Mark Scheme (Results)

October 2017

Pearson Edexcel International Advanced Level Biology (WBI04) Paper 01
The Natural Environment and Species Survival

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

October 2017
Publications Code WBI04_01_1710_MS

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	Mark
1(a)(i)	**D** - thylakoid membrane The only correct answer is D A is not correct because the matrix is in the mitochondria B is not correct because electron transport occurs in the thylakoid membrane C is not correct because electron transport occurs in the thylakoid membrane	**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	1. idea of moving protons (through the thylakoid membrane) into thylakoid space ; 2. idea of protons moving through ATP synthase channel (back into stroma) {releases energy to make ATP / produces reduced NADP / eq} ; 3. (ATP / reduced NADP used) for conversion of GP into GALP / eq ;	**1 ACCEPT** results in accumulation of protons in thylakoid space	**(2)**

Question Number	Answer	Mark
1(a)(iii)	**C** - 30 °C to 40 °C The only correct answer is C A is not correct because the optimum temperature lies between 30 °C to 40 °C B is not correct because the optimum temperature lies between 30 °C to 40 °C D is not correct because the optimum temperature lies between 30 °C to 40 °C	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	1. to act as a catalyst ; 2. carbon fixation / eq ; 3. (so that) {GP / 6C intermediate} is formed ;	**1 ACCEPT** lowers activation energy **2 ACCEPT** CO_2 binding to RuBP / CO_2 reacting with RuBP	**(3)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	1. (µmol) {concentration / mass} of {product made / named product made} ; 2. (m^{-2}) leaf area ; 3. (s^{-1}) idea of time being measured ; 4. (mean) adding together the data and dividing by the number of results / eq ; 5. idea of measuring initial rate (of reaction) ;	**1** e.g. 6C intermediate, GP, GALP, glucose, oxygen **ACCEPT {**substrate used / named substrate used} e.g RuBP, CO_2 **ALLOW** volume of CO_2 / oxygen **IGNORE** amount **2 ACCEPT** description of how this could be done e.g. draw round leaf and count squares and convert into m^2 **IGNORE** chloroplast **3 ACCEPT** stated period of time of at least 10 seconds	**(3)**

Question Number	Answer	Additional guidance	Mark
1(c)	1. RUBISCO data are reliable as a mean has been calculated / eq; 2. (RUBISCO data are) reliable as {error bars / eq} / eq ; 3. idea that (RUBISCO data are) not reliable as overlapping error bars ; 4. electron transport data may not be reliable as a mean has not been calculated / eq ; 5. (electron transport data) may not be reliable as there are no {error bars / eq} / eq;	**1 ACCEPT** investigation has been repeated at each temperature **2 ACCEPT** reliable at {10°C / 40°C / 50°C} as {no overlap / small error bars} **3 ACCEPT** not reliable as long error bar at 30°C	**(3)**

Question Number	Answer	Additional guidance	Mark
***2(a)**	**QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence** **Inflammation:** 1. {increased blood flow / eq} to the (infected) area ; 2. carrying {phagocytes / white blood cells / named white blood cell} ; **Interferon:** 3. binds to (uninfected host) cells / eq ; 4. prevents {infection by / attachment of / replication of / assembly of / multiplication of / eq} **virus** ; **Phagocytosis:** 5. to engulf {bacteria / virus / pathogen} / eq ; 6. so that {bacteria / virus / pathogen / antigen} can be {destroyed / digested / eq } ; 7. by enzymes / eq ; 8. idea that after phagocytosis the **macrophage** can present antigen ;	**QWC emphasis on clarity of expression** **1 ACCEPT** vasodilation (of arteries) / eq **2 IGNORE** macrophage **4 DO NOT ACCEPT** growth, bacteria **IGNORE** pathogen **5 ACCEPT** antigen **6 ACCEPT** kills but **DO NOT ACCEPT** kills {viruses /antigen}	**(6)**

