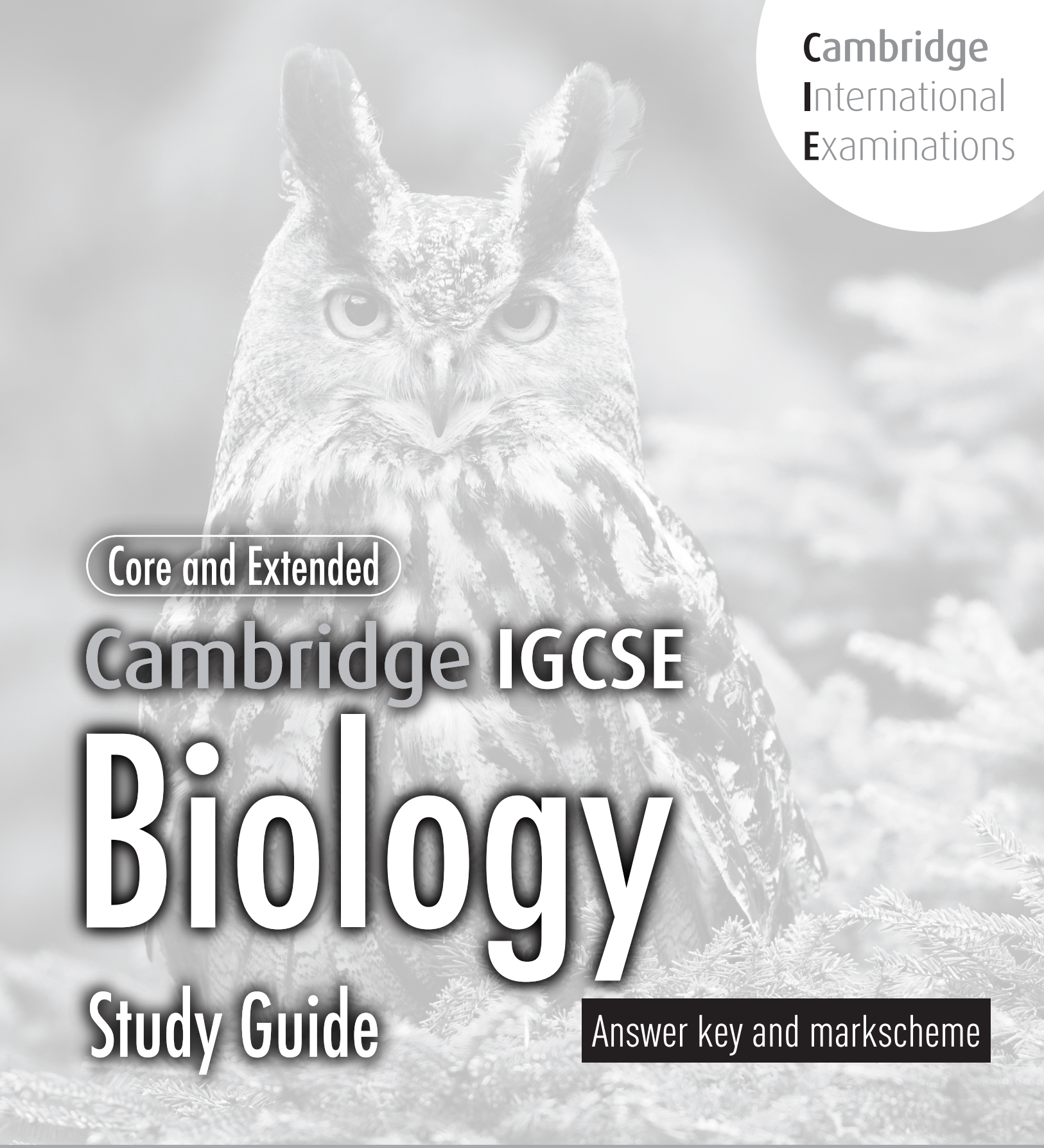

Cambridge International Examinations

Core and Extended

Cambridge IGCSE Biology

Study Guide

Answer key and markscheme

NTK Publishing Limited

CONTENTS

Answer Key

Practice test markscheme

Exercise 1

Multiple-choice questions

1	**C**	6	**D**
2	**B**	7	**A**
3	**D**	8	**D**
4	**C**	9	**A**
5	**C**	10	**D**

Structured questions

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance notes</th></tr>
<tr><td>1</td><td>carbon dioxide;
urea;</td><td>[2]</td><td></td></tr>
<tr><td>2</td><td><table><tr><td>Statement</td><td>Characteristic</td></tr><tr><td></td><td>nutrition;</td></tr><tr><td></td><td>respiration;</td></tr><tr><td></td><td>growth;</td></tr><tr><td></td><td>reproduction;</td></tr><tr><td></td><td>sensitivity / movement;</td></tr><tr><td></td><td>sensitivity;</td></tr></table></td><td>[6]</td><td></td></tr>
<tr><td>3</td><td><table><tr><td>Name of process</td><td></td></tr><tr><td>excretion;</td><td></td></tr><tr><td>nutrition;</td><td></td></tr><tr><td>homeostasis;</td><td></td></tr><tr><td>respiration;</td><td></td></tr><tr><td>reproduction;</td><td></td></tr></table></td><td>[5]</td><td></td></tr>
<tr><td>4 (a)</td><td>P: Fungus;
Q: Protoctista;
R: Animal;</td><td>[3]</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance notes
(b)	cell wall; hyphae; saprotrophic nutrition; spores;	[max 2]	
5	D, C, B, E, A	[4]	

