Mark Scheme (Results)

Summer 2016

Pearson Edexcel
International Advanced Level
in Biology (WBI04) Paper 01
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 judgement 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.

Question Number	Answer	Additional guidance	Mark
1(a)(i)	**B** a globular protein ;		(1)

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	**A** decreases the activation energy of a metabolic reaction and decreases reaction time ;		(1)

Question Number	Answer	Additional guidance	Mark
1(a)(iii)	RNA polymerase / RNA ligase / helicase ;		(1)

Question Number	Answer	Additional guidance	Mark
1(a)(iv)	remove the introns / join the exons / (RNA / exons) splicing / post-transcriptional modification /eq ;	**ACCEPT** remove the non-coding regions **IGNORE** separating introns from exons	(1)

Question Number	Answer	Additional guidance	Mark
1(a)(v)	exon(s) ;	**IGNORE** extron	(1)

Question Number	Answer	Additional guidance	Mark
1(a)(vi)	1. idea that not all of the DNA codes for the polypeptide chain ; 2. reference to {post-transcriptional changes / RNA splicing} ; 3. (RNA) {introns being removed / one exon removed / exons rearranged /eq} ; 4. idea that different mRNAs can be produced ; 5. idea that each mRNA would result in a different {amino acid sequence / (poly)peptide} ;	**2 ACCEPT** post-transcriptional modification **3 NB** CE from part (v) applies **5 ACCEPT** protein different {numbers / orders} of exons code for different amino acid sequences	**(4)**

Question Number	Answer	Additional guidance	Mark
1(b)	1. correct reference to translation ; 2. (m)RNA {attaches / eq} to a ribosome ; 3. one tRNA brings one amino acid to the {ribosome / (m)RNA} / eq ; 4. reference to {binding / eq} of codon on (m)RNA to anticodon on tRNA ; 5. idea of formation of peptide bonds between adjacent amino acids ; 6. idea that the (poly)peptide detaches (from the RNA) ;	**1 ACCEPT** (m)RNA is translated **3 DO NOT ACCEPT** amino acids unless in context of tRNAs **6 ACCEPT** translation ends at the stop codon	**(4)**
Question	Answer	Additional guidance	Mark

Number			
*2	**(QWC – Take into account quality of written communication when awarding the following points)** 1. idea of decrease in body temperature ; 2. idea that ambient temperature affects the change in body temperature / eq ; 3. idea that (body / ambient) temperature affects {other parameters / named parameter} (used to estimate time of death) ; 4. {heavier / larger body} will lose heat slower / eq ; 5. because {surface area is smaller/ fat is a (heat) insulator / eq} ; 6. the time of making the measurements is needed to work backwards from / eq ; 7. a naked body will lose heat faster / eq ; 8. credit suitable explanation relating to a named location; 9. idea that several pieces of information are used (to estimate time of death) ;	**QWC emphasis on clarity of expression** **2 IGNORE** body temperature drops until it reaches ambient temperature **3** e.g. extent of rigor / stage of decomposition / insect {stage / type} **4 ACCEPT** converse **5 ACCEPT** converse if converse of mp 4 awarded **7 ACCEPT** an appropriate converse comment e.g. clothing will reduce heat loss **8** e.g. body in water will lose more heat (than body in air)	
			(6)

Question	Answer	Additional guidance	Mark

Number			
3(a)	1. reference to {nucleic acid / RNA or DNA} ;	1 IGNORE single /double / circular	
	2. idea of {a protein coat / capsids} ;		
	3. idea that envelope may be present ;		
	4. idea that enzymes may be present ;	4 ACCEPT reverse transcriptase / integrase may be present	
	5. idea of {receptors / attachment molecules} (on surface) ;	5 IGNORE gp120 / antigens	(2)

Question Number	Answer	Additional guidance	Mark
3(b)(i)		Bald answer of {61 / 60.9 / 60.6 / 60.91 / 60.63} gets 2 marks	
	1. values correctly read from graph (670 and 1100) ;	1 ACCEPT 1105 / 1110	
	2. correct percentage calculated (61 / 60.9 / 60.91);	2 ACCEPT 61 / 60.6 / 60.63 (if 1105 given) 60 / 60.4 /60.36 (if 1110 given)	(2)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	1. idea that not all those who were ill (in 2014) have died yet ; 2. idea of {good medical care / better technology}; 3. idea that {living conditions / diet / (general) health of people / hygiene} has improved ; 4. idea that the virus is less virulent ; 5. idea that some deaths not reported ;	**2 IGNORE** refs to medicines	**(2)**

Question Number	Answer	Additional guidance	Mark
3(c)(i)	**One from:** there was a long period of time when there was no disease / eq there were not many cases of the disease / eq there was not enough money / eq drug companies were focusing on other diseases / eq lack of knowledge about the disease / eq not recorded / eq not diagnosed / eq ;		**(1)**

