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Mark Scheme (Results)

January 2014

International Advanced Level Biology (WBI04) Paper 01

Unit: 4 The Natural Environment and Species Survival

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgment is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Question Number	Answer	NOT	**Mark**
1(a)(i)	mitosis ;	meiosis	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. idea of making a slide of T cells (from blood / lymph nodes) ; 2. reference to named stain eg acetic orcein ; 3. credit correct details of method eg heating stain, using acid ; 4. idea of looking for mitotic features ;	2. ACCEPT acetocarmine, Feulgens, Schiffs, toluidine blue 3. ACCEPT idea of adding coverslip 4. ACCEPT stages of mitosis	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(b)	1. reference to cytokines (from T helper cells) ; 2. idea of involvement in {humoral response / activating B cells / eq} ; 3. idea of antibody production by plasma cells ; 4. idea of involvement in {cell mediated response / activating T killer cells / eq} ; 5. idea of T killer cells destroying infected (host) cells ;	2. ACCEPT stimulating, switching on NOT producing 4. ACCEPT stimulating 5. ACCEPT killer cells NOT natural killer cells	**(3)**

Question Number	Answer		Mark
1(c)(i)	**A** cytoplasm ;		**(1)**

Question Number	Answer		Mark
1(c)(ii)	**C** mitochondrion ;		**(1)**

Question Number	Answer	NOT	Mark
1(d)(i)	golgi / golgi body / golgi apparatus ;		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	1. reference to protein {modification / packaging / eq} ; 2. eg cytokines ; 3. eg CD4 (antigens / receptors) ; 4. idea of exocytosis (of synthesised proteins) ;	2. and 3. ACCEPT T cell receptor, protein that binds to MHC	**(3)**

Question **Number**	Answer				Mark
2(a)					
	Feature	**All viruses**	**Some viruses**	**Not found in viruses**	
	Cytoplasm			✗	
	DNA		✗		
	Protein coat (capsid)	✗			**(3)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. idea that long error bars indicate low reliability / short error bars indicate high reliability} ; 2. idea that reliability of later data is greater ; 3. reference to overlapping error bars (less reliable) ;	IGNORE refs to accuracy 1. ACCEPT range bars, standard deviation, SD 2. ACCEPT range bars, standard deviation, SD	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. idea that membrane proteins are involved ; 2. idea that {proteins / receptors} bind to the virus particles ; 3. idea that membrane needs to {be fluid / change shape / eq} ; 4. reference to movement of phospholipids (within membrane) ; 5. (to bring about) {phagocytosis / endocytosis / engulfing} ;	NB mps 1, 2 and 4 can be awarded if response is referring to penetration of virus into host cell ACCEPT Mps in context of bacteria instead of viruses 3. ACCEPT cell needs to change shape, extensions form, pseudopodia form 4. IGNORE ref. to proteins moving	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	idea that viruses are non-living ;	ACCEPT viruses do not have the target sites for antibiotics	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	1. use of hand washes / eq ; 2. reduce proximity of patients to each other / isolation / eq ; 3. reference to suitable dress eg masks, no jewellery ; 4. reference to suitable washing of {bedding / cutlery / cups / eq} ; 5. reference to correct disposal of {dressings / needles / eq} ; 6. reference to screening of {patients / visitors} ; 7. reference to {sterilizing equipment / disinfecting surfaces / eq} ;	3. ACCEPT hair covering, tying, no ties 7.ACCEPT use disinfectants IGNORE antiseptics	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	1. (rate of) {production of / energy incorporated into / eq} {biomass / organic material / eq} ; 2. reference to {losses in respiration / GPP – respiration / eq} ; 3. in {producers / plants};	1. NOT energy {converted / turned into} ACCEPT tissue 2. ACCEPT equation written in words	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a) (ii)	1. idea that NPP depends on photosynthesis ; 2. higher the temperature the more NPP ; 3. enzymes in {photosynthesis / (anabolic) chemical reactions / eq} {can work faster / have more kinetic energy / eq} ; 4. increase in rainfall increases NPP ; 5. idea of water needed for light-dependent reaction ; 6. reference to role of water in transport of {mineral ions / amino acids / sucrose / eq} ;	3. ACCEPT more enzyme-substrate complexes / more collisions of enzyme and substrate molecules / more energetic collisions 5.ACCEPT photolysis	**(5)**

