Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2024

Marking Scheme

Biology

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Introduction

The marking scheme is a guide to awarding marks to candidates' answers. It is a concise and summarised guide and is constructed so as to minimise its word content. Examiners must conform to this scheme and may not allow marks for answering outside this scheme. The scheme contains key words, terms and phrases for which candidates may be awarded marks. This does not preclude synonyms or terms or phrases which convey the same meaning as the answer in the marking scheme. Although synonyms are generally acceptable, there may be instances where the scheme demands an exact scientific term or unequivocal response and will not accept alternatives. The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable. If it comes to the attention of an examiner that a candidate has presented a valid answer and there is no provision in the scheme for accepting this answer, then the examiner must first consult with his/ her advising examiner before awarding marks. As a general rule, if in doubt about any answer, examiners should consult their advising examiner before awarding marks.

How to use the marking scheme

- Where only one answer is required alternative answers are separated by '**or**'.
- Where multiple answers are required each word, term or phrase for which marks are allocated is separated by a solidus (/) from the next word, term or phrase.
- The mark awarded for an answer appears in **bold** next to the answer, e.g. **3**.
- Where there are several parts in the answer to a question, the mark awarded for each part appears in brackets, e.g. **5(4)** means that there are five parts to the answer, each part allocated **4 marks**.
- The answers to subsections of a question may not necessarily be allocated a specific mark; e.g. there may be six parts to a question – (a), (b), (c), (d), (e), (f) and a total of **20 marks** allocated to the question. The marking scheme might be as follows, **2(4) + 4(3)**. This means that the first two correct answers encountered are awarded **4 marks** each and each subsequent correct answer is awarded **3 marks**.
- A word or term that appears in brackets ( ) is not a requirement of the answer, but is used to contextualise the answer or may be an alternative valid answer.

Some examples of the marking process

1. **Key words or terms or phrases may be awarded marks, only if presented in the correct context.**

   Sample question: *Outline how water from the soil reaches the leaf.*

   Marking scheme states: Concentration gradient / osmosis / root hair / root pressure / cell to cell / xylem / transpiration or evaporation / cohesion (or explained) or adhesion (or capillarity or explained) or tension (or explained). ***Any six*** **6(3)**

   Sample answer: *Water is drawn up the xylem by osmosis.*

   Although the candidate has presented two key terms (xylem, osmosis), the statement is incorrect and the candidate can only be awarded **3 marks** for referring to the movement of water through the xylem.

2. **Cancelled answers**

   The following is an extract from **S.63** *Instructions to Examiners, 2024 (for subjects being marked online)* (section 5.4, p.18):

   > "*Where a candidate answers a question or part of a question once only and then cancels the answer, you should ignore the cancelling and treat the answer as if the candidate had not cancelled it.*"

   Sample question: *What is pollination?*

   Marking scheme states: Transfer of pollen / from anther / to stigma. **3(3)**

   Sample answer: ~~*Transfer of pollen by insect to stigma.*~~

   The candidate has cancelled the answer and has not made another attempt to answer the question and may be awarded **2(3)** marks.

   If an answer is cancelled and an alternative version given, the cancellation should be accepted and marks awarded, where merited, for the un-cancelled version only.

   If two (or more) un-cancelled versions of an answer are given to the same question or part of a question, both (or all) should be marked and the answer accepted that yields the greater (greatest) number of marks. Points may not, however, be combined from multiple versions to arrive at a manufactured total.

3. **Surplus answers: [only in Section A] - A surplus wrong answer cancels the marks awarded for a correct answer.**

   (i) **Sample question 1**: *The walls of xylem vessels are reinforced with…….*

   Marking scheme states: Lignin **4 marks**

   Sample answer: *Chitin, lignin*

   There is a surplus incorrect answer, therefore the candidate scores **4 – 4 = 0 marks**.

Sample answer: ~~*Lignin*~~

The answer, which is correct, has been cancelled by the candidate, but there is no additional or surplus answer, therefore the candidate may be awarded **4 marks**.

Sample answer: *Lignin,* ~~*chitin*~~

There is a surplus answer, which is incorrect, but it has been cancelled and as the candidate has given more than one answer (i.e. the candidate is answering the question more than once only), the cancelling can be accepted and s/he may be awarded **4 marks**.

(ii) **Sample question 2**: *Name the four elements that are always present in protein.*

Marking scheme states: Carbon / hydrogen / oxygen / nitrogen **4(3)**

Sample answer: *Carbon, hydrogen, oxygen, nitrogen, calcium*

There is a surplus answer, which is incorrect, which cancels one of the correct answers, therefore the candidate is awarded **3(3)** marks.

