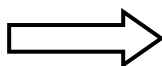


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Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2014

BIOLOGY – HIGHER LEVEL

TUESDAY, 10 JUNE – AFTERNOON, 2.00 – 5.00

Section A

Answer any **five** questions from this section.

Each question carries 20 marks.

Write your answers in the spaces provided on **this examination paper**.

Section B

Answer any **two** questions from this section.

Each question carries 30 marks.

Write your answers in the spaces provided on **this examination paper**.

Section C

Answer any **four** questions from this section.

Each question carries 60 marks.

Write your answers in the **answer book**.

It is recommended that you spend not more than 30 minutes on Section A and 30 minutes on Section B, leaving 120 minutes for Section C.

You must return this examination paper with your answer book at the end of the examination.

Section A

Answer any five questions.
Write your answers in the spaces provided.

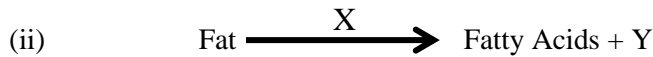
1. From your knowledge of ecology explain **any five** of the following terms:

- (a) Biosphere. _____
- (b) Niche. _____
- (c) Biotic factor. _____
- (d) Trophic level. _____
- (e) Competition. _____
- (f) Symbiosis. _____

2. (a) The following biochemical reactions took place in some living cells:



Is this an example of anabolism or catabolism?



Identify X and Y.

X . _____ Y . _____

(b) (i) How does a phospholipid differ from a fat?

Phospholipid: _____

Fat: _____

(ii) Name a fat-soluble vitamin.

(iii) State a disorder due to a dietary deficiency of the vitamin referred to in (b) (ii).

(iv) Give any **two** functions of minerals in organisms.

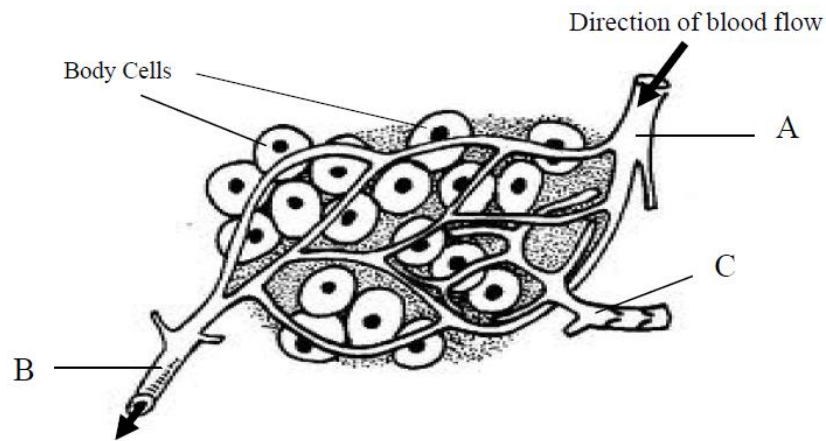
1. _____

2. _____

1.	2(7) + 3(2) i.e. best five answers from (a) – (f)		
	(a)	<i>Biosphere</i>	Parts of the earth where life (or organisms) exists
	(b)	<i>Niche</i>	The (functional) role of an organism or a role explained
	(c)	<i>Biotic factor</i>	A living factor (in an ecosystem)
	(d)	<i>Trophic level</i>	Feeding level or energy level or position in food chain
	(e)	<i>Competition</i>	The struggle for a resource (or named resource)
	(f)	<i>Symbiosis</i>	Relationship between two species involving benefit.

2.		7+6+7(1)	
	(a)	(i)	Catabolism
		(ii)	X = lipase, Y = glycerol
	(b)	(i)	(A phospholipid) has a phosphate or (a phospholipid) has two fatty acids
			(A fat) has three fatty acids
		(ii)	A, D, E, or K
		(iii)	Matching disorder
		(iv)	Formation of rigid structure (or named) / formation of soft tissue (or named) / formation of fluid (or named) / formation of pigment (or named) / biochemical function of a named mineral /any other specific function(s) of named mineral(s)

3. The diagram shows a region of tissue that includes body cells and parts of the circulatory and lymphatic systems.



(a) Name part C. _____

(b) What type of blood vessel is A? _____

(c) If a transverse section of A were viewed under the microscope state **one** way in which it would differ from a transverse section through B.

