

Question 1

Question 6

2(5) + 5(2)

Give a brief biological explanation for **each** of the following:

- (a) *Food chains are limited in length.*
Low amount of energy passed on (at each trophic level) **or** large amount of energy lost (at each trophic level)
- (b) *There is always competition between members of a species.*
Resources are limited **or** need the same resources **or** overbreeding **or** high reproduction rates
- (c) *Fruit formation by plants.*
To protect seeds **or** to aid seed dispersal
- (d) *Urine volume will be low if a person does not regularly drink fluids.*
More water is reabsorbed **or** ADH increases permeability of collecting duct (or distal convoluted tubule).
- (e) *Doctors do not prescribe antibiotics for viral infections.*
(Antibiotics) do not affect viruses **or** (antibiotics) only kill bacteria (or fungi)
- (f) *Meiosis halves the number of chromosomes in cells.*
To produce gametes (for sexual reproduction) **or** to allow for the diploid number following fertilisation **or** to restore chromosome number
- (g) *The septum separates the two sides of the human heart.*
To prevent oxygenated **and** deoxygenated blood from mixing

7

Q6 (a) – (g)	Number of correct responses	1	2	3	4	5	6	7
	Mark	5	10	12	14	16	18	20

Question 2

Question 7	20
6(3) + 2	
(a)	Explain the term <i>genetic engineering</i> . (Artificial) manipulation (or alteration) of a gene (or of DNA)
(b)	Name each stage X, Y and Z . Stage X: Cutting (accept restriction) Stage Y: Transformation <u>or</u> introduction of base sequence changes Stage Z: Expression
(c)	Give one application of genetic engineering for each of the following organisms: (i) Plant: Any correct application given (ii) Animal: Any correct application given (iii) Micro-organism: Any correct application given
7 	

Question 3

Section B	Best 1	30
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Question 8	30
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- (a) *Distinguish between:*
- Eukaryotic:*
Contains a nucleus or organelles enclosed by membranes **3**
- Prokaryotic:*
Does not contain a nucleus or does not contain organelles enclosed by membranes **3**

2	Q8 (a)	Number of correct responses	1	2
		Mark	3	6

8(3)

- (b) (i) *Which image, A or B, represents a plant tissue?*
*B **3**
- (ii) *Give a reason for your answer at part (b) (i) above.*
Cell wall present or comment on shape of cells (image **B** more regular shape or image **A** more irregular shape) or all cells joined (linked) to each other or any valid comment **3**
- (iii) *Identify structure Z.*
*Nucleus **3**
- (iv) *When examining cells with a microscope:*
1. *Name a stain you used.*
Methylene blue or iodine or other correct example **3**
 2. *Give **one** benefit of using a stain.*
Make (cells) more visible or (make cells) easier to see **3**
- (v) *The image of the cell in A was 2 cm wide. What is the actual width of this cell?*
0.005 (cm) or 2/400 (cm) or 1/200 (cm) or 5 x 10⁻³ (cm) (accept other units if correct) **3**
- (vi) *Image B shows cells at x100. Describe the steps taken to view these cells at x400.*
Select (or use) high power or select (or use) x40 (objective lens) **3**

Use fine focus **3**

8	Q8 (b) (i) – (vi)	Number of correct responses	1	2	3	4	5	6	7	8
		Mark	3	6	9	12	15	18	21	24

Question 4

11.	(a)	(i)	Chain: One species at each trophic (or feeding) level or described or diagram	3
			Web: Interconnected food chains or described or diagram or more than one species at each trophic (or feeding) level	3
		(ii)	(Diagram) that shows the number of organisms at each trophic level	3
	(b)	(i)	Food source or biological control or aesthetic or sporting or other	3
		(ii)	Failure to adapt / example of failure to adapt / preyed upon / insufficient numbers / dispersal / competition <i>Any two</i>	2(3)
		(iii)	Seed dispersal or fruit	3
		(iv)	1. Increased competition or (increased) predation or example of increased competition or example of increased predation	3
			2. Control of nuisance species or food or shelter or other	3
		(v)	1. Role of organism (in an ecosystem) or explained e.g. 'how it fits'	3
			2+3. Yes, because it is adapted (or is suited) or explained OR No, because it is not adapted (or is not suited) or explained	6, 0
	(c)		Name of investigated ecosystem:	
		(i)	1. *Plants	2
			2. *Animals	2
		(ii)	Named animal (must match named ecosystem and method if given)	2
			Details of method:	6(2)
		(iii)	More conspicuous (to predators) or social outcast or toxic marker	2
		(iv)	<i>Natural:</i> relevant matching example	2
			<i>Artificial:</i> relevant matching example	2

