Mark Scheme (Results)

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

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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	Mark
1(a)(i)	A step 1 The only correct answer is A *B is not correct because RUBISCO does not catalyse the conversion of GP to GALP* *C is not correct because RUBISCO does not catalyse the conversion of GALP to glucose* *D is not correct because RUBISCO does not catalyse the regeneration of RuBP from GALP*	(1)

Question Number	Answer	Mark
1(a)(ii)	B step 2 The only correct answer is B *A is not correct because reduced NADP and ATP are not involved carbon fixation* *C is not correct because reduced NADP and ATP are not involved in the conversion of GALP to glucose* *D is not correct because reduced NADP and ATP are not involved in the regeneration of RuBP from GALP*	(1)

Question Number	Answer	Mark
1(a)(iii)	C 3 The only correct answer is C *A is not correct because fructose,* **a glucose and β glucose are all monosaccharides** *B is not correct because* **fructose, a glucose and β glucose are all monosaccharides** *D is not correct because* **fructose, a glucose and β glucose are all monosaccharides**	(1)

Question Number	Answer	Mark
1(a)(iv)	C 3 The only correct answer is C *A is not correct because all four are polysaccharides* *B is not correct because all four are polysaccharides* *D is not correct because all four are polysaccharides*	(1)

Question Number	Answer	Additional guidance	Mark
1(b)(i)	1. (increase in temperature) increases (rate of photosynthesis) / eq ; 2. by 75 (a.u.) / 1.38 x / 1.4 x / 38.46% / 38.5% ;	1 ACCEPT converse	(2)

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	1. idea that carbon dioxide (concentration) is {the same / low} ;		
	2. therefore (the concentration of) carbon dioxide is having the effect ;	2 ACCEPT carbon dioxide is {rate limiting / a limiting factor / eq}	
	3. so there is { the same / not more} {substrate / carbon dioxide / eq } for { RUBISCO / carbon fixation / Calvin cycle / light-independent reaction / eq };		
	4. idea that the rate is not affected by temperature and light intensity ;		(3)

Question Number	Answer	Additional guidance	Mark
1(b)(iii)	1. { value / range } given for K (greater than 180 and less than 270) ;	1 ACCEPT answer written in table	
	2. because temperature is higher (than G) but light intensity is { 3 not 6 / same / eq } ;	2 ACCEPT converse	
	3. { value / range } given for L (greater than 270 and their value for K) ;	3 ACCEPT answer written in table	
	4. because the temperature is higher than H / eq ;	4 ACCEPT converse	
	5. because the light intensity is higher than K / eq ;	5 ACCEPT converse	(4)

Question Number	Answer	Additional guidance	Mark
2(a)	1. idea that { there will not be such an increase in flow of blood (to an area) / blood vessel will not become as permeable / blood vessels will not dilate / eq } 2. idea that there will not be such an increase in { white blood cells / macrophages / phagocytes } (to the area) ; 3. idea that fewer macrophages to present antigen (for T helper cells) ; 4. idea that without T helper cells activation { B cells / T killer cells / eq } will not be activated ;	2 IGNORE lymphocytes, immune cells	(3)

Question Number	Answer	Additional guidance	Mark

2(b)	1. azothioprine will prevent the increase in T (helper) cells ;
	
	2. as they will not be able to divide (to form more T helper cells) ;
	
	3. as they will not be able to replicate the DNA needed for mitosis takes place ;
		1 ACCEPT number of T cells stays the same
		  ACCEPT will decrease if justified by cells dying and not being replaced
		2 ACCEPT reproduce
		  IGNORE produce
			(2)

Question Number	Answer	Additional guidance	Mark
2(c)	1. T helper cells are needed to activate T killer cells ; 2. (T killer cells activated) by cytokines ; 3. there will { not be any / be fewer } T killer cells to release { enzymes / chemicals / perforins } ; 4. <u>cells</u> (of the transplant) will not be destroyed by the { enzymes / chemicals / perforins } / eq ;	4 IGNORE tissues	(3)

