Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCE in Biology (6BI04) Paper 01 - The Natural Environment and Species Survival

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. 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

Summer 2015
Publications Code UA040921*

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)(i)	1. (skin flora) {prevent growth of / kill} {pathogens / microorganisms / bacteria / eq} ; 2. competition for {space / nutrients / water / minerals / eq} ; 3. release of {chemicals / toxins / antimicrobials / lipids / enzymes /eq } ;	**1 ACCEPT** prevent colonisation **IGNORE** antigens / viruses / infections / diseases **2 IGNORE** food / resources **3 NOT** sebum / lysozymes	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	**B** they have antimicrobial properties that inhibit the growth of bacteria		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	**C** keratin		**(1)**

uestion Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. idea of little {tertiary / quaternary } structure / eq OR mainly secondary structure ; 2. made up of {long / linear / straight / eq} {molecules / (poly)peptides / polymers }; 3. idea of cross-linking (between one polypeptide chain and another) ; 4. idea of repeating amino acid sequences / eq ; 5. insoluble / eq ; 6. tough / strong / eq ;	**3 NOT** peptide bonds **5 IGNORE** hydrophobic on outside	**(4)**

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	1. {DNA / (m)RNA} contains the {genetic code / triplet codons / base sequence coding for amino acids / eq};	**1 ACCEPT** (DNA) template	
	DNA :		
	2. idea that the DNA strand is used {in transcription / to make (m)RNA / eq} ;		
	mRNA :		
	3. (m)RNA is a copy of the DNA ;	**4 IGNORE** to cytoplasm	
	4. mRNA carries this {information / code /eq} {out of the nucleus / to the ribosomes / eq} ;		
	5. idea that amino acids {arranged in sequence / eq } ;		**(4)**

Question Number	Answer	Additional Guidance	Mark
2(a)	1. idea that carbon dioxide dissolves (in the water / in the oceans) ;	**1 ACCEPT** absorbed / reacts with /diffuses into / becomes carbonic acid	
	2. for {carbon fixation / light-independent reaction / eq} ;		
	3. by {photosynthesis / eq} of {seaweed / algae / (phyto) plankton / autotrophs / eq} ;	**3 ACCEPT** plants (that live in the sea) **IGNORE** organisms	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	respiration / decomposition / eq ;	**ACCEPT** description **NOT** photosynthesis	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)	**B** carbon dioxide and water		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(d)	1. decomposition / idea of breakdown of {organic matter / plant material / biomass / eq} ; 2. idea of (bacteria) producing {enzymes (for digestion) / correctly named hydrolytic enzyme} ; 3. respiration {produces / eq} {carbon dioxide / eq} ;	**1 ACCEPT** animal material decay / rot	**(3)**

Question Number	Answer	Mark
2(e)	**B** light-independent reaction	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(f)(i)	Correct answer gains both marks {332 + 23 + 444 / 799 } and {338 + 450 / 788 } ; (799 – 788) = 11 (au) ;	**CE** applies	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(f)(ii)	1. idea that rate of production of carbon dioxide is greater than rate of removal of carbon dioxide ; 2. idea of using of {fossil fuels / named fossil fuel / forests / eq} {releasing / producing} carbon dioxide ; 3. idea that this carbon (in fossil fuels / forests) was {locked up / removed from the air } years ago ; 4. idea of deforestation resulting in less {photosynthesis / carbon fixation / light independent reaction / eq} ;	**1 ACCEPT** carbon dioxide **{**production / release} is greater than used in photosynthesis **3 ACCEPT** ref to carbon sink **4 ACCEPT** less carbon dioxide used for photosynthesis	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	1. solution should contain (all) the {mineral / ions} that duckweed needs ; 2. at the minimum concentration / eq ; Any two correctly named ion and its corresponding function : e.g. {nitrate (ions) / NO_3^{2-}} for {amino acids / protein / nucleic acid / ATP /chlorophyll / eq} {magnesium ions / Mg^{++}} for chlorophyll {calcium ions / Ca^{++}} for {cell wall / pectate / middle lamella / eq } {phosphate (ions) / PO_4^{3-}} for { nucleic acid /ADP / ATP / NAD /phospholipid / eq} ; ;	**1 IGNORE** nutrients **2 ACCEPT** in excess **IGNORE** carbon dioxide and wrong formulae **NOT** nitrogen **NOT** magnesium **NOT** calcium **ACCEPT** membrane **NOT** phosphorous	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	1. idea of {extrapolation / drawing a line of best fit / eq} (to estimate number of fronds after 10 days) ; 2. read value from graph / eq ; 3. idea of subtracting { 50 / 10} from the number of fronds after 10 days ;	**NB** Apply this mark scheme even if they describe weighing the fronds and calculating the mass increase **2 IGNORE** time refs.	**(2)**

