

Write your Examination Number here



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

LEAVING CERTIFICATE EXAMINATION, 2008

BIOLOGY - HIGHER LEVEL

THURSDAY, 12 JUNE - MORNING, 9.30 TO 12.30

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.

[OVER

Section A

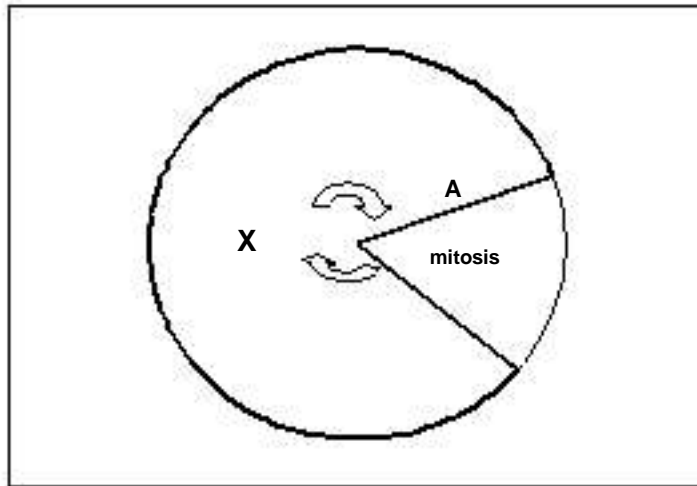
Answer any five questions.

Write your answers in the spaces provided.

1. Answer **five** of the following by filling in the blank spaces.

- (a) Biomolecules of the general formula $C_x(H_2O)_y$ are examples of
- (b) Give **two** functions of water in a living organism.
1.
2.
- (c) Is energy release a feature of anabolic or catabolic reactions?
- (d) How do fats differ from oils at room temperature?.....
- (e) Name the test or give the chemicals used to detect the presence of protein in a food sample
-
- (f) Name a structural polysaccharide

2. The diagram represents the cell cycle.



- (a) What stage of the cycle is represented by X?
- (b) Give the names of the two processes involving DNA which take place during stage X.
- 1..... 2
- (c) For convenience of study, mitosis is divided into four stages. List these in order starting at A.
-
- (d) In which of the stages of mitosis that you have listed in (c) would you expect to see the spindle fibres contracting?
- (e) Explain the term diploid number
-
- (f) What term is used to describe a group of disorders of the body in which cells lose the normal regulation of mitosis?

| | | | |
|----|-----|---|--|
| 1. | | 5(4) any FIVE points out of SEVEN | |
| | (a) | Carbohydrate or sugar or saccharide | |
| | (b) | solvent / transport / support / reaction medium/reactant / turgidity / reference to changing concentration / movement of sperm / temperature function or example | |
| | (c) | Catabolic | |
| | (d) | (fats are) solid or oils are liquid | |
| | (e) | Biuret or (sodium) hydroxide and copper sulfate or correct formulas | |
| | (f) | Cellulose | |

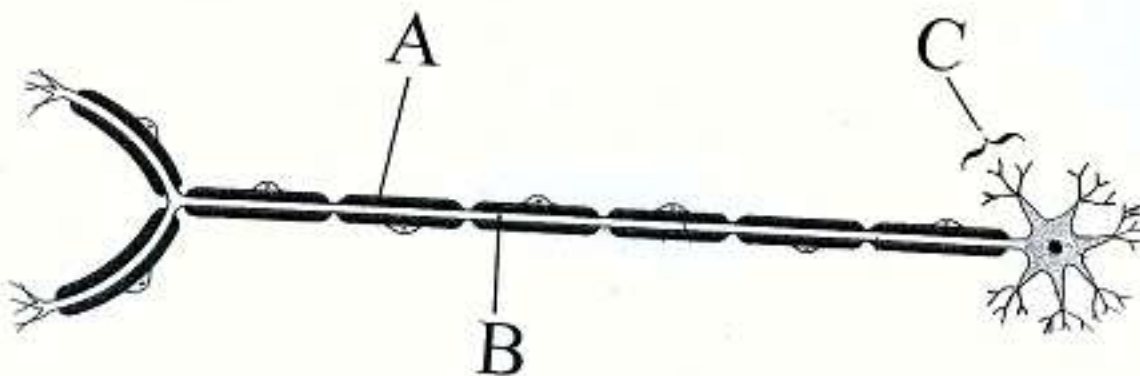
| | | | |
|----|-----|--|-----------|
| 2. | (a) | Interphase | 2 |
| | (b) | uncoiling / transcription / replication or duplication | 2(2) |
| | (c) | Prophase / metaphase / anaphase/ telophase correct order showing all four | 4(1) 4 |
| | (d) | anaphase or 3 stage | 2 |
| | (e) | <u>Chromosomes</u> in pairs (two sets of <u>chromosomes</u>) | 2 |
| | (f) | Cancer or named group of cancers or tumour | 2 |

