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 7		20
	6(3) + 2	
(a)	Explain the term *genetic engineering*.	
	(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 **or** 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 ✓		

Section B	Best 1	30

Question 8 **30**

(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

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 ***Any two***	**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 2. Control of nuisance species **or** food **or** shelter **or** other	**3** **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. *Animals	**2** **2**
		(ii)	Named animal (must match named ecosystem and method if given) Details of method:	**2** **6(2)**
		(iii)	More conspicuous (to predators) **or** social outcast **or** toxic marker	**2**
		(iv)	*Natural:* relevant matching example *Artificial:* relevant matching example	**2** **2**

12.	(a)	(i)	*Autotrophic	**3**
		(ii)	(A =) *mitochondrion	**3**
			(B =) *chloroplast	**3**
	(b)	(i)	1. *Violet *Red	**3** **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 2. NADP: to transport electrons / to transport energy / H-carrier ATP: Energy source **or** energy store	**3** **3** **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)**

5.			**6 (3) + 2**
	(a)	(i)	The breakdown of food
		(ii)	For solubility **or** for absorption **or** for transport
		(iii)	*Mechanical*: physical or grinding or cutting or churning or chewing or emulsifying *Chemical*: (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)

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

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 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 **or** 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) **3**
Defence (or immune) **3**

Q16 (a) (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 (b) — 30

(i) *Diagram:* Penis and urethra and sperm duct and testis ***All four*** **3 + 3**
Any one missing only 3 marks

Q16 (b) (i) Drawing	Number of correct responses	1	2
	Mark	3	6

Labels: Testis / sperm duct / prostate gland / urethra / penis / scrotum **6(1)**

Q16 (b) (i) Labels	Number of correct responses	1	2	3	4	5	6
	Mark	1	2	3	4	5	6

(ii) *Give the differences between the human male and female gametes using the following headings:*

1. Relative numbers:	A low number of female gametes (or eggs) and a high number of male gametes (or sperm)	**3**
2. Frequency of production:	Monthly (or from puberty to menopause) in females and continuously (or described) (or from puberty onwards) in males	**3**
3. Relative size:	Large in females (or egg is large) and small in males (or sperm are small)	**3**

(iii) *What is meant by secondary sexual characteristics?*
Features that distinguish male from female other than sex organs **or** features that distinguish the sexes but are not essential for reproduction **or** 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 **or** low sperm motility **or** hormonal **3**

Q16 (b) (ii - v)	Number of correct responses	1	2	3	4	5	6
	Mark	3	6	9	12	15	18

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 **or** macrophage **or** phagocyte (phagocytic) **or** 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) **3**

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, 1st time infected (or described) **or** no memory cells (present)
or
After B, memory cells present **3**

(vi) *Identify the part of the virus that is recognised by antibodies:*

Protein (coat) **or** capsid **or** antigen **3**

(vii) *Explain why an antibiotic is not prescribed to cure COVID-19:*

Antibiotics have no effect against viruses **or** 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 **or** 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 **or** 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 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 10			30
(a)	(i)	To which kingdom of living organisms do yeast belong?	
		*Fungi	4
	(ii)	Explain the term *sterility*.	
		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			