Question Number	Answer	Mark
2(b)(i)	**B** - glycosidic The only correct answer is B A is not correct because it is not a bond between a fatty acid and a glycerol C is not correct because it is not a bond between two amino acids D is not correct because it is not a bond between a phosphate group and a pentose sugar	**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	water / H_2O		**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)(iii)	1. viruses surrounded by {envelope / protein coat / capsid / eq} ; 2. so these bonds are not present ;	**1 ACCEPT** viruses do not have {a cell wall / these molecules} **2 ACCEPT** outside of virus does not fit active site of the enzyme **IGNORE** named bonds	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)(i)	1. GPP = 1680 and R = 960 ; 2. NPP = 1680 - 960 = 720 ;	**NB Units not required** **2** CE applies if calculation has used both values for GPP and R and includes either 1680 or 960 given	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	1. 65% of 720 (720 x 65 / 100) = 468 ; 2. 720 + 468 = 1188 ;	**1** CE applies from (a)(i) **2** CE applies	**(2)**

Question Number	Answer	Additional guidance	Mark
3(b)	1. (overall) GPP is decreasing (with age) / eq ; 2. at a faster rate than R / eq ; 3. more growth occurs in young trees / less growth in older trees / eq ; 4. idea that rate of photosynthesis decreases with age ; 5. credit reason for photosynthesis decreasing ; 6. idea that the mineral ions in the soil will be depleted ; 7. R decreases because some of the trees are {not respiring / dead / eq} ;	**2 ACCEPT** converse **4 ACCEPT** description of photosynthesis **5** e.g. lower ratio of leaves : rest of tree in older trees, 'trunk is thickening but no more leaves', trees shade each other **7 DO NOT ACCEPT** idea that trees are being removed from the area	**(4)**

Question Number	Answer	Additional guidance	Mark
3 (c)	1. reforestation {increases / eq} photosynthesis ; 2. more {trees / photosynthesis} removes carbon dioxide from the atmosphere ; 3. idea that cars put more {carbon dioxide / carbon} into the atmosphere than trees can remove ; 4. idea that large {areas of forest / numbers of trees} would be needed to compensate for all the carbon dioxide being put into the atmosphere ; 5. idea that there are more than just cars putting carbon dioxide into the atmosphere ; 6. idea that land being used to grow trees may be needed for {housing / farming / eq} ;	**1 ACCEPT** more plants to photosynthesise **NB** 'more trees to photosynthesise so more carbon dioxide taken up' = mp 1+2 'more plants to photosynthesise and take up carbon dioxide' = mp 1+2 **5 ACCEPT** an example e.g. respiration by animals	**(4)**

Question Number	Answer	Additional guidance	Mark
***4**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea that some would die (straightaway) ; 2. because of {exhaustion / dehydration / lack of food on island / predation / disease / eq } ; 3. idea that (original) iguanas would breed together (population increased) ; 4. idea of mutations in {DNA / genes} occurring ; 5. idea that conditions {on / within} Anguilla were different ; 6. idea of different selection pressures ; 7. idea that most adapted iguanas {survived / reproduced / eq} passing **alleles** onto offspring ; 8. idea of reproductive isolation occurring (after time on Anguilla) ; 9. therefore new species of iguana could evolve ; 10. by natural selection ;	**QWC emphasis logical account** **5 ACCEPT** an appropriate example **7 DO NOT ACCEPT** genes / features / characteristics **8 ACCEPT** a description e.g. different breeding seasons **9 ALLOW** subspecies / speciation	**(6)**

Question Number	Answer	Additional guidance	Mark
5(a)(i)	1. to provide protection to the newborn baby against {infection / pathogen / named pathogen / toxin } ; 2. until (newborn baby's) own immune system develops / eq ;	**1 ACCEPT** disease provides (natural) passive immunity **2 ACCEPT** idea that a newborn baby's immune system is {not developed / weak}	**(2)**

Question Number	Answer	Mark
5(a)(ii)	**D** - natural passive The only correct answer is D A is not correct because antibodies passed on from the mother is natural B is not correct because antibodies passed on from the mother is natural and passive C is not correct because antibodies passed on from the mother is passive	**(1)**