Sample answer: *Carbon, hydrogen, oxygen, calcium*

There is no surplus answer – there are three correct answers, and therefore the candidate is awarded **3(3)** marks.

Sample answer: *Carbon, hydrogen, oxygen, calcium, aluminium*

There is a surplus answer, which is incorrect, and cancels one of the three correct answers, therefore the candidate is awarded **2(3)** marks.

Sample answer: *Carbon, hydrogen, oxygen, calcium,* ~~*aluminium*~~

There is a surplus answer, which is incorrect, but it has been cancelled so the candidate may be awarded **3(3)** marks.

In the other sections of the paper (Sections B and C), there may be instances where a correct answer is nullified by the addition of an incorrect answer. This happens when the only acceptable answer is a specific word or term. Each such instance is indicated in the scheme by an asterisk *.

Annotations used in the marking

The scripts were marked by examiners using an online marking platform. The following table illustrates the various annotations (symbols) applied by the examiners when marking the scripts. The meaning and use of each of the annotations applied are also explained in the table. These annotations will be seen on a script if viewed as part of the appeal process. Annotations applied by an examiner will be viewed in red. Scripts that were also marked by an advising examiner will show annotations in a green colour.

Annotation	Meaning
	This symbol indicates a correct response / answer.
	This symbol indicates that one mark has been awarded.
	This symbol indicates that two marks have been awarded.
	This symbol indicates that four marks have been awarded.
	This symbol indicates an incorrect response /answer.
	Surplus incorrect answer. A surplus incorrect answer has cancelled a correct answer.
	This symbol is placed on all blank pages or part of page to indicate it has been seen by the examiner.
	This symbol can be used by an examiner to indicate a part of a question answer of significance.
	This symbol is used to indicate a correct response for a diagram.
	This symbol is used to indicate an incorrect response for a diagram.
	This symbol is used to indicate a correct response for a label on a diagram.
	This symbol is used to indicate an incorrect response for a label on a diagram.

Bonus marks for answering through the medium of Irish

Bonus marks at the rate of 10% of the marks obtained will be given to a candidate who answers entirely through Irish and who obtains 75% or less of the total mark available in (i.e. 300 marks or less). In calculating the bonus to be applied, decimals are always rounded down, not up ¬ e.g., 4.5 becomes 4; 4.9 becomes 4, etc. See below for when a candidate is awarded more than 300 marks.

Marcanna Breise as ucht freagairt trí Ghaeilge

Léiríonn an tábla thíos an méid marcanna breise ba chóir a bhronnadh ar iarrthóirí a ghnóthaíonn níos mó ná 75% d'iomlán na marcanna.

N.B. Ba chóir marcanna de réir an ghnáthráta a bhronnadh ar iarrthóirí nach ngnóthaíonn níos mó ná 75% d'iomlán na marcanna don scrúdú. Ba chóir freisin an marc bónais sin **a shlánú síos**.

Tábla 400 @ 10%

Bain úsáid as an tábla seo i gcás na n-ábhar a bhfuil 400 marc san iomlán ag gabháil leo agus inarb é 10% gnáthráta an bhónais.

Bain úsáid as an ngnáthráta i gcás 300 marc agus faoina bhun sin. Os cionn an mharc sin, féach an tábla thíos.

Bunmharc	Marc Bónais
301 - 303	29
304 - 306	28
307 - 310	27
311 - 313	26
314 - 316	25
317 - 320	24
321 - 323	23
324 - 326	22
327 - 330	21
331 - 333	20
334 - 336	19
337 - 340	18
341 - 343	17
344 - 346	16
347 - 350	15

Bunmharc	Marc Bónais
351 - 353	14
354 - 356	13
357 - 360	12
361 - 363	11
364 - 366	10
367 - 370	9
371 - 373	8
374 - 376	7
377 - 380	6
381 - 383	5
384 - 386	4
387 - 390	3
391 - 393	2
394 - 396	1
397 - 400	0

Section A	Best 5	100

Question 1	Best five answers from (a) – (f)	20
	5(4)	
(a)	Which **three** chemical elements are present in **all** lipids?	
	Carbon, hydrogen, oxygen (or C, H, O)	**4**
(b)	How do fats and oils differ at room temperature?	
	Fats are solid and oils are liquid	**4**
(c)	Give **one** way phospholipids differ from triglycerides.	
	Phospholipids have phosphate and triglyceride do not **or** Phospholipids have two fatty acids and triglycerides have three fatty acids	**4**
(d)	Give **one** metabolic role of lipids in cells.	
	Energy (storage) **or** hormone production **or** other correct	**4**
(e)	Give **one** structural role of lipids in cells.	
	(Cell) membrane	**4**
(f)	Name **one** fat-soluble vitamin.	
	A **or** D **or** E **or** K	**4**

5 ✓

Question 2		20
	6(3) + 2	
(a)	What is a hypothesis?	
	Proposed (or possible) explanation for an observation **or** other correct description.	
(b)	State **two** principles of good experimentation.	
	Safety / random selection or no bias or fair test / large sample size / double-blind testing / control / replicates / repeatable / other correct	**Any two**
(c)	Outline the steps of the scientific method that follow the design of an experiment.	
	Carry out the procedure / gathering results (or data) / repeat / analyse (interpret) data / making conclusions / placement of conclusions in the context of existing knowledge / publish in a scientific journal / peer review / developing a theory / develop a law or principle	**Any three in a valid sequence**
(d)	State any **one** limitation of the scientific method.	
	Extent of knowledge **or** basis of investigation **or** human error **or** experimental design **or** ability to interpret results **or** application to nature **or** accidental discovery **or** bias	

7 ✓

Question 3		20

3(1)

(a) Name tube **A**, organ **B** and gland **C**.

Tube A: Oesophagus **1**

Organ B: Liver **1**

Gland C: Pancreas **1**

5(3) + 2

(b) Give **one** function of tube **A**.

Function: Transport food to the stomach

(c) Give **one** function of organ **B**.

Function: Produce bile **or** stores vitamins **or** store minerals **or** stores glycogen **or** produces plasma proteins **or** detoxifies **or** other correct

(d) Give **one** function of gland **C** in relation to the digestive system.

Function: Produces pancreatic juice **or** correctly **named** substance or **named** enzyme

(e) State **one** structural feature of the small intestine that enables it to carry out its function.

Long **or** has villi **or** has a large network of capillaries **or** thin **walls** **or** other correct

(f) Give **two** functions of these symbiotic bacteria in the alimentary canal.

Vitamin (B and K) production / compete with pathogens / reference to digestion / other correct **Any two**

3 ✓1 + 6 ✓

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 5			**20**
		6(3) + 2	
Indicate whether the statements are true or false:		True	False
(a)	Cell walls are only found in plant cells.	☐	☑
(b)	A turgid cell has lost a lot of water.	☐	☑
(c)	Fermentation does not use oxygen.	☑	☐
(d)	DNA is only found in the nucleus.	☐	☑
(e)	There are no hydrogen bonds in a molecule of DNA.	☐	☑
(f)	Adenine and guanine are purine bases.	☑	☐
(g)	Chromosomes are composed of DNA and protein.	☑	☐
7 ✓			

Question 6			**20**
		10(2)	
Distinguish clearly between **each** member of the following pairs of terms.			
(a)	Ectotherm:	Animal whose (body) temperature varies with environmental temperature	**2**
	Endotherm:	Animal with a constant (body) temperature	**2**
(b)	Ligament:	Attaches (joins) bone to bone	**2**
	Tendon:	Attaches (joins) muscle to bone	**2**
(c)	Carpal:	Bone in the wrist	**2**
	Carpel:	Female part of the flower	**2**
(d)	Haploid:	One set of chromosomes **or** one copy of each chromosome	**2**
	Diploid:	Two sets of chromosomes **or** two copies of each chromosome	**2**
(e)	Systole:	Heart muscle is contracting	**2**
	Diastole:	Heart muscle is relaxing	**2**
10 ✓2			

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 **<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 ✓

Section B	Best 2	60

Question 8		30

2(3)

(a) Distinguish between the terms *coding DNA* **and** *non-coding DNA*.

Coding DNA:	Has genetic instructions to produce a protein	**3**
Non-coding DNA:	Has genetic instructions that do not produce a protein	**3**

2 ✓

8(3)

(b) Describe how you isolated the DNA from a **named** plant (or tissue)…

Named plant or tissue:	Correctly named plant or plant tissue	**3**
Description:	Relevant piece of apparatus named **or** any correct reference to time duration **or** reference to valid safety precaution /	
	Chopped **or** blended **or** other physical manipulation of plant tissue /	
	Detergent (washing up liquid) **and** salt (sodium chloride) added /	
	Heated to 60°C **or** cooling step described /	
	Filtered **or** protease added /	
	Added (freezer cold) ethanol slowly /	
	DNA becomes visible (at interface of mixture and ethanol)	
	Points may be obtained from an appropriately labelled diagram	**7(3)**

8 ✓

Question 9			30
		2(3)	
(a)	**(i)**	Briefly explain the term *enzyme*.	
		Biological (or organic or protein) catalyst	**3**
	(ii)	State **one** advantage of immobilising enzymes.	
		Pure product **or** easily recovered **or** reusable	**3**
2 ✓			
		8(3)	
(b)	**(i)**	Name the enzyme **or** cell you immobilised.	
		Correctly named enzyme or cell	**3**
	(ii)	Describe the procedure you used to immobilise the enzyme **or** cell.	
		Description: Relevant piece of apparatus named **or** reference to valid safety precaution **or** correct reference to time duration /	
		Dissolved alginate in water **and** added yeast (or enzyme or cell) /	
		Dropped into solution of calcium chloride /	
		Beads hardened **or** beads filtered **or** rinsed	
		Points may be obtained from an appropriately labelled diagram	**4(3)**
	(iii)	Describe how you examined the application of the immobilised enzyme **or** cell.	
		Description: Matching substrate /	
		Named product **or** name of test **or** how tested /	
		Valid control **or** comparison /	
		Result described **Any three**	**3(3)**
8 ✓			

Question 10			30
		2(3)	
(a)	**(i)**	What is meant by dormancy in seeds?	
		Period of low metabolic activity **or** period of no growth	**3**
	(ii)	Give **one** advantage of seed dormancy for plants.	
		Survive adverse conditions **or** give time for dispersal **or** other correct	**3**
2 ✓			
		8(3)	
(b)	**(i)**	Describe how you set up the apparatus for this investigation.	
		Description: Relevant piece of apparatus named **or** suitable temperature **or** suitable safety precaution /	
		Seeds soaked **or** seeds sterilised **or** how sterilised /	
		Cut (or flat) side facing agar /	
		Left for a suitable length of time /	
		Boiled seed or suitable control described /	
		Points may be obtained from an appropriately labelled diagram	**5(3)**
	(ii)	Explain how you knew digestion had occurred.	
		Iodine **or** Biuret test	**3**
		Agar underneath seeds remained clear (showed digestion) **Must match test**	**3**
		Agar underneath control seeds showed positive test result (showed no digestion) **Must match test**	**3**
8 ✓			

Section C	Best 4	4(60)

Question 11			60
		3(3)	
(a)	**(i)**	What is meant by the term *pollination*?	
		Transfer of pollen from anther to stigma	**3**
	(ii)	Distinguish between self-pollination **and** cross-pollination…	
		Self: (Pollination) within the same plant.	**3**
		Cross: (Pollination) between different plants.	**3**

3 ✓

		3(1)	
(b)	**(i)**	Name the parts of the flower labelled **A**, **B** and **C**.	
		A: *Anther	**1**
		B: *Filament	**1**
		C: *Stigma	**1**
		8(3)	
	(ii)	Give **one** adaptation of this flower that shows it is wind-pollinated.	
		Large (or long) stamen **or** large (or feathery) stigmas **or** stamen exposed **or** stigma exposed **or** small or light pollen	**3**
	(iii)	In which of the labelled parts is pollen formed?	
		*A **or** anther	**3**
	(iv)	Describe the main events of pollen grain development.	
		Diploid (2n) (microspore) mother cell / divides by meiosis / forms tetrad (or four) of haploid (n) cells / (nucleus of) each divides by mitosis / forms two nuclei / a generative nucleus / a tube nucleus **Any four**	**4(3)**
	(v)	Describe what happens during **both** of these fertilisations.	
		1st fertilisation: one (male) nucleus fuses with the egg (cell) **or** forms a diploid zygote	**3**
		2nd fertilisation: one (male) nucleus fuses with the two polar nuclei **or** forms a triploid endosperm	**3**

3 ✓1 **+ 8** ✓

Question 11 (continued)

8(3)

(c) (i) 1. What is a cotyledon?

A seed leaf **3**

2. Give **one** function of the cotyledon.

Store food **or** supplies nutrients to embryo **or** absorbs food from endosperm **3**

(ii) Give **one** function for **each** part.

Testa: Protects the seed **3**

Plumule: Develops into the (young) shoot **3**

Radicle: Develops into the (young) root **3**

(iii) 1. Give any **two** methods of fruit and seed dispersal.

Animal / wind / water / self **Any two** **2(3)**

2. Give **one** reason why fruit and seed dispersal are of benefit to plants.

Allows plant to colonise new habitats **or** increases chance of survival **or** prevents (reduces) competition with the parent plant **or** avoids overcrowding **or** other correct **3**

8 ✓

Question 12		**60**

3(3)

(a) Define each of the following terms: e*cology*; *biosphere*; *conservation*.

Ecology:	The study of (interactions between) organisms and their environment	**3**
Biosphere:	Where life can exist on Earth	**3**
Conservation:	Management (or preservation or protection) of organisms (or species or their habitats or environments or ecosystems)	**3**

3 ✓

5(2)

(b) (i) Show how the population of the predator species varies over the same time period.

	Dashed line lower peaks than prey	**2**
	Dashed line out of sync compared to prey.	**2**

(ii) Give a detailed explanation of the graph that you have drawn…

Line:	Increases due to food (prey) availability **or** decreases due to lack of food (prey)	**2**
Number:	Lower number due to loss of energy **or** reference to size (predators usually larger in size).	**2**
Time:	Delay in increase (in predator numbers) due to time taken to breed.	**2**

3(3)

(iii) If a disease affected the predator…what would you expect to happen to the graph?

	Prey (population) increases	**3**

Explain your answer.

	Less predators **or** greater chance of survival	**3**

(iv) Give a role for predation in the overall scheme of nature.

	Population control **or** described	**3**

2(4)

(v) Suggest **two** reasons human population numbers do not follow a similar pattern.

	Healthcare / food supply / lack of predators / other correct	**Any two**	**2(4)**

5 ✓2 **+ 3** ✓ **+ 2** ✓4

Question 12 (continued)

6(3)

(c) (i) Give **one** example of **each** of the following from the food web shown:

1. A producer

Phytoplankton **or** seaweed **3**

2. A secondary consumer

Salmon **or** herring **or** octopus **3**

3. A top consumer (top carnivore)

Peregrine falcon **or** orca whale **3**

(ii) What is meant by the term *producer*?

Organism that makes its own food. **3**

(iii) Write out a complete food chain from this food web.

Any correct food chain from the food web. **3**

(iv) How many trophic levels are in the food chain you wrote above?

5 **3**

3(2)

(v) What is meant by the term trophic?

Feeding **or** nutrition **2**

(vi) Explain why food chains have a limited number of trophic levels.

Large amount of energy is lost between (trophic) levels **or** little energy passed on **2**

(vii) Name the type of diagram an ecologist may draw…

Pyramid of numbers **or** ecological pyramid **2**

6 ✓ + 3 ✓2

Question 13		60

3(3)

(a) (i) Explain the term *metabolism*.

(All) chemical reactions in a cell (or organism). **3**

(ii) Distinguish between the terms *anabolic* and *catabolic*.

Anabolic: building up large molecules from small molecules **or** (a reaction) using energy **3**

Catabolic: breaking down large molecules to small molecules **or** (a reaction) releasing energy **3**

3 ✓

9(3)

(b) (i) Identify the cell organelle shown in the image.

*Mitochondrion **3**

(ii) Write out the balanced chemical equation for aerobic respiration.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

First point: formulae; second point: balancing **2(3)**

(iii) 1. What is the name given to stage 1?

*Glycolysis **3**

2. Describe the events in stage 1.

Glucose is broken down into (2) pyruvic acid / energy released / ATP is produced from ADP and P / NADH is formed / from $NAD^{(+)}$ and electrons and protons **Any three** **3(3)**

3. Describe the role of the energy carrier NAD in stage 2.

Picks up electrons (e^-) **and** protons (or H^+ or hydrogen ions) / to form NADH / these (electrons and protons) combine with O_2 / to make water **Any two** **2(3)**

9 ✓

Question 13 (continued)

8(3)

(c) (i) Name these organelles which are responsible for photosynthesis.

*Chloroplasts **3**

(ii) Where do the energised electrons come from?

*Chlorophyll **3**

(iii) Briefly describe what happens to these energised electrons in pathway 1.

Picked up by (electron) acceptor **<u>or</u>** transferred from carrier to carrier / energy released / ATP produced from ADP and P / (electron) returns to chlorophyll

Any two **2(3)**

(iv) What is another name for the light-independent stage?

*Dark **3**

(v) **1.** What name is given to the group of compounds….?

*Carbohydrates **3**

2. Name the simple molecule from which a plant obtains the protons (H^+)….

*Water (H_2O) **3**

3. Name another simple molecule from which plants obtain the carbon (C)….

*Carbon dioxide (CO_2) **3**

8 ✓

Question 14				60
			3(3)	
(a)	**(i)**	In relation to microorganisms…describe their distribution in nature.		
		They can survive in all habitats **or** they are found everywhere		**3**
	(ii)	Explain the terms *asepsis* and *sterility*….		
		Asepsis:	Absence of pathogens	**3**
		Sterility:	Absence of all (micro)organisms	**3**
3 ✓				

			1(3)		
(b)	**(i)**	Draw the structure of a bacterial cell **and** label any **three** parts.			
		Diagram:	Cell wall **and** cell membrane **and** DNA		**3**
			3(1)		
		Label:	Cell wall / cell membrane / cytosol / ribosome / plasmid / flagellum / capsule / chromosome or DNA / other correct	**Any three**	**3(1)**
			7(3)		
	(ii)	Are bacteria prokaryotic or eukaryotic? Justify your answer.			
		*Prokaryotic			**3**
		Justify:	(Cell) without nucleus **or** (a cell) without membrane-bound organelles (or examples)		**3**
	(iii)	Bacteria reproduce asexually. Name **and** describe this process.			
		Name:	*Binary fission		**3**
		Description:	DNA replicates / DNA moves to the both ends (of the cell) / cell elongates / cell divides in two **or** identical cells formed.	**Any two**	**2(3)**
	(iv)	Explain the term *pathogenic*.			
		Disease causing			**3**
	(v)	Give a possible effect of the misuse of antibiotics.			
		(Antibiotic) resistance **or** described **or** other correct			**3**
3 ✓1 **+ 8** ✓					

Question 14 (continued)

8(3)

(c) (i) Explain the difficulty in describing viruses as living organisms.

Non-cellular **or** no metabolism **or** other correct **3**

(ii) Name the **two** biochemical components that make up **all** viruses.

Protein **3**

Nucleic acid (or DNA or RNA) **3**

(iii) Describe the process of viral replication.

(Virus) attaches **or** DNA (or nucleic acid) enters / (viral) DNA replication **and** protein synthesis / using host cell organelles / viruses assembled / viruses released. **Any three** **3(3)**

(iv) **1.** Give **one** example of a harmful virus.

Common cold virus **or** coronavirus **or** HIV **or** hepatitis virus **or** other correct **3**

2. Give **one** way in which viruses can be beneficial.

Can be used (as a vector) in genetic engineering **or** vaccine production **or** any other valid answer **3**

8 ✓

Question 15				60
			3(3)	
(a)	**(i)**	What is meant by the term *species*?		
		Group of organisms that can reproduce together (or interbreed) to produce fertile offspring.		**3**
	(ii)	Give **two** causes of variation within a species.		
		Mutation / sexual reproduction / other correct	**Any two**	**2(3)**
3 ✓				

			9(3)	
(b)	**(i)**	Explain the underlined terms.		
		Allele: form of a gene		**3**
		Heterozygous: two different alleles (of a gene)		**3**
	(ii)	Give the genotypes of both plants in the cross above		
		*TTRR		**3**
		*ttRr	**Allow alternative letters for Rr e.g. RW**	**3**
	(iii)	Show the possible genotypes **and** phenotypes of the offspring of the cross…		
		Genotype: *TtRR		**3**
		Phenotype: *Tall and Red flowered		**3**
		Genotype: *TtRr		**3**
		Phenotype: *Tall and Pink flowered		**3**
	(iv)	What percentage of the offspring of the cross have pink flowers?		
		*50%		**3**
9 ✓				

Question 15 (continued)

8(3)

(c) (i) Name the **two** famous biologists.

*(Charles) Darwin **3**

*(Alfred Russell) Wallace **3**

(ii) What is meant by the term *evolution*?

Genetic (inheritable) changes in a population (or species) **3**

over a period of time **or** in response to a change in the environment **3**

(iii) Describe the main points of the theory of natural selection.

High reproductive rates (or overbreeding) /
competition (or struggle for survival) /
better adapted survive (or survival of the fittest) /
the survivors reproduce (or breed) /
others die out /
the genes of the most successful are passed on (to the next generation) /
organisms with beneficial characteristics will dominate **Any three** **3(3)**

(iv) Give **one** source of evidence that supports the theory of natural selection.

Fossils **or** comparative anatomy **or** comparative embryology **or** other correct **3**

8 ✓

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

Question 16 (a) **30**

6(1)

(i) **1.** Give the names of tubes **A and B and** the name of gland **C**.

