygen; React together at high T AW oxidation of N at high T; Both gases come from from air;	1 1 1	 Allow reference to heat of engine Mention of N or O in petrol is CON
		ii	Temperature is low ORA ; A lot of **energy** is needed to enable reaction / high activation energy AW bonds (in reactants) are strong;	1 1	Allow reference to less heat ALLOW argument based on successful collisions if energy mentioned
	b		Oxidised / bonds to oxygen in air; Dissolves / reacts in water	1 1	
	c	i	Loses oxygen AW oxidation number goes down;	1	Mention of other substances is CON. IGNORE reference to electrons
		ii	Increase temperature; Increase surface area of catalyst; Increase pressure of gases / in exhaust chamber	2	**Any two** Mention of conditions in engine is CON
	d	i	Rate is **proportional** to concentration / as concentration doubles, rate doubles AW as concentration halves, rate halves	2	Allow 1 mark for answers along lines of "rate increases when concentration increases". ALLOW linear relationship (2 marks)
		ii	Rate = k $[NO]^1$ OR Rate = k [NO];	2	-1 for minor error e.g. k omitted, square brackets omitted, use of proportional sign. Wrong order ,
		iii	(Step 1) because it is the slowest;	1	ALLOW implicit description of slowest step e.g. takes longer than other steps
			Total	**15**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	Parallel horizontal lines (at least 2); Arrow pointing R→ L;	1 1	IGNORE lines outside of region between plates
		ii	Lines become closer together / more lines	1	
	b		Both accelerate AW <u>start</u> moving towards plates; Na^+ towards – plate, Cl^- towards +;	1 1	
	c	i	Q = E/V; 2000/5 = 400 (C)	1 1	No ecf for wrongly rearranged equations

		ii	uses or implies I = Q/t;
			calculates 6 mins = 360s;
			I = 72 / 360 = 0.2A; ecf from conversion into s
				1
				1
				1
					0.2A scores 3
					12A without statement of Q/t scores 1 (but only if some working is shown)

			Total	**10i**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	Glycerol / triol		Any other name in label is CON
		ii	Contains a **carbon-carbon** double bond	1	
	b	i	Store; of energy; AW component; of membranes AW under skin; as insulation AW protects; organs from damage AW waterproofing; of leaves etc.	2	NOT provides energy Any pair of answers. Ignore second role if given Also award credit for involvement in synthesis of e.g. steroid hormones, cholesterol etc. Broken down to produce glucose =1 (equivalent to "store" mark)
		ii	Heart disease AW atheroscelorsis etc.;	1	Allow description of effects of atherosclerosis e.g. high blood pressure NOT high cholesterol alone
	c	i	Electron (groups) repel each other; 3 groups; (120^o) gives maximum separation / minimum repulsion;	1 1 1	Mention of atoms / lone pairs repelling is CON 3 needs to be linked to the features which mutually repel
		ii	$C_6H_{12}O_2$;	1	
	d	i	Reduces temperature at which reaction is done; Less fuel burnt; Less CO_2 / greenhouse gases / SO_2 produced; Finite resources preserved;	3	Any 3 point NOT less heat required
		ii	Metals may be toxic / allergenic; Could leak out / must be disposed of eventually / may be present in product; AW Production / extraction of the metal catalyst has an environmental burden; Gives examples of this e.g. SO_2 from smelting, CO_2 / greenhouse gases from burning fossil fuels	2	Allow combination of marking points from these two areas e.g. metals are toxic and metals need to be extracted
			Total	**14**	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	CO_2 concentration increases in a similar way to temperature;	1	
		ii	Temperature rise could have caused increased CO_2 levels; Other factors affect temperature e.g. changes in solar output; The correlation isn't perfect AW temperature graph fluctuates more than CO_2 graph;	1	
	b		*Processes producing greenhouse gases (3 max)* Burning of fossil fuels / examples ; Decay of vegetation / flatulent cattle; Release of methane / gases trapped in permafrost / hydrates; (denitrification) decomposition of nitrates to produce N_2O) *Reasons for rise (3 max):* Increased use of fossil fuels because of economic changes; Increased grazing of animals / change to meat-based diets Melting of permafrost Increased use of fertilisers *Effects (3 max):* Climate (in particular area) becomes hotter / wetter / drier / more extreme events if justified e.g. hurricanes in tropical regions Impact on agriculture (linked to above) Causes famine / price of food increases Species become extinct Other species (e.g. insects) increase in numbers May spread disease Sea levels rise due to melting of ice-caps AW melting of ice-caps causes disruption of ocean currents Causes flooding of coastal areas / gives example of such an area Economic growth may be restricted if energy use is restricted; Population shifts e.g. refugees from flooded / drought areas;	6	IGNORE increased use of CFC. Mention of countries which have not yet banned CFC can get AW mark NOT nitrogen oxides from car exhausts Any justified discussion of increased demand for energy / lifestyle / developing world NOT just "more car use" etc. Some detail required e.g. tropical rainforest becomes drier, S.Europe / temperate areas becomes hotter etc / more hurricanes in Gulf of Mexico ALLOW increased productivity of some agricultural areas NOT just polar bears die etc.

