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Mark Scheme (Results)

January 2013

GCE Biology (6BI04) Paper 01
The Natural Environment and Species Survival

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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.

General Information

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point
Eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point
[] square brackets	Words inside square brackets are instructions or guidance for examiners
[CE] or [TE]	Consecutive error / transferred error

Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous
  e.g. for amylase, ‘ammalase’ is acceptable whereas ‘amylose’ is not
  e.g. for glycogen, ‘glicojen’ is acceptable whereas ‘glucagen’ is not
  e.g. for ileum, ‘illeum’ is acceptable whereas ‘ilium’ is not
  e.g. for mitosis, ‘mytosis’ is acceptable whereas ‘meitosis’ is not

- candidates must make their meaning clear to the examiner to gain the mark.

- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark – irrelevant material should be ignored

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

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

Question Number	Answer	Comment	Mark
1(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 **4. Not** idea that more bacteria are killed unless supported with a ref to concentration	**(3)**

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

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

Question Number	Answer	Comment	Mark
1(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 ;	**Allow** references to pillows for pillow cases throughout **3. Allow** pillow cases should be washed daily **7. Allow** hands should always be washed	**(3)**

Question Number	Answer	Mark
2(a)(i)	C T helper cells ;	**(1)**

Question Number	Answer	Mark
2(a)(ii)	D reverse transcriptase ;	**(1)**

Question Number	Answer	Comment	Mark
2(b)(i)	1. reference to glycoprotein ; 2. credit detail of structure e.g. specific (3D) shape, L and H regions, Y-shape, 4 (peptide) chains, disulphide bridges between peptides, hinge region ; 3. reference to {antigen-binding site / variable region / Fab (region) / eq }; 4. idea of antibodies have a {similar / constant / Fc / eq } region; 5. produced by plasma cells / present on B cells ; 6. role of antibody described e.g. opsonisation, immobilisation, agglutination, lysis ;	**1. Accept** protein, chains of amino acids **2. Ignore** active site **Accept** a Y-shaped drawing **3. Accept** ref to {binding to specific antigen / antigen-specific / antigen receptors} **5**. **Accept** present on B effector cells	**(2)**

Question Number	Answer	Comment	Mark
2*(b)(ii)	(QWC – answer must be organised in a clear, logical sequence) 1. reference to artificial (active) immunity ; 2. reference to {vaccine / vaccination } ; 3. containing {synthetic molecule / (synthetic) antigen / (synthetic) glycoprotein } ; 4. ref to stimulation of the {specific / humoral} immune response (to the synthetic antigen) ; 5. credit detail of process of producing effector B cells e.g. clonal expansion of B cells, involvement of cytokines, T helper cells activate B cells ; 6. reference to (production of B) memory cells ; 7. idea that (2G12) antibodies are produced {faster / in greater concentration} on {reinfection / eq} ;	Mps are awarded if the statements are clearly expressed **5. Ignore** references to production of activated T killer cells **6. Ignore** references to production of T memory cells **7. Accept** ref to secondary immune response	**(5)**

Question Number	Answer	Comment	Mark
2(c)	1. idea that HIV infection does not always produce symptoms ; 2. reference to {provirus / latency } ; 3. reference to test needed to detect (symptomless) HIV ; 4. idea that only people who suspect they may have contracted HIV would have a test ; 5. idea that {some people would not want to be tested / impossible to test everyone} ; 6. idea that symptoms are common to other diseases ; 7. {new cases arising/ patients dying} all the time / eq ; 8. idea of new strains of virus arising ;	**2. Accept** virus is dormant	**(2)**

Question Number	Answer	Comment	Mark
3(a)(i)	1. reference to {polymerase chain reaction / PCR} ; 2. polymerase (enzyme) {added / eq } ; 3. idea of need for primers and nucleotides ; 4. {90-98} (^{o}C) → {50-65} (^{o}C) → {70-75} (^{o}C) ; 5. idea that cycle needs to be repeated {several times / to make several copies of DNA / eq} ;	**1. Accept** as a ref to PCR machine **3.** Piece together **4.** Piece together **5. Not** 'repeated' without qualification	**(4)**

Question Number	Answer	Comment	Mark
3(a)(ii)	(DNA) {profiling / fingerprinting / (gel) electrophoresis} ;	**Not** electrolysis **Ignore** Southern blotting, PCR **Accept** DNA profile / DNA fingerprint	**(1)**

Question Number	Answer	Comment	Mark
3(b)	1. idea of work appearing in a (Scientific) journal or being presented at a conference ; 2. idea that validity or reliability is considered ; 3. by other scientists / ref to peer review ;	**1. Accept** publishing a paper, scientific meeting	**(2)**

Question Number	Answer	Comment	Mark
3(c)(i)	1. reference to different {conditions / environments /eq} (in each region) ; 2. idea of different selection pressures ; 3. idea of {restricted gene flow / separate gene pools} ; 4. reference to reproductive isolation;	**1. Accept** appropriate named factor e.g. temperature **3. Ignore** different allele frequency **4. Not** if reference made to fertile offspring	**(2)**

