Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2016

Biology

Higher level

Paper 2

18 pages

Section B

Extended response questions – quality mark

- Extended response questions for HLP2 each carry a mark total of **[16]**. Of these marks, **[15]** are awarded for content and **[1]** for the quality of the answer.

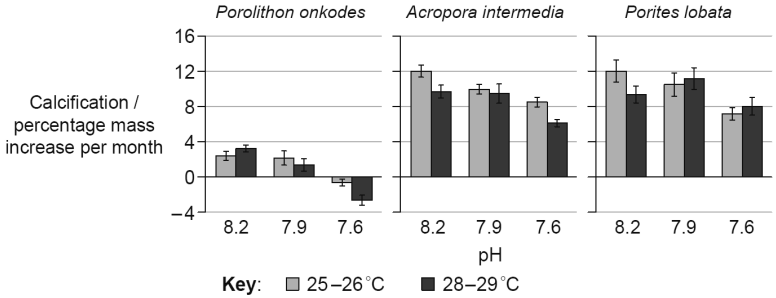
- **[1]** for quality is to be awarded when:
  - the candidate's answers are clear enough to be understood without re-reading.
  - the candidate has answered the question succinctly with little or no repetition or irrelevant material.

- It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.

- Candidates that score very highly on the content marks need not necessarily automatically gain **[1]** for quality (and *vice versa*).

Section A

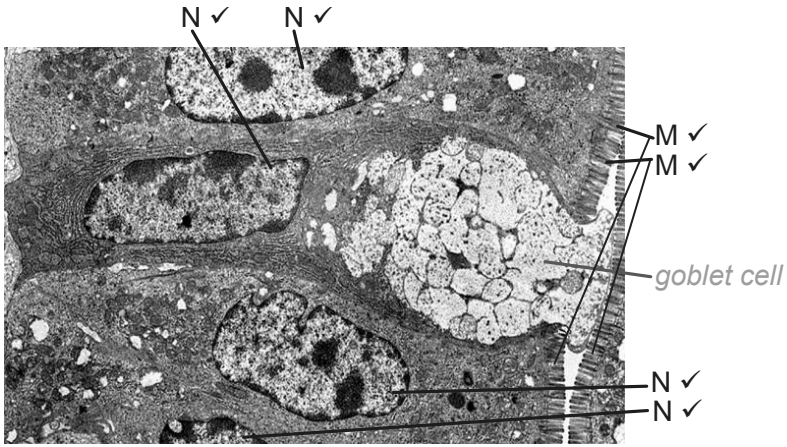
Question			Answers	Notes	Total
1.	a		60 (%) ✓		1
	b		a. coral cover decreases as temperature rises (between 1996 and 1998/2000 and 2002) / negative correlation between temperature and coral cover / coral cover highest when temperature is lowest/vice versa ✓ b. coral cover remains constant when temperature drops (between 1998/1999 and 2000)/remains (nearly) constant when temperature stops rising (between 2002 and 2003) ✓ c. no proof of causation / only a correlation / other factors could be affecting the coral ✓	*Do not award this mark for "inversely proportional", but the mark can still be awarded if other parts of the answer give one of the alternative parts of the mark point.*	2 max
	c		a. increased carbon dioxide/methane <u>in the atmosphere</u> / carbon dioxide emissions from burning of fossil fuels / other specific source of a named greenhouse gas ✓ b. increased greenhouse effect / more heat/long wave radiation trapped in the atmosphere ✓ c. heat transfer from atmosphere to ocean / ocean absorbs heat from atmosphere ✓	*No marks for increased CO_2 in the oceans, global warming or climate change.* *The idea of an increase must be included, not just greenhouse effect or heat trapping.*	2 max
	d		control of variables/pH/light/temperature / no predators of coral ✓		1
	e		a. supports because there is more dead coral/less % cover at the higher temperature b. (experimental data) does not support (observed data) because experimental temperatures were (all) higher/rose much faster ✓	*The answer must make it clear whether or not the data provides support.*	1 max

Question			Answers	Notes	Total
	f	i	less calcification in <u>all three</u>/<u>each species</u> (as pH decreased) ✓		1
	f	ii	7.6 / 7.7 / 7.8✓	*Accept any pH that is 7.6 or higher, but lower than 7.9.*	1
	f	iii	a. greater reduction in calcification as pH drops at the higher temperature in ***P. onkodes*** than on the other two species (so hypothesis not supported) ✓ b. net loss in calcification at lowest pH and highest temperature in ***P. onkodes*** whereas there is still calcification in the other two species (so hypothesis not supported) ✓ c. warming reduces calcification at all pH levels in ***A. intermedia*** but not in the other two species (so hypothesis not supported) ✓ d. combined effect of acidification and warming is a larger reduction in calcification in ***A. intermedia*** than in the other two species (so hypothesis not supported) ✓ e. more calcification as temperature rises at lower pH/pH 7.9 and 7.6 in ***P. lobata*** whereas there is less in the other two species (so hypothesis not supported) ✓ f. more calcification as pH drops from 8.2 to 7.9 at higher temperature in ***P. lobata*** whereas there is a drop/no rise in the other two species (so hypothesis not supported) ✓  	*This answer is based on the larger drop in calcification between 8.2 and 7.6 at both temperatures in onkodes than the other two species.* *This answer is based only on whether there are positive values for calcification or negative.* *This answer is based on the drop in calcification at each pH when the temperature rises in intermedia, whereas in the other species there is a rise at one or more of the pHs.* *This answer is based on the larger overall drop in calcification between pH 8.2 at 25/26°C and 7.6 at 28/29°C.* *The answer must either state pHs 7.9 and 7.6 or specify lower pH or greater acidification.* *The answer must state the two pH values and state higher temperature or 28-29°C.*	1 max

Question			Answers	Notes	Total
	g		Mollusca/named marine mollusc with a shell/crustacean/named marine crustacean/Porifera/sponges/named calcareous marine sponge ✓	*Reject terrestrial examples. Reject sea shells, shellfish. Specific named examples must be verified if it is uncertain whether they have calcified parts.*	**1**

	h		a. <u>carbon dioxide</u> makes an acid/carbonic acid in water ✓ b. (carbon dioxide from) burning fossil fuels/forest fires ✓ c. carbon dioxide forms solution with/<u>dissolves</u> into water/oceans/rain ✓	*Do not award a mark for stating only that carbon dioxide causes ocean acidification.* *Do not award marks for methane sources or sources of unspecified greenhouse gases or statements about increased carbon dioxide in the atmosphere.*	**2 max**

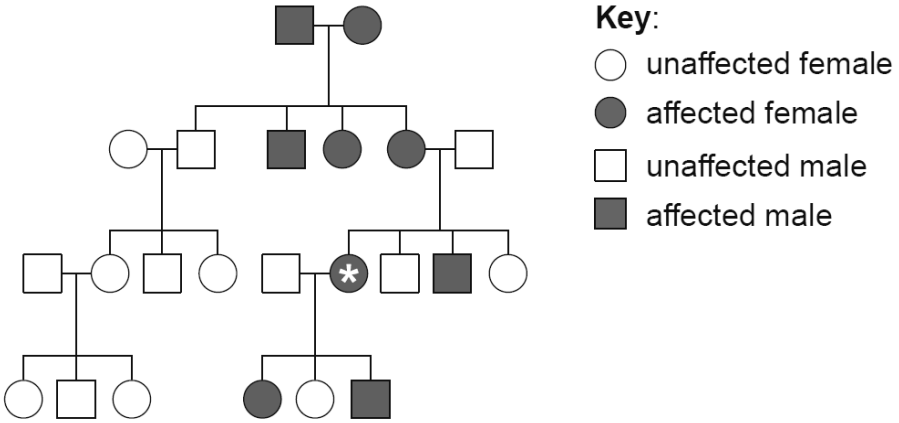
Question			Answers	Notes	Total
	i		a. international cooperation needed to reduce carbon dioxide emission/concentrations ✓ b. carbon dioxide produced anywhere increases the greenhouse effect/global warming/ocean acidification/health of coral everywhere ✓ c. ocean currents/tides/wind move carbon dioxide/acid/heat around the world / oceans of the world are interconnected/part of one overall system ✓ d. (some) coral reefs are in international waters (or words to that effect) / coral reefs cannot be protected by single national governments alone ✓ e. the more groups of people/nations/corporations that reduce their carbon emissions, the lower the impact on coral will become / not enough for one country/group/corporation to reduce carbon dioxide emissions ✓ f. sharing of technology/research/information/resources ✓ g. aid to poorer/developing countries (to help with coral conservation) ✓ h. reference to an economic/ecological benefit of conserving coral reefs ✓		**3 max**

Question			Answers	Notes	Total
2.	a	i		*Award **[1]** for one microvillus labelled M and one nucleus labelled N.* *Both are essential for the mark.* *Do not award the mark if any structure is labelled incorrectly.*	**1 max**
	a	**ii**	secretion/exocytosis / produce mucous ✓	*Candidates are not required to have studied goblet cells, so are just expected to deduce from the vesicles that the function is secretion; allow enzyme secretion but reject answers suggesting secretion of something that is clearly incorrect such as secretion of bile.*	**1**
	a	**iii**	not likely to divide as specialized/differentiated ***OR*** not likely to divide (as nucleus) is in interphase/not in mitosis ✓	*Do not award a mark for stating that the goblet cell lacks a nucleus.*	**1**

Question			Answers	Notes	Total
	b		a. cell cycle is a sequence of stages / cell cycle is G_1, S, G_2 and mitosis ✓ b. (control of the cell cycle) by cyclins/cyclin ✓ c. levels of cyclins rise (and fall)/fluctuate during the cell cycle/surge at different times/have to reach a certain concentration ✓ d. conditions inside as well as outside the cell affect regulation ✓ e. four cyclins/different cyclins to enter different stages of/events in the cell cycle / cyclins regulate the sequence/timing of the cell cycle / cyclins trigger the next stages ✓ f. cyclin-dependent kinases / cyclins bind to kinases and activate them ✓ g. kinases phosphorylate other proteins ✓ h. phosphorylated proteins perform specific functions in the cell cycle ✓	*The idea of different cyclins acting at different phases must be clear.*	**4 max**

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>3.</td><td>a</td><td></td><td>
<table>
<tr><th>process</th><th>anabolism</th><th>catabolism</th></tr>
<tr><td>light independent reactions of photosynthesis</td><td>☑</td><td>☐</td></tr>
<tr><td>glycolysis</td><td>☐</td><td>☑</td></tr>
</table>
</td><td></td><td>2</td></tr>
<tr><td></td><td>b</td><td></td><td>a. increase rate of reaction/speed up reaction ✓
b. lower <u>activation</u> energy ✓
c. a specific enzyme for each reaction/substrate ✓
d. metabolic process/pathway blocked if an enzyme is inhibited/absent ✓
e. end-product inhibition can control metabolic pathways ✓
f. differences in metabolism as cells produce different enzymes during differentiation ✓</td><td></td><td>4 max</td></tr>
</table>

Question			Answers	Notes	Total
4.	**a**		a. sexual reproduction / random fertilization / meiosis ✓ b. mutation ✓	*No mark for crossing over unqualified. Reject natural selection/evolution as causes of variation.*	**2**
	b		a. (variation is) different phenotypes/differences between individuals in a <u>population</u>/<u>species</u> ✓ b. struggle/competition for survival ✓ c. some individuals have advantageous characteristics/are better adapted/have greater chance of survival/reproduction (than others) ✓ d. favourable alleles/genetic variations passed on/inherited by offspring/next generation ✓	*Reject "pass on phenotypes".*	**3 max**
	c		a. divided species/gene pool / part of species/gene pool becomes separated / species splits into separate populations ✓ b. reproductive isolation / lack of interbreeding ✓ c. may be due temporal/behavioural/geographic isolation ✓ d. different natural selection/different selective pressures ✓	*Mark point b refers to a lack of interbreeding between separated populations in a species, not the lack of interbreeding after speciation.*	**3 max**

Question			Answers	Notes	Total
5.	**a**		a. dominant (allele) ✓ b. all the offspring of the first generation would be affected if the allele was recessive (and one son is unaffected) / affected mothers could only have affected sons if the allele was recessive (and the pedigree shows that they can have both affected and unaffected sons) / affected mothers who have an unaffected son must be carriers of allele for being unaffected so the allele for being affected must be dominant / unaffected fathers could not have affected sons/daughters/children if the unaffected allele was dominant (and the pedigree shows that they can) ✓  	*Reject dominant disease/homozygous dominant.* *There must be a coherent argument here and not just observations about individuals on the pedigree chart, but the argument can be expressed in various ways and can be shown using a Punnett square or other genetic cross diagram. Do not accept arguments that involve ratios between the phenotypes.*	**2 max**
	b		X^HX^h **«**where H = hypophosphatemia and h = normal **«**absorption of phosphate**»»** ✓	*For the mark, allow any upper and lower case versions of the same letter, as long as they are shown superscript to an X to indicate sex-linkage.*	**1**

Section B

Clarity of communication*: *[1]

The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

Question			Answers	Notes	Total
6.	**a**		a. double circulation / pulmonary and systemic circulations ✓ b. heart is a double pump / heart has separate pumps for lungs and other systems / left and right sides of heart are separate / no hole in heart (after birth) c. deoxygenated blood pumped to the lungs and oxygenated to other organs/tissues/whole body (apart from lungs) ✓ d. each side of the heart has an atrium and a ventricle ✓ e. <u>left ventricle</u>/<u>side</u> pumps blood to the systems/tissues and <u>right ventricle</u>/<u>side</u> pumps blood to the lungs ✓ f. <u>left atrium</u> receives blood from the <u>lungs</u> and <u>right atrium</u> receives blood from systems/tissues ✓ g. <u>left ventricle</u> pumps blood via the <u>aorta</u> and <u>right ventricle</u> pumps blood via the <u>pulmonary artery</u> ✓ h. <u>left atrium</u> receives blood via the <u>pulmonary vein</u> and <u>right atrium</u> receives blood via the <u>vena cava</u> ✓ i. lungs require lower pressure blood / high pressure blood would damage lungs ✓ j. high pressure required to pump blood to all systems/tissues apart from lungs ✓ k. pressure of blood returning from lungs not high enough to continue to tissues / blood has to be pumped again after returning from lungs ✓ l. oxygenated blood and deoxygenated blood kept separate / all tissues receive blood with high oxygen content/saturation ✓	*Points may be earned using an annotated diagram.*	**8 max**

Question			Answers	Notes	Total
	b		a. gas exchange ✓ b. oxygen diffuses from air to blood and carbon dioxide diffuses from blood to air ✓ c. oxygen binds to hemoglobin in red blood cells ✓ d. pressure inside/volume of alveoli increases/decreases / air enters/exits alveoli during inspiration/expiration/ventilation ✓ e. blood flow through capillaries / concentration gradients of gases/oxygen/CO_2 maintained ✓ f. type II pneumocytes secrete fluid/surfactant / secretion of surfactant to prevent sides of alveolus adhering ✓	*Accept answer in a clearly annotated diagram.*	**4 max**
	c		a. less urea/excretory waste products/creatinine in renal vein ✓ b. less oxygen in the renal vein ✓ c. more carbon dioxide in renal vein✓ d. less glucose in renal vein ✓ e. concentration of sodium ions/chloride ions/pH at normal level in the renal vein whereas it is variable in renal artery ✓ f. solute concentration/osmolarity/water balance at normal level in the renal vein whereas it is variable in renal artery ✓	*Allow answers in a table format. For all these mark points accept the converse as long as it is clear whether the artery or vein has the higher amount.* *Answers relating to volume and pressure are not relevant to the question.*	**3 max**

