GradeMax



Mark Scheme (Results)

October 2021

Pearson Edexcel International Advanced Subsidiary Level
In Biology (WBI12) Paper 01
Cells, Development, Biodiversity and Conservation

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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)(i)	The only correct answer is B covered in 80S (large) ribosomes *A is not correct because rER is covered in 80S (large) ribosomes* *C is not correct because rER forms vesicles containing polypeptides* *D is not correct because rER forms vesicles containing polypeptides*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	An answer that includes the following point: • (smooth endoplasmic reticulum synthesises) lipid / steroids / named steroid hormone	ACCEPT hormones IGNORE (named) peptide hormone	**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(iii)	A description that includes the following points: • nucleolus (1) • named genetic material (1)	ACCEPT ribosomes / rRNA e.g. DNA / chromatin / chromatid / chromosomes / nucleosome / mRNA ACCEPT histones	**(2)**

Question Number	Answer	Additional guidance	Mark
1(b)	An explanation that includes the following points: • because of water uptake / increased {volume of cytoplasm / size of vacuole} (1) • (increase in size due to) {synthesis/production} of {organelles / (named) proteins / enzymes} (1) • therefore {synthesis/production} of {new/more} cell {membrane / wall} (1)	ACCEPT organelles increase in size	**(3)**

Question Number	Answer	Additional guidance	Mark
2(a)(i)	• calculation of surface area and volume (1) • correct ratio (1)	**Example of calculation:** surface area = $6 \times 2.5^2 = 37.5$ volume = $2.5^3 = 15.625$ 2.4:1 ECF applies Correct answer with no working shown scores full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	An answer that includes the following point: • place where {organisms / species} live (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
2(a)(iii)	An answer that includes the following point: • organisms that can reproduce with others to form fertile offspring (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)	An answer that includes one of the following points: • (inheritance of) {many/multiple/several/different} genes {contribute to / code for} height (of wombat) (1) • genes at different loci {contribute to / code for} height (of wombat) (1)	 Accept different positions on a chromosome	**(1)**

Question Number	Answer	Additional guidance	Mark
2(c)	A description that includes two of the following points: • {long/sharp} claws / large paws (for digging) (1) • {short / powerful} legs (for digging) (1) • ears face backwards / small eyes (so don't fill with soil) (1)	 ACCEPT big feet / long nails ACCEPT short ears / large pupils	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)(i)	An answer that includes one of the following points: • (analysis of/ comparison of/ similarities in / differences in) {DNA / RNA / proteins / amino acid sequences / enzymes / ribosomes / membrane components / cell wall components} (1)	ACCEPT patterns in non-coding DNA ACCEPT genes ignore organelles	**(1)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	A description that includes three of the following points: • peer review (1) • repetition of experiments (by other scientists to see if same data are collected) (1) • {analysis / evaluation / discussion / comparison} of data (1)	ACCEPT extend the analysis e.g. look for {similarities / differences} in more genes (1)	**(2)**

Question Number	Answer	Mark
3(b)	one mark for each correct row	**(4)**

Feature	Archaea only	Archaea and Bacteria only	Archaea and Eukarya only	Archaea and Bacteria and Eukarya
absence of a nuclear envelope		☒		
presence of circular DNA				☒
presence of a cell membrane				☒
presence of ribosomes				☒

Question Number	Answer	Additional guidance	Mark
4(a)	An answer that includes two of the following points: • minerals (1) • (suitable) pH (1) • (suitable) light (intensity) (1)	 ACCEPT named mineral e.g. phosphate, nitrates ACCEPT oxygen, nitrogen, carbon dioxide, water ignore nutrients / moisture / predation / glucose / temperature ACCEPT suitable wavelength of light / sunlight	**(2)**

Question Number	Answer	Mark
4(b)(i)	The only correct answer is D William Withering *A is not correct because Withering tested his digitalis soup* *B is not correct because Withering tested his digitalis soup* *C is not correct because Withering tested his digitalis soup*	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation that includes the following points: • patients given a range of {doses / concentrations} / doses increase in concentration (throughout the investigation) (1) • (to allow selection of) lowest effective concentration / highest dose that can be tolerated without serious side effects (1)	 ACCEPT (selection of) dose that is effective with minimal side effects	**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	A description that includes the following points: • (selection of) patients with (colon / kidney) **cancer** (1) • {half / one group} given {curacin A / (this) cancer drug} and {half / one group} given current (best) drug (1) • neither doctor nor patient knows which treatment has been given (1) • analysis of data to see if curacin A is more effective than the {current best drug / placebo} (1)	ignore ref to stage of trial ACCEPT placebo / sugar pill ACCEPT analysis to see if there is a {significant difference/improvement} between those who took the drug compared to the placebo	**(4)**

