Mark Scheme (Results)

January 2014

International Advanced Level Biology (WBI06) Paper 01

Unit 6 - Individ.Investigation Prac.Biol.& Research(Wa)

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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)	1. idea of isolation or preparation of a DNA sample (from tissue) ;		
	2. description of reaction mix includes reference to DNA polymerase and {(deoxy) nucleotides / primers / eq} ;	2 and 3 ACCEPT ref to components where appropriate	
	3. description of reaction mix includes reference to {magnesium ions / buffer} ;		
	4. description of denaturation step to include appropriate temperature e.g. 90 to 95 ^{o}C / eq ;	4, 5 and 6 must be in correct context if components stated e.g. NOT Mp4 if restriction enzyme denatures DNA at 95 ^{o}C	
	5. description of primer binding step [to include appropriate temperature (40-70 ^{o}C)] / eq ;		
	6. description of extension step [to include appropriate temperature (70-80 ^{o}C)] / eq ;		
	7. reference to an appropriate time for any one step eg 0.5 to 2 minutes ;		
	8. reference to suitable stated number of cycles e.g.15 to 35 ;		
			(5)

Question Number	Answer	Additional guidance	Mark
1(b)	1. idea of enzyme is heat stable ; 2. idea of optimum temperature for the enzyme stated e.g. 70-80 ^{o}C ; 3. {synthesises a new strand of DNA complementary to / reads along} the template strand / eq ; 4. idea of synthesis in one direction ; 5. needs a {primer / 3'-OH} to begin synthesis of the complementary strand / eq ;	IGNORE refs to active site, enzyme reused	**(2)**

Question Number	Answer	Additional guidance	Mark

1(c)	In the context of denaturation of DNA / 90 to 95 ^{o}C / step 1
	   1. if temperature too low / eq ;
	   2. DNA strands will not separate / eq ;
	
	In the context of primer annealing / 40 to 70 ^{o}C / step 2
	   3. if temperature is too high / eq ;
	   4. idea of less annealing e.g. less binding of primers ;
	
	In the context of extension / 70 to 80 ^{o}C / step 3
	   5. if temperature is too low / eq ;
	   6. synthesis of new DNA strands not completed / eq ;
	OR
	   7. if temperature is higher than 95 ^{o}C / eq ;
	   8. the enzyme will denature / eq ;
		ACCEPT for
		3. if temperature too low
		4. then fewer primers anneal
			(2)

Question Number	Answer	Additional guidance	Mark
1(d)(i)	1. idea that one individual does not represent the whole species OR there will be {genetic / DNA sequence} variation between individuals of the same species / eq ; 2. testing more than one sample will {control / eq} for (these) differences / eq OR idea that this improves reliability of the data ;		**(2)**

Question Number	Answer	Additional guidance	Mark
1(d)(ii)	1. idea that some genes might have {little / no} variation ; 2. idea that it will allow scientists to determine how closely they are related ;		**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)	1. there will be no <u>significant difference</u> ; 2. in reaction time between students who drink the coffee with caffeine and (students) who drink the coffee without caffeine / eq ;		**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)	1. table with suitable headings, including units e.g. ms ; 2. correct sample sizes included in the table (with 15, without 12) ; 3. correctly calculated means with appropriate number of significant figures e.g. with 336 / 335.5 without 407 / 406.6 ;	1. sample column does not need a heading, IGNORE raw data	**(3)**

Question Number	Answer	Additional guidance	Mark
2(c)	A suitable axes and scale with units and labels ; P data plotted as a bar chart with bars plotted correctly ; B range bars included ;	B.with 246 to 450 without 264 to 510	**(3)**

Question Number	Answer	Additional guidance	Mark
2(d)	1. the graph shows that students drinking coffee had a faster reaction time than those drinking decaffeinated coffee / eq ; 2. idea that the graph shows there is a lot of variability between individuals e.g. the range bars are wide ; 3. the calculated value of *t* (3.03) is greater than the critical value (of 2.06) / eq ; 4. at the 95% confidence level / {probability / significance level} of {0.05 / 5%} ; 5. students who drank the coffee had a <u>significantly</u> faster reaction time than those who drank decaffeinated coffee / eq ;	5.ACCEPT converse	**(3)**