(d) Give **two** functions of the lymphatic system.

1. _____

2. _____

(e) Give **one** way in which lymph differs from blood.

(f) Name a major blood vessel that returns the blood in B to the heart.

[OVER

3.	8+7+5(1)	
	(a)	C = Lymph vessel
	(b)	Arteriole (<i>accept</i> artery)
	(c)	Narrow(er) lumen or thick(er) wall or no valves
	(d)	Maintains a constant level of ECF or drains fluid or returns fluid to blood / manufacture of lymphocytes or maturation of lymphocytes / filtering bacteria / fighting infection / transport of named material
	(e)	No red blood cells or no haemoglobin / no platelets / no clotting (proteins) /
	(f)	Vena cava

4. (a) The living world may be divided into five kingdoms: Monera; Protista; Fungi; Plantae; Animalia.

In the case of **each** of the following pairs of kingdoms give any structural feature of members of the first-named kingdom **not found** in members of the second kingdom.

- (i) Fungi and Animalia. _____
- (ii) Plantae and Fungi. _____
- (iii) Animalia and Monera. _____
- (iv) Protista and Animalia. _____

(b) In **each** of the following cases, name an organism that fits the description.

- (i) A multicellular fungus. _____
- (ii) A member of the Protista that catches and consumes smaller organisms.

- (iii) A harmful member of the Monera. _____

5. Indicate whether the following statements are true (T) or false (F) by placing a tick (•) in the appropriate box in **each** case.

- (a) Single-celled organisms use meiosis for asexual reproduction.
- (b) In telophase of mitosis, a cleavage furrow forms in plant cells.
- (c) When a cell is not dividing it is said to be in prophase.
- (d) The nuclear membrane disappears in the early part of mitosis.
- (e) Centromeres give rise to the nuclear spindle.
- (f) Mitosis is a source of variation.
- (g) In multicellular organisms mitosis is primarily used for growth.

	T	F
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		
(g)		

4.	8+7+5(1)		
	(a)	(i)	Cell wall or hypha (or named hypha) or mycelium or named reproductive structure
		(ii)	Chloroplast or cellulose cell wall or named anatomical feature
		(iii)	Nucleus or mitochondrion or multicellular or eukaryotic or nervous system or digestive system or reproductive system or muscular system
		(iv)	(Can be) unicellular or (can have) chloroplast or pseudopodia or contractile vacuole or food vacuole
	(b)	(i)	Rhizopus (or bread mould) or other named fungus
		(ii)	Amoeba
		(iii)	Any named (harmful) bacterium or named (harmful) effect of a bacterium [NB The word 'bacterium' is essential if effect given]

5.	8+7+5(1)
	F
	F
	F
	T
	F
	F
	T

6. (a) Suggest an advantage of using ATP as an energy store in cells.

(b) Name **two** processes requiring ATP that occur in cells.

1. _____ 2. _____

(c) Name **two** substances, other than carbon dioxide, into which pyruvate may be broken down under **anaerobic** conditions in cells.

1. _____ 2. _____

(d) What is the name of the two-carbon compound into which pyruvate is broken down under **aerobic** conditions?

(e) Briefly describe the fate, under **aerobic** conditions, of the two-carbon compound referred to in part (d).

[OVER

6.	8+7+5(1)	
	(a)	High-energy molecule (or bond) or easily broken down or easily re-formed or reusable or energy easily released
	(b)	Any two named cell processes e.g. (photo)synthesis, respiration, (active) transport mitosis (or named phase of mitosis)
	(c)	1. Lactic Acid
		2. Ethanol (<i>accept</i> alcohol)
	(d)	Acetyl (Co-enzyme A)
	(e)	Enters Kreb's Cycle (or explained) or (broken down) to CO ₂ and H ₂ O

Section B

Answer any two questions.

Write your answers in the spaces provided.

Part (a) carries 6 marks and part (b) carries 24 marks in each question in this section.

7. (a) (i) Name a part of a seed in which food for germination is stored.

- (ii) Name the **three** factors necessary for seeds to germinate.

1. _____ 2. _____ 3. _____

- (b) Answer the following questions on seed germination.

- (i) At the start of the investigation to show digestive activity during germination the seeds were sterilised.

1. Why is this necessary? _____

2. How did you sterilise the seeds? _____

- (ii) Name the substance that is used as a medium on which to germinate the seeds.