Exercise 2

Multiple-choice questions

1	**B**	6	**C**
2	**A**	7	**C**
3	**C**	8	**C**
4	**B**		
5	**B**		

Structured questions

<table>
<tr><th colspan="2">Question</th><th>Answer</th><th>Marks</th><th>Guidance notes</th></tr>
<tr><td>1</td><td>(a)</td><td>cell B;
contains cell wall / chloroplast / central vacuole;</td><td>[2]</td><td>Award [1] for any two structures identified</td></tr>
<tr><td></td><td>(b)</td><td>cell membrane labelled correctly</td><td>[1]</td><td></td></tr>
<tr><td></td><td>(c)</td><td>cell A: 2.5 cm ÷ 0.025 mm = 1000×;
cell B: 3.5 cm ÷ 0.08 mm = 437.5×;</td><td>[2]</td><td></td></tr>
<tr><td>2</td><td colspan="2"><table><tr><th>Organ</th><th>Tissue</th><th>Cell</th><th>Organelle</th></tr><tr><td>heart;
blood;
stomach;</td><td></td><td>platelet;
white blood cell;
neurone;</td><td>vacuole;
chloroplast;</td></tr></table></td><td>[8]</td><td></td></tr>
<tr><td>3</td><td colspan="2">ribosome → chloroplast → root hair cell → xylem vessels → leaf</td><td>[5]</td><td>One less mark for each misplaced structure</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance notes</th></tr>
<tr><td>4</td><td>
<table>
<tr><td>Cell structure</td><td>Function</td></tr>
<tr><td>Nucleus</td><td>contains genetic materials to control cell activities;</td></tr>
<tr><td>Ribosome</td><td>synthesizes proteins;</td></tr>
<tr><td>Mitochondrion</td><td>produces energy by aerobic respiration;</td></tr>
<tr><td>Cell membrane</td><td>controls exit or entry of substances into or out of cell;</td></tr>
<tr><td>Cytoplasm</td><td>allows metabolic reactions to take place;</td></tr>
<tr><td>Cell wall</td><td>maintains cell shape / prevents the cell from bursting;</td></tr>
<tr><td>Chloroplast</td><td>for photosynthesis;</td></tr>
</table>
</td><td>[7]</td><td></td></tr>
</table>

Exercise 3

Multiple-choice questions

1	**C**	6	**D**
2	**A**	7	**B**
3	**B**	8	**B**
4	**D**	9	**C**
5	**D**		

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	diffusion; higher concentration of bromine gas in the right hand side;	[2]	
(b)	increase temperature; increase the concentration of bromine gas;	[2]	
2	<table><tr><td></td><td>no</td><td>no</td></tr><tr><td></td><td></td><td>water</td></tr><tr><td></td><td>yes</td><td></td></tr></table>	[4]	
3 (a)	root hair cell;	[1]	
(b)	against concentration gradient; using energy; requires protein pump / protein carrier;	[max 2]	
(c)	high solute concentration (in root hair cell) / lowers water potential (in root hair cell); water enters by <u>osmosis</u>;	[2]	

Exercise 4

Multiple-choice questions

1	**A**	6	**B**
2	**D**	7	**C**
3	**C**	8	**A**
4	**D**	9	**A**
5	**C**	10	**B**

Structured questions

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance notes</th></tr>
<tr><td>1 (a)</td><td>
<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>protein;</td><td>amino acid;</td><td></td><td>body structure;</td></tr>
<tr><td>carbo-hydrate;</td><td></td><td>carbon, hydrogen, oxygen;</td><td></td></tr>
<tr><td></td><td>fatty acid <u>and</u> glycerol;</td><td></td><td>heat insulation / energy storage;</td></tr>
</table>
</td><td>[7]</td><td></td></tr>
<tr><td>(b)</td><td>Benedict’s test / Benedict’s solution;
warm / heat / water bath;
blue to red ppt;</td><td>[3]</td><td></td></tr>
<tr><td>(c)</td><td>biuret test;
blue to violet;</td><td>[2]</td><td></td></tr>
<tr><td>2 (a)</td><td>50 – 17;
33%;</td><td>[2]</td><td></td></tr>
<tr><td>(b)</td><td>DNA is a double helix;
2 strands (of polynucleotides) linked by bases;
wraps around protein complexes;</td><td>[max 2]</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance notes
3 (a)	transport nutrients; transport wastes; dissolve food molecules in alimentary canal; reaction medium (in cells);	[max 3]	*allow specific examples for nutrients and wastes*
(b)	three dimensional shape determines function; *example:* active site of enzymes; shape of (binding site of) antibodies;	[max 2]	

