

Markscheme

May 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	470 ✓	Accept answers in the range of 460 to 480 «mg dL ⁻¹ ».	1
	b	a. «autoimmune» destruction of <u>beta/β</u> cells ✓ b. reduced/insufficient/no production of insulin ✓	Accept B cells instead of β cells.	1 max
	c	a. indicates «stem» cells can produce insulin OR is needed for insulin production OR shows insulin gene is working/being translated ✓ b. <u>insulin</u> is needed to treat <u>type I diabetes</u> OR <u>insulin</u> is needed to bring <u>blood glucose</u> level down ✓	Answers must relate to insulin mRNA.	1 max
	d	a. decrease in transplant group «after treatment» in contrast to control group which does not decrease/decreases only very slightly «initially»/increases/is higher than treatment group ✓ b. glucose «remains» lower in transplant group «than control group» for 2 weeks/3 weeks/for a time ✓ c. «in the 4 th week» transplant group rises back to level before transplant/to higher level than before transplant/to «near» level of control group ✓	The answer must include some indication of time or non-permanency.	2 max

Question		Answers	Notes	Total
e		a. glucose level still higher than normal/higher than 100 «mg»/higher than it was before the drug injection ✓ b. effective/lowers blood glucose for 3 weeks/temporarily/for a short time OR glucose level rises back in 4 th week/by day 28 OR rises back to level of control group OR rises again but not above control group ✓	This can either be positive (the treatment is effective for a while) or negative (it isn't effective permanently). There must be a correct indication of the timing of the effects.	2
f		700 ✓	No other answer accepted.	1
g		a. more pancreatic beta-cell/β-cell function/more insulin «production»/less severe diabetes in group 1 ✓ b. stem cell transplant is more successful/more effective/more stem cells survived in group 1 ✓ c. «group 1» produces more <u>proinsulin</u> ✓	Do not accept answers suggesting that only Group 1 produces insulin, Reject more C-peptide.	2 max

Question		Answers	Notes	Total
	h	<p>a. C-peptide increases after treatment in both groups OR treatment effective in both groups OR both groups rose higher than the control ✓</p> <p>b. similar/same <u>overall/total</u> increase «in both groups» OR quoted figures to show this ✓</p> <p>c. smaller <u>percentage/%</u> increase «pre to post treatment» in group 1 «than group 2» OR quoted figures to show this ✓</p> <p>d. initial increase is greater in group 1 OR increases slowing/finished/rate of increase reduced by end of study/by week 24 in group 1 but continuing in group 2</p> <p>e. group 1 rose above lower limit «by week 12» and group 2 remained below it «even at week 24» ✓</p>	<p><i>There must be an explicit comparison.</i></p> <p><i>Reject answers relating to rates of increase.</i></p>	3 max
	i	<p>umbilical cord «stem» cells are discarded/die if not harvested OR harvesting umbilical cord cells does not harm the baby OR taking «stem» cells from an embryo may harm/kill it ✓</p>	<p><i>Do not accept answers relating to consent.</i></p>	1 max

Question	Answers	Notes	Total
j	<p>a. study 1/study with mice/embryonic stem cell study shows treatment can cause increased insulin production/ reduce blood glucose levels ✓</p> <p>b. «insulin production/reduction in blood glucose in study 1 was» only temporary/did not reduce glucose to normal levels ✓</p> <p>c. study 2 shows increases in C-peptide/insulin OR some type I diabetes patients required no insulin after treatment ✓</p> <p>d. study 2 shows treatment effective for a long time/2 years ✓</p> <p>e. «stem cell treatment in study 2» was more successful in some patients than others OR more successful for moderate «than more severe» diabetes ✓</p> <p>f. study 3 shows that stem cells can cause C peptide/insulin levels to double/rise significantly/rise above lower limit «for normal C-peptide»/rise and stay raised ✓</p> <p>g. «study 3» does not give evidence for embryonic stem cells OR used umbilical cord rather than embryonic stem cells ✓</p>	<p><i>Strength</i></p> <p><i>Limitation</i></p> <p><i>Strength</i></p> <p><i>Strength</i></p> <p><i>Limitation</i></p> <p><i>Strength</i></p> <p><i>Limitation</i></p>	<p>4 max</p>