- (iii) What substance, to be digested by the seeds, was added to the above medium?

- (iv) What control did you use in this demonstration?

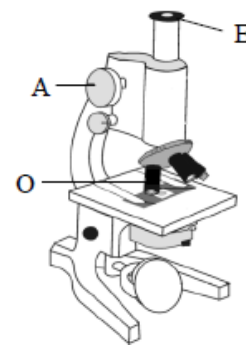
- (v) How did you demonstrate that digestive activity had taken place?

7.	(a)	(i)	*Cotyledon or *endosperm		3
		(ii)	Water / oxygen / suitable temperature (or warmth)		3(1)
	(b)	(i)	1.	To kill (or inhibit) any microorganisms (or bacteria and fungi)	3
			2.	Disinfectant or named disinfectant.	3
		(ii)	Agar		3
		(iii)	Starch or milk or protein		3
		(iv)	(Same set-up and procedure with) boiled seeds		3
		(v)	Iodine (or biuret) (solution) / negative result (or described) beneath seeds / indicates the absence of (or digestion of) starch (or protein)		3(3)

8. (a) Answer the following questions with reference to the microscope.

(i) State the function of the part labelled A in the diagram.

(ii) Lens E is marked 10 \times and lens O is marked 40 \times .
A cell is viewed through lenses E and O.
The image of the cell is 0.8 mm in diameter.
What is the actual diameter of the cell?



(b) Answer the following questions in relation to the procedures that you followed when preparing animal cells for examination with a light microscope.

(i) Describe how you obtained a sample of cells.

(ii) What stain did you use on the sample?

(iii) Outline how you used the coverslip.

(iv) Explain why a coverslip is used.

(v) Describe how you examined the cells using the microscope.

(vi) Draw a labelled diagram of the cells as seen at high magnification.

8.	(a)	(i)	Coarse focus or focus with low power	3
		(ii)	0.002 mm	3, 2, 1, 0
	(b)	(i)	Rubbed inside cheek with swab (or example)	3
		(ii)	Methylene blue	3
		(iii)	(Coverslip) at angle / how lowered	2(3)
		(iv)	To protect the sample from drying out or to protect the lens (from the stain)	3
		(v)	Focus using coarse (focus) or focus using A or focus using lower power (focus) using medium (or high) power (or using fine focus)	3 3
		(vi)	Appropriate labelled diagram [<i>at least 1 label required</i>]	3

9. (a) (i) Give **one** example of a limitation of the scientific method.

(ii) Where do scientists usually publish the results and conclusions of their investigations?

(b) Answer the following in relation to investigations that you carried out in the laboratory.

(i) 1. When dissecting a mammalian heart where, precisely, did you locate the tricuspid valve?

2. Briefly describe how you carried out the dissection to expose this valve.

3. Where did you find the semilunar valves during the dissection?

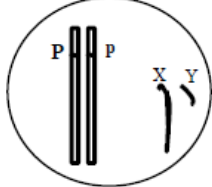
(ii) 1. When you investigated the effect of exercise on the human pulse rate or breathing rate what did you first establish?

2. How did you measure pulse rate or breathing rate?

9.	(a)	(i)	(The extent of) our basic knowledge or the basis of investigation or our ability to interpret results or application to the natural world in state of change or accidental discoveries:	3
		(ii)	Scientific journal(s)	3
	(b)	(i)	1 Between the right atrium and right ventricle	3
			2 Cut through the right side of the heart / using a scalpel	2(3)
			3 At the base / of the aorta or the pulmonary artery	2(3)
		(ii)	1 The resting (pulse) rate or resting (breathing) rate	3
			2 Feel (or locate) pulse (or observe breathing) / Count heart beats (or breaths) for stated time / Repeat and find average.	2(3)

Section C

Answer any four questions.
Write your answers in the answer book.