Exercise 5

Multiple-choice questions

1	**A**	6	**C**
2	**C**	7	**C**
3	**D**		
4	**D**		
5	**D**		

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	biological catalyst; made of proteins; speed up rate of metabolic reactions;	[max 2]	
(b)	increase and then decrease; peaks at pH 8;	[2]	
(c)	enzymes are made of protein; proteins are digested in stomach; proteins are denatured by acidic pH in stomach;	[max 2]	
2 (a)	time taken decreases as concentration of enzyme increases;	[1]	
(b)	higher rate of reaction; more active sites available;	[2]	
(c)	higher temperature increases kinetic energy; more successful collision; more enzyme-substrate complex formed; higher temperature denatures enzymes;	[max 3]	
(d)	enzymes are specific to substrate; enzymes are made of proteins; sequence of amino acids determines the 3D shape of enzyme; shape / chemical structure of active site is complementary to substrate; to form enzyme-substrate complex;	[max 4]	

Exercise 6

Multiple-choice questions

1	**A**	6	**C**
2	**B**	7	**D**
3	**B**	8	**D**
4	**B**		
5	**D**		

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	chloroplast;	[1]	
(b)	absorbs light energy;	[1]	
(c)	glucose;	[1]	
(d)	epithelial cell / xylem / phloem;	[1]	
2 (a) (i)	F;	[1]	
(ii)	E;	[1]	
(iii)	D;	[1]	
(b)	*Name:* cuticle; *Function:* prevents excess loss of water / prevents evaporation;	[2]	
(c)	closely packed; high density of chloroplast;	[2]	
3 (a)	absorbs carbon dioxide;	[1]	
(b)	destarch; to make sure that the starch present is produced during the experiment;	[2]	

Question	Answer	Marks	Guidance notes
(c)	*Result:* no colour change; *Explanation:* photosynthesis did not occur; carbon dioxide is absorbed by potassium hydroxide; carbon dioxide is required for photosynthesis;	[max 3]	*Award [max 2] for explanation*
(d)	*Result:* no colour change in white region; colour change from brown to blue black in green region; *Explanation:* chlorophyll is required for photosynthesis; glucose produced (by photosynthesis); glucose is converted into starch;	[max 3]	*Award [max 2] for explanation*

Exercise 7

Multiple-choice questions

1	**C**	7	**B**
2	**C**	8	**B**
3	**B**	9	**C**
4	**C**	10	**C**
5	**B**	11	**D**
6	**B**		

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	molar; flat surface / two roots;	[2]	
(b)	enamel; for grinding food;	[2]	
(c)	food remains; decomposition by bacteria; lactic acid dissolves enamel;	[max 2]	
(d)	nerve cell;	[1]	
2 (a)	X labelling the stomach; Y labelling the gall bladder;	[2]	
(b)	emulsification of fat; increase surface area for enzymes;	[2]	
(c)	villus / villi;	[1]	
(d)	thin epithelial cell layer to shorten diffusion distance; microvilli to increase surface area; lacteal / large network of capillaries to maintain concentration gradient;	[max 3]	

Exercise 8

Multiple-choice questions

1	**D**	6	**D**
2	**A**	7	**C**
3	**B**	8	**A**
4	**C**	9	**A**
5	**B**	10	**D**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	root hair cell;	[1]	
(b)	minerals / named minerals;	[1]	
(c)	cortex cell; xylem; palisade cell;	[3]	
(d)	by transpiration; evaporation from spongy cells; diffusion out of stomata;	[3]	
2 (a)	water loss by evaporation; weight decrease;	[2]	
(b)	temperature;	[1]	
(c)	prevent evaporation of water from soil;	[1]	

Exercise 9

Multiple-choice questions

1	**B**	6	**B**
2	**D**	7	**B**
3	**D**	8	**A**
4	**A**	9	**B**
5	**B**	10	**B**

Structured questions

Question	Answer	Marks	Guidance Notes
1 (a)	*name* atrioventricular valve; *function* prevent backflow of blood (from ventricle to atrium) / AW;	[2]	**A** biscuspid / tricuspid valve
(b)	only one ventricle in amphibian; only one artery (out of the heart / ventricle); no septum; AVP;	[max 2]	**A ora**
(c)	*similarities to mammalian heart* both have two / left and right atria; both have arteries / veins to lungs; (some) separation of oxygenated and deoxygenated blood; AVP;	[max 2]	**R** difference **A** more similar to fish if valid reasons are identified
(d)	oxygenated and deoxygenated blood not <u>completely</u> / AW separated; reduce concentration gradient for gas exchange / AW;	[2]	