Question Number	Answer	Additional guidance	Mark
3(a)	1. (mRNA) is a copy of the { DNA / genetic } code ; 2. to take this { code / information / eq } { out of the nucleus / into the cytoplasm / to the ribosomes } ; 3. for { translation / eq } ; 4. idea of post transcriptional modification to enable one { gene / (pre) mRNA } to code for more than one peptide ;	3 ACCEPT description e.g. tRNAs line up the amino acids against mRNA, template for protein synthesis	(3)

Question Number	Answer	Mark
3(b)(i)	B hydrogen The only correct answer is B *A is not correct because glycosidic bonds bind two monosaccharides together* *C is not correct because peptide bonds bind two amino acids together* *D is not correct because phosphodiester bonds bind a phosphate group of one mononucleotide to a ribose of another mononucleotide*	(1)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	1. idea that tRNA is specific for { amino acid / codon on mRNA } ; 2. to ensure that the { sequence of amino acids / primary structure of protein / (poly)peptide } is correct / eq ; 3. otherwise the { bonding / folding / structure / function / eq } of the protein will be incorrect ;	2 ACCEPT if tryptophan is not inserted then the wrong peptide will be made IGNORE protein	(2)

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	1. reference to { degenerate code / code is degenerate } ; 2. idea that (some) amino acids have more than one code ; 3. idea that there will be a different tRNA for each codon (on the mRNA) ;	2 ACCEPT codon / correspond to more than one base sequence	(2)

Question Number	Answer	Additional guidance	Mark
3(b)(iv)	1. reference to stop codons ; 2. so tRNAs anticodons (to the stop codons) do not exist / eq ;	1 IGNORE start codon 2 ACCEPT tRNAs do not bind to stop codons	(2)

Question Number	Answer	Additional guidance	Mark
*4(a)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)	QWC emphasis on logical sequence	
	1. as temperature increases the rate of development decreases / eq ;	1 ACCEPT idea that rate of development is faster below OST and is lower above OST Piece together	
	2. reference to enzymes (involved in development) ;		
	3. idea that the optimum temperature for these enzymes is below the OST;		
	4. increase in temperature increases the kinetic energy / eq ;		
	5. (increase in temperature) increases { number of collisions / energy of collisions / eq } (up to optimum temperature) ;		
	6. (increase in temperature) results in vibrations of the R groups / eq ;		
	7. (increase in temperature) causes bonds to break within the enzyme ;		
	8. denaturing the enzyme / active site does not bind (so well) with substrate / eq ;	8 DO NOT ACCEPT start to denature	
	9. idea that temperature could be affecting gene activity ;		(6)

Question Number	Answer		Mark
4(b)(i)	☒ C The only correct answer is C A is not correct because there are more females than males at OST B is not correct because the number of females does not level off D is not correct because the number of females does not level off		(1)

Question Number	Answer	Mark
4(b)(ii)	C interactions between genotype and the environment The only correct answer is C A is not correct because there are only two sexes B is not correct because crossing over occurs in meiosis D is not correct because there are only two sexes	(1)

Question Number	Answer	Additional guidance	Mark
4(c)	1. global warming results in the increase in <u>sand</u> temperature / eq ;		
	2. idea that numbers could decrease (as rate of development is slower) because more eggs are { eaten / collected / eq } ;		
	3. idea that (decrease in embryo survival) will reduce number of turtles hatching ;		
	4. idea of fewer turtles increases risk of predation / eq ;	4 ACCEPT increase in predator prey ratio	
	5. idea that as there is an increased proportion of females more eggs will get laid ;		
	6. idea that a decreased proportion of { males / females } results in { less eggs fertilised / difficulty in finding a mate } ;		
	7. idea that a decrease in numbers will decrease the genetic diversity, decreasing numbers (further) ;		
	8. credit an indirect affect of global warming ;	8 e.g. flooding washes eggs away, effect on food supply	(4)