			QWC: organization and use of technical terms **2 marks** A: answer is clearly and coherently organized throughout **and** B: appropriate specialist vocabulary is used **1 mark** A: answer shows a degree of organization **and** B: some appropriate use of specialist vocabulary is made **0 mark** A: answer is not organized B: appropriate specialist vocabulary is not used	2	Or, e.g. cost of preventative measures such as flood protection Other valid points in each section, to a maximum of 3 Deals with all aspects of question Logical links between points No irrelevant information Lots of irrelevant information included
			Total	**10**	

2843/01

Question	Expected Answer	Mark
1(a)	Cut down & burn forest (to provide land for crops)	1
(b) (i)	300 million hectares	1
(ii)	$\frac{300,000,000}{1.7 \times 10^9}$ x 100% = 17.6% (ecf)	2
(c) (i)	40%	1
(ii)	starch/cellulose/glucose/biomass/carbohydrate/sugar/oil/ leaves/seeds/stem/roots	1
(iii)	converted to CO_2 CO_2 is greenhouse gas/ absorbs heat/ ir; (leading to) global warming/icecaps melting/sea level rise etc; CON if ozone layer mentioned. (Mention of smoke pollution, with justification, 2 marks)	3
(d)	insect pests; crop disease; nutrient depletion; weed growth; any 2	2
	Total	11
2(a)	Crops grown between rows of trees	1
(b)	layer of organic matter/material on land/leaves; Protects the soil;	2
(c)	Shades and smothers them;	1
(d)	**Plant trees a few metres apart** → **Prune trees** → **Put leaves on ground** → **poke holes in leaf layer (to plant crops)**	3
(e)(i)	Convert atmospheric N_2 to nitrates/ammonia;	1
(ii)	Increase nitrates in soil so trees/crops grow better; (or any other reasonable suggestion)	1

Question	Expected Answer	Mark
2(f)	*Inga* trees either side; Maize between; Labelled to show the rows a few metres apart; (Recognisable drawings of plants but no labels, 1 mark only)	3
(g)	(Excess nutrients) absorbed by tree roots; <u>Stored</u> in tree; Returned in subsequent prunings;	3
	Total	15
3(a)	Divided area into smaller plots; Added different nutrient to each; Only plot + P flourished;	3
(b)	<u>Ash</u> from burning; Encourages soil microbes to decompose organic matter; Releasing phosphorus;	3
(c)	No fresh organic matter; Bacteria die; No (P retrieving) trees to take up nutrients (therefore they are washed away); Any 2 from 3	2
(d)	Continuous supply of leaves feeding microbes; *Inga* trees take up P;	2
	Total	10

Question	Expected Answer	Mark
4(a)	Less light (for photosynthesis)/drier; So crops grow less well;	2
(b)	Takes less time; Supplies firewood;	2
(c)	Replace that removed by crops when harvested;	1
(d)	Shortage of seed/trees have not borne fruit;	1
(e)(i)	$\frac{5000 \times 1000}{2} = 2{,}500{,}000$	2
(ii)	$\frac{2{,}500{,}000 \times 2}{2{,}000} = 2500$ (ecf)	1
	Total	9

