BIOLOGY **9790/02**

Paper 2 Data Analysis and Planning **May/June 2019**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: •   the specific content of the mark scheme or the generic level descriptors for the question •   the specific skills defined in the mark scheme or in the generic level descriptors for the question •   the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: •   marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate •   marks are awarded when candidates clearly demonstrate what they know and can do •   marks are not deducted for errors •   marks are not deducted for omissions •   answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks	Guidance
1(a)	*any 2 of:* transfer of amine group ; from glutamate **OR** from alanine ; to pyruvate **OR** to α-ketoglutarate ; pyruvate is converted to alanine **OR** α-ketoglutarate is converted to glutamate ;	**2**	
1(b)	partially permeable membrane ; immobilised enzyme ; glucose oxidase ; converts glucose to gluconic acid **OR** gluconolactone ; production of hydrogen ions / electrons ; ref. to transducer / electron, carrier / acceptor ; ref. to amplification ; AVP ;	**4**	e.g. additional details of any one point e.g. how H_2O_2 releases e^-, ref. to specificity
1(c)	ALT <u>released from</u> hepatocytes / liver cells ; damage to (hepatocyte) cell (surface) membranes ; not normally in blood (so must be from damaged hepatocytes) ; *idea of,* more damage = more ALT in the blood ;	**2**	**I** membranes unqualified

Question	Answer	Marks	Guidance
1(d)	(AST) could be coming from other (named) tissues / organs ; implication of short half-life / volatile ; difficult to release from mitochondria ;	**2**	*idea of,* could get damage but by time the test is done the AST will have broken down **A** idea of, three membranes to get past
1(e)(i)	16 ;	**1**	
1(e)(ii)	*Acute non-alcoholic liver damage* A **AND** B ; *Chronic alcoholic liver damage* E ;	**2**	
1(f)	mitochondria contain (large quantities / 80%) AST ; hepatocytes contain <u>many</u> mitochondria ; AST moves out of hepatocytes (into blood) ; AVP ;	**2**	e.g. hepatocytes allow alcohol entry/more permeable to alcohol, detail of how alcohol increases membrane permeability through denaturing membrane proteins / dissolving membrane
2(a)	*stomach* digestion of <u>proteins</u> **OR** mechanical digestion **OR** *idea of,* protection against pathogens ; *small intestine* digestion **and** absorption ; *large intestine* absorption of water / salts / vitamins **OR** bacterial / anaerobic, digestion ;	**3**	

Question	Answer	Marks	Guidance
2(b)	*at least 1 of:* 1 horse and wild boar have a bigger ratio than dog **ORA** ; 2 horse has a similar ratio to the wild boar ; *plus :* *horse and / or wild boar* 3 eat plant material, which is difficult to digest / takes a long time to digest ; *dog* 4 eats meat / high protein diet, which is easy to digest ; 5 food digested primarily in stomach ;	**4**	**A** ref. to cellulose being difficult to digest

Question		Answer	Marks	Guidance
2(c)	1	horse has larger volume for stomach, SI and LI ;	**5**	
	2	stomach smaller than SI and LI in horse **OR** stomach larger than SI and LI in dog ;		
	3	large intestine volume greater than small intestine volume in horse ;		
	4	relevant data manipulation ;		
	5	larger volumes of food needed in horse due to lower nutritional value of plants ;		
	6	cannot make direct comparison as mammals have different total body, volume / size ;		
	7	*idea of*, dividing by body length (for comparison) ;		
	8	*idea of,* relative stomach volume for horse and dog about the same / horse slightly smaller ;		
	9	*idea of*, but, relative size of SI and/or LI of horse is massive compared to dog ;		
	10	ref. to digestion continues after SI in horse / description of gut flora in LI in horse ;		

Question	Answer	Marks	Guidance
2(d)	*any 2 of:* anaerobic ; motile ; produce cellulase ; resistance to enzymes ; cilia for attachment to cells / prevent protoctist from being dislodged ; cilia for trapping of food particles ; fast reproductive rate ; AVP ; ;	**2**	
2(e)	DNA / RNA, sequencing ;	**1**	**A** base / gene / genetic, sequencing **A** molecular phylogenetics
2(f)	identify number of different species of microbes **OR** total number of, individuals / organisms, in all species ; numbers of, individuals / organisms, of each species ;	**2**	

