

Question 1

Question 2

2(5) + 5(2)

- (a) *Draw a vertical line on the graph that indicates a pH most suitable for the germination of grass seeds.*
Correct vertical line drawn through peak
- (b) *Explain the term hypothesis.*
Proposed (or possible) explanation for an observation
- (c) *State **one** variable from the investigation described.*
(Soil) pH or percentage germination
- (d) *What is the function of a control?*
To act as a comparison to the test (or results or experiment)
- (e) *Where might the horticulturist first publish the results of their research?*
Scientific journal (or named)
- (f) *Give **two** limitations of the scientific method.*
Extent of knowledge / basis of investigation / human error / experimental design / ability to interpret results / application to nature / accidental discovery / bias **Any two**

7

Q2 (a) – (f)	Number of correct responses						
	1	2	3	4	5	6	7
Mark	5	10	12	14	16	18	20

Question 2

Question 1		Best five answers from (a) – (f)						3(6) + 2(1)	
(a) Name the three chemical elements that are present in all carbohydrates.		Carbon, hydrogen and oxygen						(accept C, H and O)	
(b) Give the general formula for carbohydrates.		$C_x(H_2O)_y$							
(c) Name the smallest unit of a carbohydrate.		Monosaccharide							
(d) Name the type of carbohydrate formed when many of the smallest units of a carbohydrate bond together.		Polysaccharide							
(e) Give one structural role of carbohydrates in living organisms.		Cell wall <u>or</u> other correct							
(f) State one dietary source of carbohydrates.		Bread <u>or</u> pasta <u>or</u> other correct dietary source							
6	Q1 (a) – (f)	Number of correct responses		1	2	3	4	5	6
				6	12	18	19	20	20

Question 3

Question 3

6(3) + 2

- (a) Name the **two** chemical components that make up chromosomes.
DNA
Protein
- (b) Is the karyotype shown above from a female or a male?
Female
- (c) Justify the answer you have given at part (b) above.
Has two X chromosomes or no Y chromosome
- (d) What evidence is shown in the karyotype that this person has the genetic condition Down's syndrome?
There is an extra chromosome present or three (copies) of a chromosome 21 or three copies of one of the chromosomes.
- (e) Name this other type of mutation.
Gene or point (mutation)
- (f) Give **one** other application of tissue culture
Cancer research or plant breeding or stem cell research or skin grafts or any valid example.

Q3 (a) – (f)	Number of correct responses	1	2	3	4	5	6	7
	Mark	3	6	9	12	15	18	20

Question 4

Question 7

6(3) + 2

- (a) Name molecule A.
Nucleic acid or RNA or DNA
- (b) Draw an arrow from 'X' to accurately show the location of an antigen.
Correct arrow
- (c) Explain why viruses are described as obligate parasites.
Need a host to replicate (or reproduce) or cannot replicate by themselves
- (d) Explain in detail what is meant by the term vaccination.
What it is: Administration of a non-disease-causing (non-living) dose of a pathogen (or antigen or part of a pathogen) or described
What it does: Stimulates production of antibodies or stimulates active immunity or stimulates memory cells
- (e) Name **one** harmful virus other than SARS-CoV-2.
Any valid harmful virus.
- (f) Give **one** example of a beneficial application of a virus.
Genetic engineering (vector) or treat bacterial infection or vaccine production or any other valid answer

Q7 (a) – (f)	Number of correct responses						
	1	2	3	4	5	6	7
Mark	3	6	9	12	15	18	20

Question 5

Question 4		20
6(3) + 2		
(a)	Label any one structure on the diagram and draw an arrow.... Correct label and correct arrow indicating structure	
(b)	To which type of plant tissue do xylem and phloem belong? Vascular	
(c)	Give one function of xylem. Transport water (or minerals or other correct) or support	
(d)	Give one function of phloem. Transport food	
(e)	1. Is this stem a monocotyledonous (monocot) stem or a dicotyledonous (dicot) stem? Monocot	
	2. Justify your answer above. (Vascular) bundles are scattered	
(f)	State the location of the tissue containing xylem and phloem in a T.S of a root. Centre or described	
7 		

Question 6

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

12

Mark

36

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

12345678

Mark

3691215182124

Question 7

Section B

Best 2

60

Question 8

30

2(3)

(a) Write down the terms that describe each of the following:

(i) The parts of the Earth where life can exist.

Biosphere

3

(ii) Living factors that have an effect on an ecosystem.

Biotic

3

2

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

8(3)

(b) (i) Identify the following animal collection apparatus **and** describe how they would be used.

Apparatus: Pooter

3

How used: Suck through A **and** animal enters through B.