10. (a) (i) Explain the term *species*.
- (ii) What is meant by the term *gene expression*? (9)
- (b) Last year it was discovered, by DNA analysis, that meat products labelled as beef contained meat from other animals, particularly horses and pigs.
- (i) Name the biomolecule that is the major component of meat.
- (ii) Where in a cell are these biomolecules manufactured?
- (iii) Name the molecule, formed from DNA, which carries the instruction to manufacture these biomolecules.
- (iv) Name **and** outline the procedure used for analysing the DNA samples that revealed the presence of horse meat in products labelled as beef.
- (v) Would the result obtained from the procedure referred to in (iv) be the same if the beef were contaminated with pig meat? Explain your answer. (27)
- (c) The diagram shows part of the genotype of an individual of the Aberdeen Angus cattle breed. This breed is unusual in that the allele for the polled (hornless) condition is dominant to the one for the horned condition.
- 
- (i) What term is used to describe the allele pair Pp?
- (ii) Is this a sex-linked condition? Explain your answer.
- (iii) What is the phenotype **and** sex of the animal whose partial genotype is shown above?
- (iv) Draw a diagram, similar to the one shown, to describe an Aberdeen Angus which, when crossed with the one above, would **ensure** the production of a polled calf.
- (v) Name a group of organisms in which the XY chromosome pair gives rise to a different sex than in cattle. (24)

[OVER

10.	(a)	(i)	Interbreeding (population) / producing fertile offspring.	2(3)
		(ii)	The production of a (particular) protein (using the gene's code)	3
	(b)	(i)	*Protein	3
		(ii)	Ribosomes	3
		(iii)	*mRNA	3
		(iv)	(DNA) profiling	3
			Cut (DNA into fragments) / with (restriction) enzymes / separate fragments / on basis of size / analyse results (or explained)	3(3)
		(v)	No, because pig DNA is not the same as horse DNA OR Yes, because not all the DNA is beef DNA	6, 3, 0
	(c)	(i)	*Heterozygous	3
		(ii)	No Because they ('P' genes) are not on the X (or Y or sex) chromosome	3 3
		(iii)	Hornless (or polled) Male	3 3
		(iv)	PP properly located on chromosome pair XX properly labelled as chromosome pair [genotype alone gets 3 marks]	3 3
		(v)	Birds or butterflies or moths	3

11. (a) (i) Name the **type** of joint shown in the diagram.
- (ii) Name the structure labelled A, which attaches muscle to bone.
- (iii) Explain what is meant by an *antagonistic muscle pair*.

(9)



- (b) Answer the following questions in relation to the human nervous system.
- (i) Name the **type** of particle whose movement in and out of neurons is an essential feature of nerve impulse transmission.
- (ii) One of the roles of the particles referred to in (i) is the activation of neurotransmitters.
- Give an account of how neurotransmitters work.
- (iii) 1. Distinguish between the position of the cerebellum and the position of the cerebrum in the human brain.
2. State **three** functions of the cerebrum. (27)

- (c) Read the following extract and then answer the questions below.

Alzheimer's disease (a degenerative brain condition), like many other degenerative illnesses, is driven by genes and recently scientists have identified a group of genes that are thought to be associated with this disease. The disease is thought to be caused by a build up of protein-based plaques in the brain, and investigators now believe they have an understanding of ways to interrupt that process. Technology is helping too, as researchers exploit new ways to scan the brain and detect the first signs of trouble, peering deeper into human and animal neural tissue to pinpoint the very molecules that give rise to the disease.

(Adapted from *Alzheimer's Unlocked*, TIME, Volume 176, No. 17. 2010.)

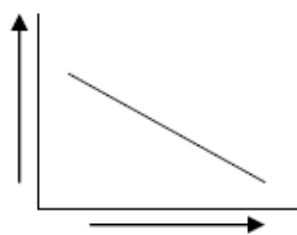
- (i) What do you think is meant by the term "degenerative illnesses"?
- (ii) Is Alzheimer's disease driven by a single gene or by many genes?
- (iii) What is thought to cause the disease?
- (iv) Suggest a possible symptom of Alzheimer's disease.
- (v) How is the advance of technology helping in the fight against the disease?
- (vi) There are probably more people suffering from the disease now than ever before. Suggest a reason for this.
- (vii) Name another disorder of the nervous system **and** give a possible treatment for it. (24)

11.	(a)	(i)	*Hinge	3
		(ii)	*Tendon	3
		(iii)	(A pair of muscles that) work with opposing actions or explained.	3
	(b)	(i)	*Ion	3
		(ii)	(Neurotransmitters are) secreted by the neuron / into (or crosses) the synaptic cleft / react with receptors / (on) the next neuron / set up the impulse in this neuron / inactivated by enzymes / reabsorbed by (presynaptic neuron)	4(3)
		(iii)	1. The cerebellum – hind brain and cerebrum – forebrain	3
			2. <i>Any three functions:</i> memory / learning / emotion / speech / vision / intelligence / movement / language / smell / hearing / logic / personality / taste	3(3)
	(c)	(i)	Getting worse	3
		(ii)	Many (or group)	3
		(iii)	A build up of protein plaques	3
		(iv)	e.g. memory loss	3
		(v)	Scans can examine the brain (for early detection)	3
		(vi)	Larger population or more people living into old age	3
		(vii)	Name / treatment	2(3)