2844 Science and Environmental Management

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Question	Expected Answers	Marks
1 (a) (i)	Rainfall varies from year to year; Presence of pests varies; AW temperature / sunlight intensity vary;	2
(ii)	23 kg: Working – 2 from selection of 4600, calculation of 50%, calculation of 1%	2
(b)	400 tonnes = 400,000 kg; 400,000 / 20 = 20,000 hectares;	2
(c) (i)	Choose a plant which is <u>high yielding</u>; <u>Cross pollinate</u> two of these plants / <u>self-pollinate</u> plant AW gives detail of pollination technique e.g. transfer pollen from anthers to stigma; Grow seed and identify high-yielding plants AW if self-pollinate all plants will then be high yielding and can be cloned;	3
(ii)	Advantages: can introduce gene for high yield from <u>different species;</u> Technique is more predictable / faster; Disadvantages: introducing high-yielding genes can produce "superweeds" / cross-pollination with other plants; Long-term environmental effects uncertain; Needs more expensive technology / research is costly OVP e.g. ethical arguments properly made	4 TOTAL: 13

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Question	Expected Answers	Marks
2 (a) (i)	Equilibrium shifts to oppose; change in conditions;	2
(ii)	Equilibrium shifts to RHS; More gas molecules AW products occupy greater volume; Hence opposes decrease in pressure / raises pressure; ANY TWO	2
(iii)	Releases heat energy / converts chemical energy to heat energy;	1
(iv)	Heat released from condensation; Used to (pre-)heat (salt) water	2
(b)	Pressure causes water molecules to be closer together AW opposes water potential More frequent collisions with the membrane; water molecules pass through membrane To equalize concentration (of water molecules) / water potential AW moves from high concentration to low concentration AW from low concentration of water to high concentration AW opposes change in pressure; Amount of pure water increases / concentration of salt increases / salt molecules remain on LHS; ANY FOUR	4
(c)	Energy requirement of reverse osmosis and MSF is too great ; AW irrigation does not require completely pure water (if related to cost-effectiveness); AW irrigation requires too much water	1 2
(d)	Magnesium / sulphate / calcium / hydrogen carbonate ALLOW potassium, bromide ANY two ACCEPT completely correct formula	TOTAL: 14

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Question	Expected Answers	Marks
3 (a)	Increases; Increases;	2
(b) (i)	Liquid occupies less space / molecules are less free to move **ora** Particles are more ordered in a liquid **ora**; Fewer ways of arranging particles in a liquid **ora**; (ANY TWO)	2
(ii)	Energy is released / converted into heat; heat is a disordered form of energy; AW more ways of arranging (quanta of) energy ;	2
(iii)	Overall entropy change takes into account system and surroundings Entropy of system decreases but entropy of surroundings increases; Entropy increase of surroundings outweighs entropy decrease of system;	3 TOTAL: 9

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Question	Expected Answers	Marks
4 (a)	Lakes may have low nutrient levels when first formed; Nutrients enter lake through run-off ALLOW leaching; Nutrients = phosphates / nitrates; Cause an increase in plant growth; New / altered food chains can develop; High nutrient levels may cause increase in surface plants; Decrease sunlight levels at bottom of lake; Plants at bottom of lake are unable to survive; Decomposition may lower oxygen levels; May reduce population of fish / decrease biodiversity ANY FIVE POINTS	5
(b) (i)	Abiotic;	1
(ii)	Sunlight intensity / currents in lake causing mixing / rainfall (causing increased run-off);	1
(iii)	Farming / fertilizers cause increase in nitrates / phosphates; Sewage / fertilizers / detergents cause increase in phosphates; AW farming and sewage; These cause increase in nitrate AND phosphates	2
(c) (i)	Sewage works / factory;	1
(ii)	Not from a single location / widely spread;	1
(iii)	Run-off from fields; ALLOW acid rain	1
		TOTAL: 12

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Question	Expected Answers	Marks
5 (a)	Sexual; Gamete; Zygote; Meiosis; Homologous; Independent assortment; Four; Haploid;	8
(b) (i)	Tissue culture / grafting / taking cuttings /micropropagation;	1
(ii)	All plants will be identical to original plant; All plants identical to each other; Produces many plants from one original; ANY two points	2
		TOTAL: 11