Question Number	Answer	Additional guidance	Mark
5(a)	An answer that includes three of the following points: • deforestation / loss of habitat (1) • increased grazing (of forest) (1) • reduced number of new trees (1) • disease (that has killed the trees) (1) • reduced genetic diversity (1)	 ACCEPT loss of trees due to natural events e.g. landslides / tsunamis / fire / poor soil quality ACCEPT new grazing species e.g. reduced {pollination / reproduction / pollinators} / tree doesn't flower often / reduced enzyme activity due to {changing temperatures / drought} / few trees producing seeds / {air pollution / global warming / climate change} e.g. fungal disease ACCEPT reproduce asexually so no variation	**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	 • correct line measurement and conversion (1) • correct calculation (1) • correct answer in standard form (1)	ACCEPT ±1mm <u>Example of calculation:</u> 38 000μm (38 000 ÷ 200) =190 (μm) 1.9×10^2 (μm) ecf applies Correct answer with no working shown scores full marks	**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An answer that includes the following points: • {transport/ translocation} of {sucrose / amino acids} (1) • from {source /site of production / leaves} to {sink / site of use / site of storage} (1)	ACCEPT products of photosynthesis / lipids / hormones / mRNA / sugars ignore glucose	**(2)**

Question Number	Answer	Mark
5(b)(iii)	The only correct answer is C two *A is not correct because all the statements are correct apart from, they do not contain cytoplasm* *B is not correct because all the statements are correct apart from, they do not contain cytoplasm* *D is not correct because they do not contain cytoplasm*	**(1)**

Question Number	Answer	Additional guidance	Mark
5(c)	An answer that includes three of the following points: • the edge of the xylem is closer to the {outside of the structure / epidermis} (than the phloem) in the root / the phloem is closer to the {outside of the structure / epidermis} than the xylem in the stem (1) • xylem and phloem are contained in (separate vascular) bundles in the stem (1) • more equal phloem:xylem in stem (whereas 4:1 in root) • (xylem and phloem / (vascular) bundles) are arranged in {outer part of / a circular pattern in} stem (1)	ACCEPT xylem and phloem are separated by cambium in stem ignore sclerenchyma/parenchyma ACCEPT xylem and phloem together make an oval shape ignore {sizes/number unqualified} of {xylem/phloem} ACCEPT both xylem and phloem are closer to epidermis in stem ACCEPT (xylem and phloem/ (vascular) bundles) are arranged in all areas of stem (in monocots) ACCEPT vascular tissue in one area in the root whereas in several areas in the stem ACCEPT labelled diagram showing the distribution in the stem	**(3)**

Question Number	Answer	Additional guidance	Mark
6(a)(i)	An answer that includes the following point: • amyloplast (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	An explanation that includes three of the following points: • {polymer of / contains} glucose because (glucose) is an energy source (1) • {branched / 1,6 bonds} therefore can be rapidly hydrolysed (to release glucose/energy) (1) • compact so more {glucose/energy} can be stored / compact so high energy density} (1) • insoluble therefore does not affect osmosis (1)	ACCEPT branched so quickly broken down ignore easy to break down ACCEPT compact so does not take up much space ACCEPT too big to diffuse across cell surface membrane / large molecules therefore remain in cells	**(3)**

Question Number	Answer	Mark
6(b)(i)	The only correct answer is D 67% *A is not correct because that is 100-67* *B is not correct because the correct answer is 67%* *C is not correct because that is incorrectly rounded from 66.6667*	**(1)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	• 1074 (million tonnes)		**(1)**