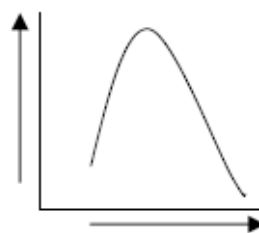
12. (a) (i) Name the structures found in stems, equivalent to stomata in leaves, which are involved in gaseous exchange in plants.
- (ii) Name **two** compounds that leave the plant through the structures referred to in part (i). (9)
- (b) (i) Draw a large labelled diagram of the human breathing tract.
- (ii) Outline the details of the process of inhalation. (27)
- (c) Answer the following questions in relation to carbon dioxide.
- (i) Name a structure found in cells in which carbon dioxide is produced.
- (ii) Give a feature of a capillary which allows the rapid uptake of carbon dioxide.
- (iii) Carbon dioxide levels are usually higher in venous blood than in arterial blood. Why is this the case?
- (iv) Name a blood vessel which is an exception to the situation outlined in (iii) above. Give a reason for the exception.
- (v) Briefly outline the role of carbon dioxide in the control of the human breathing rate. (24)

12.	(a)	(i)	*Lenticels	3
		(ii)	Water / Carbon dioxide	2(3)
	(b)	(i)	Diagram showing: trachea, bronchus and bronchioles Labels: trachea / cartilage / bronchi / bronchioles / alveoli	6, 3, 0 3(1)
		(ii)	Brain sends message to muscles / intercostals contract / diaphragm contracts / ribcage moves up and out / diaphragm moves down / volume of thoracic cavity increases / pressure drops / air in	6(3)
	(c)	(i)	*Mitochondrion	3
		(ii)	Wall one cell thick or thin wall	3
		(iii)	Venous blood has collected CO ₂ / from respiration (or cells) / arterial blood has been cleared of CO ₂ (in lungs)	2(3)
		(iv)	Pulmonary Vein	3
			Blood has been cleared of CO ₂ in the lungs	3
			OR	
			Pulmonary Artery	3
			Brings CO ₂ rich blood to the lungs	3
		(v)	Medulla oblongata registers blood CO ₂ levels	3
			More CO ₂ results in faster (breathing) or less CO ₂ results in slower (breathing)	3

13. (a) Study the graphs of enzyme activity below and answer the questions that follow.



Graph A



Graph B

- (i) In the case of **each** graph state the relationship between the rate of reaction (y-axis) and another factor (x-axis).
- (ii) In the case of graph B, what factor could be responsible for the changes in activity of the enzyme? (9)
- (b) (i) Give a detailed account of how enzymes work, referring in your answer to their specificity.
- (ii) Name **two** processes that occur in plant or animal cells that require the use of enzymes.
- (iii) Some biological washing powders contain enzymes similar to the ones found in our digestive system. Many of these enzymes are extracted from bacteria.
1. Suggest why such enzymes are included in washing powder.
 2. Why is 40 °C the recommended temperature for these washing powders?
 3. Suggest what would happen to these enzymes in an 80 °C wash. (27)
- (c) In the course of your practical studies you immobilised an enzyme and then investigated its activity. You also prepared alcohol using yeast.
- (i) Draw a labelled diagram of the apparatus you used to prepare alcohol.
- (ii) Give **two** advantages of using immobilised yeast cells in the production of alcohol.
- (iii) How did you test for the presence of alcohol? (24)