Question Number	Answer	Additional Guidance	Mark
3(a) (iii)	1. idea that shape would be similar / credit a {description / sketch} of the graph; 2. idea that the {line would be higher / increase in GPP would be greater}(than NPP) ; 3. idea that GPP has to be higher than NPP as respiration has to be subtracted from GPP;	NB award 1 mark for idea that GPP would increase as rainfall increases as photosynthesis is faster, if no other marks awarded	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. correct subtraction (2800-1750 / 1050) ; 2. 1050 x 100 / 5300 (= 19.8 / 19.81 / 20) ;	NB Correct bald answer = 2 marks 2. C.E. eg 2800 x 100 / 5300 = 52.8 / 53	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)	{fatty acids / named fatty acid / eq} and {glycerol / propane triol / eq} ;	IGNORE numbers given IGNORE references to saturated or unsaturated	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)	1. idea that enzyme activity increases up to 60^{o}C and then drops ; 2. idea of increase in temperature results in increase in kinetic energy ; 3. resulting in more {collisions / energetic collisions} / enzyme-substrate complexes / eq} ; 4. idea that enzyme is denaturing (above 60°C) ; 5. due to {vibrations of within the enzyme / bonds changing / eq} ; 6. credit manipulation of figures e.g. 30 to 60°C increases by 55 a.u. ;	ACCEPT references to lipase and triglycerides throughout 1. piece together 4. NOT idea that enzyme starts to denature at 60°C 6. ACCEPT subtraction, division, %	**(5)**

Question Number	Answer	Mark
4(c)(i)	**D** valid ;	**(1)**

Question Number	Answer	Mark
4(c)(ii)	**D** $70^{o}C$ - $100^{o}C$;	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	1. idea of pollen {transferring / eq} genetic material ; 2. reference to pollen tube is {formed / eq} from the pollen ; 3. idea that pollen tube grows to {ovary / ovule / female gamete / micropyle /eq} ; 4. reference to {fertilisation / fusion} of the female gamete and the male gamete ; 5. producing a {(diploid) zygote / diploid cell} ; 6. idea of cell division (in formation of embryo plant) ;	ACCEPT nucleus for gamete 4. ACCEPT egg cell IGNORE generative nucleus 6.ACCEPT mitosis	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	1. starch is a {polysaccharide / polymer of glucose / eq} so stores energy / eq ; 2. Idea of compact so {lots of energy stored / more can be stored} ; 3. insoluble ; 4. idea it does not affect osmotic potential / eq ; 5. { branches / 1-6 glycosidic bonds} (in amylopectin) / eq ; 6. breaks down quickly / eq ;	2. IGNORE occupies less space 6. IGNORE references to easily broken down	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(b)	1. reference to {bacteria / fungi / named decomposer} (involved in decomposition) ; 2. idea that tannins absorbed by the { microorganisms / decomposers / eq} ; 3. reference to tannins killing the { microorganisms / decomposers / eq } / eq ; 4. idea of enzymes involved in {breakdown / eq} of {organic molecules / organic matter / eq (in leaves) } ; 5. credit named enzyme eg amylase ; 6. credit description of hydrolysis eg starch to maltose ; 7. idea that tannins may inhibit the enzymes ; 8. idea that there are only a few organisms that can decompose the leaves (which is why decomposition takes a long time) ; 9. idea that decomposition cannot happen until tannins broken down ;	IGNORE references to animals, that are not decomposers, eating the leaves Mps 2, 3, 7 and 9 relate to tannins 4.ACCEPT named organic molecule e.g. starch 7. IGNORE denaturing	**(4)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. idea that area varies (from 1970 to 2000) ; 2. description of a change in 1970s eg red areas disappear ; 3. description of a change in 1980s eg red areas increase towards the end ; 4. description of a change in 1990s eg red areas increase to 1995 ; 5. credit correct manipulation of figures ;	1. do not piece this statement together 2. IGNORE ref fluctuations in Mp2, 3 and 4 4.ACCEPT increases and decreases in 1990s	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)	idea that {there were no damaged trees / there were no beetles / survey had not started / photographic equipment not available / technology not available / no one realised what 'red areas' were / no records were kept (of the red areas) } ;	IGNORE planes not invented	**(1)**

