On the Wild Side -5

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: On the Wild Side -5

Type: Mark Scheme

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to two of the following: • the integrin binds to receptors • on (the surface of capillary) endothelial cells (1) • holding the immune cell in place / stopping the immune cell moving with the blood (1) • giving the immune cells time to squeeze between the endothelial cells (into the brain) (1)	ALLOW (complementary) proteins in placxe of receptors IGNORE activates (capillary) endothelial cells ALLOW trapping the immune cell ALLOW allowing immune cells to cross {the basement membrane / capillary wall}	**(2)**

Q2.

Question number	Answer	Additional guidance	Mark
(i)	An explanation that makes reference to two of the following: • primers have a specific base sequence (1) • bind to complementary bases (at either end) of the DNA be amplified (1) • therefore, provide a site for the DNA polymerase to bind (1)	IGNORE contain complementary bases ALLOW primers attach to the start of the STR sequence ALLOW anneal for bind ALLOW allowing DNA polymerase to create a complementary strand	(2)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to three of the following: • the base sequences of the alleles are different (1) • the restriction enzyme {recognises / cuts} at a specific {site / DNA base sequence} (1) • that is only present in the G20210A allele (1) • therefore, a shorter fragment is produced for the G20210A allele (1)	ALLOW they have different numbers of base pairs e.g. wild type 345bp and the G20210A has 322bp	(3)

Question number	Answer	Additional guidance	Mark
(iii)	An answer that makes reference to four of the following: • identify an appropriate reagent to be provided (in excess) (1) • identify appropriate conditions (to control) (1) • change the number of cycles (1) • use gel electrophoresis (to determine quantity of DNA produced) (1) • choose the smallest number of cycles that produces an observable band (1)	e.g. DNA, polymerase, primers, mononucleotides e.g. temperatures used are 95, 55 and 70°C / duration of steps in cycle ALLOW a description of gel electrophoresis ALLOW choose the number of cycles giving the {thickest / clearest} band	**(4)**

Q3.

Question Number	Answer
	Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Comparisons between phospholipid bilayer and proteins in the cell surface membrane: • judgement about the relative importance of the phospholipid bilayer and the proteins within that bilayer Use of data: • most proteins in the cell are associated with the cell membrane • whilst quantities of phospholipid are the same the proteins have more functions Importance of proteins in the cell surface membrane: • immune response e.g. as antigens and therefore body defence, antibodies, MHC proteins • receptors e.g. receptor proteins on tip of sperm allowing acrosome reaction when encounters zona, for neurotransmitters • regulation e.g. with regards to hormones such insulin • signal / transcription e.g. transcription factors, secondary messengers • transport e.g. active transport, as channel proteins allowing facilitated diffusion, as {voltage-gated / eq} channels for the nerve impulse / resting potential or / and role of Na^+-K^+ pump Importance of phospholipid bilayer in some of: • the role of fluidity and structure of cell the membrane • inhibiting polar substances moving across due to having a hydrophobic component • having both hydrophilic and hydrophobic components which leads to the separation of the aqueous contents of the cell from its aqueous external surroundings • allowing diffusion of gases directly across it • myelin sheath / nerve impulse

Level	Marks	Descriptor	Additional guidance
0		No awardable content	
1	1-3	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just **one** piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.	Discussion of one type of membrane protein linked to its role May have lots of irrelevant information
2	4-6	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of **more than one** piece of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.	Discussion of more than one membrane protein linking them to their function Also discussing the role of phospholipids
3	7-9	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of **several** pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Good discussion of role of proteins and phospholipids – reaching a judgement Linking role of proteins and phospholipids Number of specific examples of membrane proteins Very little if any irrelevant information

Q4.

