



Mark Scheme (Results)

Summer 2016

Pearson Edexcel
International Advanced Level
in Biology (WBI04) Paper 01
The Natural Environment and Species
Survival

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016

Publications Code 46645_MS*

All the material in this publication is copyright

© Pearson Education Ltd 2016

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 exon	(1)

Question Number	Answer	Additional guidance	Mark
1 (a) (vi)	<ol style="list-style-type: none"> idea that not all of the DNA codes for the polypeptide chain ; reference to {post-transcriptional changes / RNA splicing} ; (RNA) {introns being removed / one exon removed / exons rearranged /eq} ; idea that different mRNAs can be produced ; idea that each mRNA would result in a different {amino acid sequence / (poly)peptide} ; 	<p>2 ACCEPT post-transcriptional modification</p> <p>3 NB CE from part (v) applies</p> <p>5 ACCEPT protein different {numbers / orders} of exons code for different amino acid sequences</p>	(4)

Question Number	Answer	Additional guidance	Mark
1 (b)	<ol style="list-style-type: none"> correct reference to translation ; (m)RNA {attaches / eq} to a ribosome ; one tRNA brings one amino acid to the {ribosome / (m)RNA} / eq ; reference to {binding / eq} of codon on (m)RNA to anticodon on tRNA ; idea of formation of peptide bonds between adjacent amino acids ; idea that the (poly)peptide detaches (from the RNA) ; 	<p>1 ACCEPT (m)RNA is translated</p> <p>3 DO NOT ACCEPT amino acids unless in context of tRNAs</p> <p>6 ACCEPT translation ends at the stop codon</p>	(4)
Question	Answer	Additional guidance	Mark

Number			
*2	<p>(QWC – Take into account quality of written communication when awarding the following points)</p> <ol style="list-style-type: none"> 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) ; 	<p>QWC emphasis on clarity of expression</p> <p>2 IGNORE body temperature drops until it reaches ambient temperature 3 e.g. extent of rigor / stage of decomposition / insect {stage / type}</p> <p>4 ACCEPT converse</p> <p>5 ACCEPT converse if converse of mp 4 awarded</p> <p>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)</p>	<p>(6)</p>

Question	Answer	Additional guidance	Mark
----------	--------	---------------------	------

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

Question Number	Answer	Additional guidance	Mark
3(b)(i)	1. values correctly read from graph (670 and 1100) ; 2. correct percentage calculated (61 / 60.9 / 60.91) ;	Bald answer of {61 / 60.9 / 60.6 / 60.91 / 60.63} gets 2 marks 1 ACCEPT 1105 / 1110 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)	<ol style="list-style-type: none"> 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)	<p>One from:</p> <p>there was a long period of time when there was no disease / eq</p> <p>there were not many cases of the disease / eq</p> <p>there was not enough money / eq</p> <p>drug companies were focusing on other diseases / eq</p> <p>lack of knowledge about the disease / eq</p> <p>not recorded / eq</p> <p>not diagnosed / eq ;</p>		(1)

Question	Answer	Additional guidance	Mark
----------	--------	---------------------	------

Number			
3(c)(ii)	<ol style="list-style-type: none"> (phase I) (small) number of healthy individuals tested / eq ; (phase II) small number of patients tested / eq ; (phase III) large number of patients tested / eq ; (phase II or III) idea of {placebo / double blind trial / eq} ; 	<p>1 ACCEPT <100</p> <p>2 ACCEPT idea that there are more people than in phase I < 1000</p> <p>3 ACCEPT several hundred / 1000 <</p>	(3)

Question Number	Answer	Additional guidance	Mark
3(c)(iii)	<ol style="list-style-type: none"> idea that {interferon / chemicals} would prevent attachment of virus to host cell ; therefore virus particle can be {destroyed by the immune system / engulfed by macrophages / eq} idea that without a host cell the virus cannot replicate ; <p>Chemicals only :</p> <ol style="list-style-type: none"> idea that chemicals could inhibit (viral) enzymes ; idea that chemicals could prevent nucleic acid synthesis ; idea that chemicals could prevent protein synthesis ; idea that no new particles would be made ; 	<p>1 ACCEPT prevents entry / infection of host cell</p> <p>2 DO NOT ACCEPT killed</p> <p>IGNORE interferon for mp 4 - 7</p> <p>4 IGNORE reverse transcriptase / integrase</p> <p>5 ACCEPT DNA / RNA</p>	(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)	<ol style="list-style-type: none"> 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 ; 	<p>ACCEPT the converse throughout</p> <p>4 ACCEPT humans have no IgG2 but bovine does</p> <p>5 e.g. IgA 13.5 mgcm^{-3}, IgG 47.2 mgcm^{-3} / 119 times more, Total 36.6 mgcm^{-3}</p> <p>IGNORE 'calculations' of IgG2 only</p>	(3)