Question Number	Answer	Additional guidance	Mark
2(e)	1 + 2. two marks for suitable named variables that were not controlled e.g. age, gender, body mass, previous coffee consumption, lesson commented on ; 3. only investigated regular coffee drinkers / eq ; 4. idea that only one time of day is investigated ;	IGNORE sample size, range bar overlap	**(3)**

Question Number	Answer	Additional guidance	Mark
3(a)	1. reference to welfare of frogs e.g. frogs should {be kept in suitable conditions / not be harmed when collecting secretions} ; 2. idea of returning the frogs to their habitat ; 3. avoid skin contact with frogs e.g. {wear gloves when handling frogs / wash hands after handling frogs / eye protection} ; 4. need to prevent {growth of harmful bacteria / exposure to harmful bacteria} / eq ; 5. other acceptable risk ;		**(3)**

Question Number	Answer	Additional guidance	Mark
3(b)	1. practise proposed method / see if proposed method will work / eq ; 2. idea of selection of appropriate species of frog ; 3. (carry out experiments to) determine a suitable method for collecting secretions from frog / eq ; 4. (carry out experiments to) determine appropriate {concentration / volume} of frog secretion / eq ; 5. (carry out experiments) to determine the most appropriate method of applying the secretions to the plates / eq ; 6. (carry out experiments to) determine the best parameters for another named variable e.g. suitable timescale for measuring the inhibition of bacterial growth / conditions for growth of the bacteria / type of bacteria / eq ; 7. determine best method of measuring dependent variable ;	The Mps need to be awarded for the idea that the preliminary work is needed to determine / find out / investigate the best / appropriate values for the variables / factors in the investigation	**(3)**

Question Number	Answer	Additional guidance	Mark
3(c)	1. clear statement of dependent variable e.g. {zone of inhibition / absorbance of culture /eq } ; 2. clear statement of independent variable as secretions from different frogs / eq ; 3. clear description of how secretions will be added to the bacterial culture / eq ; 4. clear reference to need for nutrient gel / nutrient broth / eq ; 5. some clear consideration of time period over which the growth will be measured / eq ; 6. idea of selection of type of bacteria / named example ; 7. and 8. Identification of up to two other variables that could affect growth of bacteria ; 9. and 10. description of how these two identified variables can be controlled ; 11. clear reference to need for repeats (for each secretion) ; 12. clear description of how the bacterial {culture / plate} will be set up e.g. lawn, inoculation of broth ;	 5.ACCEPT within range 24 hours to 1 week 6.ACCEPT only one type used 7/8.IGNORE humidity ACCEPT control of secretion as a variable	**(8)** **+ 2** **SPG** **(see** **below)**

Level	Mark	Descriptor
Level 1	**0**	The account is very disorganised and is very difficult to follow. Scientific vocabulary is very limited with many spelling and grammatical errors.
Level 2	**1**	There is some disorganisation in the account which is not always in the correct sequence. Some relevant scientific vocabulary is used. The account is not always in continuous prose and there are grammatical errors and some important spelling mistakes.
Level 3	**2**	The account is well organised with no undue repetition and a correct sequence. There is good use of scientific vocabulary in the context of the investigation described. The account is written in continuous prose which is grammatically sound with no major spelling errors.

Question Number	Answer	Additional guidance	Mark
3(d)		ACCEPT Mps 2 and 3 from table	
	1. table which matches method described with headings and units ;		
	2. change in bacterial growth calculated e.g. by measuring area of zone of inhibition / absorbance of culture ;		
	3. means calculated from repeat data ;		
	4. graph type selected that matches the data to be collected ;	4.idea of axes needs to be included Units not required	
	5. reference to an appropriate statistical test e.g. suitable test to compare bacteria growth with different secretions (t-test / Mann-Whitney U test / Chi–squared / eq) ;		
	6. idea that action taken to deal with anomalous data ;		(4)

Question Number	Answer	Additional guidance	Mark
3(e)	1. difficult to control all variables (affecting bacterial growth) / eq ; 2. idea that other components of secretions may affect bacterial growth masking the effect of the antibiotics / eq ; 3. Idea of difficult to standardise extraction of secretion ; 4. reference to other variables related to frog e.g. age, size, gender ; 5. idea of uneven spread of bacteria ; 6. reference to a variable that may be acting as a limiting factor for bacterial growth / eq ; 7. idea of need to test effect on more than one type of bacteria / eq ;		**(3)**