A: *Urethra **1**

B: *Sperm duct (or vas deferens) **1**

C: *Prostate (gland) **1**

2. Give **one** function for **each** structure labelled **A**, **B** and **C**.

A: Release semen **or** release urine **1**

B: Carries sperm from testes to urethra (or penis) **1**

C: Produces seminal fluid **1**

6(4)

(ii) In which part of the male reproductive system does meiosis occur?

*Testes **4**

(iii) Which part of the male reproductive system is directly involved in copulation.

*Penis **4**

(iv) Give **one** cause of male infertility **and** a corrective measure.

Cause: Low sperm count **or** low sperm mobility **or** low testosterone levels **or** blockage **or** other correct **4**

Corrective measure: IVF **or** other correct **4**

(v) Give any **two** methods of contraception.

Mechanical / surgical / natural / chemical / named examples **Any two** **2(4)**

6 ✓1 + 6 ✓4

Question 16 (b)				30
		12(2)		
(i)	Name glands **X**, **Y** and **Z**.			
	X: *Thyroid			**2**
	Y: *Adrenal			**2**
	Z: *Ovary			**2**
(ii)	Name **one** hormone secreted by **each** gland **and** give **one** function for **each**.			
	Thyroid:	Hormone: Thyroxine **or** other correct		**2**
		Function: Controls the rate of metabolism **or** other correct	**Must match**	**2**
	Adrenal:	Hormone: Adrenaline **or** other correct		**2**
		Function: Fight or flight response **or** other correct	**Must match**	**2**
	Ovary:	Hormone: Oestrogen **or** other correct		**2**
		Function: Secondary sexual characteristics **or** other correct	**Must match**	**2**
(iii)	**1.** For any **named** human (male or female) hormone, give: a symptom of its deficiency.			
		Deficiency symptom to match hormone named		**2**
	2. a symptom of its excess.			
		Excess symptom to match hormone named		**2**
	3. a corrective measure for **either** its deficiency **or** excess.			
		Corrective measure to match either symptom		**2**
		2(3)		
(iv)	Briefly describe the feedback mechanism of any **one** human hormone.			
	The concentration (or secretion) of one (named) hormone			**3**
	Inhibits or stimulates the concentration (or secretion) of another (named) hormone or itself			**3**

12 ✓₂ + 2 ✓

Question 16 (c)			30
		10(3)	
(i)	What name is given to the growth response of plants to light?		
	*Phototropism		**3**
(ii)	How does this growth response benefit plants?		
	Get more light **or** more photosynthesis **or** more food produced **or** described		**3**
(iii)	Name any **other** type of growth response in plants.		
	Geotropism **or** thigmotropism **or** chemotropism **or** hydrotropism		**3**
(iv)	Explain the term *growth regulator*.		
	Chemical that controls (or influences) growth (in plants)		**3**
(v)	Describe the mechanism of any **one** plant growth response to an external stimulus.		
	Where regulator produced /		
	Movement of regulator /		
	Unequal distribution of growth regulator /		
	How growth affected /		
	Result on growth	**Any three**	**3(3)**
(vi)	Give **one** example of the use of plant growth regulators, e.g. by horticulturists.		
	Seedless fruits **or** rooting powder **or** tissue culturing **or** fruit ripening **or** (selective) herbicide **or** other correct		**3**
(vii)	Give any **two** methods plants use to protect themselves.		
	Bark / cuticle / guard cells / thorns / chemicals / other correct	**Any two**	**2(3)**
10 ✓			

Question 16 (d)				30
		10(3)		
(i)	**1.**	Name any **two** methods used by the general defence system.		
		Barrier (e.g. skin) / phagocytosis/ chemicals (e.g. sebum, sweat, interferon) / fever / (stomach) acid / tears / blood clotting / other correct	**Any two**	**2(3)**
	2.	Name any **one** organ that is specific to the immune system.		
		Spleen **or** thymus **or** lymph node **or** tonsils **or** other correct		**3**
(ii)	**1.**	Distinguish between the terms *antigen* **and** *antibody*.		
		Antigen: chemical (or molecule) that stimulates the production of antibodies		**3**
		Antibody: protein produced in response to an antigen **or** protein produced by lymphocytes **or** protein which inactivates an antigen		**3**
	2.	Name the **other** type of lymphocyte.		
		*B		**3**
	3.	Name any **two** types (of T cell) **and** give **one** function for **each** named type.		
		Suppressor (or regulatory) / helper / killer (cytotoxic) / memory	**Any two**	**2(3)**
		Matching functions	**Any two**	**2(3)**
10 ✓				

Question 17	Any two of (a), (b), (c), (d)	30, 30

Question 17 (a)		30

2(4)

(i) **1.** What is the optimal pH of enzyme **A**?