Question	Answer	Marks	Guidance notes
(e)	ectothermic; slower metabolism; gas exchange through skin; AVP;	[max 1]	**R** "cold-blooded" / "poikilothermic"
2 (a)	hepatic portal vein;	[1]	
(b)	artery has thicker wall; artery has smaller lumen; artery has more muscle / elastic fibres; artery does not have valves;	[max 2]	**A ora**
(c)	thin wall; large lumen; few muscle / elastic fibres; valves;	[max 1]	**A** ecf from **(a)**
(d)	more oxygen in vessel P; more nutrients / named nutrient in vessel P; less urea; less carbon dioxide; AVP;	[max 3]	**A ora** **A** more / less glucose if correctly explained
(e)	nutrient / named nutrient / oxygen diffuses from tissue fluid to cell; waste / named waste diffuses from cell to tissue fluid; plasma pushed out of capillary (to form tissue fluid); due to high blood pressure;	[max 3]	ref to diffusion required
(f)	injury to blood vessels causes blood clotting; ref to process of blood clotting; blood clot blocks blood vessels / thrombosis; reduce / block blood flow to heart muscles; less glucose / oxygen supplied to heart muscles; heart (muscles) cannot contract; ref to respiration;	[max 5]	**R** "heart" alone

Exercise 10

Multiple-choice questions

1	**A**	6	**A**
2	**D**	7	**D**
3	**C**	8	**A**
4	**C**	9	**B**
5	**A**	10	**B**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	pathogen;	[1]	
(b)	mosquitoes puncture skin / blood vessels; *Plasmodium* directly introduced into blood; ref to methods to evade defences inside body;	[max 2]	
(c)	mosquitoes live in warm and humid areas; mosquito species transmitting malaria are only found in (Sub-Saharan) Africa;	[max 1]	**A ora**
(d)	insect repellent; insecticides; AVP;	[max 1]	
(e)	stimulate immune response / ref to primary response; formation of memory cells; memory cells produce antibodies quickly / ref to secondary response; eliminate pathogen quickly;	[max 3]	

Question	Answer	Marks	Guidance notes
(f)	*Plasmodium* / malarial parasites live inside red blood cells; cannot be targeted by antibodies; move into (liver) cells quickly after infection; many species of *Plasmodium* / malarial parasites; AVP;	[max 3]	

Exercise 11

Multiple-choice questions

1	**B**	6	**D**
2	**A**	7	**D**
3	**A**	8	**D**
4	**A**	9	**C**
5	**C**	10	**A**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	2.8 (dm^3);	[1]	**A** answers between 2.7 and 2.9
(b)	measure time taken for multiple e.g. 10 ventilations; calculate length of 1 ventilation (by dividing measured time by number of ventilations); divide 60 by time of 1 ventilation;	[2 max]	**A** description for measuring rate in volume per minute
(c)	total volume (of air) remains constant; distance between peaks / troughs increase (over time) / AW; difference between peak and trough increases;	[3]	**A** frequency / ventilation rate / breathing rate **A** "amplitude" / "tidal volume" / "depth of breathing / ventilation"
(d)	difficulty of ventilation; thoracic cavity not airtight; lung volume does not change with thoracic cavity / AW; cannot change / control pressure in lungs / AW;	[max 3]	**I** ref to rate / depth **A** "lungs cannot expand and contract"

Exercise 12

Multiple-choice questions

1	**D**	6	**B**
2	**B**	7	**A**
3	**B**	8	**A**
4	**D**	9	**C**
5	**B**	10	**A**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	chemical reactions (in cells) that break down nutrient / organic molecules to release energy / AW; without using oxygen / in absence of oxygen / AW;	[2]	**R** "produce"
(b)	*type of respiration* aerobic; *explanation* air / oxygen supplied to / pumped into set-up;	[2]	**R** ref to amount of energy from anaerobic respiration
(c)	remain unchanged / colourless / AW; carbon dioxide is removed / absorbed by sodium hydroxide;	[2]	**R** "clear" / "transparent" **R** "no carbon dioxide"
(d)	same set-up of apparatus; without mammal / animal;	[2]	**A** correct description of set-up **A** appropriate non-living substitute e.g. stone
(e)	from red to yellow; carbon dioxide produced by mammal; carbon dioxide concentration increases; no photosynthesis;	[max 3]	**A** correct ref to acidity / pH **A** absence of photosynthetic organisms

Exercise 13

Multiple-choice questions

1	**A**	6	**B**
2	**D**	7	**D**
3	**B**	8	**D**
4	**C**	9	**D**
5	**D**	10	**B**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	high (blood / hydrostatic) pressure in glomerulus; pressure (in glomerulus) pushes plasma into Bowman's capsule; basement membrane blocks large molecules (and blood cells); formation of glomerular filtrate; ref to pores of capillaries / glomerulus; ref to pore size of basement membrane;	[max 4]	
(b)	occur in <u>proximal</u> convoluted tubule; all glucose and amino acids reabsorbed; (re)absorbed by active transport (and diffusion); against concentration gradient;	[max 3]	**R** diffusion alone
(c)	concentration increases; more water reabsorbed (by collecting duct); increased ADH secretion;	[max 2]	**A** correct ref to role of loop of Henle
(d)	$\frac{1.0 - 0.075}{1.0} \times 100\%$; 92.5 (%);	[2]	**A** answers between 92 and 94 **I** positive / negative sign

Question	Answer	Marks	Guidance notes
(e)	small enough to pass through basement membrane; present in glomerular filtrate; not reabsorbed;	[max 2]	**I** ref to specific parts of nephron **R** Bowman's capsule

Exercise 14

Multiple-choice questions

1	**D**	6	**C**
2	**C**	7	**D**
3	**C**	8	**D**
4	**B**	9	**B**
5	**A**	10	**C**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	*sensitivity* detection of and response to stimulus / AW; detection by photoreceptor (of light); response by ciliary muscle;	[3]	**A** "change in environment" **R** receptor unqualified **A** description of response by ciliary muscle **I** coordination / integration
(b)	*effector nerve* optic nerve; *motor nerve* oculomotor nerve;	[2]	
(c)	ciliary muscle relaxes; suspensory ligaments slacken / AW; lens become thicker / AW; decrease refraction;	[max 3]	
(d)	rapid / AW; involuntary / AW; stereotyped / AW;	[max 2]	
(e)	2;	[1]	
2 (a)	control (for experiments 2 and 3) / AW;	[1]	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance notes</th></tr>
<tr><td>(b)</td><td>conclusion
light is detected by (shoot) tip / AW;
explanation
presence of shoot tip required for response (ref to experiment 2);
covering shoot tip leads to lack of response (ref to experiment 3);</td><td>[3]</td><td>A ora</td></tr>
<tr><td>(c)</td><td><u>total</u> amount of auxin not decreased by light (ref to experiment 4);
amount of auxin on both sides the same in presence of light and when blocked by glass plate (ref to experiment 5);
more auxin on shaded side when not blocked by glass plate (ref to experiment 6);</td><td>[max 2]</td><td></td></tr>
<tr><td>(d)</td><td><table><tr><th>tropism</th><th>endocrine coordination</th></tr><tr><td>transmission by diffusion / active transport</td><td>transmission by blood / transport system;</td></tr><tr><td>mainly growth response</td><td>many types of response;</td></tr><tr><td>signals produced by unspecialised cells</td><td>signals produced by specialised cells;</td></tr></table>AVP;</td><td>[max 2]</td><td>A cellular transport
A description of response</td></tr>
</table>

Exercise 15

Multiple-choice questions

1	**C**	6	**B**
2	**D**	7	**A**
3	**D**	8	**B**
4	**B**	9	**A**
5	**C**	10	**A**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	positive correlation between antibiotic consumption and percentage resistance / AW; large variation in percentage resistance (at any antibiotic consumption level); most countries consume 10–30 units of antibiotics (per 1000 per day) **ora**;	[max 2]	**R** "cause" unit not required
(b)	antibiotic kills non-resistant bacteria; resistant bacteria survive <u>and</u> reproduce; resistance passed to offspring / AW; non-resistant bacteria reproduce less; resistance caused by mutation;	[max 3]	**A** ref to genes / alleles
(c)	recreation; research; AVP;	[max 2]	

Exercise 16

Multiple-choice questions

1	**C**	6	**B**
2	**D**	7	**B**
3	**A**	8	**D**
4	**B**	9	**D**
5	**C**	10	**B**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	stigma;	[1]	
(b)	transfer pollen from anther to stigma; between different plants (of the same species);	[2]	**A** "individuals"
(c)	both show variation within species; species B flowers later than species A; ref to normal distribution; some overlapping between species; correct use of figures;	[max 3]	
(d)	release pollen at different times; cannot pollinate each other; prevent fertilisation; different pollinators; AVP;	[max 3]	
(e)	*asexual reproduction* faster production / larger number of offspring; preserve characteristics / genes / alleles; produce sterilised plants; AVP; *sexual reproduction* allow selective breeding / hybridisation; AVP;	[max 1]	**A** named characteristic e.g. flower pattern

Question	Answer	Marks	Guidance notes
2 (a)	both increase from day 4 to day 9; both decrease after day 9;	[2]	**R** comparison between the two variables
(b)	progesterone stimulates thickening of uterine lining; increase amount of tissues (in uterus);	[2]	**R** "maintain"
(c)	incorrect use; damage e.g. due to storage / transport; AVP;	[max 2]	
(d)	convenient; cheaper; can prevent STIs; AVP;	[max 2]	
(e)	high level of progesterone / oestrogen; progesterone / oestrogen inhibits secretion of FSH / LH; prevent egg development / ovulation; prevent fertilisation ;	[max 3]	
(f)	fusion of male and female gametes / nuclei (to form a zygote);	[1]	**A** "sperm", "egg"
(g)	nutrients (e.g. glucose) diffuse from mother to fetus; wastes (e.g. urea) diffuse from fetus to mother; oxygen diffuses from mother to fetus; ref to concentration difference; (chorionic) villi increase surface area; blood systems are close; transported between fetus and placenta through umbilical cord;	[max 4]	direction required

Question	Answer	Marks	Guidance notes
(h)	(unprotected) sexual intercourse; unhygienic blood transfusions; sharing of syringes; AVP;	[max 2]	
(i)	reduce number of lymphocytes; reduce amount of antibody produced; increase risk of infections; AVP;	[max 2]	**R** health effects not directly related to HIV or lymphocytes