3

Apparatus: Tullgren funnel

3

How used: Heat (or warmth or light) causes animals to move downwards

3

(ii) Describe how you carried out a quantitative survey of plants using the percentage cover technique.

Quadrat

3

Random (sample) / how random / count (plants) or estimate cover or frequency / repeat or a number of times / a correct calculation described

Any three 3(3)

8

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

Question 8

Question 12 60

3(3)

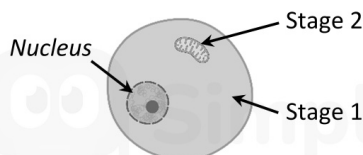
- (a) (i) Explain the term metabolism.
(All) chemical reactions in an organism (or in a cell) 3
- (ii) Is the reaction shown below an anabolic or catabolic?
*Catabolic 3
Explain your answer.
Large molecule broken down into smaller molecules or energy released 3

3

Q12 (a) (i) – (ii)	Number of correct responses	1	2	3
	Mark	3	6	9

9(3)

- (b) (i) Copy the diagram of the cell **and** indicate clearly the specific locations of stage 1 and stage 2. 3



- (ii) What is the name given to stage 1?
*Glycolysis 3
- (iii) Stage 1 ends with the formation of a three-carbon compound. Name this compound.
*Pyruvate or pyruvic acid 3
- (iv) Describe in detail what happens to these electrons after they are removed.
Pass to NAD⁽⁺⁾ / to make NADH / pass to electron transport chain / lose energy /
pass to oxygen / and to protons (H⁺ or hydrogen ions) / to make water **Any three** 3(3)
- (v) Complete the missing parts of the equation.
 $ADP + P + Energy \rightarrow ATP + H_2O$ 2(3)

9

Q12 (b) (i) – (v)	Number of correct responses	1	2	3	4	5	6	7	8	9
	Mark	3	6	9	12	15	18	21	24	27

Question 12 (continued)

8(3)

- (c) (i) What is an enzyme?
Protein (or biological) catalyst 3
- (ii) Describe in detail the active site theory of enzyme action.
Complementary shape to substrate / active site changes shape or induced fit / to
accommodate substrate / enzyme substrate complex is formed / product
formed / enzyme unchanged or active site changes back to original shape or
enzyme can be reused **Any four** 4(3)
- (iii) Describe what happens to an enzyme if it is overheated.
Loses shape or loses function or becomes denatured 3
- (iv) Give **one** example of a catabolic enzyme **and one** example of an anabolic enzyme.
Catabolic enzyme: Amylase or any correct example 3
Anabolic enzyme: Polymerase or any correct example 3

8

Q12 (c) (i) – (iv)	Number of correct responses	1	2	3	4	5	6	7	8
	Mark	3	6	9	12	15	18	21	24

Question 9

60

3(3)
Which famous scientist is regarded as the father of genetics?
(or) Mendel

- 3

- Each trait is controlled by a pair of factors / these factors separate during the formation of gametes / each gamete contains only one factor for each trait

3

Q13 (a) (i) – (ii)	Number of correct responses	1	2	3
	Mark	3	6	9

9(3)
in each of the underlined terms ('gene' and 'recessive').
: Piece of DNA (or chromosome) that codes for a protein or

- 3

3

- 3

- 3

3

m

- 3

3

3

- 3

9

Q13 (b) (i) – (v)	Number of correct responses	1	2	3	4	5	6	7	8	9
	Mark	3	6	9	12	15	18	21	24	27

continued)

8(3)

Y term is used to describe an allele present on the Y chromosome

8(3)
 A term is used to describe an allele present on the X chromosome
 linked or X-linked

- 3

- 3**

3

3

- 3

3

3

- 3

8	Q13 (c) (i) – (iv)	Number of correct responses	1	2	3	4	5	6	7	8
		Mark	3	6	9	12	15	18	21	24

Question 10

Question 13

60

(a) (i) Draw **and** label the structure of any one nucleotide.

Drawing

6, 3, 0

2

Q13 (a) Diagram:	Number of correct responses	1	2
	Mark	3	6

Phosphate (or P)

1

Deoxyribose or ribose

1

Base or any one named base or letter

1

3

Q13 (a) Labels:	Number of correct responses	1	2	3
	Mark	1	2	3

(b) (i) What is the name of process **K** that results in the formation of molecule **L**?

*Transcription

3

(ii) Name molecule **L**.

*mRNA or *messenger RNA

3

(iii) Write out the complementary sequence of bases of **ACGTGCTGA**

U G C A C G A C U

(all must be correct for 3)

3

(iv) Give the name of the opening through which molecule **L** leaves the organelle **J**.