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Question	Expected Answers	Marks
6 (a) (i)	Substance / gas which moves through the column / carries the sample	1
(ii)	Substance / solvent in the column which does not move;	1
(b) (i)	Any noble gas / nitrogen; ALLOW hydrogen	1
(ii)	To maintain a constant temperature / to ensure that different components remain vapourised;	1
(iii)	Substances have different boiling points / polarities AW interact differently with stationary phase ALLOW different charges; Rate of movement varies between compounds / depends on boiling point / polarity; Substances with low boiling point / low tendency to dissolve in solvent move faster AW reach end of column first	3
(c) (i)	Time spent in the column / before detection;	1
(ii)	A: 20% +/- 2 B: 20% +/- 2 C: 50% +/- 5 D: 10% +/- 1 1 mark – all numbers within 10% of above values 1 mark: evidence that intensity of peak has been divided by total intensity of all peaks (20);	2
(iii)	One substance may have retention time > 15 mins / is not volatile One substance may have same retention time as A,B,C or D	1
(d)	Atomic absorption spectroscopy / atomic emission spectroscopy / infra-red spectroscopy / uv spectroscopy / mass spectrometry ALLOW spectroscopy for 1 mark AW titration / any named chemical test ANY two named techniques NOT colorimetry	2 TOTAL: 13

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Question	Expected Answers	Marks
7 (a) (i)	x-axis drawn with appropriate scale and labeled as "CO_2 concentration / ppm"; points plotted correctly; smooth curve drawn;	3
(ii)	biomass must be breaking down /plant is producing CO_2 /respiration is occurring faster than photosynthesis	1
(iii)	(yes); the graph does not level off until CO_2 concentration exceeds 800 ppm **owtte;**	1
(iv)	More productivity means <u>more</u> photosynthesis / more biomass produced; This removes CO_2 (from the atmosphere<u>);</u>	2
(b)	**Photorespiration:** O_2 binds to an enzyme; RuBisCo / ribulosebisphosphate carboxylase; Which is involved in the first step of (light-independent) photosynthesis / C3 mechanism / Calvin cycle; In which RuBiP / ribulose bisphosphate combines with a CO_2 molecule; **Effect on photosynthesis** O_2 competes with CO_2 for (active site of)enzyme; Reduces rate of collision with active site (and hence rate of photosynthesis); Energy / respiration / ATP is required to remove O_2 from active site / regenerate PGA **C4 pathway** CO_2 converted into a C4 molecule; Malic acid This step occurs in palisade mesophyll cells C4 molecule transported to bundle sheath cells Broken down to release CO_2; and a 3C molecule PEP / phosphoenolpyruvate 3C molecule transported back to palisade mesophyll cells Combines with CO_2	

	Advantage of C4 pathway (one step in) photosynthesis occurs away from surface of leaf This is the step involving RuBisCo; Light intensity is lower in this part of the leaf / bundle sheath cells So less oxygen (to compete with CO_2 / bind to enzyme) **for quality of written communication** **organization & vocabulary** 2 marks **A** answer is clearly and coherently organized throughout **and** **B** appropriate specialist vocabulary is used extensively; *(e.g. names types of cell in leaf, names range of molecules involved in process, uses some terms related to enzyme mechanism)* 1 mark **A** answer shows a degree of organization **and** **B** some appropriate use of specialist vocabulary is made; *(more limited range of above)* 0 mark **A** answer is not organized **and** **B** appropriate specialist vocabulary is not used; **legibility & grammar** 2 marks **A** text is clearly legible **and** **B** spelling, punctuation, grammar are accurate throughout; (at least 4 sentences) 1 mark **A** text is untidy but can be read without difficulty **and** **B** spelling, punctuation, grammar show some mistakes; (at least 2 sentences) 0 mark **A** text is difficult to read; **and** **B** sp, punct, gram show a high proportion of mistakes;	7 4 TOTAL: 18