Exercise 17

Multiple-choice questions

1	**C**	6	**A**
2	**B**	7	**B**
3	**B**	8	**D**
4	**A**	9	**B**
5	**B**	10	**D**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	a segment of DNA that controls a characteristic / codes for a protein / AW;	[1]	
(b)	diploid ; idea that <u>two</u> alleles are present;	[2]	
(c)	allele;	[1]	
(d)	mRNA produced based on gene / DNA (base sequence); mRNA (carries copy of gene / DNA) to ribosomes; ribosome joins amino acids into protein / polypeptide; amino acid sequence determined by base sequence of mRNA / gene;	[max 3]	**A** cytoplasm / rough endoplasmic reticulum
(e)	not found (in mature red blood cell) because no nucleus;	[1]	
2 (a)	(a characteristic) caused by a gene on a sex chromosome / more common in one sex than in the other;	[1]	
(b)	*expected ratio* 1 : 1 / 50% male <u>and</u> 50% female; *explanation* 50% sperms carry X chromosome <u>and</u> 50% carry Y chromosome / AW;	[2]	do not award unless explicitly stated **A** use of genetic diagram / Punnett square

Question	Answer	Marks	Guidance Notes
(c)	males only have one X chromosome; have either orange or brown allele **ora**;	[2]	
(d)	*parent genotype* $X^OX^B \times X^BY$; *gamete* X^O, X^B, X^B, Y; *offspring* X^OX^B, X^BX^B, X^OY, X^BY tortoiseshell, brown, orange, brown; *genotypic ratio* 1 : 1 : 1 : 1; *phenotypic ratio* (brown : orange : tortoiseshell =) 2 : 1 : 1;	[5]	**R** incorrect formats of symbols genotypes and phenotypes must be correctly linked **A** 1 : 1 : 1 : 1 if sex also identified e.g. brown male
(e)	chance; random fertilisation; AVP;	[max 1]	**R** small sample size unqualified
(f)	have extra X chromosome; caused by other genes; AVP;	[max 1]	

Exercise 18

Multiple-choice questions

1	**A**	6	**D**
2	**B**	7	**C**
3	**C**	8	**A**
4	**C**	9	**A**
5	**A**	10	**C**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	$\frac{237\,381}{305\,773} \times 100\%$; 78%;	[2]	**A** 77.6
(b)	difference (in phenotype / genotype) between individuals (of the same species);	[1]	
(c)	*type of variation* discontinuous; *explanation* only three / two phenotypes / phenotypes identified / AW;	[2]	**A** continuous if valid explanation is given **R** stating discreet / discontinuous phenotypes only
(d)	no / little malaria outside Africa; Hb^AHb^A has highest survival; Hb^AHb^S has higher survival than Hb^SHb^S; Hb^SHb^S dies from sickle-cell anaemia; ref to reproduction and transmission of alleles; malaria increases survival of Hb^AHb^S <u>in Africa</u>;	[max 4]	**A ora** if difference in selection pressure in and outside Africa is explicitly stated

Question	Answer	Marks	Guidance notes
(e)	genetic diseases reduce survival; only one dominant allele is needed to cause disease; less likely to pass to offspring; recessive alleles can be carried without causing diseases; two recessive alleles are needed to cause disease; (carriers) can pass recessive allele to offspring;	[max 4]	**A** co-dominance if correctly described

Exercise 19

Multiple-choice questions

1	**D**	6	**B**
2	**B**	7	**C**
3	**A**	8	**C**
4	**D**	9	**A**
5	**B**	10	**B**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	maize / bean / squash → human;	[1]	**A** other appropriate consumers **A** more trophic levels
(b)	fewer trophic levels / energy transfers; less energy loss (between trophic levels) / more energy transferred; 90% energy loss / AW; ways of energy loss e.g. heat loss;	[max 3]	**A ora**
(c)	plants absorb water (from soil); ref to transpiration; ref to feeding; reduce evaporation from soil;	[max 3]	ref to water flow required
(d)	low density; difficult to manage / harvest; different demands for crops; AVP;	[max 2]	
(e)	nitrogen in crops are removed; not returned to soil; ref to decomposition; reduce nitrate content of soil; fertilisers supply nitrate; increase productivity;	[max 3]	**R** other ions **A ora**

Question	Answer	Marks	Guidance notes
(f)	increase from 2004 / 2005 to 2007; decrease from 2007 to 2009; increase from 2009 to 2011 / 2013;	[max 3]	
(g)	ref to decomposition; ref to nitrification;	[2]	
(h)	population exceed carrying capacity (in swarming phase); definition of carrying capacity ; depletes resources / food; increase death rate / mortality; AVP;	[max 3]	