*(Plus up to **[1]** for quality)*

Question				Notes	Total
7.	**a**		a. phloem transports organic compounds/sucrose ✓ b. from sources/leaves/where produced to sinks/roots/where used ✓ c. through sieve tubes/columns of cells with sieve plates/perforated end walls ✓ d. loading of organic compounds/sucrose into /H^+ ions out of phloem/sieve tubes by active transport/using ATP ✓ e. high solute concentration causes water to enter by osmosis (at source) ✓ f. high (hydrostatic) pressure causes flow (from source to sink) ✓ g. companion cells help with loading / plasmodesmata provide a path between sieve tubes and companion cell ✓ h. translocation/mass flow ✓		**4 max**
	b		a. meiosis / production of male and female gametes ✓ b. pollination / transfer of <u>pollen</u> from <u>anther</u> to <u>stigma</u> ✓ c. fertilization happens after pollination / fertilisation is joining of gametes ✓ d. <u>seed</u> dispersal / spread of <u>seeds</u> to new locations ✓	*Reject fruit dispersal.*	**3 max**

Question			Answers	Notes	Total
	c		a. helicase unwinds the double helix ✓ b. gyrase/topoisomerase relieves strains during uncoiling ✓ c. helicase separates the two strands of DNA/breaks hydrogen bonds ✓ d. each single strand acts as a template for a new strand / process is semi-conservative ✓ e. <u>DNA polymerase III</u> can only add nucleotides to the end of an existing chain/to a primer ✓ f. (DNA) <u>primase</u> adds <u>RNA</u> primer/short length of <u>RNA</u> nucleotides ✓ g. DNA polymerase (III) adds nucleotides in a 5' to 3' direction ✓ h. complementary base pairing / adenine to thymine and cytosine to guanine ✓ i. DNA polymerase (III) moves towards the replication fork on one strand and away from it on the other strand ✓ j. continuous on the leading strand and discontinuous/fragments formed on the lagging strand ✓ k. <u>DNA polymerase I</u> replaces primers/RNA with DNA ✓ l. ligase joins the fragments together/seals the nicks ✓	*Accept unzips here but not for mark point a.* *Do not accept letters.*	**8 max**

*(Plus up to **[1]** for quality)*

Question			Answers	Notes	Total
8.	**a**		a. plants/producers/autotrophs convert light to chemical energy by photosynthesis ✓ b. chlorophyll/photosynthetic pigments absorb light ✓ c. electrons are excited/raised to higher energy level ✓ d. excited electrons pass along chain of electron carriers ✓ e. energy from electrons used to pump protons across thylakoid membrane/into thylakoid space ✓ f. chemiosmosis/proton gradient used to make ATP ✓ g. ATP synthase generates ATP ✓ h. pigments arranged in photosystems ✓ i. electrons from Photosystem II flow via the electron chain to Photosystem I ✓ j. electrons from Photosystem I are used to reduce NADP ✓ k. ATP and reduced NADP used in the light independent reactions/Calvin cycle ✓ l. carbohydrate/glucose/carbon compounds produced containing energy ✓	*Award marking points for any point made on a clearly annotated diagram.*	**8 max**

Question			Answers	Notes	Total
	b		a. by photosynthesis / using energy from light ✓ b. attached to carbon compounds ✓ c. phosphates used to make phospholipids/nucleotides/nucleic acids/DNA/RNA/ATP ✓ d. nitrates are used to make amino acids/proteins/nucleotides/nucleic acids/DNA/RNA/ATP ✓ e. transported from roots to leaves (in xylem) ✓	*Other phosphorus-containing metabolites are acceptable if verified.* *Other nitrogen-containing metabolites are acceptable if verified.*	**3 max**
	c		a. producers/plants/autotrophs obtain energy from light/sun/inorganic sources ✓ b. food contains energy / energy passed in the form of food/carbon compounds (along food chains/between trophic levels) ✓ c. consumers obtain energy from other organisms/from previous trophic level ✓ d. energy released (in organisms) by (cell) respiration ✓ e. ATP produced ✓ f. energy/ATP used for biosynthesis/movement/active transport/other valid use of ATP ✓ g. less energy available / energy lost at each trophic level ✓	*This mark point distinguishes consumers from producers.* *Reject energy used in respiration.*	**4 max**

*(Plus up to **[1]** for quality)*