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	1. to {bind / present (to themselves)} antigen ; 2. B cells become plasma cells ; 3. (so that) antibody can be {produced / released / eq} (from plasma cells) ; 4. for {opsonisation / agglutination / antitoxin / eq } ; 5. B cells generate (B) memory cells ; 6. for long term immunity / rapid response on reinfection / eq;	**1 ACCEPT** act as antigen-presenting cells (to themselves) **NB** Accept mp 2 and 3 in context of primary or secondary immune response **3 ACCEPT** idea that B cells are involved in the humoral (immune) response	**(4)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	1. substance / eq ; 2. that stimulates {immune response / antibody production (by plasma cells) / eq} ;	**1 ACCEPT** protein / chemical / molecule / appropriate named molecule / particle **2 ACCEPT {**recognition / identification / eq} of {non-self / pathogen / eq}	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	1. maternal antibodies will {bind to/ attach to / stick to / agglutinate / opsonise /eq} the {antigen / eq} (in the vaccine) ; 2. phagocytes will {engulf / destroy / eq} the {antigen / eq} ; 3. (the child's) immune system is not activated / eq; 4. credit details of what would not happen ;	**2 ACCEPT** antibodies will neutralise the toxin **DO NOT ACCEPT** antibodies destroy antigen **3 ACCEPT** no {(artificial) active immunity / humoral response} **4** e.g. macrophages cannot present the antigen, B cells cannot bind to antigen, no plasma cells, no memory cells	**(3)**

Question Number	Answer	Mark
6(a)(i)	**A** <table><tr><td>transcription</td><td>post-transcription</td><td>translation</td><td>post-translation</td></tr></table> ; The only correct answer is A B is not correct because post-transcription comes after transcription C is not correct because post-transcription comes after transcription D is not correct because translation comes after post-transcription	**(1)**

Question Number	Answer
6(a)(ii)	**C** <table><tr><td>nucleus</td><td>nucleus</td><td>ribosomes</td><td>Golgi apparatus</td></tr></table> ; The only correct answer is C A is not correct because translation occurs on the ribosomes B is not correct because transcription occurs in the nucleus D is not correct because translation occurs on the ribosomes

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. idea that a correlation is when a change in one {variable / factor} is reflected by a change in another {variable / factor} ; 2. idea that there is no {proof / evidence} that a change in one variable {causes / results in / eq} a change in the other variable ;	**1 ACCEPT** reference to change once **DO NOT ACCEPT {**causes / affects / responsible for / eq} **2 ACCEPT** no evidence for a causal relationship **NB for 2 marks to be awarded there must be some context i.e {time / severity of disease / eq} and calcitonin levels,**	**(2)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. idea that the doubling time is more than 24 months (at any one time) ; 2. treatment is effective /eq ; 3. credit an appropriate calculation to justify either mp 1 or mp 2 ;	**1 ACCEPT** has not doubled in 24 months **3** e.g.	**(3)**

Time period	Doubling time / months	% increase in calcitonin
0	36	50
2	31.2	67 / 68
4	31.2/33.6	79 / 80
6	38.4	55
8	38.4	57
10	43.2	50
12	-	51/52

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	1. calcitonin is an antigen ; 2. idea that antibodies bind to {calcitonin /specific molecule / eq} ; 3. idea that antibodies can be labelled to be visualised ;	**1 ACCEPT** has antigens **3** e.g. fluorescence, radiolabelled, dye, enzyme **ACCEPT** idea of change in levels of {calcitonin / antibody} when mixed together / idea if antibody to calcitonin is present calcitonin must be too	**(3)**

Question Number	Answer	Additional guidance	Mark
6(c)	1. post-transcriptional {modification / eq} (of RNA) ; 2. reference to spliceosomes ; 3. idea that (mRNA) introns (and exons) can be removed ; 4. idea that {exons are recombined / (different) RNA} (coding) for either CGRP or calcitonin ;	**1 ACCEPT** RNA splicing **4 ACCEPT** (coding for) {either / each} (CGRP and calcitonin) proteins	**(3)**

Question Number	Answer	Additional guidance	Mark
7(a)	1. idea that locusts food store (fat) has a high energy content ; 2. idea that their metabolic rate is lower so that energy is not used as quickly ; 3. idea that they do not use as much of their {food / energy} store because hourly consumption is low ;	**2 ACCEPT** idea of {do not require so much energy / can use stored energy for a longer time}	**(3)**