Exercise 20

Multiple-choice questions

1	**B**	6	**D**
2	**D**	7	**C**
3	**B**	8	**D**
4	**A**	9	**D**
5	**A**	10	**A**

Structured question

Question	Answer	Marks	Guidance notes
1 (a)	break cell wall; cells break more easily;	[2]	**I** "break down pectin"
(b)	reduce debris / clearer extract / more attractive; AVP;	[max 1]	
(c)	nutrients in culture medium; control temperature / pH e.g. using a water jacket; oxygen supply; stirring paddle for mixing; growth of fungus; extraction of pectinase; ref to aseptic technique e.g. air filter;	[max 5]	**A** named nutrients e.g. glucose **A** air sparger for mixing
(d)	addition of yeast; ref to anaerobic respiration / condition; convert sugar to ethanol;	[max 2]	**I** "alcohol" **A** word / balanced chemical equation

Question	Answer	Marks	Guidance notes
(e)	isolate gene from fungus; isolate and cut plasmid; ref to restriction enzymes; ref to sticky ends; join gene and plasmid with (DNA) ligase; insert recombinant plasmid into bacteria; expression of gene / production of pectinase by bacteria / AW;	[max 5]	
(f)	rapid growth / replication; little resource / small space required; plasmid for transferring genes; AVP;	[max 1]	

Exercise 21

Multiple-choice questions

1	**C**	6	**B**
2	**D**	7	**B**
3	**D**	8	**B**
4	**D**	9	**C**
5	**D**	10	**C**

Structured questions

Question	Answer	Marks	Guidance notes
1 (a)	economic development; nutritional requirements; AVP;	[max 1]	
(b)	machinery; fertiliser; pesticide / herbicide; selective breeding; genetic engineering; AVP;	[max 2]	
(c)	*falling prices* increased supply / production; reduced demand (for cereal); AVP; *rising prices* increased demand (for cereal); reduced supply of other food sources; AVP;	[max 2]	

Question	Answer	Marks	Guidance notes
(d)	both (milk and wheat consumption) increase at a higher rate in developing countries / AW; milk consumption always higher than wheat consumption in developed countries / AW; milk consumption exceed wheat consumption after 2012 in developing countries / AW; similar changes in milk and wheat consumption in developed countries; ref to different rate of change in milk and wheat consumption in developing countries;	[max 3]	ref to countries required
(e)	clear land for constructing farms / pastures; wood for fuel; for construction materials; AVP;	[max 2]	must be linked to deforestation
(f)	soil erosion; no roots to hold soil / exposed to wind / rain; flooding; no trees to absorb water / eroded soil blocks waterways; increased greenhouse effect / carbon dioxide concentration; less photosynthesis; death of species; loss of habitat / food sources; AVP;	[max 6]	explanation must be linked to impact
2 (a)	high energy consumption / use of fuels; carbon dioxide from fuels / climate change; acid rain; AVP;	[max 2]	

Question	Answer	Marks	Guidance notes
(b)	particulate matter / dust blocks light / irritate respiratory system; carbon dioxide from vehicles / machinery increases greenhouse effect / climate change; water pollution / tailings poisons organisms / pollutes soil / groundwater; AVP;	[max 1]	must be linked to extraction of fuels
(c)	leaching of fertilisers (into water bodies) / AW; increased nitrate / phosphate concentration (in water); rapid growth of algae / producers; block sunlight for (submerged) aquatic plants; death of producers / algae; decomposition of dead algae / producers; increased <u>aerobic</u> respiration by decomposers / oxygen consumption by decomposition; depletion of <u>dissolved</u> oxygen; death of aquatic organisms;	[max 5]	
(d)	*effect* acidification of water / soil; killing of trees; death of aquatic organisms; AVP; *method to reduce impact* liming / AW; alkaline scrubbers (to remove acidic gases); reduce use of fossil fuels / use alternative energy sources / AW; AVP;	[max 2]	**R** effects on humans
(e)	unsustainable; use of fossil fuels / minerals / ref to non-renewable resources;	[2]	

Question	Answer	Marks	Guidance notes
(f)	screening / filtering of wastes; sedimentation of wastes; decomposition by decomposers;	[3]	
(g)	high level of inorganic ions (in discharge); ref to impacts of eutrophication;	[2]	
(h)	hunting / collection; loss of habitats; introduced species; AVP;	[max 1]	
(i)	slow reproductive rate; difficult to recover; reduction in genetic variation; less able to adapt to environmental pressures; AVP;	[max 2]	
(j)	protection from human activities; easy to manage; AVP;	[max 1]	

Practice Test – Paper 2

1	**B**	21	**C**
2	**A**	22	**A**
3	**B**	23	**B**
4	**B**	24	**B**
5	**D**	25	**A**
6	**C**	26	**A**
7	**D**	27	**C**
8	**A**	28	**C**
9	**D**	29	**B**
10	**D**	30	**C**
11	**B**	31	**B**
12	**D**	32	**B**
13	**C**	33	**B**
14	**B**	34	**C**
15	**C**	35	**D**
16	**C**	36	**D**
17	**C**	37	**D**
18	**B**	38	**B**
19	**D**	39	**C**
20	**D**	40	**B**

Practice Test – Paper 4

1 (a) a unit containing the community of organisms and their environment [1]

