Mark Scheme (Results)

Summer 2017

Pearson Edexcel International Advanced Level
In Biology (8BI01) Paper 01
Core Cellular Biology and Microbiology

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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	Mark
1(a)	**1(a). The only correct answer is C** ***A*** *is not correct because this describes Endoplasmic reticulum which is involved in protein synthesis not modification* ***B*** *is not correct because this describes centrioles* ***D*** *is not correct because this describes a ribosome which is involved in synthesis (not modification) and is much smaller*	**(1)**

Question Number	Answer	Mark
1(b)	**1(b). The only correct answer is C** ***A*** *is not correct because Q describes a chloroplast which is not found in an animal cell* ***B*** *is not correct because chloroplasts are not found in animal cells, but they are found in plant cells, animal cells would also contain mitochondria (R)* ***D*** *is not correct because chloroplasts are not found in animal cells, plant cells would also contain mitochondria (R)*	**(1)**

Question Number	Answer	Mark
1(c)	**1(c).The only correct answer is A** ***B*** *is not correct because 6 μm is 6000 nm which is bigger than 2500nm* ***C*** *is not correct because* 10^{-9} *m is a nanometer so the smallest not the largest organelle* ***D*** *is not correct because they are listed from largest to smallest in this sequence*	**(1)**

Question Number	Answer	Mark
1(d)	**1(d). The only correct answer is C** ***A*** *is not correct because Q (chloroplast), R (mitochondria) and T (nucleus) all have DNA* ***B*** *is not correct because Q (chloroplast), R (mitochondria) and T (nucleus) all have DNA* ***D*** *is not correct because because only Q (chloroplast), R (mitochondria) and T (nucleus) have DNA. P is a ribosome, S is the Golgi and each of the organelles containing DNA each has a double membrane*	**(1)**

Question Number	Answer		Mark
1(e)	Correct calculation	<u>Example of calculation</u> (13 ÷ 37) x 100 = 35.1 **ACCEPT** 35 or 35.14	**(1)**

Total for Question 1 = 5 MARKS

Question Number	Answer		Mark
2(a)	A description that makes reference to the following: • part of a chromosome breaks off **(1)** • this then joins to another (non-homologous) chromosome **(1)**	**ACCEPT** one mark only for an answer that makes reference to {part of a chromosome / genes} being swapped between (non-homologous) chromosomes **ACCEPT** phosphodiester bonds break **ACCEPT** genes or section of DNA **DO NOT ACCEPT** parts of a gene **DO NOT ACCEPT** homologous chromosome	**(2)**

Question Number	Answer		Mark
2(b)	Non-disjunction	**ACCEPT** Translocation, polysomy, aneuploidy, trisomy, partial trisomy, partial aneuploidy	**(1)**

Question Number	Answer		Mark
2(c)	An explanation that makes reference to the following: • polysomy / not Down's Syndrome **(1)** • because {of chromosome 13 / more than two copies of one chromosome} **(1)**	**ACCEPT** trisomy, aneuploidy **DO NOT ACCEPT** has {Turner's / Down's} Syndrome **ACCEPT** chromosome 21 only two copies **ACCEPT** extra chromatid	**(2)**

Total for Question 2 = 5 MARKS

Question Number	Answer	Mark
3 (a)	**3(a). The only correct answer is B** ***A*** *is not correct because chromatids are visible in metaphase* ***C*** *is not correct because the first two statements only occur in meiosis not mitosis* ***D*** *is not correct because the first two statements only occur in meiosis not mitosis*	**(1)**

Question Number	Answer	Additional Guidance	Mark
3 (b)(i)	An explanation that makes reference to the following: • a stain is needed to see chromosomes that would not be clearly visible **(1)** • because the stain must attach to {chromosomes / DNA / histone} **(1)**	**ACCEPT** can see chromatids, nucleus **ACCEPT** {take up / absorb} stain	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	A description that makes reference to four of the following: • use {5 mm / shorter} piece of root tip **(1)** • add acid and then stain separately **(1)** • heat the root tip in { acid / stain } **(1)** • tease the cells apart before staining **(1)** • intensify the stain by warming (after squashing) **(1)**	**ACCEPT** use more concentrated acid **ACCEPT** maceration	**(4)**