Question Number	Indicative content
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Basic information • All the treatment combinations were effective at treating TB • All treatments had some { relapses / individuals with TB } 3 years after treatment • { Group 1 / Groups 1 and 2 / Rifampicin + Pyrazinamide / Rifampicin + Isoniazid } had the lowest number of patients with TB (3 years later) Evidence for linkages made • Percentage relapse varies depending on second part of treatment • Combinations involving Rifampicin most effective • The antibiotics tested act on different targets in bacteria • Gaps in information - not all combinations tested, other combinations might be more effective • Other time scales may have been more effective Evidence for sustained scientific reasoning • Could be other reasons for infections with TB 3 years later not due to the antibiotic treatment • No information about dormant TB (only percentage of active cases) • Bacterial RNA polymerase possibly the best target for antibiotics • Antibiotics targeting synthesis of cell wall fatty acids least effective in terms of relapses • Idea of combination of antibiotics with different mode of activity most effective

Level	Mark	Descriptor	
Level 0	Marks	No awardable content	
Level 1	1-2	An answer may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The answer will contain basic information with some attempt made to link knowledge and understanding to the given context.	Reference to effectiveness of different combinations of antibiotics.
Level 2	3-4	An answer will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows some linkages and lines of scientific reasoning with some structure.	Reasons for differences in effectiveness considered.
Level 3	5-6	An answer is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Information about action of antibiotics related to effectiveness. Evaluation of study design considered.

Q5.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: Any two of • more (new) cases • the total number of cases is relatively constant • and the number of people dying from TB is decreasing And • so {more are being successfully treated / the programme is effective}	ALLOW only slight change in total number of cases	(3)

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	1. idea that bacteria are resistant to fewer {antibiotics / antibiotic combinations} (in 2006 than 2007) ; 2. in both years there are resistant strains to {streptomycin / INH + rifampicin + ethambutol / INH } ; 3. idea that there are resistant strains to INH + rifampicin in 2006 but not in 2007 ; 4. idea that there are resistant strains to {ethambutol / rifampicin} in 2007 but not in 2006 ;	**ACCEPT** clear abbreviations to the names of the antibiotics throughout **1 ACCEPT** a description e.g. new resistances, resistant to 4 in 2006 and 5 in 2007 **3 ACCEPT** idea that {resistance decreased to zero / no longer resistant} **4 ACCEPT** idea of resistance developing **NB** development of new resistances to {ethambutol / rifampicin} = Mp 1 and 4	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	1. bacteria have a mutation in {DNA / gene / eq } ; 2. idea that the {presence / usage of} {antibiotic (INH) / INH} acts as a selection pressure ; 3. idea that the allele (for resistance) is passed on ; 4. idea that bacteria {divide by asexual reproduction / divide by binary fission / produce clones / eq} ; 5. idea of increasing the allele frequency ;	**3 NOT** gene **4 ACCEPT** divide by mitosis / conjugation / transduction / transformation / eq	

Question Number	Answer	Additional Guidance	Mark
	6. idea that the more resistant bacteria there are, the more likely new strains will acquire the (resistance) gene ;		(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	1. reference to codes of {practice / conduct / eq } ; 2. idea that appropriate {antibiotics / named example} should be given to patients ; 3. idea of {educating patients about taking antibiotics / taking the full course of antibiotics ; 4. credit another appropriate procedure e.g. hand washing, screening ;	**1 ACCEPT** named policy /code **NB** Mp5 is for named practice **2 ACCEPT** not giving antibiotics if not necessary / not using antibiotics for prophylactic treatment / using narrow spectrum antibiotics / rotate antibiotic use	(2)

Q7.