Question Number	Answer	Additional Guidance	Mark
*3(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea of using {solution of ions / complete medium} ; 2. idea of using a {range of / minimum of 5} temperatures ; 3. idea that different temperatures will be achieved using {waterbaths / incubators / eq} ; 4. idea of determining growth over a period of time ; 5. credit appropriate named example of how growth is to be assessed eg {number / size / mass } of {fronds / plants}, length of roots ; 6. credit named control variable e.g. same concentration of (each) inorganic ions ; 7. idea of repeats to calculate a {mean / average} ;	**QWC with an emphasis on logical sequence** 2. **ACCEPT** 5 quoted temperatures in between 1°C and 70°C **IGNORE** room temp if 6 or more values given 5. **IGNORE** height / refs to germination **7 ACCEPT** for reliability	**(5)**

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	1. idea of binding of {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} to (phagocytic) cell ; 2. idea that {bacteria / virus / pathogen / microorganism / antigen / eq} is {engulfed by / taken into / endocytosis into } (phagocytic) cell ; 3. idea of bacteria being inside a {vacuole / phagosome / eq} ;	**1 ACCEPT** phagocyte **2 ACCEPT** phagocyte **3 ACCEPT** vesicle	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. idea that the body {reacts / defends itself / responds /eq } to a {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} ; 2. idea that the response is not dependent on the specific {bacteria / virus / pathogen / microorganism / antigen / eq} ; 3. credit named reaction e.g. lysozymes , inflammation, phagocytosis, interferon production ;	**1 NOT** reference to immune response **2 ACCEPT** idea of no previous infection / responds to any pathogen **3 IGNORE** egs of barriers	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	1. reference to {bacteria / virus / pathogen / microorganism / eq} ; 2. being inside {tissues / cells } / eq ;	**1 IGNORE** disease / infection / foreign matter / antigen **2 IGNORE** body **ACCEPT** idea that has evaded barriers, named cell or tissue **IGNORE** {infects / attaches / harms / attacks} cells	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)	reaction A = phosphorylation ; reaction B = hydrolysis ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	Diagram marks : 1. two membranes shown ; 2. inner membrane folded into cristae ; Label marks (correct) : [max 2 marks] 3. outer membrane and {inner membrane / cristae} ; 4. matrix ; 5. stalked particles / ATPase / eq (labelled on inner membrane) ; 6. DNA (circular / loop) ; 7. ribosomes ;	 **1 NOT** if cristae shown as a 3rd membrane **NB** do not choose which labels to accept eg 2 right + 1 wrong = 1 mark 2 wrong = 0 marks **5 ACCEPT** oxisome **6 ACCEPT** plasmids **7 IGNORE** size references	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	chloroplast ;	**IGNORE** chlorophyll	**(1)**

Question Number	Answer	Additional Guidance	Mark
5 (a)	1. idea that the {alveoli / air sacs / lung / tissue } have been {replaced / destroyed / eq} (by the tubercle) ; 2. idea that the (tubercle / destroyed lung tissue) has reduced the (surface) area (of the lung) ; 3. breathing problems due to { gas exchange being reduced / less oxygen in blood / eq } ; 4. idea that the coughing is { due to irritation /to remove the dead tissue / eq} ; 5. blood coughed up is due to damage of (lung) blood vessels / eq ;	**1 IGNORE** blocks **4 ACCEPT** tubercle **5 IGNORE** idea that lung damage causes bleeding	**(4)**

Question Number	Answer	Additional Guidance	Mark
5 (b)(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
5(b)(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 ; 6. idea that the more resistant bacteria there are, the more likely new strains will acquire the (resistance) gene ;	**3 NOT** gene **4 ACCEPT** divide by mitosis / conjugation / transduction / transformation / eq	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)(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 no necessary / not using antibiotics for prophylactic treatment / using narrow spectrum antibiotics / rotate antibioti use	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. idea that the temperature of the {body / core} changes (with time after death) ; 2. idea that (core) temperature depends upon the {ambient / eq} temperature ; 3. idea that {other post-death changes / muscle contraction / insect life cycles / decomposition / eq} depend on (ambient / body) temperature ;	**1 ACCEPT** cooling	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	Correct answer gains all 3 marks 1. line drawn between 25°C (core) and 15°C (ambient) ; 2. line drawn from centre of circle through the intersect of line 1 with diagonal ; 3. time of death = {23 - 24} ;	**1 ACCEPT** within the next scale line **2 CE** applies **3 CE** applies	**(3)**