Question 5

12.	(a)	(i)	*Autotrophic	3
		(ii)	(A =) *mitochondrion	3
			(B =) *chloroplast	3
	(b)	(i)	1. *Violet	3
			*Red	3
			2. *Blue	3
		(ii)	Not absorbed or little absorption or it is reflected	3
		(iii)	Able to absorb more light (or energy) or able to absorb more (or different) colours (or wavelengths) or increased photosynthesis (or increased food production)	3
		(iv)	Use violet (or blue or orange or red) light	3
		(v)	1. *Air (or atmosphere) or *respiration	3
			2. NADP: to transport electrons / to transport energy / H-carrier	3
			ATP: Energy source or energy store	3
	(c)	(i)	First stage of respiration / in cytoplasm (or in cytosol) / anaerobic / starts with glucose (or indicated) / produces pyruvate / low energy release	2(3)
		(ii)	Aerobic / formed from pyruvate / 2-carbon (group) / joins Krebs cycle / in mitochondrion	2(3)
		(iii)	High energy bonds (or high energy molecule) / energy store / releases energy / forming ADP (or formed from ADP) / large ATP production in stage 2	2(3)
		(iv)	Aerobic / in mitochondrion / carries high-energy electrons / from NADH or from Krebs cycle / to protons / formation of water / ATP produced or high energy release	2(3)

Question 6

5.		6 (3) + 2	
	(a)	(i)	The breakdown of food
		(ii)	For solubility or for absorption or for transport
		(iii)	<i>Mechanical:</i> physical or grinding or cutting or churning or chewing or emulsifying <i>Chemical:</i> (action of) enzyme or named enzyme or (action of) acid or named acid
	(b)	(i)	Duodenum or small intestine
		(ii)	Gall bladder or liver
		(iii)	Stomach
		(iv)	(Produces) enzymes or named enzyme or neutralises (chyme)

Question 7

2

4 + 2 + 2 + 2 + 2 + 2 + 6

- (a) *Hypothesis:*
Proposed (or possible) explanation **or** an explanation of an observation **or** an educated guess **or** untested (or unproven) idea **or** prediction
- (b) *Double-blind testing:*
Neither the tester nor the subject knows who gets the drug (or who gets the placebo)
- (c) *Necessity for random selection:*
Reduces bias **or** greater reliability **or** greater validity (or accuracy) (of results or of data)
or fair (test)
- (d) *Other good experimental design features: **Any two***
A control/ only one variable/ safe (procedure)/ large sample size/ repeatable/ replicates
[do not allow random selection or double-blind testing]
- (e) *Where results of scientific research published:*
A scientific journal (or publication or website) **or** named scientific journal
- (f) *Why important to publish research:*
For peer review **or** so that others can learn (from their work) **or** so others can repeat it **or** information made widely available

Question 8

15. Any two of (a), (b), (c) (30, 30)

15. (a) 2(5) + 4(4) + 4(1)

(i) *Beneficial effect of bacteria:*
 Decomposition **or** nutrient recycling **or** food production **or** vaccine (or hormone) production **or** aid digestion **or** produce vitamins in digestive system
Harmful effect of bacteria:
 Food decay **or** (cause) disease **or** pathogenic

(ii) 1. *Bacterial method of asexual reproduction:*
 *Binary fission
 2. *Description of bacterial asexual reproduction:*
 DNA replicates/ cell elongates/ DNA (copies) move to opposite sides/ ingrowth of membrane (or walls)/ cell splits in two **Any three**

(iii) 1. *Batch processing:*
 Fixed amount of nutrient added (at start)/ product removed at the end/ bacteria go through all (4/5) stages of the growth curve **Any two**
 2. *Why overuse of antibiotics is potentially dangerous:*
 Development of resistant bacteria **or** described