Question Number	Answer	Additional guidance	Mark
(a)(i)	1. reference to {death / killing / destroying / eq } (of bacteria cells) ; 2. idea that {bacteria / cells} burst ;	**1. Ignore** reference to stopping growth **2. Accept** lysis, loss of osmotic control	**(2)**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	1. reference to cells cannot {reproduce / increase in number / produce new cells / multiply / replicate / eq} ; 2. idea of no (cell) division ;	**2. Accept** no binary fission	**(2)**

Question Number	Answer	Additional guidance	Mark
(b)(i)	1. (A and C resistant as) no {clear zone / zone of inhibition / eq} around A and C ; 2. idea that {clear zone / eq} indicates where antibiotic {inhibits growth / kills bacteria / eq} ; 3. {clear zone / eq} around B {smaller/ eq} than clear zone around D ; 4. idea of {size / diameter / width /eq} of clear zone indicates {effectiveness / eq} ; [check diagram for appropriate labels]	**1. Accept** a clear description of this area around the disc **2. Accept** converse **3. Accept** converse	**(3)**

Question Number	Answer	Mark
(b)(ii)	C reliability ;	**(1)**

Question Number	Answer	Mark
(b)(iii)	D validity;	**(1)**

Question Number	Answer	Additional guidance	Mark
(c)	1. reference to hospitals {having / changing / eq } a {code of practice / protocol / policy / standards / eq} (for dealing with hospital acquired infections) ; 2. idea of clothing rules for hospital workers ; 3. reference to <u>improved</u> laundry of bed linen e.g. {<u>increased</u> frequency / higher washing temperature / eq} ; 4. reference to use of special {pillow cases / treatment of pillow cases} e.g. microfilters, treated with antibacterials, sterilisation, disposable pillow cases ; 5. reference to use of special procedures when carrying {pillow cases / bed linen} to laundry e.g. sealed plastic bags ; 6. screening of patients / isolation of infected patients / eq ; 7. idea of hand washing regimes / eq ;	**1. Allow** references to pillows for pillow cases throughout **3. Allow** pillow cases should be washed daily **7. Allow** hands should always be washed	**(3)**

Q8.

Question Number	Answer	Mark
(a)	**A** active artificial	(1)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. antibodies appear (in blood) {immediately / on day 0 / eq} in group B but {on day 4 / after 3 days} in group A ; 2. antibodies reach higher levels in group B / eq ; 3. credit comparative manipulated data ;		(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. antibodies present from the first vaccination / eq ; 2. idea of a secondary immune response ; 3. memory cells already present / eq ; 4. due to first vaccination / eq ; 5. memory cells mean that {antibodies produced immediately} / eq ; 6. on exposure to (same) antigen / eq ;		(3)

Question Number	Answer	Additional Guidance	Mark
(c)	1. idea that the virus will be destroyed quicker ; 2. {more / wider range of} memory cells present ; 3. so {higher levels / faster production} of antibodies ;		(2)

Question Number	Answer	Additional Guidance	Mark
(d)	**Comparisons of groups A and B** 1. not very reliable as sample size is small / eq ; 2. data for first 15 days after vaccination are reliable as error bars do not overlap ; 3. data for 30 and 60 days not reliable as error bars overlap ; **Comparisons within either of the groups** 4. there may be no change in the first fifteen days ;		(3)

Q9.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	A		**(1)**

Question Number	Indicative content		
***(b)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • Vaccination stimulates primary immune response • Reference to antigen presenting cells • Activation of T helper cells / reference to cytokines • Reference to B effector cells / activation of T killer cells • (Differentiation into) plasma cells that secrete antibody • Reference to memory cells • (Secondary immune response) antibody production is {sooner / faster / greater} for pathogen A • Insufficient antibody initially produced in primary response for pathogen B		
Level	Mark	Descriptor	
	0	No awardable content	

Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of
		relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

Q10.

Question number	Answer	Additional guidance	Mark
	A description that makes reference to the following: • { phagocytes / macrophages } engulf antigens (1) • antigen is presented on the surface of antigen presenting cells (1) • lymphocytes with receptors that are (specific / complementary) to (particular) antigens bind to APC (1)	ALLOW reference to production of APCs / antigen presenting cells ALLOW CD4 receptors ALLOW T cells for lymphocytes	**(3)**

Q11.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>Keratin in the skin</td><td>Lysozyme in mucus</td><td>Hydrochloric acid in the stomach</td></tr>
<tr><td>Physical barrier</td><td>✓</td><td>x</td><td>x</td></tr>
<tr><td>Chemical barrier</td><td>x</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>3 correct answers 1 mark
All correct 2 marks</td><td>(2)</td></tr>
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Q12.

