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Mark Scheme (Results)

Summer 2013

GCE Biology (6BI04) Paper 01R

Unit 4: 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.

Question Number	Answer	Additional Guidance	Mark
1(a)	C ; nucleus and large (80S) ribosomes		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	A ; algae have chloroplasts, the fungi do not		(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	1. (advantage of sexual reproduction / meiosis) {genetically different / greater gene pool / greater genetic diversity /eq} ; 2. (advantage of asexual reproduction / mitosis) faster / one of each organism needed / conserves advantageous alleles ;	**2. Accept** don't need a mate	(2)

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	C ; area exposed to bright sunlight and protected from the wind		(1)

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	1. idea of using a quadrat ; 2. idea of {random / systematic} sampling (of wall) ; 3. {count number of squares/ determine area} containing lichen /eq ; 4. credit an indication of how the percentage was calculated ;	**1. Accept** description of quadrat, use of photo and a grid **3. NB** reference to measuring percentage cover only is too vague as it is repeating stem of question	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(d)(iii)	1. ref to use of light {probe / sensor /eq} ; 2. idea of taking several measurements ;	**1 Accept** description of a light sensor 2. Accept ref to places or times of day	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(d)(iv)	1. plot a (scatter) graph of light intensity against lichen / eq ; 2. reference to looking for a correlation ; 3. reference to use of statistics test ; 4. appropriate named test eg Spearman's rank, Pearson ;	**2. Accept** ref to line of best fit, ref to correlation coefficient also gets Mp 3	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	Line to diagram feature {grana / thylakoids / thylakoid membrane / inter-granal membrane } ;	**Ignore** any labelling of the line	(1)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	A ; ATP		(1)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	stroma ;	**Accept** phonetic spelling eg strona, stromma **Not** stoma / stomata	(1)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	Y. RuBP / ribulose bisphosphate ; Z. GP / glycerate (3) phosphate ;	**Y. Accept** ribulose biphosphate **Not** ribose **Z. Accept** (3) phosphoglyceric acid / (3) PG / PGA / 2-Hydroxy-3-phosphonooxypropanoic acid **Not** glyceraldehydes (3) phosphate / GALP	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(iii)	RUBISCO / ribulose bisphosphate carboxylase (oxygenase) ;	**Accept** ribulose biphosphate carboxylase RUBISCO written in upper or lower case or a mixture **Not** ribose	**(1)**

Question Number	Answer	Additional Guidance	Mark
***2(b)(iv)**	QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence 1. idea of conversion (of *GP / Z*) to *GALP* / eq ; 2. using *ATP* and reduced *NADP* / eq ; 3. idea of conversion (of *GALP*) to {*glucose* / hexose} eq ; 4. (which is) α *glucose* ; 5. reference to formation of *glycosidic bonds* ; 6. these bonds are 1-4 and 1-6 (*glycosidic bonds*) / eq ; 7. by *condensation* ; 8. ref to *amylose* and *amylopectin* ; 9. credit details of *amylose* e.g. straight chain, 1-4 bonds ; 10. credit details of *amylopectin* eg branched, 1-4 and 1-6 bonds ;	**QWC emphasis is spelling** **NB** this is a question about the **conversion** of GP and the **formation** of starch, not its structure 1. **NB** idea of conversion needed 3. **NB** idea of conversion needed **5. NB** a reference to these bonds being formed must be made	**(5)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	**C** ; The number of fires in Mato Grosso each year is always higher than other areas ;		**(1)**