Question Number	Answer	Additional guidance	Mark
5(a)	bacteria are inside { cells / tissues } / eq ;	ACCEPT invade IGNORE infect	(1)

Question Number	Answer	Additional guidance	Mark
*5(b)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. idea of culturing *M. tuberculosis* with { agar / broth } ; 2. idea that different antibiotics are used ; 3. in a number of different <u>combinations</u> ; 4. credit mode of applying antibiotic; 5. idea of incubating bacteria with antibiotic for a period of time ; 6. credit reference to using { aseptic technique / named aseptic technique } ; 7. credit appropriate description of how results are assessed to determine most suitable <u>combination</u> ;	QWC emphasis on clarity of expression 1 IGNORE bacteria put in petri dish 4 e.g. soaked filter paper disc on agar, added to broth, incorporated into agar 5 DO NOT ACCEPT stated time period of less than 12 hours 6 e.g. work near a Bunsen burner 7 e.g. most suitable combination has largest zone of inhibition, most suitable combination has the least turbidity	(6)

Question Number	Answer	Additional guidance	Mark
5(c)(i)	1. 100 x 3 x 8 / 2400 ; 2. Hero rat can analyse 2370 more samples ;		(2)

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	1. 80% of 150 = 120 ; 2. 58% of 150 = 87 ; 3. 33 more people identified ;	3 ACCEPT 1.38 x /1.4 x / 37.9%	(3)

Question Number	Answer	Additional guidance	Mark
5(c)(iii)	1. body temperature of rat is not suitable / eq ; 2. rat macrophages can destroy *M. tuberculosis* / eq ;		(1)

Question Number	Answer	Additional guidance	Mark
6(a)	group of { organisms / eq } that can { reproduce / eq } to produce fertile offspring / eq ;	IGNORE viable	(1)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. to reduce inbreeding / eq ; 2. idea of maintaining { genetic diversity / size of gene pool / eq } ; 3. ensuring the giant panda has ability to adapt to change ; 4. to identify the { fertile / suitable / eq } males / eq ;	NB accept the converse in the correct context 3 ACCEPT prevent inheritance of a defect / e.g. of a change	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. DNA used from cub, mother and all the possible fathers ; 2. credit named source of DNA ; 3. credit detail of gel electrophoresis ; 4. credit method of visualising DNA ; 5. idea of matching the (DNA) <u>bands</u> ;	1 piece together 2 e.g. blood, skin, fur, saliva, sperm (from male) 3 e.g. restriction enzymes / loading onto gel / applying current 4 e.g. southern blotting / staining	(4)

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	*In vitro* method: 1. idea of observing sperm under a microscope ; 2. idea of looking at structure / number (of sperm) ; 3. idea of looking at sperm mobility ; 4. idea of { observing fertilisation taking place / looking at viability of embryo / eq }; 5. idea of comparing frozen sperm to fresh sperm (from the same male) ; 6. idea of using { proteomics / DNA analysis / eq } ; OR *In vivo* method: 7. credit detail of A.I. ; 8. idea of looking at pregnancy success rate ; 9. idea of looking at full term pregnancy rate ; 10. idea of looking at health of cubs ; 11. idea of comparing frozen sperm to fresh sperm (from the same male) ; 12. idea of using { proteomics / DNA analysis / eq } ;	7 e.g. inject sperm into female, use of fertility hormones	(4)

Question Number	Answer	Mark
6(c)	C primers *The only correct answer is C* *A is not correct because DNA polymerase is not DNA-specific* *B is not correct because mononucleotides are present in all DNA* *D is not correct because restriction enzymes are base sequence specific*	(1)

Question Number	Answer	Additional guidance	Mark
7(a)		DO NOT ACCEPT gene for allele	
	1. idea that the baby needs both alleles to be recessive to have the disorder ;	1 ACCEPT homozygous recessive labelled genotype in a genetic diagram	
	2. therefore has to inherit a recessive allele from each parent ;	2 'inherits two recessive alleles one from each parent and gets the disease' = 2 marks ACCEPT from a genetic diagram **that has labelled the parent's alleles**	
	3. therefore each parent must be { heterozygous / carriers } ;	3 ACCEPT description of heterozygosity in terms of different alleles from a genetic diagram **that has labelled the parent's alleles**	(3)