Question Number	Answer	Additional guidance	Mark
7(b)(i)	1. idea of using eggs to obtain the locusts ; 2. idea of timing each stage of development ; 3. growth measured by {length / (fresh) mass / eq} (of locust) ; 4. idea of dividing growth measurement by time (to calculate rate) ; 5. idea of using several {locusts / eggs} to calculate a mean ; 6. credit a named relevant control variable being kept constant (if more than one {locust / egg} used) ;	**1 ACCEPT** idea of starting with eggs and locusts at each stage **3 ACCEPT** description of how it is measured **4 ACCEPT** plot a graph of growth measurement against time and work out the gradient **6** e.g. species, gender, type of food, humidity **IGNORE** light, water, food, temperature	**(4)**

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	1. idea that {growth / life cycle / development} is controlled by enzymes ; 2. credit explanation of effect of temperature on enzyme action ;	**1 IGNORE** metabolism, respiration **2** e.g. increase in temperature increases number of enzyme-substrate complexes, increase in temperature may denature enzymes	**(2)**

Question Number	Answer	Mark
7(c)(i)	**A** carbon dioxide, methane and water vapour The only correct answer is A B is not correct because oxygen is not a greenhouse gas C is not correct because oxygen is not a greenhouse gas D is not correct because oxygen is not a greenhouse gas	**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)(ii)	1. locusts will reduce global warming / eq ; 2. idea that if less {greenhouse gases / carbon dioxide} produced there will be less accumulation (of gases in the atmosphere) ; 3. idea that {greenhouse gases / carbon dioxide} trap {infra-red radiation / eq} (in the atmosphere) ; 4. therefore the temperature of the earth's {atmosphere / surface} will not increase (as much) ;	**2 IGNORE** other named greenhouse gases **3 ACCEPT** absorb, heat energy, long wavelength **IGNORE** other named greenhouse gases	**(3)**

Question Number	Answer	Additional guidance	Mark
8(a)	(mitochondrial) membrane proteins / matrix enzymes / enzymes involved in (aerobic) respiration / ribosome proteins / named protein found in mitochondria e.g. ATP synthase ;	electron transport proteins / enzymes involved in (mitochondrial) {DNA / RNA / protein} synthesis	**(1)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	Similarities: 1. idea that both strands in each DNA molecule are acting as templates ; 2. idea that each new DNA molecule consists of one old strand and one newly-synthesised molecule ; 3. {(DNA mono)nucleotides / primers / DNA polymerase} used ; Differences: 4. heat is used in PCR to separate strands whereas the cell uses {enzymes / helicase} / eq ; 5. PCR temperatures are higher than cell temperatures ; 6. PCR is quicker ;	**DO NOT PIECE TOGETHER** **2 ACCEPT** producing identical molecules / both involved complementary base pairing **3 IGNORE** PCR uses primers semi-conservative replication does not **4 ACCEPT** PCR uses Taq polymerase but cells do not / cells use ligase but PCR does not ; **5 ACCEPT** PCR temperatures vary but cell temperatures do not **6 ACCEPT** converse for S-CR	**(4)**

Question Number	Answer Additional guidance	Mark
8(b)(ii)	**C** smaller DNA fragments move further because they travel faster than the larger fragments The only correct answer is C A is not correct because larger DNA fragments do not push the smaller fragments B is not correct because larger fragments do not have more negative charges D is not correct because smaller fragments do not have more negative charges	**(1)**

Question Number	Answer	Additional guidance	Mark
8(c)	1. idea that mt DNA is unique to the individual ; 2. idea that mitochondria {persist longer than nuclei / are still present but nuclei are not **in the skeleton** }; 3. idea that there are many mitochondria present ; 4. so there would be multiple copies of the DNA ;	**NB Accept mitochondria or mtDNA throughout where appropriate** **4 ACCEPT** any indication that there is more mtDNA	**(2)**

Question Number	Answer	Additional guidance	Mark
8(d)	1. mitochondria **only** inherited from the mother / eq ; 2. mitochondria are present in the {secondary oocyte / ovum } ; 3. mitochondria are present in the {mid-piece / neck / eq} (of the sperm) / eq ; 4. which does not enter the {secondary oocyte / ovum} (on fertilisation) ; 5. idea that an individual's mitochondria are derived from the zygote ;	**NB Accept mitochondria or mtDNA throughout where appropriate** **2 ACCEPT** egg cell / female gamete **IGNORE** egg **4 ACCEPT** sperm mitochondria do not enter secondary oocyte **5 ACCEPT** idea that the child's mtDNA will be copied from the mother's mtDNA	**(3)**

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom