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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCE in 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.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. {antigen / bacteria / virus / pathogen} {binds / eq} to B cell ; 2. {antigen / bacteria / virus / pathogen} {binds / eq} to MHC (antigen) ; 3. T helper {lymphocytes / cells} {bind / eq} (to B cell) ; 4. reference to cytokines (from T helper cells) ;	**1 ACCEPT** B cell is an antigen-presenting cell **3 ACCEPT** CD4 cells	**(3)**

Question Number	Answer	Mark
1(b)(i)	mitosis ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. idea of sample of B cells from lymph nodes ; 2. reference to named stain e.g. (acetic) orcein ; 3. credit correct details of method for B cells e.g. heating / add { HCl / acid } ; 4. idea of looking for mitotic features ;	**1 ACCEPT** from blood **2 ACCEPT** acetocarmine, Feulgen's, Schiff's, toluidine blue **3 ACCEPT** squashing of lymph node **4 ACCEPT** stages of mitosis	**(3)**

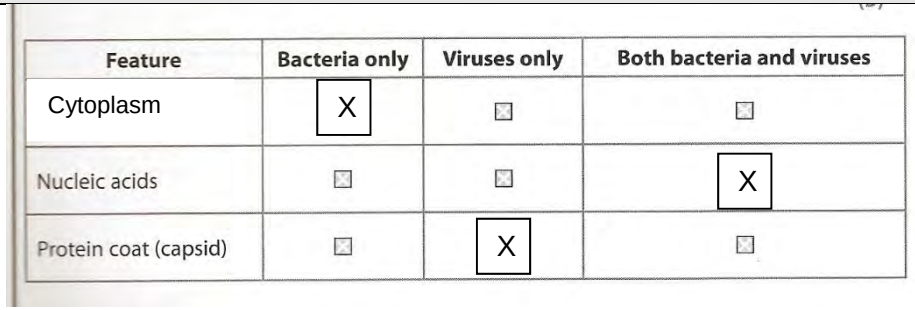
Question Number	Answer	Mark
1(c)(i)	**C** mitochondrion ;	(1)

Question Number	Answer	Mark
1(c)(ii)	**C** nucleus ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	endoplasmic reticulum / ER ;	**IGNORE** smooth , rough **ACCEPT** RER / SER / ribosome	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(iv)	**IF RER / SER HAS BEEN GIVEN AS ANSWER IN (iii):** 1. {protein synthesis / translation / eq} occurs ; 2. on the ribosomes ; 3. idea that {polypeptide / protein} {moves into / transported into} the ER ; 4. to the Golgi apparatus / through the cytoplasm / eq ; **IF GOLGI HAS BEEN GIVEN AS ANSWER IN (iii):** 5. it modifies the protein / eq ; 6. credit example of modification e.g. addition of carbohydrate group ;	**IF CYTOPLASM HAS BEEN GIVEN AS ANSWER IN (iii): apply either the RER OR Golgi Mps** **1 ACCEPT** description of translation **4 ACCEPT** idea of folding into {secondary / tertiary} structure	

	7. idea that antibody moved into vesicles ; 8. exocytosis / eq ; **IF RIBOSOME HAS BEEN GIVEN AS ANSWER IN (iii):** 9. {protein synthesis / translation / eq} occurs ; 10. ribosome holds mRNA / eq ; 11. ribosome holds two tRNA / eqs ; 12. so that peptide bonds can form between (adjacent) amino acids ;		**(3)**

Question Number	Answer	Mark
2(a)		(3)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. idea of little difference between the groups (at each incubation time) ; 2. idea of {large / eq} error bars ; 3. idea of {overlapping / eq} error bars ;	2 and 3 **ACCEPT** range bars	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. idea that membrane {receptors / proteins / glycosidic groups / eq} interacts with bacteria ; 2. idea of {pseudopodia formed around / macrophage surrounds} the bacteria ; 3. idea that membranes (of pseudopodia) {fuse / pinch off / eq} ; 4. to form a vacuole (that contains the bacteria) / eq ; 5. idea that {change in shape / fusion /movement / eq} of membrane is due to fluidity of membrane ; 6. caused by the {movement of phospholipids / presence of cholesterol / eq } ;	**1 ACCEPT** antibodies bind to both bacteria and macrophage / opsonisation **2 IGNORE** engulf **4 ACCEPT** vesicle, phagosome	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	1. bacteriostatic antibiotics stop the bacteria from dividing / eq ; 2. bactericidal antibiotics {kill / eq} the bacteria ;	**IGNORE** description of mechanism **1 ACCEPT** growing, replicating	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	1. idea that viruses are non-living ;	**ACCEPT** viruses do not have the target sites for antibiotics	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. (rate at which) energy {incorporated / eq} into {biomass / organic matter } ; 2. by { plants / producers} ;	**1 NOT** energy produced, converted, turned into **ACCEPT** organic material, organic molecules **2 ACCEPT** by photosynthesis	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. GPP {depends / eq} on photosynthesis ; 2. higher the temperature the higher the GPP / eq ; 3. enzymes in (photosynthesis / chemical reaction) {can work faster / more kinetic energy / eq } ; 4. higher the {precipitation / eq} the higher the GPP / eq ; 5. idea that water is needed for the light-dependent reaction ; 6. role of water in transport of { mineral ions / named mineral ion / amino acids / sucrose / eq } ;	1 needs to be a clear statement **2 ACCEPT** converse **3 ACCEPT** increased enzyme activity **4 ACCEPT** converse **5 ACCEPT e.g.** photolysis, H^+ donor, replacing electrons	**(5)**

Question Number	Answer	Additional Guidance	Mark
3(c)	1. credit two values that lie in the range: greater than 0 to 11000 ; 2. appropriate justification based on temperature ; 3. appropriate justification based on precipitation ;	**1NB** (actual value is 126-3100) **ACCEPT** below 850	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(d)	1. (trophic level 2) 2300 - 1500 / 800 (kJ) ; 2. (trophic level 3) 760 - 690 / 70 (kJ) ; 3. ((70 ÷ 800) x 100) = 8.8 / 8.75 (%)	**Correct answer gains three marks** **3 ALLOW** ecf for two values used	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(a)	1. idea that enzyme activity decreases ; 2. credit calculated reduction e.g. 0.6, 2.7 , 3.3 ; 3. idea that an increase in temperature results in increase in kinetic energy ; 4. causing changes in bonds (in the enzyme) / eq ; 5. idea that enzyme is denaturing (above 40 ºC) ; 6. idea that carbon fixation is reduced ;	**5 ACCEPT** fewer enzyme-substrate complexes **NOT** starts to denature	**(5)**

Question Number	Answer	Additional Guidance	Mark
4(b)	{RuBP / ribulose bisphosphate} AND {carbon dioxide / CO_2} ;	**ACCEPT** Rubp / ribulose biphosphate NOT CO / CO^2	**(1)**

Question Number	Answer	Mark
4(c)(i)	**D** valid ;	**(1)**

Question Number	Answer	Mark
4(c)(ii)	**C** measuring the activity at 1ºC intervals between 35ºC and 45ºC ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(a)	1. idea that cellulose is a {polymer / polysaccharide} of β glucose ; 2. reference to 1-4 glycosidic {bonds / eq} ; 3. idea that every other glucose is inverted ; 4. idea of cellulose molecules arranged {parallel /as microfibrils} ; 5. joined by hydrogen bonds / eq ;	**1 ACCEPT** made of β glucose monomers **3 ACCEPT** 180° angle between each glucose	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(b)	1. idea of {lack of / very slow} decomposition ; 2. due to lack of {microorganisms / bacteria / fungi / named decomposer} (involved in decomposition) / eq ; 3. as a result there are fewer enzymes / eq ; 4. low pH {reduces enzyme activity / kills microorganisms /eq} ; 5. low oxygen affects respiration (of microorganisms) / eq ; 6. idea that bacteria cannot produce enzymes to breakdown sporopollenin ;	**1 ACCEPT** breakdown, decay **2 ACCEPT** cannot survive **4 ACCEPT** acidic	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(c)	1. reference to double fertilisation ; 2. idea that one (haploid) male {gamete / nucleus } fuses with (haploid) {egg cell / egg nucleus / female gamete / female nucleus} ; 3. to produce a {diploid / 2n} {zygote / embryo} ; 4. idea that one (haploid) male {gamete / nucleus} fuses with { polar nuclei / diploid endosperm nucleus / fusion nucleus} ; 5. to produce a {triploid / 3n} endosperm (nucleus) ;	**2 ACCEPT** sperm nucleus **NOT** generative nucleus **IGNORE** ovum / egg unqualified **4 NOT** generative nucleus / polar bodies	**(4)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. (overall) increase in pollen count (as the layers get deeper) ; 2. by 28 (au) ; 3. idea that increase is {greater between 12.5 and 13 m / smaller between 13 and 13.5 m} ; 4. {22 compared to 6 / 18 compared to 10} ; 5. idea that fluctuations are {greater between 12.5 and 13 m / smaller between 13 and 13.5 m} ;	**ACCEPT 12.9 as time of eruption** **1 ACCEPT** converse **3 ACCEPT** increase is {greater after the eruption / smaller before the eruption} ACCEPT converse **5 ACCEPT** fluctuations are {greater after the eruption / smaller before the eruption}	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)	idea of layers being { destroyed / mixed together / eq } ;	**ACCEPT** area destroyed / layers are indistinct / not clear / no peat / rocks present	**(1)**