*2 **4**

2. What is the optimal pH of enzyme **B**?

*7 **4**

1(4)

(ii) Which enzyme (**A** or **B**) is most likely to be found in the stomach? Justify your answer.

Enzyme: *A **4**

1(3)

Justify: pH in the stomach is low **or** acidic environment in the stomach **3**

3(3)

(iii) Describe the active site theory of enzyme action…

Active site has a complementary shape to only one 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 three** **3(3)**

3(2)

(iv) Give the product(s) of **each** enzyme.

Amylase: *Maltose **2**

Lipase: *Glycerol **and** fatty acids **2**

Protease: *Amino acids or peptides **2**

3 ✓4 + 4 ✓ + 3 ✓2

Question 17 (b)			30
		2(3)	
(i)	Explain the terms *saprophytic* **and** *parasitic*.		
	Saprophytic:	(organism that) feeds on dead organic matter	**3**
	Parasitic:	(organism that) feeds on another living organism causing it harm	**3**
		2(3)	
(ii)	Draw a large labelled diagram of *Rhizopus* during asexual reproduction.		
	Diagram:	sporangiophore **and** sporangium	**3**
		stolon **or** rhizoid	**3**
		3(1)	
	Labels:	stolon / rhizoid / sporangiophore / sporangium / spore / hypha / mycelium / apophysis / columella / other correct **Any three**	**3(1)**
		1(3)	
	Indicate clearly **on your diagram** which part is involved in asexual reproduction.		
	Spores **or** sporangium indicated		**3**
		4(3)	
(iii)	**1.** What is the name of this structure?		
	*Zygospore		**3**
	2. What happens to the structure you named above if suitable conditions return?		
	Germinates **or** described		**3**
(iv)	Give any **two** examples of beneficial fungi.		
	Named edible mushrooms / yeast / other correct named **Any two**		**2(3)**

3 ✓1 + 9 ✓

Question 17 (c)			30
		1(3)	
(i)	What term describes in maintenance of a constant internal environment within the body?		
	*Homeostasis		**3**
		2(3)	
(ii)	Draw a large labelled diagram of the human nephron **and** its associated blood supply.		
	Diagram: Bowman's capsule **and** (proximal or distal) convoluted tubule **and** loop of Henle		**3**
	Glomerulus **or** other blood supply		**3**
		6(1)	
	Labels: Any six correct labels e.g. glomerulus / Bowman's capsule / proximal convoluted tubule / loop of Henle / distal convoluted tubule / collecting duct / afferent arteriole / efferent arteriole / renal venule / renal arteriole / capillary	**Any six**	**6(1)**
		5(3)	
(iii)	Give **one** way in which the composition of blood is different to the composition of glomerular filtrate.		
	Blood contains blood cells, glomerular filtrate does not **or** Blood contains (large, plasma) proteins, glomerular filtrate does not **or** Other correctly described difference		**3**
(iv)	**1.** Name any **two** parts of the nephron that reabsorb water.		
	Proximal convoluted tubule / loop of Henle / distal convoluted tubule / collecting duct	**Any two**	**2(3)**
	2. Name any **two other** substances that are reabsorbed during urine formation.		
	Glucose / amino acids / minerals / salts / ions / other correct	**Any two**	**2(3)**

6 ✓1 + 8 ✓

Question 17 (d)			30
		10(3)	
(i)	What is the name given to the stage when the cell is in a state of non-division?		
	*Interphase		**3**
(ii)	Give any **two** cell activities that occur during the state of non-division.		
	Photosynthesis / respiration / DNA replication / protein synthesis / other correct	**Any two**	**2(3)**
(iii)	**1.** What name is given to the stage of mitosis shown in the image?		
	*Anaphase		**3**
	2. Explain how you know it is this stage.		
	Chromosomes are being pulled apart **<u>or</u>** spindles contracting (shortening)		**3**
(iv)	What stage of mitosis occurs immediately before the stage you named above?		
	*Metaphase		**3**
(v)	Sketch a simple cell with a diploid number of 4 that is at the stage you named above.		
	Diagram: Cell with 4 duplicated chromosomes on the equator of the cell		**3**
	Spindle fibres from chromosomes to the ends (poles) of the cell		**3**
(vi)	What is the function of mitosis in multicellular organisms such as the onion?		
	Growth **<u>or</u>** repair (of tissue)		**3**
(vii)	What name is given to the group of disorders….?		
	*Cancer		**3**

10 ✓

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