13.	(a)	(i)	Graph A: (Rate of reaction) decreases as x-axis (or other) factor increases	3
			Graph B: (Rate of reaction) increases and (then) decreases as x-axis (or other) factor increases	3
		(ii)	pH or temperature	3
	(b)	(i)	(Enzymes have) active site(s) / induced fit (or explained) / complementary shape to substrate / particular to small number of substrates / enzyme-substrate complex / products formed or products released / enzyme unchanged (or can be reused)	4(3)
		(ii)	Any two named cellular processes	2(3)
		(iii)	1. To break down food-based (or other biological) stains	3
			2. Optimum (temperature) or explained	3
			3. Denaturation or explained	3
	(c)	(i)	Diagram: flask + contents + indication of air exclusion Labels: glucose (solution) / yeast / fermentation (or air) lock or oil layer or anaerobic conditions	3 3(1)
		(ii)	Can be reused / are easy to extract from the solution / pure product	2(3)
		(iii)	Iodoform test / sodium hypochlorite / potassium iodide / heat or warm / yellow (crystals) OR Dichromate test / potassium dichromate or sodium dichromate / acidified / warm / from orange to green	4(3)

14. Answer any **two** of (a), (b), (c). **(30, 30)**

- (a) (i) Name:
1. the site of production of a pollen grain **and**
 2. the structure on which it must land to complete pollination.
- (ii) Name **two** methods of cross pollination.
- (iii) Many species of plant have mechanisms that prevent self-pollination. Suggest how such plants could benefit from this.
- (iv) Describe in detail the events that follow the arrival of a pollen grain at the destination referred to in (i), up to and including fertilisation.
- (v) Which part of a flower usually develops into a fruit?
- (b) (i) Draw a diagram of a transverse section through a young dicotyledonous stem as seen under the low power lens of a microscope. Indicate on your diagram a location for **each** of the following: dermal tissue, ground tissue, vascular tissue.
- (ii)
 1. Which of the above tissue types has a different location in a young root?
 2. Where precisely is the tissue type referred to in 1. found in the root?
 3. Give **one** function of ground tissue.
- (iii) Draw labelled diagrams to show the detailed structure of the **two** vascular tissues of plants.
- (iv) Which of the tissues referred to in (iii) is composed of living cells?
- (v) What is the function of meristematic tissue?
- (c) (i) Explain how water enters root hairs and then passes to the vascular tissue.
- (ii) In which of the vascular tissues will water now rise through the plant?
- (iii) Give **two** features of the tissue referred to in (ii) that facilitate this upward movement of water.
- (iv) Name **and** briefly explain any **two** processes involved in the upward movement of water in plants.

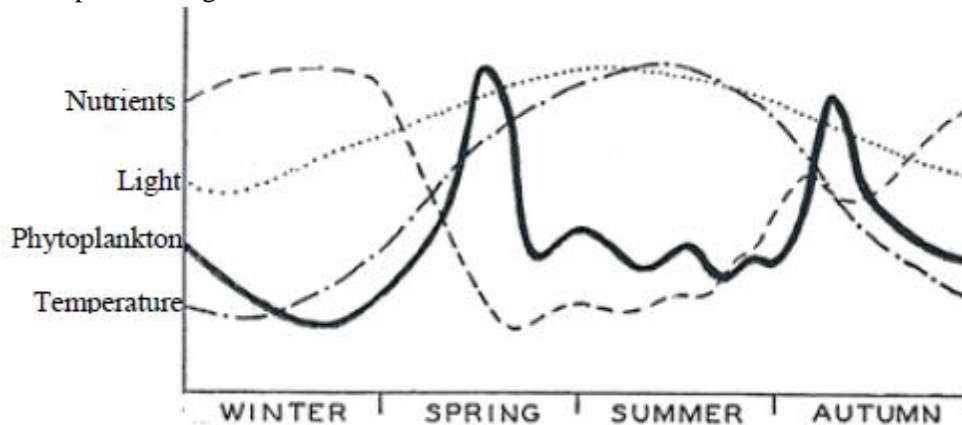
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14.	(a)	(i)	Anther [accept stamen] *Stigma	3 3
		(ii)	Wind / animal or example or water	2(3)
		(iii)	Greater variation or explained or prevents inbreeding or explained	3
		(iv)	Pollen (grain) germinates or pollen tube produced / grows through style / generative nucleus divides by mitosis / to form 2 (male) gametes / entry into embryo sac / one (gamete) fertilises the egg (cell) / one fertilises the polar nuclei.	4(3)
		(v)	*Ovary	3