Question Number	Answer	Additional Guidance	Mark
*3(a)(ii)	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence 1. reference to {fires / burning / eq} produces carbon dioxide ; 2. which is a greenhouse gas ; 3. idea that these gases {build up / remain / form a layer / increase} in (upper) atmosphere ; 4. which {absorb / trap / eq} {heat energy / infra red / IR / eq} ; 5. reflected from earth's surface ; 6. idea that increased levels of these gases increase the greenhouse effect ; 7. idea that (mean) temperature of earth's {surface / atmosphere} is increasing ; 8. idea that less carbon dioxide {removed / used / eq} by photosynthesis ;	**QWC emphasis clarity of expression** **1. Accept** carbon dioxide, water vapour, sulphur dioxide, oxides of nitrogen **Not** methane **2. NB** do not penalise ref to methane twice **4. Accept** long wavelength light	**(5)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. reference to biofuels being (possibly)carbon neutral ; 2. idea that {plants / crops} are used for biofuels ; 3. idea that carbon dioxide used for photosynthesis (by plants / in production of biofuels) ; 4. idea of using biofuels to replace fossil fuels ;	**Ignore carbon unqualified** **1. Accept** idea of no (net) change in carbon dioxide levels in atmosphere	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	1. land has to be cleared to grow plants for biofuels / eq ; 2. burning produces carbon dioxide / the plants growing there would have been {photosynthesising / using carbon dioxide} / machinery uses fossil fuels / loss of habitat ; OR 3. decomposition of dead plant material (after clearing) / eq ; 4. produces carbon dioxide / eq ; OR 5. idea that the land could have been used for food production ; 6. less food produced / eq ; OR 7. ref to use of fertilisers ; 8. idea of eutrophication OR use oil-based products ;	**Mark as pairs** **1 Accept** reference to deforestation of land to grow plants for biofuels **6 Accept** shortage of food, contributes to world hunger, idea of causing starvation	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. (rate of) { energy incorporated into / production of / eq} {biomass / organic material} ; 2. in {plants / producers} ;	**2. Accept** from photosynthesis	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. very little GPP in seagrass / majority present in {microphytobenthos and phytoplankton / phytoplankton} ; 2. (roughly) equal distribution (of GPP) between microphytobenthos and phytoplankton ;	**1. Accept** only 2.5 to 5% in seagrass, 95% in micro and phyto, more than 50% or about 55% of phyto 2. **Accept** about 50% in each **Accept** idea that GPP in microphytobenthos is slightly lower than in phytoplankton	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. idea of obtaining a value from the chart e.g. percentage, area, degrees, ratio ; 2. idea of how to use this to calculate GPP ;	**Ignore** units **1. Accept** appropriate figures in range 50 – 55 % **2. Accept e.g. (**percentage) multiplied by 8.4 x 10^6 **NB** $\frac{\text{angle}}{360} \times 840 \times 10^6$ = 2 marks $\frac{\text{area of segment}}{\text{area of circle}} \times 840 \times 10^6$ = 2 marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	1. {more / fast / high / eq} photosynthesis ; 2. water less {cloudy / churned up } / shallow water / high light penetration / eq ; 3. high {nutrient / carbon dioxide} levels in the sea / eq ; 4. {high / optimum} temperatures ; 5. high light intensity (in this area) / eq ; 6. idea of less respiration ;	**2. Accept** less current, less tidal	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)	1. NPP = GPP – R / eq ; 2. energy lost as heat / eq ; 3. named use of energy (released by respiration);	**1. Accept** correct description in words **3. Accept** e.g. movement, opening of flowers, glycolysis, metabolic processes	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	{Met Gly Ile} / {methionine glycine isoleucine} ;	**Not** other abbreviations	(1)

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	idea that each {triplet is discrete / base is only used once in a triplet / eq} ;	**Accept** a description of how the code could be read if overlapping	(1)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. idea that each amino acid needs a code ; 2. idea that {using three bases give enough codes / using less bases does not give enough codes} ; 3. idea of three bases means there can be 64 {triplets / codes / combinations / eq} ;	**Accept** codons	(2)

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. idea that {effects of mutations are reduced / the amino acid may not be altered} ; 2. reference to the third base (being the one that can be changed with no effect) ; 3. no effect on (resulting) {polypeptide / protein} / eq ;	**1. Accept** description of effect **Accept** from a description of a specific example **Accept** always results in same amino acid **Not** similar amino acid **2 NB** If mp 2 is awarded it will usually incorporate mp 1 as well = 2 marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(c)	1. reference to (TAA, TAG and TGA as) stop codons ; 2. occur at the end of the gene (on the DNA) / eq ; 3. reference to transcribed as mRNA / eq ;	**1. Not** codes, triplets	

	4. as AUU, AUC and ACU ; 5. idea that they are recognised by ribosome ; 6. idea that they signal the end of the polypeptide (chain) ; 7. reference to (during) translation ;	**6. Accept** stops the synthesis of the polypeptide / the polypeptide is finished	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(d)	1. ref to peptide {bond / link} ; 2. between (amino group / NH_3 / NH_4^+} and {carboxyl group / COOH / COO^-} ; 3. ref to condensation (reaction) ; 4. idea of role of {tRNA / ribosome / enzymes / correctly named enzyme} in joining amino acids together ;	**Accept** mp 1 and 2 from correctly drawn and labelled diagram **2. NB** formulae must be correct if only these are given **4. Accept** e.g. hold the amino acids next to each other, ribosome contains enzyme	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. bacteria are cells, viruses are {not / particles} ; 2. idea of bacteria surrounded by {cell wall / slime / capsule } , viruses surrounded by {protein / capsids / envelope} **;** 3. bacteria have { plasmids / ribosomes / other named structure} , viruses do not have {plasmids / ribosomes / other named structure } ; 4. bacteria (genome) are DNA, viruses can be DNA or RNA ; 5. bacterial DNA is double-stranded, viral genetic material is single (or double) stranded / eq ; 6. idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} genetic material ;	**NB** piece answers together throughout **Accept** only matched structures **2. Accept** for envelope: membrane / phospholipid layer / eq **3. Accept** bacteria have membranes, flagella cytoplasm, glycogen, lipid droplets **6. Not** in context of plasmid	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	1. reference to humoral (immune) response ; 2. reference to {phagocytosis / eq} by {phagocytes /named phagocyte} ; 3. reference to macrophages as { antigen-presenting cells / APCs} (to T helper cells) ; 4. reference to B cells as { antigen-presenting cells / APCs} (to itself) ; 5. idea that T helper cells release cytokines for B cell {activation / stimulation} ; 6. idea of B cells {forming clones / dividing /eq} (to form B effector cells) ; 7. reference to {differentiation of B cells into plasma cells / formation of plasma cells from B cells} (subsequent to cloning) ;	**2. Accept** dendritic cells / Langerhans cells / B cells **3 Accept** dendritic cells / Langerhans cells 4. **Accept** antigen binds to B cells **6. Not** to form plasma cells	**(4)**