(iv) *How certain bacteria respond to unfavourable conditions:*
 (Form an) endospore

15. (b) 2(5) + 4(4) + 4(1)

Biological explanations

(i) *Bile contains bile salts:*
 (They) emulsify fats/ neutralise acid from stomach **or** neutralise chyme/ provide optimum (or suitable) pH for enzymes (in the duodenum) **Any two**

(ii) *Active immunity lasts:*
 Antibodies produced/ by (body's own) lymphocytes/ (production of) memory cells **Any two**

(iii) *Humans sweat during exercise:*
 (Body) temperature increases/ sweat (or water) evaporates using heat from body/ lowers (body) temperature **Any two**

(iv) *Antibiotics should not be prescribed for the flu:*
 Antibiotics are not effective against viruses (or influenza)/ influenza is (caused by) a virus/ antibiotics could kill useful bacteria **or** do not kill resistant bacteria **Any two**

(v) *High sugar or high salt concentrations used in food preservation:*

(The high sugar or salt concentration) causes bacteria (or fungi) to lose water by osmosis/ food decay caused by bacteria (or fungi)/ death of bacteria (or fungi)

Any two

15. (c)

2(5) + 4(4) + 4(1)

(i) *Name and role of eye parts*

1. *Fluid that fills rear chamber:*

Name: *Vitreous humour

Function: Gives shape **or** transmits light **or** supports lens

2. *Both types of light receptor cells:*

Name: *Rods **and** cones

Function: Rods active (work in) dim light **or** BW vision

Function: Cones active (work in) bright light **or** colour vision

3. *Transparent covering on cornea:*

Name: *Conjunctiva

Function: Protection against infection (or irritants) **or** moistens (or lubricates)

(ii) *Advantage of having two eyes:*

Depth perception (judge distance) **or** increased visual field **or** 3D vision **or** binocular vision

(iii) *Disorder of eye or ear with corrective measure:*

Appropriate disorder

Matching corrective measure

Question 9

Question 16 **Any two of (a), (b), (c), (d)** **30, 30**

Question 16 (a)		30																								
(i)	Which labelled structure is involved in vasoconstriction? *B (or arteriole)	3																								
(ii)	Explain the role of vasoconstriction in temperature regulation: In cold conditions / arterioles (or blood vessels) narrow / less blood flow to skin / less heat lost <u>or</u> more heat retained	Any three 3(3)																								
(iii)	Which labelled structure is involved in piloerection? *A (or hair)	3																								
(iv)	Which labelled structure is involved in both excretion and temperature regulation? *C (or sweat gland)	3																								
(v)	Name the excretory product produced by the part named at (iv): Sweat (or two named components)	3																								
(vi)	Name given to organisms that can generate their own heat: *Endotherm	3																								
(vii)	Name two other systems in which the skin has a role: Nervous (or sensory) Defence (or immune)	3 3																								
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Question 16 (b)		30								
(i)	Diagram: Penis and urethra and sperm duct and testis	All four 3 + 3 Any one missing only 3 marks								
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	Mark	3	6							