Question Number	Answer	
6 (c)	Answers will be credited according to candidate's 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 indicated as relevant. Additional content included in the response must be scientific and relevant. • both types of cassava require less water (than maize) / maize needs {more / lots of} water • both types of cassava require fewer nutrients (than maize) / maize needs {more / lots of} nutrients • both types of cassava contain more carbohydrates (than maize) / maize contains less carbohydrates • maize contains more protein / both types of cassava contain less protein (than maize) • higher mean dry mass for bitter cassava / lower mean dry mass for sweet cassava • higher concentrations of {(bitter) chemicals / hydrogen cyanide} in bitter cassava / sweet cassava contains more (bitter) chemicals than maize • if not processed properly then {(bitter) chemicals / hydrogen cyanide} will remain in the crop and cause death • higher mean dry mass means more food is grown / growing bitter cassava feeds more people • carbohydrates are needed as a source of energy / broken down into glucose / needed for respiration • more maize would need to be eaten (to meet body need) • protein is needed for {growth and repair / mitosis / making new proteins, hormones} etc • reduced growth with low protein diet / more cassava would need to be eaten / converse • reduced cost to grow cassava than maize / less irrigation needed / fewer fertilisers needed / converse • ability to grow cassava in more areas (than maize) • reduced {cost/labour} to grow maize and sweet cassava (than bitter cassava) as no need to remove (bitter) chemicals / converse • higher concentrations of {(bitter) chemicals / hydrogen cyanide} will result in {fewer pesticides being needed by farmers / increased yields for farmers} / converse for {maize/sweet cassava} • as {(bitter) chemicals / hydrogen cyanide} deter {herbivores / insects / pests} that feed on the plant **(6)**	

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.	consideration of advantage(s) and disadvantage(s) from given information only
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.	all level 1 including two of the following aspects -explanation of the {advantage of higher /disadvantage of lower} carbohydrate content - explanation of the {advantage of higher /disadvantage of lower} protein content -consideration of disadvantage of cost of providing resources / removing bitter chemicals -consideration of advantage of {not having to buy pesticides /reduced loss of crops to pests} / converse for maize and sweet cassava
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.	all level 2 including all the following aspects -explanation of the {advantage of higher /disadvantage of lower} carbohydrate content - explanation of the {advantage of higher /disadvantage of lower} protein content -consideration of disadvantage of cost of providing resources / removing bitter chemicals -consideration of advantage of {not having to buy pesticides /reduced loss of crops to pests} / converse for maize and sweet cassava

Question Number	Answer
*7 (a)	Answers will be credited according to candidate's 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 indicated as relevant. Additional content included in the response must be scientific and relevant. • hermaphrodites can self-fertilise / reproduce without the need to find a mate • fertilising own egg cells using their own sperm cells • produce fewer nematode offspring • all offspring likely to be hermaphrodites • as all gametes will contain a sex chromosome • hermaphrodites can reproduce with a {mate / male nematode} / need to find a male to mate with • males have only one chromosome • if hermaphrodite mates with a male then (700) more egg cells are fertilised • half of the offspring will be {hermaphrodites / male} • if sperm cells without a sex chromosome fertilise an egg cell then the offspring will be male • if sperm cells with a sex chromosome fertilise an egg cell then the offspring will be hermaphrodites • half of the male sperm cells will not contain a sex chromosome • consideration of advantages of {reproducing without the need to find a mate/ all offspring being hermaphrodites} on chance of survival (of nematodes) • consideration of disadvantages of fewer offspring on chance of survival (of nematodes) • consideration of disadvantages of needing to find a mate reproducing on chance of survival of nematodes • consideration of advantages of more offspring on {increased reproductive success /chance of survival/ increased future sexual reproduction} of nematode {population/species/offspring} • self-fertilisation leads to limited genetic variation (in offspring) / {decrease/no change} in gene pool • {sexual reproduction / mating with male nematode} results in increased genetic variation of offspring • consideration of disadvantages of limited genetic variation on chance of survival (of nematodes) • consideration of advantages of increased genetic variation on chance of survival (of nematodes) • consideration of benefits of more offspring with increased genetic variation **(6)**

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.	consideration of both types of reproductive behaviour from given information only or more detailed consideration of one type of reproductive behaviour
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.	all level 1 info plus consideration of two of -explanation of adv/disadv of asexual on survival of nematodes (not GD) -explanation of adv/disadv of sexual on survival of nematodes (not GD) -effect of reproductive behaviour on genetic diversity of offspring -explanation of impact of genetic diversity on survival of nematodes
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.	all level 2 info plus consideration of all of -explanation of adv/disadv of asexual on survival of nematodes (not GD) -explanation of adv/disadv of sexual on survival of nematodes (not GD) -effect of reproductive behaviour on genetic diversity of offspring -explanation of impact of genetic diversity on survival of nematodes

Question Number	Answer	Additional guidance	Mark
7(b)	An answer that includes the following points: • histone modification can be passed onto zygotes (1) • if enzyme M is present, histone modification is passed on to {all chromosomes / embryo} (after cell division in experiment 1) (1) • cells divide by mitosis (1) • if enzyme M is absent (in the egg cell cytoplasm) then the histone modification decreases until no longer detected (1) • (histone modification decreases because) replicated DNA can't be modified without enzyme (M) (1) • description of histone modification (1)	ACCEPT fertilised egg cells (in both experiments) have histone modification ACCEPT enzyme M causes histone modification ACCEPT histone modification is passed on to {all chromosomes/embryo} in experiment 1 ACCEPT cell division involves replication of DNA ACCEPT histone modification is not passed on to all chromosomes in experiment 2 ACCEPT enzyme M can't be produced (if absent in egg cell) ignore genes being switched {on/off}	**(5)**

Question Number	Answer	Additional guidance	Mark
8(a)	An explanation that includes two of the following points: • haploid so that when it is fertilised {a zygote is formed / it becomes diploid} (1) • contains lipid droplets as a source of energy (1) • {cortical granules / enzymes} to {harden zona pellucida / prevent polyspermy} (1)	ACCEPT large cell to store more {lipid/energy} ACCEPT releases chemicals to attract sperm ACCEPT sperm bind to glycoproteins on egg cell (surface)	**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	An answer that includes the following points: Similarities • lining up of {chromosomes/ chromatids} on equator (of cell) (1) • centromere bonds to spindle fibres (in metaphase) (1) Differences (max 2): • two metaphase stages in meioisis whereas mitosis has one (1) • {independent/random} assortment occurs (in metaphase I) in meiosis whereas it does not occur in mitosis (1) • meiosis involves homologous pairs of chromosomes (in metaphase I) and sister chromatids (in metaphase II) whereas mitosis involves sister chromatids (1)	Full marks can only be awarded if there is a similarity in the answer ACCEPT centre of cell / metaphase plate ACCEPT {chromosomes/chromatids} bond to spindle fibres ACCEPT independent assortment only occurs in metaphase I in meiosis ACCEPT meiosis involves pairs of chromosomes whereas mitosis involves pairs of {sister chromatids/ single chromosomes} ACCEPT meiosis involves pairs of chromosomes whereas mitosis does not	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation that includes four of the following points: • morula cells are totipotent whereas blastocyst cells are pluripotent (1) • (specialisation / differentiation occurs because) gene(s) switched off (in blastocyst cells) (1) • due to {epigenetic modification / DNA methylation / histone modification} (1) • transcription of (active) genes to produce (active) mRNA / (active) mRNA translated at the ribosomes (1) • the protein(s) produced {determine / change} cell {structure / function} (1)	ACCEPT cells become pluripotent ACCEPT differential gene expression occurs ACCEPT transcription and translation of (active)gene to produce protein	**(4)**

Question Number	Answer	Additional guidance	Mark
8(c)(i)	• correct D2 values (1) • correct calculation of $\sum D^2$ (1)	<table><tr><th>Age (weeks)</th><th>Rank</th><th>Mass of egg (g)</th><th>Rank</th><th>D</th><th>D^2</th></tr><tr><td>36</td><td>1</td><td>2.27</td><td>8</td><td>-7</td><td>49</td></tr><tr><td>39</td><td>2</td><td>1.91</td><td>1</td><td>1</td><td>1</td></tr><tr><td>42</td><td>3</td><td>2.18</td><td>5.5</td><td>-2.5</td><td>6.25</td></tr><tr><td>45</td><td>4</td><td>2.28</td><td>9</td><td>-5</td><td>25</td></tr><tr><td>48</td><td>5</td><td>2.12</td><td>4</td><td>1</td><td>1</td></tr><tr><td>51</td><td>6</td><td>2.19</td><td>7</td><td>-1</td><td>1</td></tr><tr><td>54</td><td>7</td><td>2.18</td><td>5.5</td><td>1.5</td><td>2.25</td></tr><tr><td>57</td><td>8</td><td>2.09</td><td>3</td><td>5</td><td>25</td></tr><tr><td>60</td><td>9</td><td>2.03</td><td>2</td><td>7</td><td>49</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>159.5</td></tr></table> $\sum D^2 =$ 159.5 Correct answer with no working shown scores full marks 1 mark awarded for correct $\sum$ using incorrect D^2 values calculated in table	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(ii)	• correct values substituted into formula (1) • correct r_s value (1)	Example of calculation: 957 ÷ 720 = -0.329 / -0.33 / -0.3 Allow ECF from answer calculated in (c)(i) Correct answer with no working shown scores full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
8(c)(iii)	An explanation that includes the following points: • (the null hypothesis) should be accepted (1) • (because) 0.38 is lower than 0.683 (1)	mark points independently	**(2)**

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