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	1. reference to {opsonisation / antibodies bind to bacteria / eq} ; 2. (as a result) enhancing phagocytosis / eq ; 3. reference to {immobilisation / agglutination / eq } (of bacteria) ; 4. idea of antibodies neutralising toxins / eq ;	**1. Not** reference to killing bacteria **2. Accept** easier, better	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(b)(iii)	1. idea that the immune response will be weaker ; 2. person may not recover from this infection / eq ; 3. idea of {other (opportunistic) infection / cancer} ; 4. reference to cytokines released from {T helper / CD4 } cells ; 5. idea that cytokines are involved in {activation / division } of {B cells / T killer cells} ; 6. credit consequence of impaired B cell function ; 7. credit consequence of impaired T killer cell function ;	**1. Accept** in context of either humoral or cell-mediated immune response **6. Accept** e.g. no antibody produced by plasma cells **7. Accept** e.g. infected cells not destroyed	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. reference to enzymes {killing / destroying / eq} (microorganisms) ; 2. reference to {stomach acid / hydrochloric acid / HCl} {killing / destroying / eq} (microorganisms) ; 3. reference to lack of oxygen affecting (microorganisms) ; 4. idea of competition by gut flora with (microorganisms) ; 5. idea that insufficient numbers of (microorganisms) (to cause food poisoning) ; 6. idea that the (microorganisms) may not be {pathogenic/ harmful / cause food poisoning} ; 7. reference to (immediate) vomiting to remove (microorganisms) ;	**1. Accept** lysozymes / enzymes in saliva **Accept** enzymes destroying viruses **2. Accept** acid destroying viruses **3. Not** viruses **4. Not** viruses **6. Not** pathogens	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	1. reference to synthesis of RNA ; 2. using host cell {enzymes / named enzyme / (RNA) nucleotides} ; 3. reference to synthesis of (viral) proteins ; 4. using host cell {enzymes / named enzyme / amino acids / ribosomes / tRNA / ATP} ; 5. reference to assembly of {viruses / particles} (inside cells) ;	**1. Accept** mRNA **2. Not** reverse transcriptase **5. Accept** protein and RNA {form / make / eq} {viruses / particles}	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. idea of a delay (up to 24 hours) whilst viral particles are replicating / eq ; 2. idea that a virus can {result in many particles being formed / replicate very fast} ; 3. idea that more host cells infected ;	**2. Accept** reference to lytic cycle	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)(iii)	1. reference to the {hand wash / alcohol} not affecting the virus ; 2. reference to (noro) virus {not having an envelope / surrounded by protein / eq} ; 3. alcohol does not {damage protein coat / penetrate} virus / eq ; 4. protein is hydrophilic / alcohol is an organic solvent / eq ;	**1. Not** does not kill virus **2. Accept** surrounded by a capsid	**(2)**

Question Number	Answer	Additional Guidance	Mark
8(a)	idea of organisms that breed to produce fertile offspring ;	**Ignore** reproductively isolated **Ignore** viable	**(1)**

Question Number	Answer	Additional Guidance	Mark
8(b)	1. idea of geographical isolation ; 2. idea of different {environmental conditions / habitats / eq} ; 3. reference to different selection pressures ; 4. idea that mutation resulted in {adaptation / increased survival} ; 5. idea of {decrease in gene flow / different alleles} ; 6. ref to reproductive isolation ; 7. credit suitable example e.g. different songs, incompatible genitals ;		**(4)**

Question Number	Answer	Additional Guidance	Mark
8(c)	1. idea of descending from common ancestor ; 2. idea of living in similar habitats ; 3. idea of similar (environmental) {conditions / factors} ; 4. idea of similar selection pressures ; 5. idea that both well-adapted ; 6. idea that mutations have not changed appearance ; 7. idea of similar gene pool ;	**Accept** same for similar throughout **2. Accept** place / environment / area	**(3)**

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