Question Number	Answer	Additional Guidance	Mark
6(c)	1. idea that temperature affects {enzyme activity / metabolic reactions / eq} ; 2. idea that {growth / reproduction / life cycle / eq} of beetles is affected ; 3. credit appropriate comment about availability of food in relation to temperature ; 4. credit appropriate comment about numbers of (competitors / predators} ; 5. beetles die if conditions very cold /eq ; 6. credit appropriate comment about availability of food in relation to lack of water (due to high temperatures) ;	1.ACCEPT named metabolic reaction e.g. photosynthesis	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(d)	1. idea that before 1970 the temperature was {low / below the mean} and there was no 'red area' ; 2. idea that before 1970 the drought index was {low / below the mean} and there was no 'red area' ; 3. idea that as the temperature increases so does the 'red area' ; 4. idea that as the drought index increases so does the 'red area' ;	NB if years are quoted they must be sensible ACCEPT converse for mp3,4,5 and 6	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(e)	1. idea that this is a relatively short period of time ; 2. data only relates to {Alaska / one country /eq} / eq ; 3. {beetles / trees} may be affected by another (appropriate) factor ; 4. idea of only a correlation ; 5. periods of {drought / high temperatures} do not always coincide with years with large areas of 'red area' ; 6. reference to fluctuations in data ; 7. no information about number of measurements of {temperature / drought index} ; 8. no information on { validity of investigation / methodology / eq} ;	1. ACCEPT no data before 1970 2. 'not enough data' = 1 mark if neither mp 1 nor mp 2 awarded 3. ACCEPT size of red area	**(3)**

Question Number	Answer	Mark
7(a)	**D** stiffening of the muscles ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	1. correct values read from graph (57 to 57.5 & 12.5); 2. correct subtraction (=to 44.5 to 45) ;	NB Correct bald answer = 2 marks 2. C.E.	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. idea that (drop in) core temperature is related to time after death ; 2. idea that the drop in core temperature depends on ambient temperature ; 3. idea of using a {calibration / cooling} curve ; 4. idea that temperature affects rigor mortis ; 5. idea that evidence can be combined ;	1. ACCEPT reference to loss of (body) heat 5.ACCEPTtemperature and rigor mortis are both used ;	**(2)**

Question Number	*Answer*	Additional Guidance	*Mark*
7(b)(iii)	1. stated factor and effect on {heat loss / body temperature / drop in temperature} ; 2. idea of more heat loss gives an under-estimate OR idea of less heat loss gives an over-estimate ; ACCEPT any of the following factors that reduce heat loss: clothing / eq {large / fat} person / high BMI body { curled up / buried / in water / covered / in still air / in humid conditions / eq} {body temperature / fever / eq} (at time of death) ACCEPT any of the following factors that increases heat loss: (large) wounds / (lots of) bleeding /eq body moved from a cooler area / eq OR 3. {activity / exercise / eq} (at time of death) ; 4. Less ATP / speeds up rigor (mortis) / over-estimate / eq ;	NB ACCEPT converse throughout ACCEPT the estimate would be shorter ACCEPT the estimate would be longer 4.ACCEPT less glucose, glycogen, oxygen, more lactic acid	**(2)**

Question Number	*Answer*	Additional Guidance	*Mark*
7(c)	QWC assessing clarity of expression 1. idea of using a range of temperatures ; 2. in a {water bath / incubator} ; 3. idea that timing starts when a new stage of life cycle appears ; 4. and ends when the next stage appears ; 5. idea that several organisms should be used at each temperature ; 6. idea of providing food for organism ; 7. reference to appropriate controlled variable e.g. humidity, mass of food, species ; 8. idea that total length of life cycle can be{measured directly /	1. ACCEPT 5 temperatures / 5 stated temperatures, min -1 0°C and max 50°C ACCEPT {measuring length of stage / time to develop into next stage} for 1 mark 5. ACCEPT repeat 7. IGNORE light, pH, amount of food	**(5)**

Question Number	*Answer*	Additional Guidance	*Mark*
8(a)	1. reference to triplet coding system ; 2. idea that sequence of bases determines {order of amino acids / primary (protein) structure /eq} ; 3. reference to importance of {primary structure / eq} in {folding / 3D structure / tertiary structure / eq} of protein ; 4. idea of start sequences ; 5. Idea of stop codons ;	1. ACCEPT reference to triplet codons / 3 bases coding for one amino acid	**(3)**

Question Number	Answer	Additional Guidance	Mark
8 * (b)	QWC – emphasis spelling 1. reference to *transcription* ; 2. reference to {*post-transcriptional modification* / *splicing*} of (pre-) mRNA ; 3. reference to *spliceosomes* ; 4. reference to removal of *introns* ; 5. idea that *exons* are arranged in different combinations ; 6. idea that the (m)RNAs are different ; 7. reference to *translation* ; 8. idea of different {*primary structure* /*sequence* of *amino acids*} ; 9. idea that this results in different *bonds* ;	1. ACCEPT *transcribed* 2. ACCEPT *post-transcriptional changes* 5. ACCEPT the idea that not all *exons* are used 6. ACCEPT many (m)RNAs if not ambiguous 7.ACCEPT *translated*	**(6)**

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