Question Number	Answer	Additional Guidance	Mark
6(c)	1. idea that at {higher / eq} temperature {ice melts / water expands} so level rises ; 2. idea that at { lower / eq} temperatures {ice forms /eq} so level falls ;	**1 ACCEPT** more evaporation (of water) with increase in temperature so level falls	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(d)(i)	1. decrease in pollen count (in peat) after eruption / eq ; 2. decrease in sea level after eruption / eq ;		(2)

Question	Answer	Additional Guidance	Mark

Number			
6(d)(ii)	**General point:** 1. idea of {fluctuations (in the data) /only a correlation} ; Pollen data: 2. idea that other factors affected the {pollen / plants} ; OR idea that data only comes from one peat bog ; OR idea that the lowest values before the eruption are lower than th values after the eruption ; OR idea that there is data is missing so we {do not have the complet / are only assuming that values are lower} ; Sea level data: 3. idea that the sea is in only one area ; OR idea that sea levels were already falling before eruption ; OR no evidence that drop in sea level is due to temperature decrease / eq;	**1 ACCEPT** in context of either graph **2 ACCEPT** idea that the highest values after the eruption are higher than the lowest values after the eruption ;	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. idea that {body / core / eq} temperature drops after death ; 2. (rate / extent) of temperature drop depends on {ambient / eq} temperature ; 3. idea that ambient temperature {fluctuates (over time) / does not stay constant} ; 4. idea that the sooner after death the more accurate the (estimate of) time of death ;	**2 IGNORE** body temperature drops to ambient temperature **ACCEPT** idea that if body temperature has already reached ambient temperature there will be no further fall	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	1. correct values read from graph (37.5 & 36.27) ; 2. (correct subtraction) = 1.23(°C) ;	**Correct answer only scores 2 marks** **2 IGNORE** + or – signs **ACCEPT** ECF for 36.26 to 36.28 e.g. 36.28 = 1.22(°C)	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. idea that calculations of time of death are based on {average body temperature / 37˚ C} ; 2. body temperature at time of death will depend on time of day / eq ; 3. idea that therefore the calculated value for time of death may not be accurate ;	**3 ACCEPT** therefore the estimate will have to be a range of times **ACCEPT** take into account 1.23°C range	**(2)**

Question Number	Answer	Additional Guidance	Mark
*7(c)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea of using {a range / at least five} temperatures ; 2. description of temperature control e.g. water bath, incubator ; 3. idea that timing starts when eggs hatch into first instar maggots ; 4. and ends when the (third instar) maggots begin to pupate / eq ; 5. idea that several {eggs / maggots} should be used at each temperature ; 6. idea of providing food for maggots ; 7. reference to appropriate controlled variable e.g. humidity. mass of food, species ; 8. reference to plotting data on a graph of temp against time (for first instar to become a pupa);	**Emphasis is on clarity of expression** **1 ACCEPT** a min of -10°C and a max of 50°C **5 ACCEPT** minimum of 3 eggs **/** maggots **7 IGNORE** light, pH, amount of food, oxygen	**(5)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>8(a)</td><td>
<table>
<tr><th></th><th>Fibrous</th><th>Globular</th><th></th></tr>
<tr><td>1.</td><td>insoluble / large</td><td>Soluble / small</td><td>;</td></tr>
<tr><td>2.</td><td>hydrophobic on outside</td><td>hydrophilic on outside</td><td>;</td></tr>
<tr><td>3.</td><td>mainly secondary structure</td><td>3D /folded / compact shape / tertiary / eq</td><td>;</td></tr>
<tr><td>4.</td><td>repeated amino acid sequences</td><td>little repetition</td><td>;</td></tr>
<tr><td>5.</td><td>structural / eq</td><td>enzymes / hormones / eq</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
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</td><td>Do not piece together

3 ACCEPT chains / straight proteins
IGNORE quaternary</td><td>(3)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
*8(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. reference to {*post-transcriptional modification* / *splicing*} (of mRNA) ; 2. reference to *spliceosomes* ; 3. reference to {removal / eq} of *introns* ; 4. idea that different {number / length} of *exons* are put together (in the different sexes) ; 5. idea that the length of the *mRNA molecules* will be different (for males and females) ; 6. idea that the longer mRNA will have more *codons* ; 7. and therefore more *amino acids* will be coded for ; 8. reference to (during) *translation* ; 9. idea of removal of some amino acids post-translation ;	**QWC emphasis is on correct spelling of biological terms** **1 ACCEPT** post-transcriptional changes **7 ACCEPT** converse **8 in the context of Mp7 ACCEPT** converse	**(6)**

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