Question Number	Answer	Comment	Mark
3(c)(ii)	1. idea of different {alleles/ gene pool} ; 2. idea that this leads to {new / different} phenotypes ; 3. idea of new {allele / gene} can be {advantage / disadvantage} ; 4. reference to (advantageous) {(mutated) gene / (new) allele} passed onto offspring ;	**1. Ignore** allele frequency **2. Accept** traits / characteristics / features	**(2)**

Question Number	Answer	Comment	Mark
4(a)	1. reference to increase in {metabolic rate / enzyme activity / eq} as temperature rises ; 2. reference to increase in {kinetic / eq} energy of molecules (as temperature rises) / eq ; 3. reference to increase in {enzyme-substrate complexes / energy of collisions / eq} (as temperature rises) ; 4. idea of {inactivation at lower temperatures/ denaturation at higher temperatures} of enzymes ; 5. idea that temperature affects {differentiation / growth /division / eq} ;	**1. Accept** converse argument for mp 1 – 3 **2. Accept** movement **4.Accept** the idea that enzyme-substrate complexes cannot be made if denaturing **5.** Do not accept a ref to development on its own (as in stem of question)	**(3)**

Question Number	Answer	Comment	Mark
4(b)	1. idea that temperature affects {survival / development / growth / metabolism / cell division / eq} ; 2. idea that enzymes affect {development / growth / metabolism / cell division/ eq} ; 3. idea that temperature affects enzymes ; 4. idea that different frogs have different enzymes ;		**(2)**

Question Number	Answer	Comment	Mark
4(c)	*sylvatica*, *pipiens*, *palustris*, *clamitans* ; ;	if order correct but reversed = 1 mark	**(2)**

Question Number	Answer	Comment	Mark
4(d)	1. idea that different species are reproductively isolated ; 2. idea of different breeding {times / seasons / eq} ; 3. idea of different {breeding / courtship / eq} {behaviour / rituals / displays / colour / songs / croaks / eq} ; 4. idea that population at {northerly / southerly} limit of range may not develop (to adulthood) ; 5. idea that breeding between different species results in infertile offspring ;	**1. Not** with a ref to infertile offspring **3. Accept** idea of incompatible {genitalia / gametes}	**(3)**

Question Number	Answer	Comment	Mark
4(e)	1. idea that global warming will increase the temperature (at the latitudes) ; 2. idea that temperatures (at these latitudes) may become too high for any of the species ; 3. idea that new temperature may be above the maximum to complete development or above the upper lethal limit ; 4. idea that species move {north / to cooler regions / eq} ; 5. ref to change in {food source / predators / competition / eq} ;	**2.Accept** become extinct	**(3)**

Question Number	Answer	Comment	Mark
5(a)	1. idea that products of light-dependent stage are {needed for / used in / eq} {light-independent stage / Calvin cycle} ; 2. reference to (products of light-dependent stage) are {reduced NADP / eq} and ATP ; 3. reference to use of {reduced NADP / eq} for {reduction / eq} of {carbon dioxide / GP / eq} ; 4. reference to use of ATP as source of energy ;	**2. Piece together** **3. Accept** source of hydrogen ions for GALP **Ignore** ref to ATP	**(3)**

Question Number	Answer	Mark
5(b)(i)	D volume of oxygen produced ;	**(1)**

Question Number	Answer	Comment	Mark
5(b)(ii)	1. (minimum temperature) is {between 0 ^{o}C and 10 ^{o}C / above 0 ^{o}C but less than 10 / 10 ^{o}C} ; 2. idea of no photosynthesis at 0^{o}C but photosynthesis is taking place at 10 ^{o}C ; 3. reference to no {data / readings / measurements / evidence / eq} between 0 ^{o}C and 10 ^{o}C ; 4. idea that at 0 ^{o}C water is frozen ;	**3 Accept** if correct temp range has been given already	**(2)**

Question Number	Answer	Comment	Mark
5(b)(iii)	1. reference to abiotic factors {are non-living / non-biological / do not involve organisms / eq} ; 2. idea that other factors need to be kept constant ;	**1. Not** if a wrong example is given **2. Ignore** controlled	**(2)**

Question Number	Answer	Comment	Mark
5(b)(iv)	**Supporting conclusion:** 1. idea that shape of graph is typical of an enzyme-temperature graph ; 2. rate increases (up to 30 ^{o}C) because more {enzyme-substrate complexes / collisions between enzymes and substrates} / eq ; 3. rate decreases (after 30^{o}C) due to enzyme denaturation / eq ; **Not supporting conclusion:** 4. idea that other factors could be affecting photosynthesis ; 5. idea of {gas / oxygen / carbon dioxide} solubility changing with temperature ; 6. idea of {correlation / not causation} ;	**1.** idea that rate of photosynthesis is affected by temperature in a similar way to enzymes **3. Not** enzyme dies, starts to denature	**(4)**