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Question	Expected Answers	Marks
1		
(a) (i)	0.452 m^3 (allow 0.45)	1
(ii)	M = d x v; mass = 980 x 4.0 x 10^{-4} = 0.392 kg (allow 0.39. (0.4 scores 1)	2
(iii)	D = m/v = 450/0.452 = 995 kg m^{-3} (1000 if 0.45 used in (i) ecf only if d is similar to 980)	1
(iv)	(Similar / less dense than water) so will be able to float / swim	1
(b) (i)	Force on each leg = 450 x 9.8 / 4; (=1.10 x 10^3) Area of leg bone = π x $(0.05)^2$ = 7.85 x 10^{-3} m^2	1
(ii)	Pressure = 1.10 x 10^4 / 7.85 x 10^{-3} = 1.40 x 10^6 (OR ecf e.g. 1.4 x 10^5) (pressure = 1.27 x 10^6 if 10,000N used as force on leg)	2
(iii)	(no) breaking stress is significantly higher than pressure on leg (yes) while walking pressure may increase to higher than breaking stress	1
(iv)	Force on leg = 0.392 x 9.8 / 4 = 0.96 N;ecf from (a) (ii) Pressure = 0.96 / 1.96 x 10^{-5} = 4.9 x 10^4 N m^{-2} so no risk of fracture;	2
(v)	Legs are unable to support very large bodies (without breaking) Movement may be too slow to avoid predators / find food / requires too much energy OVP e.g overheating	2 TOTAL: 13

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Question	Expected Answers	Marks
2		
(a)	Electrons occupy shells / energy levels; Electrons in high energy levels / further away from nucleus fall back (to lower energy levels / closer to nucleus) Difference in energy is given out as a specific frequency (hence separate lines) AW energy loss is quantised (hence separate lines); Bigger energy gap = higher frequency / E = hf Energy levels/ shells are closer together at high energies so frequencies are closer together at high frequency (any four points)	4
(b) (i)	Electron is lost / gained ; Producing a positive or negative ion AW cation or anion AW becomes charged;	2
(ii)	Missing value = 0.040	1
(iii)	All Points accurately plotted (allow missing value to be omitted ecf); Smooth curve drawn (extrapolated to x-axis);	2
(iv)	3.28×10^{15} Hz (Accept 3.26 – 3.30); ecf from graph	1
(v)	2.17×10^{-18} J (Accept 2.16 – 2.19) ecf; Answer given to 3 s.f;	2
		TOTAL: 12

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Question	Expected Answers	Marks
3	Need for N: Nitrogen is required to synthesise proteins AW DNA, chlorophyll Needed for use as enzymes / other valid role of proteins AW DNA used as genetic material, chlorophyll used in photosynthesis; Effect of farming: Farming removes crops / biomass Hence removes nitrogen from cycle / interrupts the cycle Not returned to soil / no decomposition occurs Natural nitrogen fixing e.g. by bacteria cannot replace this N Ploughing can encourage denitrification Bare soil can encourage run-off Use of agrichemicals: Agrochemicals / fertilisers replace lost N Example of **fertiliser** e.g ammonium salts, urea, nitrate compounds These compounds are soluble Problems caused by use of these agrichemicals:; Overuse of fertilisers causes eutrophication Nitrogen compounds run-off / leach into lakes etc. Cause algal blooms / other valid point about eutrophication Fertilisers require fossil fuels to be produced Causing global warming	10

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Question	Expected Answers	Marks
4 (a)	**Forces within structure** Molecular structure Atoms bonded together by; Covalent bonds Some covalent bonds e.g. C=C, C=O are double (CON if all bonds or if e.g. described as hydrogen bonds) Pairs of electrons attract nuclei OVP e.g. delocalised electrons in benzene ring **Intermolecular forces** Hydrogen bonds between molecules ; Between O and H of OH group; O = δ-, H = δ+; Caused by differences in electronegativities / high electronegativity of O Lone pair of electrons on O also involved; Both are small atoms; Hydrogen bonding is strongest imf; Dipole-dipole AW dipole(-type) forces between molecules AW Permanent dipole-permanent dipole; Dipole = opposite charges at two ends of bond / molecule; Gives example of a polar bond (could be shown in diagram) ; Molecule is asymmetrical; So whole molecule has a dipole; *Also* Instantaneous dipole – induced dipole / AW Van der Waals between molecules ALLOW permanent dipole-induced dipole Non-polar bonds / regions Become temporarily polarised by movement of electrons Induce dipole on neighbouring molecule	7
(b)	Soluble aspirin has an ionic structure / contains ions (Covalent O-H bond replaced by) ionic bond (O^- Na^+) Water molecules hydrate ions AW describes water molecules bonding / being attracted to ionic group / O^-Na^+ IGNORE reference to hydrogen bonds; Describes hydration e.g. δ+H of water bonds to O-, Na^+ bonds to O of water; Energy released by hydration Provides energy to break imf AW overall energy change is exothermic / energy changes balance out	3