Question Number	Answer	Additional Guidance	Mark
(a)	1. bacteria have DNA, viruses have DNA or RNA ; 2. idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} ; 3. bacterial DNA is double-stranded, viral {DNA / RNA} is single (or double) stranded / eq; 4. bacteria (may) have plasmids, viruses do not have plasmids / eq;	**NB** piece answers together throughout **Do not accept** in context of plasmid	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. reference to {phagocytosis /endocytosis / engulfing} ; 2. credit details of phagocytosis ; 3. reference to bacterium inside a {vacuole / vesicle / phagolysosome} ;	eg formation of {pseudopodia / membrane extensions around bacteria} / cytoplasmic streaming / binding to bacteria **Not** phagolysozyme	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. idea that bacteria need to be accessible to antibiotics ; 2. idea of bacteria inside macrophages ; 3. reference to waxy layer of (these) bacteria ; 4. idea that (bacteriostatic) antibiotics affect dividing bacteria; 5. reference to antibiotic resistance (of these bacteria) ;	**Not** bacteriocidal antibiotics	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. idea of {dead / attenuated / eq} {organisms / pathogen / bacterium / eq} put into person; 2. reference to (stimulation of) {specific / primary} (immune) response ; 3. credit details of T helper cell activation ; 4. credit details of B cell activation ; 5. credit details of T killer cell activation ; 6. reference to production of memory cells ;	**NB** not simply crediting ref to vaccination as in stem of question **Accept** antigen eg macrophages as APCs eg involvement of cytokines, B cells as APCs eg involvement of cytokines, infected cells as APCs	**(3)**

Question Number	Answer	Additional Guidance	Mark
(c)	1. reference to {<u>further</u> lung damage / severe breathing problems / eq} ; 2. idea that the *Mycobacterium* get into the {blood / lymph}; 3. idea that organ failure (leads to death) ; 4. idea of {reduced / weakened} immune response (due to a loss of T cells) ; 5. credit detail of role of T (helper) cells ; 6. credit detail of effect of no T killer cells ; 7. credit detail of effect of no B cells ; 8. ref to {secondary / opportunistic / other} infections (causing death) ;	eg cannot obtain enough oxygen eg production of cytokines eg infected cells will not be destroyed eg no antibody produced	**(4)**

Q13.

Question Number	Answer	Additional guidance	Mark
(i)	A description that makes reference to three of the following • (small groups of) healthy volunteers are given the vaccine to test for side effects (1) • (healthy volunteers) tested for presence of antibodies to the virus (following vaccination) (1) • a group of people at risk of contracting the disease is given the vaccine (1) • the number of people who develop the viral disease (following vaccination) are monitored (1)		(3)

Question Number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to four of the following • large numbers of people died from the disease (1) • health workers are in close contact with people suffering from the disease (1) • the side effects of the vaccine will not be worse than contracting Ebola (1) • vaccinating immediate family will help to reduce the spread of disease (1) • if health workers were vaccinated they could care for more people (1)	ALLOW disease is (usually) fatal ALLOW health workers and family most likely to be exposed to the virus ALLOW risk from the disease is much greater than the risk from the vaccine	(4)

Q14.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to three of the following: <u>Similarities</u> • both contain { genetic material / RNA } (1) • both have a phospholipid bilayer (1) <u>Differences</u> • (only) bacteria have { cytoplasm / ribosomes / pili / slime capsule / flagellum /cell wall / cell membrane / plasmid } (1) • (only) HIV has { capsid / protein coat / GP 120 } (1)	IGNORE both have DNA ALLOW lipid bilayer ALLOW converse i.e. HIV does not have... ALLOW converse i.e. bacterium does not have...	(3)