(b) spider and owl; [1]

(c) grasshopper and rabbit; [1]

(d) (i) decrease;
ref. to lack of grass; [2]

(ii) increase;
ref. to more grasshoppers to feed on; [2]

(e) (i) a group of organisms of one species, living in the same area, at the same time; [1]

(ii) less rabbits for owls to eat;
so owls eat more shrew; [2]

2 (a) Class A; [1]

(b) light intensity of the habitat is very low / the habitat is completely dark;
as the salamander does not have eyes to survive in the habitat; [2]

(c) fish; [1]

(d) bottom of cave is covered in white, sand / rock;
colourful salamander are conspicuous / easily seen, by predators / more likely to be predated;
no need to make pigment;
less energy needed (to make pigment);
mutation / change in gene / DNA;
so no pigment is made due to such mutation;
white salamanders survive and reproduce;
pass on their allele(s) for no pigment / albino allele;
ref. to natural selection; [max 6]
not artificial selection, selective breeding

(e) homozygous (recessive); [1]

(f) normal skin colour x albino;
Nn x nn;
N, n + n;
Nn, nn;
normal skin colour, albino; [5]

(g) 100%; [1]

3 (a) (i) 2.2-0.03 / 0.03 x 100%;
+7233%; [2]

(ii) urea will not be reabsorbed from the glomerular filtrate while water is reabsorbed; [1]

(b) plasma proteins are too large to pass through / filter across the glomerulus;
with less proteins, water content in filtrate becomes higher than that in plasma; [2]

(c) (i) urea concentration of blood at A is higher than that of blood at B;
ref. to the dialysis membrane is partially permeable;
urea concentration in the dialysis fluid is low / no urea in the dialysis fluid;
urea diffuse from blood into the dialysis fluid; [max 3]

(ii) coronary artery supplies glucose / nutrient / food / oxygen to the heart muscle;
blockage leads to no blood supply to the heart muscle;
ref. to (aerobic) respiration stops;
heart muscles die; [max 2]

(iii) ref. to body temperature of human is 37 ^{o}C;
prevent cooling of the blood / keep the blood warm; [max 1]

(d) fewer diet / fluid intake restrictions;
no need for regular visits to hospital;
less unwell / tried / nausea / headaches / less pain (after surgery);
no needles / no fistula, permanently in arm;
long term cost lower;
permanent fix; [max 3]

4 (a) P: vena cava;
Q: pulmonary artery;
R: aorta;
S: pulmonary vein; [4]

(b) atrioventricular valve / bicuspid valve;
prevent backflow of blood from left ventricle to left atrium; [2]

(c) wall of left ventricle is thicker than that of right ventricle;
ref. to thicker muscular wall generate greater force;
to pump blood to all parts of the body except lungs; [3]

(d) septum prevents the mixing of blood between left ventricle and right ventricle;
a hole in the septum leads to mixing of oxygenated blood and deoxygenated blood;
oxygenated blood is pumped to the lung / more blood is pumped to the lungs;
lower the oxygen level of arterial blood / blood supplied to the skeletal muscle and heart muscle;
vigorous exercises is oxygen demanding / require additional oxygen for respiration;
ref. to oxygen consumption is greater than oxygen supply;
heart muscle and skeletal muscle lack of oxygen for respiration;
heart beat rate increases during vigorous exercise;
ref. to increase burden of heart;
ref. to damage of lung tissue due to increased blood flow / pressure to the lungs; [max 5]

(e) arterioles carrying blood near the surface of the skin dilate / get wider;
ref. to vasodilation;
shunt vessels connect an arteriole to a venule directly;
less blood passes though the shunt vessels;
increase the blood flow to the skin surface capillaries;
increase heat loss by conduction; [max 4]

(f) (kidney) → renal vein → vena cava → heart → pulmonary artery → (lung); [2]

5 (a) photosynthesis: curve A, it takes place only in the presence of light;

respiration: curve C, respiratory rate is constant at the time;

transpiration: curve B, occurs all the time and its rate is higher in the daytime; [3]

(b) 9 a.m. and 6 p.m.; [1]

(c) area below curve A represent the food production by the plant;
area below curve C represents the food consumption of the plant;
crucial for food production to be greater than food consumption;
ref. to net amount of food produced;
provides energy for the plant to survive, growth and produce fruits; [max 4]

(d) transpiration rate increases;
wind sweeps away the water vapour around the plant;
steepens the concentration gradient of water vapour between the atmosphere and the air space in the leaves;
water vapour diffuse out to the atmosphere at a faster rate; [4]

6 (a) water leaves (out) the cells by osmosis;
down a water potential gradient / from high water potential to low water potential;
through partially / selectively / semi permeable membrane;
both cells decrease in volume;
red blood cell shrinks;
onion epidermal cell becomes flaccid / plasmolysed; [max 4]

(b) active transport / diffusion; [1]

(c) cell wall presents in plant cells but not in animal cells;
vacuole presents in plant cells but not in animal cells;
chloroplast presents in plant cells but not in animal cells; [max 2]