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

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	<ol style="list-style-type: none">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)	<ol style="list-style-type: none"> 1. idea that spruce present 14 000 years ago but disappeared about 10 000 years ago ; 2. idea that ash was very high around 12 000 years ago and then remained (in low numbers) until about 2 000 years ago ; 3. idea that elm was very high around 11 000 years ago and then remained (in low numbers) until about 2 000 years ago ; 	<p>NB Piece together</p> <p>1 ACCEPT values between 9000 and 10 000 if actual figures given</p> <p>2 ACCEPT values between 11000 and 12 000 if actual figures given</p> <p>3 ACCEPT values between 10000 and 12 000, between 1000 and 2000 if actual figures given</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	<ol style="list-style-type: none"> 1. idea that conditions were (fairly) dry 14 000 years ago ; 2. idea that conditions got wetter ; 3. and then got gradually drier about 5000 years ago ; 	<p>NB if no other marks given, accept the idea that conditions get drier (overall) for 1 mark</p> <p>1 ACCEPT at first</p> <p>3 ACCEPT values between 5000 and 4000 if actual figures given</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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} ; 	<p>2 ACCEPT absorbed / trap</p> <p>4 ACCEPT ice melts faster</p>	(3)

Question Number	Answer	Additional guidance	Mark
6(b)	<ol style="list-style-type: none"> 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 ; 	<p>2 ACCEPT bears will be without food for longer / death due to competition (with other polar bears)</p> <p>3 ACCEPT starving /not enough energy to reproduce</p>	(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)	<ol style="list-style-type: none"> 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} 	<p>1 ACCEPT painful / harmful</p> <p>2 ACCEPT in context of either the bear or the human</p>	(2)

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

Question Number	Answer	Additional guidance	Mark
6(c)(iv)	<ol style="list-style-type: none">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)	<ol style="list-style-type: none"> idea that an environment includes the biotic and abiotic factors (of a habitat) ; 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)	<ol style="list-style-type: none"> for decomposition / eq (of plants / animals / excrement); to improve the {quality / mineral content / depth / structure / eq } of the soil ; idea of releasing carbon dioxide (back into atmosphere) ; idea that carbon dioxide is used in photosynthesis ; to recycle the {nitrogen / elements} ; (microbes) provide food for other (soil) organisms ; 	<p>1 ACCEPT breakdown / decay / rotting</p> <p>2 ACCEPT adding humus</p> <p>3 ACCEPT recycle carbon / involved in carbon cycle</p> <p>5 IGNORE nutrients ACCEPT nitrogen fixation / involved in nitrogen cycle</p> <p>6 IGNORE nutrients</p>	(3)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	<ol style="list-style-type: none"> 1. {range / variety / number / abundance} of (different) species ; 2. in an {area / habitat / location / ecosystem / environment / community } ; 	<p>1 ACCEPT amount</p> <p>2 ACCEPT in the biosphere</p>	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	<ol style="list-style-type: none"> 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 ; 	<p>1 IGNORE number of plants</p>	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(iii)	<ol style="list-style-type: none">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 ;	<p>NB must be at least one reference to {less / eq} for full marks to be awarded</p> <p>1 ACCEPT {photosynthesis / light-dependent reaction} will be slower</p> <p>3 ACCEPT less GP</p>	(4)

Question Number	Answer	Additional guidance	Mark
8(a)	<ol style="list-style-type: none"> idea that cellulose is {polymer / polysaccharide} of β glucose ; reference to 1-4 glycosidic {bonds / eq} ; 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)	<p>(QWC – Take into account quality of written communication when awarding the following points)</p> <ol style="list-style-type: none"> idea that {each / all} of the 5 habitats have to be sampled ; idea that an area is marked off in each habitat ; idea of placing the quadrat at random ; credit method of generating random sites ; idea of counting which { quadrat / quadrat sections} contain pellets (and which don't) ; idea that several quadrats used in each area to calculate a mean ; credit description of how percentage is calculated ; 	<p>QWC emphasis on logical sequence</p> <p>1 Piece together</p> <p>4 e.g. number generator, phone APP</p> <p>6 ACCEPT a stated value $3 \leq$</p>	(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)