Question	Answer	Additional guidance	Mark

Number			
3(c)(ii)	1. (phase I) (small) number of healthy individuals tested / eq ;	**1 ACCEPT** <100	
	2. (phase II) small number of patients tested / eq ;	**2 ACCEPT** idea that there are more people than in phase I < 1000	
	3. (phase III) large number of patients tested / eq ;	**3 ACCEPT** several hundred / 1000 <	
	4. (phase II or III) idea of {placebo / double blind trial / eq} ;		(3)

Question Number	Answer	Additional guidance	Mark
3(c)(iii)	1. idea that {interferon / chemicals} would prevent attachment of virus to host cell ;	**1 ACCEPT** prevents entry / infection of host cell	
	2. therefore virus particle can be {destroyed by the immune system / engulfed by macrophages / eq}	**2 DO NOT ACCEPT** killed	
	3. idea that without a host cell the virus cannot replicate ;		
	Chemicals only :		
		IGNORE interferon for mp 4 - 7	
	4. idea that chemicals could inhibit (viral) enzymes ;	**4 IGNORE** reverse transcriptase / integrase	
	5. idea that chemicals could prevent nucleic acid synthesis ;	**5 ACCEPT** DNA / RNA	
	6. idea that chemicals could prevent protein synthesis ;		
	7. idea that no new particles would be made ;		(3)
Question	Answer	Additional guidance	Mark

Number			
4(a)(i)	D plasma cell ;		(1)

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	C two antigen binding sites and one binding site for macrophages ;		(1)

Question Number	Answer	Additional guidance	Mark
4(a)(iii)	1. more IgA in humans / eq ; 2. less IgG (and IgG2) in humans / eq ; 3. human colostrum has less total antibody / eq; 4. human colostrum has fewer classes of antibody / eq; 5. credit correct comparative (between humans and bovine) manipulation of figures with units where appropriate ;	**ACCEPT** the converse throughout **4 ACCEPT** humans have no IgG2 but bovine does **5** e.g.IgA 13.5 mgcm^{-3}, IgG 47.2 mgcm^{-3}/ 119 times more, Total 36.6 mgcm^{-3} **IGNORE** 'calculations' of IgG2 only	(3)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	**D** natural passive ;		(1)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	1. calf is protected against {pathogens / eq} ; 2. idea that calf's immune system takes time to develop ; 3. idea of opsonisation ; 4. idea of agglutination ; 5. idea that phagocytosis is enhanced ; 6. idea of antitoxins ;	**4 ACCEPT** antibodies neutralize pathogen	(2)

Question Number	Answer	Additional guidance	Mark
5(a)(i)		**NB Piece together**	
	1. idea that spruce present 14 000 years ago but disappeared about 10 000 years ago ;	**1 ACCEPT** values between 9000 and 10 000 if actual figures given	
	2. idea that ash was very high around 12 000 years ago and then remained (in low numbers) until about 2 000 years ago ;	**2 ACCEPT** values between 11000 and 12 000 if actual figures given	
	3. idea that elm was very high around 11 000 years ago and then remained (in low numbers) until about 2 000 years ago ;	**3 ACCEPT** values between 10000 and 12 000, between 1000 and 2000 if actual figures given	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)(ii)		**NB if no other marks given, accept the idea that conditions get drier (overall) for 1 mark**	
	1. idea that conditions were (fairly) dry 14 000 years ago ;	**1 ACCEPT** at first	
	2. idea that conditions got wetter ;		
	3. and then got gradually drier about 5000 years ago ;	**3 ACCEPT** values between 5000 and 4000 if actual figures given	**(3)**

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	1. idea that the {abundance / types} of plant is reflected by the percentage of pollen grains present ; 2. idea that pollen from all species are low ; 3. adding the (four) values together does not add up to 100 ; 4. credit a reasonable estimate of total pollen count in a given year ;	**1 ACCEPT** if there were no other plants the value would be 100	(2)

Question Number	Answer	Additional guidance	Mark
5(b)	1. dendrochronology is the study of tree rings / eq ; 2. idea that each year a (new) tree ring is formed ; 3. idea that the size of the ring reflects the growth of the tree (that year) ; 4. idea that {size of ring / growth} is affected by {climate / named factor} ; 5. idea that photosynthesis is affected by {climate / named factor} ; 6. idea that the number of rings can be used to work out the timescale;		(3)

Question	Answer	Additional guidance	Mark

Number			
6(a)(i)	**B** methane and carbon dioxide ;		**(1)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	1. idea that {UV / shorter wavelengths of / eq} light can pass through the greenhouse gases ; 2. {heat (energy) / IR / longer wavelengths of light / eq} cannot pass back out (through greenhouse gases) / eq ; 3. increasing the temperature of the earth's {atmosphere / surface} / eq ; 4. idea that higher temperatures melt more of the ice ; 5. idea that less ice will {refreeze / form / eq} ;	**2 ACCEPT** absorbed / trap **4 ACCEPT** ice melts faster	**(3)**

Question Number	Answer	Additional guidance	Mark
6(b)	1. idea of less {habitat / hunting ground / eq} ; 2. idea that there will be less (seals) to feed on ; 3. idea that the bears are not building up sufficient food reserves ; 4. idea that the polar bears have to swim further {for food / to reach their dens}; 5. idea that there are fewer dens ;	**2 ACCEPT** bears will be without food for longer / death due to competition (with other polar bears) **3 ACCEPT** starving /not enough energy to reproduce	**(3)**