Question Number	Answer	Additional guidance	Mark
7(b)	SIMILARITY: 1. both result in weakened immune system / eq ; OR both affect T helper cells ; DIFFERENCE: 2. adenosine deaminase deficiency { caused by a mutation / is a genetic condition / is inherited / eq } but HIV caused by a { virus / infection } ; OR { both B and T cells / B cells } affected in adenosine deaminase deficiency but { only the T helper cells / no B cells (directly) } affected in HIV ;	DO NOT piece together 1 IGNORE affect / attack	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(i)	1. { attach / target / eq } (specific) cells; 2. are hollow (to carry gene) / eq ; 3. can enter { itself / nucleic acid / DNA / RNA /eq } into (host) cells / eq ;	1 ACCEPT bone marrow cells / lymphocytes	(2)

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	1. liposome can { fuse with / eq } (target cell) membrane ; 2. because the phospholipid layer is fluid / eq ; 3. idea that non polar (fatty acid) tails prevent { large / polar } DNA from escaping ; 4. idea that DNA can be carried because it is a { micelle / non polar (fatty acid) tails face each other / eq } ; 5. idea that the polar heads make the liposome soluble in { blood / cytoplasm / water } ;	2 IGNORE fluid mosaic model	(2)

Question Number	Answer	Additional guidance	Mark
8(a)	1. idea that the tree roots will hold the sand together ; 2. idea that decomposition (of trees) will add { humus / organic matter / mineral ions / eq } to the <u>sand</u> ; 3. idea that improved soil (from growing trees) will hold more water ; 4. idea that { improved soil / more water in soil / humus / eq } will encourage growth of (other) plants ;		(2)

Question Number	Answer	Additional guidance	Mark
8(b)	1. idea that biodiversity is { species richness (and genetic diversity) / the number of different <u>species</u> in a habitat } ; 2. idea that fast-growing trees would { outcompete / outgrow / choke / eq } the existing plants ; 3. (competition for) { light / water / mineral ions / space } ; 4. causing a decrease in the number of { species / eq } of { plants / trees } ; 5. idea that the number of animal { species / eq } in the original forests would drop ; 6. (drop) due to loss of { food / shelter / habitat / eq } / eq ;	4 ACCEPT types / different species die out 5 ACCEPT types / different species die out	(4)

Question Number	Answer	Additional guidance	Mark
8(c)	1. idea that fast-growing trees will { have a greater GPP / be producing biomass faster / have a greater NPP } ; 2. idea that fast-growing trees will be photosynthesising faster ; 3. and therefore (fast-growing trees) removing more carbon dioxide from the atmosphere / eq ; 4. idea that if the removal of carbon dioxide is greater than the rate carbon dioxide being added into the atmosphere then global warming will be reduced ; 5. idea that there is less carbon dioxide to trap the { infra red radiation / heat <u>energy</u> / eq } ; 6. idea that more carbon is locked up in { larger/ fast-growing } trees ;	4 ACCEPT decrease net increase 5 ACCEPT absorb	(4)

Question Number	Answer	Additional guidance	Mark
8(d)(i)	scientific { conferences / publications / journals } / peer review ;	ACCEPT idea that these studies should be repeated IGNORE internet	(1)

Question Number	Answer	Additional guidance	Mark
8(d)(ii)	1. idea of insufficient evidence (for planting of the trees) ; 2. idea that some scientists are more interested in global warming than wildlife ; 3. idea that some scientists want to preserve the natural wildlife ; 4. idea that politicians are trying to win votes ; 5. idea that { economists / government / eq } { are concerned about money / want to develop the land / eq } ; 6. idea that farmers want the land for crops (not forests) ; 7. idea that not everyone agrees that global warming is a problem ;		(2)