5	**Nature of ultraviolet radiation** **Electromagnetic** radiation Gives details of this e.g. electric + magnetic fields High f**requency /** short wavelength (e.g. in comparison to visible light) Carries high energy Likely to cause bond breaking / ionisation Produced from very hot objects (e.g. Sun) **Importance of avoiding mutations** DNA consists of a sequence of bases Arranged in **codons** Three bases code for an amino acid If base sequence is altered, different amino acid is produced Altered **protein** results Changes in DNA / mutation passed on to daughter cells / next generation **Type of scientific studies used to assess danger of UVR** Called **epidemiology;** e.g. cohort study; Monitor two similar groups of people; Different levels of exposure to sun /UVR; Look for differences in skins cancer cases e.g. case control Look at sufferers from skin cancer Compare with similar patients without skin cancer Look for differences in uv exposure **The ozone layer and damage caused** Ozone = O_3 Present in **stratosphere** At relatively high concentrations e.g. 1% Absorbs uv radiation; ..of a a specific frequency range Ozone normally in steady state ALLOW equilibrium (with O_2) Presence of man-made chemicals / **pollutants** (damages ozone layer); Increase rate of breakdown; Decrease concentration of ozone / depletes ozone (NOT just creates holes) More uv reaches surface Example of these chemicals e.g. **CFCs**, methyl bromide Gives detail of process e.g. **chain reaction** / radical mechanism **The processes of absorption and reflection** White / shiny surfaces reflect well / e.g clouds reflect some uv Angle of incidence = angle of reflection Radiation not reflected is absorbed ora All frequencies reflected Reflection can be regarded as absorption followed by emission owtte Black surfaces / chemical bonds (in suncream) absorb light / radiation (Suncream) absorbs specific frequencies of radiation / photons (e.g. those causing damage) Energy transferred into another form AW energy of uv is absorbed e.g. heat / chemical energy / electrons promoted to higher energy levels

19 marks

for quality of written communication
organization & vocabulary

2 marks **A** answer is clearly and coherently organized throughout **and**
B appropriate specialist vocabulary is used extensively (e.g. words in bold);

1 mark **A** answer shows a degree of organization
and
B some appropriate use of specialist vocabulary is made;

0 mark **A** answer is not organized
and
B appropriate specialist vocabulary is not used;

legibility & grammar

2 marks **A** text is clearly legible
and
B spelling, punctuation, grammar are accurate throughout; (at least 4 sentences)

1 mark **A** text is untidy but can be read without difficulty
and
B spelling, punctuation, grammar show some mistakes;
(at least 4 sentences)

0 mark **A** text is difficult to read;
and
B sp, punct, gram show a high proportion of mistakes;

TOTAL: 23

Q6

Mark Scheme Page 6 of	Unit Code 2845	Session June	Year 2008	Version post-standardisation
Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT= answers which are not worthy of credit ( ) = words which are not essential to gain credit __ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument			

Question	Expected Answers	Marks
6	**Structure of cells:** (Cell/plasma) membrane is outer boundary of cells / keeps contents of cell separate / holds cell together Eukaryotic cells contain other organelles Organelles are membrane-bound structures Cell membrane controls passage of substances into cells Lipid bilayer Protein channels Mitochondria are site of respiration Break down glucose to produce ATP Ribosomes are site of protein synthesis Attached to endoplasmic reticulum Lysosomes break down unwanted substances Contain enzymes Nucleus controls cell / contains genetic material / DNA Nuclei has highest density Cytoplasm = solution of various substances Some respiration occurs in cytoplasm / other named reaction (glycolysis etc.) **Nature of enzymes** Proteins Globular / complex 3-D structure Have an active site Substrate enters and reaction occurs (AW is broken down) Active site is complementary to substrate Inhibition = reduces / stops enzyme activity Inhibitor blocks / fits into active site Or bonds to enzyme (at a separate active site), changing shape of enzyme (Changes in) pH causes shape of active site to change NOT denature Buffer solution maintains constant pH Changes in pH = changes in H+ (concentration) Groups in active site gain / lose H+ ions High temperature causes denaturation (IGNORE denaturation due to pH) Weak forces break Tertiary / 3-D structure changes AW active site changes shape Reactions will be slow at low temperature; because rate of (successful) collisions is low;	