Q15.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four of the following: <u>Similarities</u> • to avoid adverse environmental conditions **(1)** • formation of resistant {outer coating / capsule} **(1)** • reduce metabolic activity **(1)** <u>Differences</u> • sporulation and no sporulation **(1)** • different reasons for entering dormancy **(1)** • (only) genetic material is in a protective capsule in Bacillus **(1)**	e.g. mycobacterium enters dormancy to avoid immune response and Bacillus to survive lack of resources	**(4)**

Q16.

Question Number	Answer	Mark
	B - smaller than ribosomes in eukaryotes *The only correct answer is **B*** ***A** is not correct because bacterial ribosomes are smaller than eukaryotic ribosomes* ***C** is not correct because bacterial ribosomes are smaller than animal ribosomes* ***D** is not correct because bacterial ribosomes are smaller than plant ribosomes*	**(1)**

Q17.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to two of the following: • only one cell as opposed to potentially many **(1)** • no nucleus present **(1)** • no membrane-bound organelles present / absence of named membrane-bound organelle other than nucleus **(1)**	 ALLOW DNA not associated with histones ALLOW example e.g. no mitochondrion	**(2)**

Q18.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • at the start of composting the percentage of organic carbon is less and the percentage of nitrogen is more when cow dung is added (1) • adding cow dung does not change the decrease in organic carbon (1) • adding cow dung causes {a slight / no change} to the increase in nitrogen (1) • adding cow dung has no significant effect on composting (of coffee husks) (1)	e.g. 12.8% and 12.7% e.g. 0.43% compared with 0.47%	3

Q19.

Question Number	Indicative content		
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • the CVID group is more susceptible to bacterial infections • the CVID group produces fewer antibodies to bacterial antigens • have a reduced percentage of B cells • have a similar ratio of T helper to T killer cells • have a normal percentage of T lymphocytes • can defend themselves against viruses but not bacteria • (therefore) antiviral medication not required • could prescribe (prophylactic) antibiotics • could provide passive immunity by giving them antibodies / immunoglobulins		
Level	Mark	Descriptor	
0	0	No awardable content	
1	1-2	Limited scientific judgement made with a focus	

Level	Mark	Descriptor
		on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.
2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.
3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.

Q20.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• positive correlation		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	• correct diameter or radius measured (1) • correct answer (1)	14 mm Example of Calculation $3.14 \times 7^2 = 154$ mm^2 Allow full marks for correct answer with no working	**(2)**

Q21.

Question Number	Answer	Mark
(a)	**C** hydrolysis	**(1)**

Question Number	Answer	Mark
(b)(i)	**B** to give a range of values for the independent variable	**(1)**

Question Number	Answer	Mark
(b)(ii)	**B** one	**(1)**

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. idea that {bacteria / fungi / decomposers / eq} release enzymes (for decomposition) ; 2. idea of the formation of {monomers / glucose / amino acids / small molecules} / eq ; 3. that {are soluble / dissolve} ; 4. idea that some (soluble) molecules {soak into the ground / taken up (by organisms) ; 5. idea of {respiration / fermentation} of {glucose / eq} (by decomposers); 6. carbon dioxide (released) / eq ; 7. idea of water loss ; 8. idea of {worm / appropriate named organism} activity;	1. ACCEPT external digestion / extracellular digestion 7. e.g. evaporation of water / leaves drying out 8. e.g. animals eat the leaves, leaves pulled into soil	**(4)**