*Nuclear pore

3

(v) 1. Identify structure **M**.

*Ribosome

3

2. Name the main molecule from which structure **M** is made.

*rRNA or *Ribosomal RNA

3

(vi) Describe the events that occur at structure **M**, which allow the production of a functioning protein.

tRNA brings amino acids to ribosome / tRNA binds to mRNA / with matching codon (triplet) or anticodon / sequence of amino acids assembles or peptide bond forms / folding / start or stop codon

Any three

3(3)

9

Q13 (b) (i) – (vi)	Number of correct responses	1	2	3	4	5	6	7	8	9
	Mark	3	6	9	12	15	18	21	24	27

(c) (i) Explain the terms:

Allele: A version (variant) of a gene or (alternative) form of a gene

3

Homozygous: (When) identical alleles are present (for a trait)

3

(ii) Draw **two** chromosome diagrams (one for each parent).

Chromosome diagrams shows 2 pairs of homologous chromosomes for each parent.

(Chromosomes for first parent must match chromosomes for second parent)

3

1 parent clearly FFDD or ffdd

3

Loci of the alleles for each parent

(must be correct and matching)

3

(Homozygous) recessive **and** (homozygous) dominant correctly indicated.

3

(iii) Using a Punnet square, or otherwise, describe the result of this cross.

*FfDd

3

*White and disc-shaped fruit

3

8

Q13 (c) (i) – (iii)	Number of correct responses	1	2	3	4	5	6	7	8
	Mark	3	6	9	12	15	18	21	24

Question 11

Question 11

60

- (a) (i) Give **one** precaution scientists use when working with microorganisms in the laboratory.
Wipe surface with disinfectant (or antiseptic or alcohol or named) **or** minimal opening of plates or seal plates **or** flame (or sterilise) equipment **or** wear gloves **or** use hand sanitiser **or** wash hands with soap **or** keep Bunsen lit (nearby) **or** dispose of correctly **or** any other correct precaution (i.e. PPE) 3
- (ii) Explain the terms applied to living organisms.
Asepsis: free of pathogens 3
Sterility: free of microorganisms 3

3

Q11 (a) (i) – (ii)	Number of correct responses	1	2	3
	Mark	3	6	9

- (b) (i) Drawing of a typical bacterial cell:
Cell wall + cell membrane + indication of nucleic acid 3

1

Q11 (b) (i) Drawing:	Number of correct responses	1
	Mark	3

Labels:

Cell wall / cell membrane / cytoplasm / chromosome / plasmid / flagella / capsule **or** slime layer Any three 3(1)

3

Q11 (b) (i) Labels:	Number of correct responses	1	2	3
	Mark	1	2	3

- (ii) Describe the main events of endospore formation.
DNA replicates / moves to ends of cell / shrinkage (or water loss) of cytoplasm (or cell) / thick wall forms (or described) / inside original cell / encloses DNA (strand) / (cell) rounds up Any three 3(3)
- (iii) 1. Give any **two** examples of harmful bacteria.
Any two correctly named bacteria **or** named bacterial diseases 2(3)
2. Bacterial infections can be treated with antibiotics. What is an antibiotic?
A chemical that kills (or inhibits growth of) bacteria 3
3. State **one** possible reason why antibiotic resistance has arisen in bacteria.
Overuse (misuse) **or** mutation in bacteria 3

7

Q11 (b) (ii) – (iii)	Number of correct responses	1	2	3	4	5	6	7
	Mark	3	6	9	12	15	18	21

Question 11 (continued)

- (c) (i) Give **two** factors that affect the growth of microorganisms.
Temperature / oxygen concentration / pH / external solute concentration **or** water availability / pressure / food availability / presence of antibiotics / presence of waste products Any two 2(3)
- (ii) Explain how **one** these factors affect growth.
Matching explanation (accept enzyme activity as explanation for temperature, pH, water availability, etc) 3
- (iii) Distinguish between:
Batch: organisms go through all phases of the growth curve (or named phases) **or** fixed amount of nutrients added at start **or** bioreactor emptied at end. 3
Continuous flow: organisms maintained in one (log or stationary) growth phase **or** nutrients constantly added **or** products constantly removed. 3
- (iv) Sketch plot of a growth curve. Label the axes **and** label the curve with the five phases.
Sketch: All five phases visible on curve 3
Axes labels: x-axis: Time **and** y-axis: Population **or** Number of organisms 3
Curve labels: Correctly labelled with all five phases in the correct order 3

8

Q11 (c) (i) – (iv)	Number of correct responses	1	2	3	4	5	6	7	8
	Mark	3	6	9	12	15	18	21	24