	Techniques used *chromatography* Allows mixtures to be separated and/or identified Small spots of a solution of sample Placed on a thin-layer / silica / paper Dipped into solvent / water Silica/ thin layer/ paper = stationary phase, solvent = mobile phase Level of solvent must be below spots of sample Placed in beaker / tank and covered Solvent allowed to rise up plate Rf values measured / compare heights of spots with pure samples *NOT just "how far they have travelled"* Height of spots depends on polarity (ALLOW charge) of sample *Killing of animal* Must be rapid; And painless; Gives example of suitable method *Disruption of cell membrane* Use of ultrasound Use of detergent to break up lipids *Centrifugation* Separates organelles according to their density Gives order of density (e.g. cytoplasm → nucleus) Comment about density e.g. depends on mass of component molecules AND how closely-packed they are **18 marks** **for quality of written communication** **organization & vocabulary** 2 marks **A** answer is clearly and coherently organized throughout **and** **B** appropriate specialist vocabulary is used extensively; 1 mark **A** answer shows a degree of organization **and** **B** some appropriate use of specialist vocabulary is made; 0 mark **A** answer is not organized **and** **B** appropriate specialist vocabulary is not used; **legibility & grammar (in at least 4 sentences)** 2 marks **A** text is clearly legible **and** **B** spelling, punctuation, grammar are accurate throughout; 1 mark **A** text is untidy but can be read without difficulty **and** **B** spelling, punctuation, grammar show some mistakes; 0 mark **A** text is difficult to read; **and** **B** sp, punct, gram show a high proportion of mistakes;	18 4

2846

Mark Scheme Page 1 of 6	Unit Code 2846	Session June	Year 2008	Version pre-standardisation
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Question	Expected Answers	Marks
1 (a) (i)	A: core ALLOW outer core; B: inner /lower mantle; C: mantle AW mesosphere	3
(ii)	Reflected waves obeying law of reflection; *(any reasonable angle)* Refracted waves bent towards normal; Wavefronts closer in asthenosphere; *(first two marks can be awarded without wavefronts)*	3
(iii)	Random trace with **sudden** increase in amplitude AW random trace with start clearly labeled at t=0;	1
(iv)	**Different types** of waves may move at **different speeds**; Waves follow different route AW may be reflected off boundaries;	2
(v)	Waves arrive at different times (so they must have been reflected / refracted); AW no waves / S waves are detected at some points on the Earth surface / shadow zones exist (so the pathway has been altered by refraction / reflection)	1
(vi)	Asthenosphere is (semi)-molten / is able to flow; Allows plates to slide above it; (*needs to be linked to nature of asthenosphere in some way)* (Convection) currents exist in the (molten) asthenosphere (ANY two points) *NOT discussion of rising magma*	2
(b) (i)	The bands are arranged symmetrically; (+ any **two** from points below:) Bands on opposite sides formed at the same time; Magnetic polarity in rocks depends on Earth's magnetic field at the time the rock was formed Rocks separate when sea-floor spreads	3
(ii)	Spreading could be caused by the rising of rocks at a plate boundary AW plate tectonics provides a mechanism for sea-floor spreading	1 TOTAL 16

Mark Scheme **Page 1 of 6**	**Unit Code** **2846**	**Session** **June**	**Year** **2008**	**Version** **pre-standardisation**
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Question	**Expected Answers**	**Marks**
2 (a)	Molecular =dodecane; Giant molecular = diamond Ionic = sodium chloride Metallic = copper (4 correct → 3 marks, 3,2 correct → 2 marks, 1 correct → 1 mark)	3
(b)	Electrons are delocalized / free in the structure / sea of electrons NOT just "electrons move"; These electrons can move **when voltage applied** / from + to – in a circuit AW moving electrons = a current; NOT allows a current to pass	2
(c)	<u>Identification of differences/ similarities:</u> Diamond has a higher m.pt; Both have low electrical conductivity; Diamond has higher thermal conductivity (all these must be in the form of a comparison) <u>Explanation of differences</u> : *Melting point:* forces between **particles** greater in diamond; NOT just stronger bonds detail of this e.g. covalent bonds in diamond, id-id forces in dodecane *electrical conductivity* no ions / charged particles / no <u>free</u> electrons present in either substance; detail on this e.g. all bonds are non-polar; *thermal conductivity* energy can be passed on between particles more easily in diamond; detail of this e.g. all atoms / electrons are closer together;	6 TOTAL: 11