Total for Question 3 = 7 MARKS

Question Number	Answer	Additional Guidance	Mark
4(a)	An explanation that makes reference to the following: • glycogen is a {polymer / polysaccharide} **(1)** • therefore glycosidic bonds need to be broken **(1)**	**DO NOT ACCEPT** glucose {is a polysaccharide/ has more glycosidic bonds} **ACCEPT** description of polysaccharide structure **ACCEPT** needs hydrolysis before it can be used in respiration	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	An explanation that makes reference to three of the following: • carbohydrates and proteins are {hydrophilic / polar} molecules **(1)** • triglycerides are {hydrophobic / non polar} molecules **(1)** • therefore water will associate with proteins and carbohydrates **(1)** • but be repelled by the triglycerides **(1)**	**ACCEPT** {absorb / bond to} water **ACCEPT** can't bond to water	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	An explanation that makes reference to two of the following: • triglycerides store more energy per gram than carbohydrates and proteins in both wet and dry matter **(1)** • because it has a high {carbon / hydrogen} content **(1)** • because it contains no water **(1)**	**ACCEPT** low oxygen content	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	An explanation that makes reference to the following: • units given for energy only **(1)** • therefore a comparison cannot be made **(1)**	**ACCEPT** no indication of mass	**(2)**

Total for Question 4 = 9 MARKS

Question Number	Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following: **Similarities** • cytoplasm **(1)** • cell membrane **(1)** • ribosomes **(1)** **Differences** • eukaryotic cells contain {Membrane-bound organelles / named example e.g. mitochondria }, prokaryotic cells do not **(1)** • eukaryotic cells have 80S ribosomes, prokaryotic cells have 70S ribosomes **(1)** • eukaryotic cells have {a nucleus / nuclear envelope }, prokaryotic cells {have a nucleoid / do not have a nucleus} **(1)** • some eukaryotic cells have a cellulose cell wall and prokaryotic cells have a {murein / peptidoglycan} cell wall **(1)**	Max of 3 marks if only differences given **ACCEPT** eukaryotic cells have larger ribosomes **ACCEPT** as comparison: prokaryotes have free-floating genetic material (in the cytoplasm)	**(4)**

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	A description that makes reference to three of the following: • composed of nucleotides / nucleotides described **(1)** • nucleotides held together by phosphodiester bonds **(1)** • complementary base pairs held together by hydrogen bonds **(1)** • two {sugar phosphate backbones / polynucleotide chains / DNA strands} that form a double helix **(1)**	**ACCEPT** description e.g. between named base pairs	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	An explanation that makes reference to the following: • the DNA strands will not be able to separate / no template strand will be available **(1)** • leading to inhibition of {transcription / mRNA synthesis / RNA polymerase binding to DNA} **(1)** • DNA of both cell types are the same (structure) so both cell types affected **(1)**	**ACCEPT** DNA can't be unzipped	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	An explanation that makes reference to the following: • will inhibit {transcription / mRNA synthesis} **(1)** • because the RNA polymerase {will be inhibited / will not be able to bind to the DNA} **(1)** • each antibiotic affects different cell types because the (structure of) RNA polymerases are different **(1)**	**ACCEPT** cannot catalyse the reaction, prevent enzyme-substrate complex formation	**(3)**

Total for Question 5 = 13 MARKS

Question Number	Answer	Mark
6(a)(i)	**6(a)(i). The only correct answer is B** ***A*** *is not correct because lambda phage does not have an envelope* ***C*** *is not correct because both lambda phage and tobacco mosaic virus do not have envelopes* ***D*** *is not correct because tobacco mosaic virus does not have an envelope*	**(1)**

Question Number	Answer	Mark
6(a)(ii)	**6(a)(ii). The only correct answer is A** ***B*** *is not correct because lambda phage does not have a helical capsid* ***C*** *is not correct because neither HIV or lambda phage have a helical capsid* ***D*** *is not correct because HIV does not have a helical capsid*	**(1)**

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	A description that makes reference to the following: • virus {attaches to / penetrates} host cell **(1)** • assembly of virus particles from synthesised {DNA / RNA} and proteins **(1)** • (immediate) lysis of the host cell **(1)**	**ACCEPT** virus genetic material goes into the cell **ACCEPT** virus replicates **DO NOT ACCEPT** exocytosis	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b) (ii)	• number of bacteria in 0.25 cm^3 **(1)** • number of phage needed to give MOI of 0.5 **(1)** • answer = volume of phage needed **(1)**	<u>Example of calculation</u> $8 \times 10^8 \div 4 = 2 \times 10^8$ $0.5 \times 2 \times 10^8 = 1 \times 10^8$ $1 \times 10^8 \div 2 \times 10^9 = 0.05\,cm^3$ **ACCEPT** 1 mark for calculation of MOI as 2.5 for using equal volumes of the concentrations given Correct answer with no working gains full marks	**(3)**

Total for Question 6 = 8 MARKS

Question Number	Answer	Additional Guidance	Mark
7(a)(i)	An explanation that makes reference to the following: • glycine is very small so the collagen fibres are very close together **(1)** • so this allows the formation of bonds that hold the polypeptide chains together **(1)**	**ACCEPT** amino acids have small R groups which enables the proteins to be close together	**(2)**