Question Number	Answer	Additional Guidance	Mark
*6(b)(ii)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** **Clothing** 1. for the clothed body the {estimate was too short / eq } ; 2. because the clothing would {reduce heat loss / body would cool more slowly / temperature would drop slower / eq} ; 3. idea that clothing would {insulate / trap the heat / eq} ; **Position** 4. for the body curled up the {estimate was too short / eq } ; 5. because {heat loss is reduced / body would cool more slowly / temperature would drop slower / eq} ; 6. as the (exposed) surface area was smaller/ eq ; **Air movement** 7. for the moving air {the estimate was too long / eq } ; 8. as moving air {speeds up heat loss / body would cool faster / temperature would drop faster / eq } ;	**QWC emphasis is clarity of expression** **ACCEPT** converse arguments for Mps other than 1, 4 and 7 **1 ACCEPT** time of death was earlier / died longer ago **4 ACCEPT** time of death was earlier / died longer ago **7 ACCEPT** time of death was more recent / died later **IGNORE** submersion in water	**(6)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. (gradual) increase in {average / eq } temperature ; 2. (of earth's) {surface / atmosphere} (and oceans) ;	**NB IGNORE** any explanations as to the cause **1 IGNORE** warming	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	**Effects on plants:** 1. { loss / eq } of (existing) species / extinction ; 2. idea of changes in distribution (of plants / species) ; 3. idea of changes in {numbers / size / growth / eq } (of plants / species) ; **Explanations (max 3):** 4. idea that there will be changes in rainfall patterns ; 5. idea of a change in growing seasons ; 6. idea that temperature may become too hot for some species OR credit a link made between temperature and enzyme activity ; 7. idea of increased carbon dioxide results in more {photosynthesis / GPP / NPP / biomass / eq} ; 8. idea of fall in pH in {oceans / rivers / eq} ;	**NB** any link to an affect must be correct 4 **ACCEPT** droughts 5 **ACCEPT** flowering times	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. idea of reduction of {herbivore / primary consumer} ; 2. idea that this would result in a reduction of {predator / secondary consumer / tertiary consumers} ; 3. idea that a change in {distribution / numbers / types / eq} of plants could result in a change in distribution of {herbivores / eq} ; 4. idea of loss of {habitat / eq} decreasing {breeding rate / numbers / eq } ; 5. idea of loss of {shelter / camouflage / eq} provides more food for predators so they would increase in {size / number} ;	**ACCEPT** converse for increase in plant {number / size / eq} 1 **ACCEPT** idea of loss of animals because of reduction in food supply 2 **ACCEPT** idea of loss of animals that feed on the herbivores 4 **ACCEPT** named example e.g. nesting place	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. idea that we can only {make predictions about the future / extrapolate data / work on correlations / eq } ; 2. idea that {scientists / industry / eq} are presenting {different views / insufficient evidence / eq} about global warming ; 3. idea that some people surveyed did not {understand / know about} global warming ; 4. idea that some people do not believe in {global warming / harmful effects of global warming} because they do not want it to affect their { lifestyle / named lifestyle / eq } ; 5. idea that some people think that a solution to global warming will be found ; 6. idea that some people do not want to think about the future ;	**NB just a reference to do not believe is too vague** 1 **ACCEPT** it is due to natural cycle / normal fluctuations	**(3)**

Question Number	Answer	Mark
8(a)	**C** kJ m^{-2} $year^{-1}$	(1)

Question Number	Answer	Mark
8(b)	**B** NPP = GPP - R	(1)

Question Number	Answer	Additional Guidance	Mark
8(c)	1. idea that light is reduced by the deeper water ; 2. idea that carbon dioxide levels might be lower deeper down ; 3. idea that temperature might be lower deeper down ; 4. idea that {photosynthesis / eq} will be reduced ; 5. idea that less {glucose / hexose / GALP / GP / eq } produced to convert into {biomass / NPP / eq} ; 6. idea that GPP goes down but respiration {stays the same / increases} ;	**NB ACCEPT** converse of mp 1 - 5 if in context of shallow water **5 IGNORE** energy	