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Question	Expected Answers	Marks
3 (a)	equation used F = ma; Answer = 6.4×10^{10}; Unit = N; **Any** number in standard form obtained by a sensible **calculation**;	4
(b) (i)	Equation used $v^2 = u^2 + 2as$; Calculate value of v^2 (with correct value of u) [$4.0 \times 10^8 + 3.2 \times 10^6 = 4.032 \times 10^8$];	3
	Shows calculation of square root of v^2 (=2.008×10^4);ecf from wrong value of u *(=1789 if u taken as 0);*	1
(ii)	Change in velocity is very small / no change (no ecf)	
(c) (i)	Equation used Ek = ½mv^2 Substitutes **correct values** into equation ½ x 4.0 x 10^{10} x (2.0×10^4)^2; Obtains value of 8.0×10^{18} [2nd and 3rd marks awarded for correct answer with no working] *ecf if value from (b) (i)* Unit: J	4
(ii)	Transferred (temporarily) to kinetic energy of Moon material / causes movement of Moon material / AW vibration / sound generated in rock NOT sound, light alone; Causes heating; **Energy** dissipates / spreads/is dispersed;	3 TOTAL: 15

Mark Scheme Page 1 of 6	Unit Code 2846	Session June	Year 2008	Version pre-standardisation
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Question	Expected Answers	Marks
4 (a) (i)	(Surface temperature is high) because heated by sunlight; Temperature falls (rapidly) with depth ora; Reaches a constant temperature / 4C /does not change with depth below 2000m; 4C is maximum density of water and hence sinks to bottom;	4
(ii)	Evaporation occurs (at surface)	1
(b) (i)	It has a high density; Because it is salty it has been cooled (by air / cold water currents) ANY two	2
(ii)	The densities are different AW deep water current has a higher density than surface current;	1
(c)	Intermolecular distance in ice is greater (ora)	1
(d) (i)	Bottom half of molecule (H atoms) have positive charges AND Top half of molecule (O atoms) have negative charges; AW electronegativities / net nuclear charge of O and H are different / more electron clouds / lone pairs in O; Molecule / charges is unsymmetrical owtte	2
(ii)	δ+ H atom and δ- O atom / O atom with lone pair on different molecules; attract each other / some sharing of electrons	2
(e) (i)	Energy is required to break (hydrogen) bonds AW presence of hydrogen bonds make it more difficult to increase vibrational energy of water Water has more / stronger hydrogen bonds than any other liquid; The energy **input** is stored by the water AW energy is re-released when hydrogen bonds reform (any TWO points)	2

(ii)	Temperature remains mild owtte AW summers are cooler / winters are warmer (than continental regions); + 2 points from: Water cools down (more) slowly AW water stores energy ; Water heats up (more) slowly AW a lot of energy is required to raise 1kg by 1C owtte; Temperature of air is affected by temperature of ocean;	3 TOTAL: 18

Grade Thresholds

Advanced GCE Science 3885/7885
June 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
2841	Raw	60	41	36	31	27	23	0
	UMS	90	72	63	54	45	36	0
2842	Raw	60	42	37	32	27	23	0
	UMS	90	72	63	54	45	36	0
2843 Option A	Raw	120	96	86	76	66	57	0
	UMS	120	96	84	72	60	48	0
2843 Option B	Raw	120	96	86	76	66	57	0
	UMS	120	96	84	72	60	48	0
2844	Raw	90	61	54	48	42	36	0
	UMS	90	72	63	54	45	36	0
2845	Raw	90	53	46	39	33	27	0
	UMS	90	72	63	54	45	36	0
2846 Option A	Raw	120	84	76	68	61	54	0
	UMS	120	96	84	72	60	48	0
2846 Option B	Raw	120	84	76	68	61	54	84
	UMS	120	96	84	72	60	48	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3885	300	240	210	180	150	120	0
7885	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3885	9.4	23.2	41.4	61.6	81.2	0	405
7885	3.0	14.9	31.7	63.4	93.1	0	101

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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