Question Number	Answer	Comment	Mark
6(a)(i)	1. idea of (a sequence of) changes in {a community / organisms / species / plants} ; 2. over a period of time / eq ;	**1. Accept** the idea of species replacing or succeeding each other **2. Accept** gradually	**(2)**

Question Number	Answer	Comment	Mark
6(a)(ii)	1. idea of final {stage / sere / community} ; 2. feature of community described e.g. self-sustaining , stable, one dominant species, a few codominant species ;	**1. Accept** at the end of succession **2. Ignore** named example	**(2)**

Question Number	Answer	Comment	Mark
6(b)(i)	1. idea of conservation of {genetic diversity / genetic variation / biodiversity} ; 2. idea of extinction ; 3. idea of aesthetic reasons ; 4. idea that these plants may be useful e.g. as medicines ; 5. idea that other animals depend on these plants as a {source of food / habitat} ;	**1. Accept** gene pool **5. Accept** part of a food chain **Ignore** survival	**(2)**

Question Number	Answer	Comment	Mark
6(b)(ii)	grazing / remove saplings / mowing / eq ;	**Accept** burning	**(1)**

Question Number	Answer	Mark
6(c)(i)	C systematic ;	**(1)**

Question Number	Answer	Comment	Mark
6(c)(ii)	1. comparison (of the value) to the critical value indicates no significance / stronger correlation the nearer the value is to 1.0 / 0.565 is too low / eq ; 2. idea that sample size too small ; 3. idea that {there is no correlation between height and width / other factors affect height / other factors affect width / eq} ;	**1. Ignore** plus and minus numbers **2. Accept** not enough data	**(2)**

Question Number	Answer	Comment	Mark
7(a)	1. idea of less {stress / trauma / discomfort / depressed /eq} (for the animals) ; 2. idea that animals are more likely to breed in natural environment ; 3. idea that animals may require large areas ; 4. idea that problems of releasing animals back into the wild is avoided eg habituation ; 5. idea that {disease is less likely / disease will not wipe out population} ; 6. idea of allowing (natural) {interspecific relationships / communities} to exist ; 7. idea of allowing (natural) {intraspecific relationships / family / social / eq} {structure/ behaviour} ; 8. (because) large numbers of animals needed / wider gene pool / eq ; 9. idea that (natural) {diet / food / eq} available ;	**Accept** converse argument throughout **6. Accept** ref to maintaining their niche	**(3)**

Question Number	Answer	Comment	Mark
7*(b)	(QWC– Spelling of technical terms *(in italics)* must be correct) 1. reference to *succession* ; 2. reference to (*forensic) entomology* ; 3. example of {insect / eq} e.g. *fly, beetle, wasp* ; 4. idea that the {types / *species* / life cycle stages} (of insects) are used ; 5. reference to {*decomposition / decay* / eq} ; 6. idea that there are different stages of {*decomposition / decay* / eq} ; 7. detail of {*decomposition / decay* / eq} e.g. production of *gases, liquefaction* of *tissue, bloating, discolouration* ; 8. reference to rate of {*succession / insect development / decomposition*} influenced by {external factor / appropriate named factor} ; 9. idea that insect and decomposition information is used to determine time of death ;	Penalise spelling once **1. Accept** in context of either insects or decomposition **3.** Named insect must be spelt correctly **6. Accept** if 2 or more stages listed **8.** Named *factor* must be spelt correctly	**(5)**

Question Number	Answer	Comment	Mark
8(a)(ii)	1. reference to (lysozyme) is an enzyme ; 2. idea that {proteins / active sites / enzymes} have a specific shape ; 3. idea that lysozyme acts on cell wall ; 4. of bacteria ;	**Accept** lysosome in this context	**(4)**

Question Number	Answer	Comment	Mark
8(b)(i)	1. reference to histamine released as a result of damaged {tissue / cells} ; 2. (histamine released from) {basophils / mast cells / platelets} ; 3. detail of effect of histamine e.g arterioles dilate, vasodilation, increased blood flow, capillaries more permeable ; 4. named effect of inflammation e.g. {oedema / swelling /redness / heat / pain / eq} ;	**2. Accept** white blood cells, macrophages and neutrophils **4. Accept** raises temperature	**(3)**

Question Number	Answer	Comment	Mark
8(b)(ii)	1. idea of (only) {a local reaction produced / histamines produced around bite area} ; 2. idea that cream {has been applied to actual site of production of histamine } ; 3. idea of {effect / treatment / relief / eq} {more rapid / immediate / eq }; 4. idea of higher concentration of antihistamine at site ; 5. idea that the antihistamines will not be {digested (by enzymes) / destroyed (by acid / enzymes) / eq} ; 6. idea that tablets may lower immune response generally / lead to side-effects ;	**2-6 Accept** converse	**(3)**

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