Question			Answers	Notes	Total
2.	a	i	60 kg ✓	<i>Units required.</i>	1
		ii	coronary heart disease or coronary artery disease or thrombosis or stroke or hypertension or high blood pressure or atheroma or fatty deposits in arteries or plaque «in arteries» or arteriosclerosis or atherosclerosis ✓		1
	b		[CH ₂] _n / hydrocarbon chain with single bonds and at least four carbons ✓ COOH head at one end AND three hydrogens on other end ✓	<i>The minimum of four carbons includes the end of the hydrocarbon chain and the COOH group.</i>	2
	c		a. hormone produced by adipose/fat cells/adipose tissue ✓ b. acts on/target cells are in the hypothalamus «of the brain» ✓ c. inhibits/reduces appetite/hunger OR causes feeling of satiety OR makes you feel full ✓ d. more leptin with more adipose tissue/fat «storage» tissue/cells ✓ e. eat less/decreases/reduces food intake/in humans obese people can have leptin resistance ✓	<i>Reject produced by fat.</i> <i>Reject produced by pituitary.</i>	3 max

Question		Answers	Notes	Total
3.	a	<p>a. I and II are both muscle ✓</p> <p>b. circular and longitudinal ✓</p>		2
	b	<p>a. neonicotinoid pesticides are similar to nicotine «chemically» ✓</p> <p>b. bind to nicotinic/acetylcholine receptors ✓</p> <p>c. not broken down by «acetyl» cholinesterase OR binding is irreversible ✓</p> <p>d. prevents/blocks acetylcholine binding ✓</p> <p>e. blocks transmission from CNS OR blocks signals going to muscle OR muscle contraction blocked OR causes paralysis ✓</p>	<i>Reject slows transmission.</i>	3 max
	c	<p>a. <u>mutations</u> «for resistance in some insects» ✓</p> <p>b. «mutation causes» breakdown of pesticide/detoxification of pesticide/changes to receptor site ✓</p> <p>c. natural selection for resistance OR resistant insects survive and reproduce OR non-resistant killed leaving only resistant insects ✓</p>	<p><i>Do not award mark if the answer implies directed mutations or that the pesticide causes the mutation.</i></p> <p><i>Do not accept natural selection if not in context. Do not accept answers that use the term immunity instead of resistance.</i></p>	2 max

Question		Answers	Notes	Total
4.	a	<p>a. A: gills or fins or scales or no limbs or external fertilization ✓</p> <p>b. B: homeothermic or warm-blooded or endothermic or lungs or tetrapod or <u>four</u> limbs or pentadactyl limbs or internal fertilization ✓</p> <p>c. C: hair or fur or mammary glands or milk ✓</p>		3
	b	<p>a. gene pool is all genes/all alleles ✓</p> <p>b. geographic isolation OR migration to different areas OR temporal isolation OR behavioural isolation ✓</p> <p>c. speciation/gene pool split if populations are reproductively isolated/do not interbreed ✓</p> <p>d. in different environments there are different selection pressures/opportunities/natural selection/adaptations/niches «to exploit» ✓</p> <p>e. <u>allele</u> frequencies change/diverge ✓</p>	<p><i>Reject all alleles/genes in a species.</i></p> <p><i>Reject isolation if no type of isolation given.</i></p> <p><i>Reject gene frequencies.</i></p>	3 max

Question		Answers	Notes	Total
	c	<p>a. double membrane/small intermembrane space/small gap between inner and outer membrane for a gradient «of protons» to develop ✓</p> <p>b. cristae/folds in inner membrane/large surface area of inner membrane for ATP synthesis/chemiosmosis/proton pumping/electron transport chains ✓</p> <p>c. ATP synthase/stalked particles generates ATP from ADP + phosphate/Pi ✓</p> <p>d. electron transport chains for generating a proton gradient/for releasing energy from reduced NAD ✓</p> <p>e. matrix contains <u>enzymes</u> for Krebs cycle/link reaction/oxidation of fats/oxidation of substrates/aerobic respiration ✓</p> <p>f. ribosomes/DNA for <u>protein</u> synthesis/replication ✓</p>	<p><i>Accept only the first two adaptations in the answer.</i></p> <p><i>Reject ATPase.</i> <i>Allow ATP synthetase.</i></p>	2 max

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
5.	a	a. catalyse/speed up reactions ✓ b. substrate-specific ✓ c. lower the activation energy «of a chemical reaction» ✓ d. substrate collides with/binds to <u>active site</u> ✓ e. enzyme–substrate complex formed OR transition state formed OR bonds in substrate weakened ✓		4 max

Question	Answers	Notes	Total
<p>b</p>	<p>a. «DNA» gyrase/topoisomerase «II» prepares for uncoiling/relieves strains «in the double helix» ✓</p> <p>b. helicase uncoils/unwinds the DNA/double helix ✓</p> <p>c. helicase separates/unzips/breaks hydrogen bonds between the two strands of DNA ✓</p> <p>d. «DNA» primase adds an <u>RNA</u> primer/short length of <u>RNA</u> ✓</p> <p>e. DNA polymerase III adds «DNA» nucleotides/replicates DNA/synthesizes complementary strand in a <u>5' to 3' direction</u> ✓</p> <p>f. DNA polymerase III starts replication/adding nucleotides <u>at the primer</u> ✓</p> <p>g. DNA polymerase I removes the primer OR replaces RNA with DNA ✓</p> <p>h. «DNA» ligase seals the nicks OR links sections of replicated DNA OR links Okazaki fragments ✓</p> <p>i. DNA polymerase I/DNA polymerase III proofreads for mistakes ✓</p>	<p><i>Accept RNA primase.</i></p>	<p>7 max</p>

Question	Answers	Notes	Total
c	<p>a. key or text giving alleles with upper case for dominant allele and lower case for recessive allele/allele causing disease ✓</p> <p>b. Punnett grid showing that both parents can pass on either a dominant or a recessive allele in their gamete ✓</p> <p>c. four possible genotypes for child correctly shown on grid ✓</p> <p>d. double/homozygous recessive shown having the disease ✓</p> <p>e. 25 % or 0.25 or $\frac{1}{4}$ chance of inheriting the disease ✓</p>	<p><i>Reject key showing a sex linked gene such as hemophilia. Reject if X or Y chromosomes are shown with the alleles. Accept Aa or any other upper and lower case letters.</i></p> <p><i>For example row and column headings with A and a. This mark can be awarded if X or Y chromosomes are shown but each parent has one recessive and one dominant allele as if for autosomal inheritance.</i></p> <p><i>AA, Aa, aA and aa for example. This mark can be awarded if X or Y chromosomes are shown but the genotypes are correct for autosomal inheritance.</i></p> <p><i>Cannot be awarded with sex linkage.</i></p> <p><i>This mark can be awarded if X or Y chromosomes are shown but the ratio is correct for autosomal inheritance.</i></p>	4 max

(Plus up to [1] for quality)

Question		Answers	Notes	Total
6.	a	<p>a. <u>phospholipid bilayer</u> drawn and labelled with at least one <u>protein</u> labelled and drawn embedded either in one or both halves of the bilayer ✓</p> <p>b. <u>integral/intrinsic/transmembrane/carrier/pump/channel/pore protein</u> labelled and shown crossing the membrane ✓</p> <p>c. <u>extrinsic/peripheral</u> protein labelled and shown on membrane surface/not embedded in bilayer ✓</p> <p>d. <u>glycoprotein</u> labelled and shown integral and with a clear carbohydrate region projecting out on one side of the membrane ✓</p>	<p><i>Reject if only peripheral proteins are shown.</i></p> <p><i>The carbohydrate should be shown differently from the protein but need not be labelled specifically.</i></p> <p><i>The protein part can be embedded in one or both phospholipid layers.</i></p>	3 max

Question	Answers	Notes	Total
b	<p>a. hypertonic solution has more <u>solutes</u>/higher <u>solute</u> concentration «than the tissue/cells/cytoplasm» ✓</p> <p>b. water moves out of the cells/tissue by <u>osmosis</u> «into the hypertonic solution» ✓</p> <p>c. water moves from lower solute <u>concentration</u> to higher solute <u>concentration</u>/up the solute <u>concentration</u> gradient ✓</p> <p>d. pressure inside cell drops OR cell no longer turgid OR cell becomes flaccid ✓</p> <p>e. volume of cytoplasm drops OR «plasma» membrane retracts from the cell wall OR cell is plasmolysed ✓</p>	<p><i>Reject answers based on water concentrations.</i></p> <p><i>Reject cell decreases in size.</i> <i>Reject plant wilts and other answers about whole plants.</i></p> <p><i>Reject plant cells shrink or shrivel.</i></p>	<p>4 max</p>

Question	Answers	Notes	Total
c	a. <u>osmoregulation/excretion</u> of nitrogenous waste/urea «is a function of the» <u>kidney</u> ✓ b. ultrafiltration in the glomerulus/smaller molecules filtered out in the glomerulus OR capillary walls/glomerulus permeable to smaller molecules ✓ c. basement membrane/filtration slits/podocytes act as filter/prevent loss of «large» «proteins»/prevent loss of blood cells ✓ d. high «blood» pressure in glomerulus due to larger afferent than efferent arteriole ✓ e. «selective» reabsorption of glucose/useful substances in proximal convoluted tubule ✓ f. microvilli/coiling/convolutions give large surface area OR pump proteins to reabsorb specific solutes «in proximal convoluted tubule» ✓ g. water reabsorbed in descending limb «of loop of Henle» OR descending limb permeable to water ✓ h. active transport/active pumping of sodium ions/Na ⁺ out of ascending limb «from filtrate to medulla» ✓ i. ascending limb is impermeable to water ✓ j. <u>loop of Henle</u> creates solute gradient/high solute concentration/hypertonic conditions in <u>medulla</u> ✓ k. distal convoluted tubule adjusts pH/adjusts concentration of Na ⁺ /K ⁺ /H ⁺ ✓ l. water reabsorbed in collecting duct ✓ m. collecting duct permeability to water varies due to number of aquaporins/ADH ✓ n. osmoregulation by varying the amount of water reabsorbed «in the collecting duct» ✓	Reject ultrafiltration in the Bowman's capsule	8 max

(Plus up to [1] for quality)

Question		Answers	Notes	Total
7.	a	<p>a. <u>cell wall</u> shown with two continuous lines to indicate the thickness ✓</p> <p>b. <u>plasma membrane/cell membrane</u> shown as a single continuous line ✓</p> <p>c. <u>nuclear membrane/nucleus</u> shown with double membrane and nuclear pores ✓</p> <p>d. <u>vacuole «membrane»/tonoplast</u> shown as a single continuous line ✓</p> <p>e. <u>chloroplast/plastid</u> shown with a double line to indicate the envelope and thylakoids/grana ✓</p> <p>f. <u>mitochondrion</u> shown with double membrane/cristae ✓</p>	<p><i>Accept inner line of wall as membrane if clearly labelled</i></p>	<p>4 max</p>
	b	<p>a. only a small proportion/20 %/10 % «of energy» can pass from one trophic level to the next OR large proportion/80 %/90 % lost between one trophic level and the next ✓</p> <p>b. energy released by <u>respiration</u> AND lost as <u>heat</u> ✓</p> <p>c. energy losses due to uneaten parts/undigested parts/feces/egestion ✓</p> <p>d. not enough energy for 4th/5th/later stages of a food chain OR more energy available if feeding at an earlier stage in a food chain ✓</p>	<p><i>Accept named trophic levels or named stages in a food chain in place of “trophic levels”.</i></p> <p><i>Accept if clearly shown in a diagram such as a pyramid of energy.</i></p> <p><i>Not just respiration or heat.</i></p>	<p>3 max</p>

Question	Answers	Notes	Total
<p>c</p>	<p>a. <u>evaporation</u> of water «in leaf/mesophyll» creates tension/low pressure/negative pressure «potential»/pulling force/transpiration pull ✓</p> <p>b. water drawn through cell walls/out of xylem «in leaf» by <u>capillary action/adhesion</u> «to cellulose» ✓</p> <p>c. <u>low pressure/tension/suction</u>/pulling force in <u>xylem</u> ✓</p> <p>d. <u>hydrogen bonds</u> make water cohesive/allow water to be pulled up under tension/allow the transpiration pull «to move water» ✓</p> <p>e. xylem resists tension/low pressure/collapse with <u>thickened/lignified walls</u> ✓</p> <p>f. water travels from the <u>roots</u> to the <u>leaves</u> in <u>xylem</u> ✓</p> <p>g. water absorbed in roots by <u>osmosis</u> ✓</p> <p>h. active transport of ions/solutes into roots «enabling osmosis» ✓</p> <p>i. deep/wide ranging/extensive root systems/taproots/many root hairs ✓</p> <p>j. thick/waxy cuticle reduces transpiration/water loss/evaporation ✓</p> <p>k. small/no leaves/reduced surface area of leaves/thorns instead of leaves ✓</p> <p>l. few stomata/stomata in pits/rolled leaves ✓</p> <p>m. hairs on leaf surface «to reduce air flow near the leaf/reflect sunlight» ✓</p> <p>n. stomata open at night/CAM physiology to reduce water loss ✓</p>		<p>8 max</p>

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