Question Number	Answer	Mark
7(a)(ii)	**7(a)(ii). The only correct answer is C** ***A*** *is not correct because ester bonds are involved in bonding carboxyl and OH groups* ***B*** *is not correct because glycosidic bonds are found in carbohydrates* ***D*** *is not correct because peptide bonds join the amino acids in the individual polypeptide chains, not between the chains as there are no free carboxyl and amino groups along the length of the chain*	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(b) (i)	A response that makes reference to the following: • the collagen with hydroxyproline has more helix present than collagen without hydroxyproline (at higher temperatures) **(1)** • therefore hydroxyproline must be responsible for holding the helix together **(1)**	**ACCEPT** collagen without hydroxyproline loses helical structure at lower temperature **ACCEPT** hydroxyproline maintains strength of collagen	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(b) (ii)	A response that makes reference to the following: • the T_s values for collagen with hydroxyproline is 49°C / collagen without hydroxyproline is 15°C **(1)** • therefore presence of hydroxyproline increases the thermal stability of collagen **(1)** • calves will have the most stable collagen **(1)** • which is necessary as calves have the highest body temperature **(1)**	**ACCEPT** prevents helical structure breaking down **ACCEPT** converse **ACCEPT** converse / correlation between the two variables e.g. calf has the highest % of hydroxyproline and highest body temperature	**(4)**

Total for Question 7 = 9 MARKS

Question Number	Answer	Additional Guidance	Mark
8(a)	• percentage of each polypeptide in each type of haemoglobin **(1)** • total percentage of α chains given **(1)** • ratio calculated **(1)**	<u>Example of calculation</u> HbA_1: α = 48 β = 48 HbA_2: α = 1.5 δ = 1.5 HbF : α = 0.5 γ= 0.5 α = 48 + 1.5 + 0.5 = 50 α : β : δ : γ = 100 : 96 : 3 : 1 Correct answer with no working gains full marks Award 2 marks for 200 :192: 6: 2 OR 50: 48: 1.5 : 0.5	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)	A response that makes reference to the following: **Similarities** • there will be {27 bases / 9 triplet codons } in the sequence **(1)** • all three will have the code for { phe / amino acid 1 / amino acids 4-9 / leu, ser, glu, leu, his, cys } **(1)** • β and γ will both code for the same amino acid 2 / δ and γ will both code for the same amino acid 3 **(1)** **Differences** • the sequence of bases in the code for the same amino acid might be different **(1)** • {β and δ will have different sequences for amino acids 2 and 3 / β and γ different for amino acid 3 / δ and γ different for amino acid 2 } **(1)**	**ACCEPT** they have the same number of (DNA) bases **ACCEPT** triplet sequence is the same for … / same codon **ACCEPT** if clear context of bases coding for … in the whole response **ACCEPT** if clear context of bases coding for … in the whole response	**(4)**

Question Number	Answer	Additional Guidance	Mark
8(c)(i)	change in the base sequence or quantity of DNA **(1)**		**(1)**

Question Number	Answer	Additional Guidance	Mark
8(c)(ii)	An explanation that makes reference to the following: • the oxygen-carrying capacity of the haemoglobins are very similar **(1)** • therefore {gas exchange / breathing} will not be affected **(1)**	**ACCEPT** have similar saturation of O_2 **ACCEPT** HbF has better O_2 carrying ability **ACCEPT** have no symptoms, no effect **ACCEPT** oxygen will not limit activity	**(2)**

Total for Question 8 = 10 MARKS

Question Number	Answer	Additional Guidance	Mark
9(a)(i)	A drawing that includes the following: • only cell K drawn **(1)** • the shape of the cell and its nuclei are representative of those in the photograph **(1)** • there is no sketching or other structures shown **(1)** • drawn cell is twice the size of cell in the photograph **(1)**		**(4)**

Question Number	Answer	Additional Guidance	Mark
9(a)(ii)	A description that makes reference to the following: • measure the length of the blood cells using an {eye piece / stage } micrometer **(1)** • divide the length by the magnification of the objective / calibrate the graticule using a stage micrometer **(1)** • more than one measurement taken **(1)** • divide this value into the length of the blood cells in the drawing **(1)**	**ACCEPT** use an eyepiece graticule E.g. repeats, length and breadth	**(4)**

Question Number	Answer	
9*(b)	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • data used to support trends e.g. figures quoted / calculation done • table 1 shows that resolution increases with an increase in numerical aperture • table 2 shows an increase in wavelength decreases the resolution • table 1 suggests an increase in magnification increases the resolution • comparison of objectives with the same magnification shows that increase in numerical aperture increases resolution • at higher magnifications shorter wavelengths of light would need to be used to achieve maximum resolution	
Level	**Marks**	
0	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. **Attempts to comment on each of the factors but fails to understand that a small value represents better resolution**
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. **Understands that a small value means better resolution and correct comments made about two**

		variables using quoted data.
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. **Correct comments made about the interaction of the three variables on resolution.**

Total for Question 9 = 14 MARKS

TOTAL FOR PAPER = 80 MARKS

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