Labels:	Testis / sperm duct / prostate gland / urethra / penis / scrotum	6(1)																
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(ii)	Give the differences between the human male and female gametes using the following headings:																	
	1. <i>Relative numbers:</i>	3																
	A low number of female gametes (or eggs) and a high number of male gametes (or sperm)																	
	2. <i>Frequency of production:</i>	3																
	Monthly (or from puberty to menopause) in females and continuously (or described) (or from puberty onwards) in males																	
	3. <i>Relative size:</i>	3																
	Large in females (or egg is large) and small in males (or sperm are small)																	
(iii)	What is meant by secondary sexual characteristics? Features that distinguish male from female other than sex organs <u>or</u> features that distinguish the sexes but are not essential for reproduction <u>or</u> features that emerge at puberty	3																
(iv)	Name the hormone responsible for male secondary sexual characteristics: *Testosterone	3																
(v)	Give one cause of male infertility: Low sperm count <u>or</u> low sperm motility <u>or</u> hormonal	3																
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Question 16 (c)												30
(i)	Name two places in the body where mucous membrane linings are found: Respiratory tract / digestive tract / reproductive tract / any correct examples	Any two									2(3)	
(ii)	Give precise location where lymphocytes are produced: *(Red) bone marrow											3
(iii)	Identify the particular type of white blood cell that produces antibodies: *B (lymphocytes)											3
(iv)	Identify one other type of white blood cell: Monocyte <u>or</u> macrophage <u>or</u> phagocyte (phagocytic) <u>or</u> other correctly named WBC											3
(v)	1. Compare the antibody response after vaccine (A) and infection (B): (Antibody response) is slow after vaccine (or A) and fast after infection (or B) Number (of antibodies) produced is low after vaccine (or A) and high after infection (or B)											3
	2. Suggest a reason for this: After A, 1 st time infected (or described) <u>or</u> no memory cells (present) <u>or</u> After B, memory cells present											3
(vi)	Identify the part of the virus that is recognised by antibodies: Protein (coat) <u>or</u> capsid <u>or</u> antigen											3
(vii)	Explain why an antibiotic is not prescribed to cure COVID-19: Antibiotics have no effect against viruses <u>or</u> antibiotics only kill bacteria											3
Q16 (c) (i - vii)		Number of correct responses	1	2	3	4	5	6	7	8	9	10
		Mark	3	6	9	12	15	18	21	24	27	30

Question 16 (d)												30
(i)	Name the structures involved in gaseous exchange: *Alveoli											3
(ii)	State two adaptations of these structures to increase the efficiency of gaseous exchange: Large surface area / rich (blood) capillary supply / moist surface / membranes (or walls) are thin <u>or</u> walls one cell thick	Any two									2(3)	
(iii)	Identify the gas that controls the rate of breathing: *Carbon dioxide (CO ₂)											3
(iv)	Identify the region of the human brain that detects the gas you have named at (iii) above: *Medulla oblongata											3
(v)	How does the breathing system respond to a high level of the gas named at (ii) above? Increases rate <u>or</u> increases depth (of breathing)											3
(vi)	Process of inhalation: Brain sends impulse (message) to muscles / intercostal muscles and diaphragm contract / ribcage moves up and out / diaphragm moves down / volume of thoracic cavity (or chest) increases / pressure inside (thoracic cavity or chest) decreases / air moves in											Any four 4(3)
Q16 (d) (i - vi)		Number of correct responses	1	2	3	4	5	6	7	8	9	10
		Mark	3	6	9	12	15	18	21	24	27	30

Question 10

Question 3		20
(a)	Name the cell organelle shown.	
	Mitochondrion	2
(b)	Name the cycle of reactions that occurs in stage 2 of aerobic respiration.	
	Krebs	3
(c)	What does ATP stand for?	
	Adenosine triphosphate	3
(d)	Give the function of NAD ⁺ .	
	Carries (high energy) electrons and protons.	3
(e)	Suggest a condition under which anaerobic respiration might occur.	
	Lack of oxygen or described	3
(f)	State where anaerobic respiration occurs in the cell.	
	Cytosol	3
(g)	Name one main product of anaerobic respiration.	
	Lactic acid or ethanol	3
1 ✓ ₂ + 6 ✓ ₃		

Question 11

Question 10		30
(a)	(i)	To which kingdom of living organisms do yeast belong?
		*Fungi
		4
	(ii)	Explain the term <i>sterility</i> .
		Absence of all (micro)organisms or described
		2
1 ✓ ₄ + 1 ✓ ₂		
(b)	(i)	Describe how you set up the investigation. Include one safety precaution. You may include a labelled diagram if you wish.
		Named piece of apparatus used
		3
		Correct position of leaf (or leaf disc) on lid or described
		3
		Left at a suitable temperature
		3
		Left for a suitable time
		3
		Control named and setup described
		3
		Safety precaution described
		3
		Points may be obtained from an appropriately labelled diagram
	(ii)	Describe the result of the investigation, assuming the leaf yeast grew successfully.
		Pink colonies (in test)
		3
		No growth (in control)
		3
8 ✓ ₃		