Question Number	Answer	Additional guidance	Mark
6(c)(i)	idea that there are {(skin / blood) cells / skin / blood / fur } in the footprint ;	**ACCEPT** hair / nails	(1)

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	1. less {intrusive / stressful / eq } to the bear ; 2. less likelihood of infection ; 3. idea of being safer for the scientist ; 4. cheaper ; 5. {easier / quicker / eq} to collect the {cells / hair / eq}	**1 ACCEPT** painful / harmful **2 ACCEPT** in context of either the bear or the human	(2)

Question Number	Answer	Additional guidance	Mark
6(c)(iii)	**B** gel electrophoresis ;		(1)

Question Number	Answer	Additional guidance	Mark
6(c)(iv)	1. idea of comparing (number / size / position) bands ; 2. idea of {comparing /matching} samples to (both) polar bears and the seals ; 3. idea that the polar bears and seals would have unique profiles but the sample would be a combination ; 4. idea of checking bands against those expected for other animals ;	**1 DO NOT ACCEPT** fragments	**(2)**

Question Number	Answer	Additional guidance	Mark
7(a)	1. idea that an environment includes the biotic and abiotic factors (of a habitat) ; 2. idea that a habitat is an area where organisms {live / interact / eq} ;	**1 ACCEPT** physical and biological factors	(2)

Question Number	Answer	Additional guidance	Mark
7(b)	1. for decomposition / eq (of plants / animals / excrement); 2. to improve the {quality / mineral content / depth / structure / eq } of the soil ; 3. idea of releasing carbon dioxide (back into atmosphere) ; 4. idea that carbon dioxide is used in photosynthesis ; 5. to recycle the {nitrogen / elements} ; 6. (microbes) provide food for other (soil) organisms ;	**1 ACCEPT** breakdown / decay / rotting **2 ACCEPT** adding humus **3 ACCEPT** recycle carbon / involved in carbon cycle **5 IGNORE** nutrients **ACCEPT** nitrogen fixation / involved in nitrogen cycle **6 IGNORE** nutrients	(3)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	1. {range / variety /number / abundance} of (different) species ; 2. in an {area / habitat / location / ecosystem / environment / community } ;	**1 ACCEPT** amount **2 ACCEPT** in the biosphere	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	1. idea of fewer {types of plant / (plant) species} ; 2. idea of absorbing different {amounts / wavelengths} of light ; 3. different species have different structures (related to absorbing light) eq ;	**1 IGNORE** number of plants	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(iii)	1. idea that if there is less light (energy) being used there will be less photosynthesis ; 2. idea that if light-dependent reaction is reduced there will be less {ATP / reduced NADP / eq} ; 3. idea that {carbon fixation / Calvin cycle / light-independent reaction } will be less ; 4. idea that as a result less GALP will be made ; 5. so less {hexose / glucose} made ; 6. so less {biomass / organic material / named organic polymer / eq} made ;	**NB must be at least one reference to {less / eq} for full marks to be awarded** **1 ACCEPT {**photosynthesis / light-dependent reaction} will be slower **3 ACCEPT** less GP	**(4)**

Question Number	Answer	Additional guidance	Mark
8(a)	1. idea that cellulose is {polymer / polysaccharide} of β glucose ; 2. reference to 1-4 glycosidic {bonds / eq} ; 3. idea that every other glucose is {inverted / rotated by 180°C} ;	**1 ACCEPT** made of β glucose monomers	(3)

Question Number	Answer	Additional guidance	Mark
*8(b)(i)	**(QWC – Take into account quality of written communication when awarding the following points)** 1. idea that {each / all} of the 5 habitats have to be sampled ; 2. idea that an area is marked off in each habitat ; 3. idea of placing the quadrat at random ; 4. credit method of generating random sites ; 5. idea of counting which { quadrat / quadrat sections} contain pellets (and which don't) ; 6. idea that several quadrats used in each area to calculate a mean ; 7. credit description of how percentage is calculated ;	**QWC emphasis on logical sequence** **1** Piece together **4** e.g. number generator, phone APP **6 ACCEPT** a stated value 3 ≤	(5)

Question	Answer	Additional guidance	Mark

Number			
8(b)(ii)	1. idea that hares eat {a number of / five / eq} different plant species ;		
	2. idea that {most feeding is done on young heather / old heather and mat grass is fed on the least} ;	**2 ACCEPT** most pellets in young heather / least pellets in old heather and mat grass	(2)

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	1. idea that there may be other plants that they eat (that weren't sampled) ; 2. idea that the abundance of food affected the number of pellets ; 3. idea that pellets may have been from other species ; 4. idea that quantity of pellets was not measured (so may not represent the number of hares in an area) ; 5. idea that hares move from feeding site before producing pellets ; 6. idea of seasonal variation ; 7. idea that the pellets get moved {away from/ into / eq} where they were sampled ; 8. idea that pellets get {decomposed / eaten / eq} ;		(3)