14.	(b)	(i)	Diagram: Labels correctly located:	3, 0 3(1)
		(ii)	1. *Vascular	3
			2. In the centre	3
			3. Support or storage or photosynthesis	3
		(iii)	Diagram 1 (phloem): tube + companion cell (or sieve plate) [accept transverse section] Diagram 2 (xylem): tube + 1 wall feature (or tapering ends) Labels (diagram 1): phloem, sieve tube, sieve plate, companion cell or (companion cell) nucleus, (sieve tube) cytoplasm Labels (diagram 2): xylem, pits, thick wall, tracheid, vessel [maximum of two labels from either diagram]	3, 0 3, 0 3(1)
		(iv)	Phloem	3
		(v)	Mitosis or cell division or growth or to produce new cells	3

14.	(c)	(i)	Osmosis / soil water more dilute or cytoplasm of the root cells more concentrated / cell to cell (by osmosis)	3(3)
		(ii)	*Xylem	3
		(iii)	Narrow / continuous tube (no end walls or open ended) or pits / no cell contents / attraction of H ₂ O to walls / thick wall	2(3)
		(iv)	Root pressure / transpiration / adhesion / cohesion Two explanations: <i>Root pressure:</i> H ₂ O in pushes H ₂ O up <i>Transpiration:</i> H ₂ O out pulls H ₂ O up (or creates tension) <i>Adhesion:</i> H ₂ O attracted to walls <i>Cohesion:</i> H ₂ O (molecules) attracted to each other or allows continuous stream	2(3) 2(3)

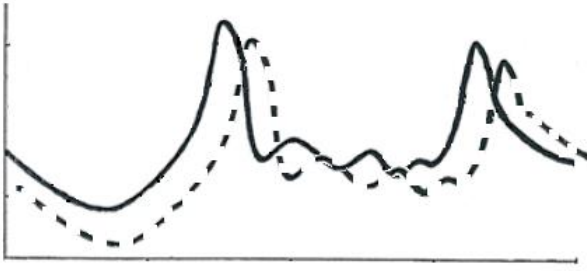
- (a) *Phytoplankton* is the collective term covering the small photosynthetic organisms which are part of aquatic ecosystems. The solid line in the graph below shows the fluctuation in phytoplankton numbers in a lake over a twelve month period. The broken lines show the variations over that period in temperature, light and nutrient levels.



- (i) What does the graph tell you about the phytoplankton population?
 - (ii) Why do you think that **nutrient** levels are high in winter **and** then drop sharply in spring?
 - (iii) Give an example of an inorganic nutrient, necessary for phytoplankton growth, that you would expect to find in lake water.
 - (iv) *Zooplankton* is the collective term for the small animals present in the lake. **Copy the graph for phytoplankton into your answer book** and then, on the same axes and using a dashed (---) line, show how the numbers of zooplankton would vary over the twelve month period. Briefly explain the graph that you have drawn.
 - (v) Other than the effect of the zooplankton, suggest why the phytoplankton population drops in late autumn.
- (b) Read the passage below and answer the questions that follow.

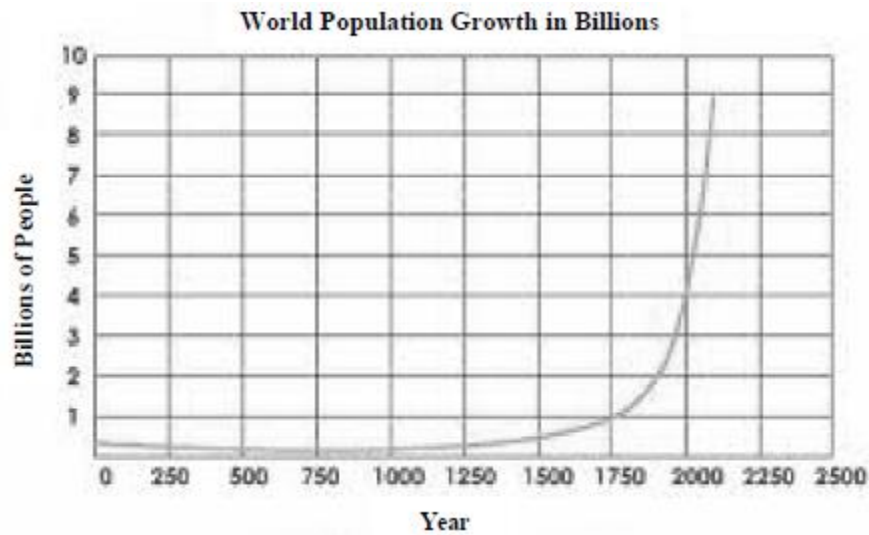
European rabbits were introduced by settlers into Australia in 1859. Within 70 years the rabbit population grew enormously across most of the continent. The rapid spread of the rabbit led to the destruction of large areas of vegetation, leading to the extinction of many plant species. Loss of vegetation leads to soil erosion as the exposed soil is washed or blown away, removing valuable soil nutrients required for new plants to develop. This soil is typically deposited in waterways, causing siltation and destroying aquatic ecosystems. Farmers battled the problem, fencing their properties with special netting, using poisons, digging out warrens and finally introducing the *Myxoma* virus as a form of biological control. This virus, a benign parasite of the Brazilian forest rabbit, was lethal for European rabbits. It quickly reduced Australia's rabbits to a mere 5% of former numbers. However, this solution was not long-lasting and rabbit numbers recovered.

- (i) Describe a procedure for estimating rabbit numbers in an ecosystem.
- (ii) Suggest **one** reason for the initial rapid increase of the rabbit population.
- (iii) Give **two** possible effects on an ecosystem of the extinction of a plant species.
- (iv) Suggest **one** advantage **and one** disadvantage of biological control of a pest organism.
- (v) Suggest **one** reason why the rabbit numbers recovered.

15.	(a)	(i)	Decreases (or low) in winter / increases (or high) in spring or decreases (or low) in spring / fluctuating (or low) in summer / increases (or high) in autumn or decreases (or low) in autumn	3(2)
		(ii)	Plankton absorb (or use) (nutrients) / low plankton numbers (in winter) / increasing (or high) plankton numbers (in spring) / (extra) nutrients from dead organisms Any three	3(2)
		(iii)	e.g. Nitrate (<i>accept</i> nitrogen)	2
		(iv)	Graph: 	
			Features to look for in Graph: zooplankton numbers lower than phytoplankton / curve more or less matches the phytoplankton curve / Spring peak shifted to the right / Autumn peak shifted to the right	4(2)
			<i>Explanation:</i> Zooplankton eat phytoplankton / (In a food chain) predator numbers are smaller than prey numbers or explained / Time lag required for numbers to change	2(2)
		(v)	Low temperature or low light (intensity)	4

15.	(b)	(i)	<i>Capture-recapture:</i> how captured / how marked / animal welfare comment / release same place / recapture / count / formula or calculation described	6(2)
		(ii)	No predator or plenty of food or warm climate	3
		(iii)	Soil erosion / less nutrients / siltation / destroying aquatic ecosystems / decrease in consumer numbers / increase in numbers of other plant(s) / change of animal species	2(3)
		(iv)	<i>Advantage:</i> No (harmful) chemicals or specific (target pest) <i>Disadvantage:</i> Possible extinction (of a species) or may not be specific (or explained) or immunity develops or balance of nature disturbed (or explained)	3 3
		(v)	Immunity (to the virus evolved)	3

- (c) The graph shows the growth in human population from 1 AD to present times.



- (i) Name **three** factors that can affect human population.
- (ii) Suggest **two** reasons why the human population increased so rapidly from the mid-1800s.
- (iii) Suggest what could happen to biological diversity as the human population continues to increase.
- (iv) The vast amount of waste generated is one of the consequences of this huge increase. Mention the **three** main ways in which waste can be minimised.
- (v) What is pollution?
- (vi) What is the role of microorganisms in pollution control?
- (vii) Describe the role of
1. Plants
 2. Animals
- in the Nitrogen Cycle **and** in the Carbon Cycle.

15.	(c)	(i)	War / famine / contraception / birth rate or death rate or longevity / natural disaster (or example) / disease or health care	3(2)
		(ii)	Better nutrition or better food distribution or better farming or improved food preservation techniques / new technology or improved living conditions / or improved medicine or improved hygiene	2(2)
		(iii)	Decrease or increase or stays the same	1
		(iv)	Reduce / reuse / recycle	3 (1)
		(v)	Any harmful addition to the environment	2
		(vi)	Decomposition (or explained)	2
		(vii)	1. <i>Plants:</i> absorb nitrates / synthesise protein / absorb CO ₂ / synthesise carbohydrate (or photosynthesise) / respire / die	3(2)
			2. <i>Animal:</i> consume plants / assimilate protein / assimilate. carbohydrate / produce nitrogenous waste / respire / die	3(2)

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