Question	Answer	Marks	Guidance
2(g)	*claim is true* increase in diversity ; *claim is false* only a small increase ; no indication of beneficial / harmful organisms ; no indication of, number of species / population size (only an index) ; *neutral* increase at low concentration, less of an increase at high concentration ; only one study – no replicate / no idea of sample size in study ; no indication of significance ; no data above 32(%) / will the decrease continue above 32(%)? ;	3	**I** unqualified statement about drop at 32%

Question	Answer	Marks	Guidance

3	*hypothesis & variables*
	
	1 hypothesis or prediction ;
	   • higher concentrations of teixobactin will kill / inhibit more bacteria
	   • teixobactin will have a minimum concentration below which it is not effective
	
	2 theory to support hypothesis or prediction ;
	   • *idea of,* high concentrations reduce formation of, more peptidoglycan / cell walls
	   • unable to grow
	
	3 independent variable identified ;
	   • concentration of teixobactin
	
	4 dependent variable identified ;
	   • diameter / area around disc
	
	5&6 **two** controlled variables for 1 mark, 2 marks available, e.g. ; ;
	   • strain of bacterium **I** species of bacterium
	   • plating density / density of bacteria / concentration of culture broth **I** same number / amount, of bacteria
	   • incubation time
	   • depth / volume, of agar
	   • (incubation) temperature
	   • type of agar / nutrients in agar / growth medium
	   • volume of antibiotic (solution)
	
	7 control identified ;
	   • no teixobactin used / 0% concentration / water
	   • no bacterial broth used / boiled broth
		25	*some points may be taken from a diagram or a flow or sequence diagram*
			
			A H or H_0
			
			A alternative dv depending on method chosen
			
			check controlled variables against the method chosen

Question	Answer	Marks	Guidance

3	*Methods*
	
	 8 dilution method ;
	     • serial dilution **OR** standard / simple / proportional, dilution described
	
	 9 suitable range ;
	     • at least five concentrations
	
	 techniques
	
	 10 disinfecting work area / washing hands ;
	
	 11 flaming (loop and/or neck of bottle) ;
	
	 12 waiting for inoculating loop to cool / neck of culture bottle to cool ;
	
	 13 description of use of plates or broth ;
	
	 14 careful lifting of lid of Petri dish ;
	
	 15 production of lawn ;
	
	 16 preparing discs ;
	
	 17 sterilising items before use (e.g. plates, syringes) ;
	
	 18 taping of plates (look out for RA mark for not sealing completely) ;		

Question	Answer	Marks	Guidance

3	19 covering of broth bottles ;
	
	20 incubating plates upside down
	
	21 labelling BASE of plate / labelling bottles
	
	22 method of controlling temperature ;
	   • use of thermostatically controlled incubator
	     A put in an incubator at a <u>stated</u> temperature
	
	23 choosing <u>suitable</u> temperature ;
	   • between 20°C and 30°C ;
	
	24 stated time ;
	   • at least 12 hours / overnight
	
	25 description of how measured ;
	   • diameter measured (ruler use)
	   • area calculated (grid used)
	
	26 repeat each concentration (at least) 2 × more ;
	
	27&28 Risk assessment (each is worth one mark) ; ;
	   • alcohol near naked flame
	   • safe disposal of tubes and plates
	   • avoidance of growth of pathogenic anaerobic bacteria by not completely taping plates all the way round /not completely sealing broth bottles
	   • avoidance of incubation temperature near human body temperature		

Question	Answer	Marks	Guidance

3	*presentation and analysis of results:*
	
	29 calculation of means (of replicates) ;
	
	30 calculation of SD / SE ;
	
	31 use of suitable statistical test ;
	     • test of correlation between bacterial growth and concentration of antibiotic
	     • chi squared (but only if method is counting colonies)
	       I *t*-test
	
	32 correct description of statistical test analysis ;
	     • closer to 0, less significance, relevance of positive and negative values
	     • *idea of,* compare value of chi squared against a table of critical values for appropriate degrees of freedom
	
	33 suitable table described / drawn ;
	
	34 suitable graph described ;
	     • scatter graph for correlation, with antibiotic concentration along one axis
	
	35 AVP ;
	     • e.g. investigate idea of bactericidal vs bacteriostatic ;
	       rate of growth		