Question Number	Answer	Additional Guidance	Mark
(b)(iv)	1. idea that an increase in temperature would increase the rate of decomposition (up to an optimum temperature) ; 2. reference to enzymes (in decomposition) ; 3. idea that increased {heat / kinetic} energy results increase in {number of collisions / energy of collisions (between enzymes and substrate) / enzyme-substrate complexes} ; 4. idea that increased temperature increases rate at which bacteria increase ; 5. idea that above a certain temperature rate of decomposition would {decrease / stop} ; 6. idea that at higher temperatures enzymes become denatured OR bacteria killed ;	6. NOT enzymes start to denature NB need the term 'denaturing' or its derivative	**(4)**

Q22.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	larvae show no significant preference for light over dark side (1)	Allow vice versa Must have NO in hypothesis.	**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	calculation of expected frequency 10 and 10 (1) $(O-E)^2/E$ for both light and dark sides $49 \div 10 = 4.9$ (1) sum = 9.8 (1)		**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to the following: • higher than 3.84 therefore Chi square value as high as 9.8 arise by chance alone less than 1 in 20 / 0.05 therefore there is a significant difference (1)	allow ECF for incorrect value of Chi allow converse if calculated of Chi is lower than 3.84	**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An explanation that makes reference to five of the following: • use of dead tissue containing toxin and dead tissue not containing tissue so valid comparison can be made (1) • {young larvae of same length / fly eggs} allowed access to both types of dead tissue so they have same potential for growth (1) • reference to time scale before growth of larvae measured to allow time for growth to occur (1) • length measured for several larvae to ensure reliability (1) • control of {temperature / type of tissue / age of tissue / species of larvae} because these factors affect growth (1) • recognition that comparison of results may show under or over estimate of time of death (1)		**(5)**

Q23.

Question Number	Answer	Mark
(a)	**A** bacteria and fungi	**(1)**

Question Number	Answer	Mark
(b)(i)	**A** none	**(1)**

Question Number	Answer	Mark
(b)(ii)	**D** validity	(1)

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. 2. ref to hydrolysis ; 3. by {enzymes / cellulase} / eq ; 4. produced by microorganisms / eq ; 5. into(β) glucose ; 6. uptake of glucose into microorganisms / eq ; 7. idea that glucose is used in {respiration / fermentation} ; 8. releasing carbon dioxide into the atmosphere / eq ; 9. idea that some of glucose (solution) soaks into ground ;		(4)

Question Number	Answer	Additional Guidance	Mark
(b)(iv)	1. to make investigation valid ; 2. idea that {temperature / heat energy} affects {rate of enzyme reactions / enzyme activity / rate of decomposition} ; 3. increase in {heat / kinetic} energy results in more {collisions / energetic collision / enzyme-substrate complexes / eq} ; 4. idea that high temperature results in enzyme {denaturing / becoming denatured} ; 5. (so) decomposition would stop / eq ;	4. ACCEPT bacteria killed / eq	(4)

Q24.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to two of the following: • PERVs (are retroviruses) present in the pig'sgenome (1) • PERV virus particles {are produced by / bud of from} the pig cells (1) • PERVs bind to membrane receptors (on humancells) (1) • PERVs insert their nucleic acid into the cells (1)	ALLOW pigs inherit the PERVs /retroviruses in their genomic DNA ALLOW membrane coated particlesfuse with human cells ALLOW enter cells by endocytosis	Choose an item. (2)

Q25.

Question Number	Answer	Additional guidance	Mark
(i)	A description that makes reference to three of the following: • standardisation of pigs studied (1) • named {environmental condition / abiotic factor} controlled (1) • record the presence of different species (of insects) (1) • at regular intervals of time (1)	e.g. same {size / breed / mass / type / age /sex} ALLOW example of an abiotic factor being monitored such as temperature e.g. every 24 hours, every day, hourly, weekly	**(3)**

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to three of the following: • record which {insects / species} are present (on the human) (1) • compare with results from investigation (on pigs) to determine time of death (1) • take into account which stages of the lifecycle are present (1) • (when using stage of succession to determine time of death) environmental variables need to be taken into account (1)		**(3)**