3. Answer the following, which relate to the scientific method, by completing the blank spaces.

- (a) As a result of her observations a scientist may formulate a
 She will then progress her investigation by devising a series of
 and then carefully analysing the resulting
- (b) Why is a control especially important in biological investigations?
- (c) If a scientist wished to determine the effect of a certain herbicide on weed growth she would include a control in the investigation. Suggest a suitable control in this case.

- (d) The use of replicates is an important aspect of scientific research. What, in this context, are replicates?
- (e) Suggest where a scientist may publish the results of her investigations

4. The diagram shows a motor neuron.



- (a) Identify parts A, B and C.
 A..... B C.....
- (b) Give a function of A
- (c) Place an arrow on the diagram to show the direction of the impulse.
- (d) Give a function of C
- (e) Place an X on the diagram at a point at which a neurotransmitter substance is secreted.
- (f) What is the role of the motor neuron?

| | | | |
|----|-----|--|--|
| 3. | | 3(1) + 3(4) + 5 | |
| | (a) | Hypothesis | |
| | | Experiments | |
| | | data or information or findings or outcomes | |
| | (b) | for comparison or reference to (biological) variability | |
| | (c) | no herbicide or implied | |
| | (d) | repeat of experiment | |
| | (e) | (scientific) journal or named journal [<i>accept</i> Internet] | |

| | | | |
|----|-----|---|------|
| 4. | (a) | A = myelin sheath or Schwann cell B = myelin sheath or axon C = dendrite | 3(1) |
| | (b) | A: (myelin sheath) insulates or protection or speeds up impulse (message) | |
| | | A: (schwann cell) produces myelin (or sheath) or insulates or protection or speeds up impulse (message) | 3 |
| | (c) | arrow (right to left) or from dendrites towards cell body | 3 |
| | (d) | receives impulse or carries impulse (message) <u>to cell body</u> | 3 |
| | (e) | X on terminal dendrites on left | 3 |
| | (f) | receive or carry impulse (message) and to muscle or gland or effector or from CNS | 5,0 |

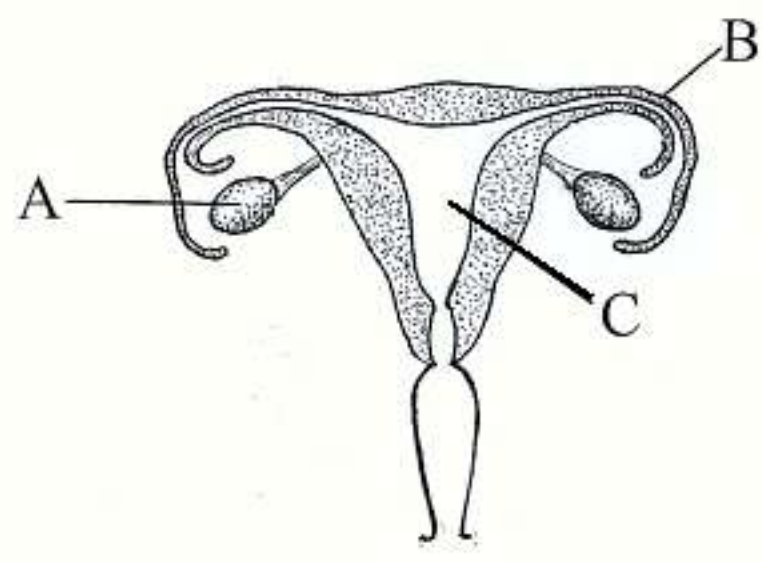
5. (a) Write a balanced equation on the line below to represent aerobic respiration.

 (b) The first stage of respiration takes place in the cytosol. What is the cytosol?

 (c) Does the first stage of respiration release a small or large amount of energy?
 (d) What is fermentation?

 (e) Where in the cell does the second stage of aerobic respiration take place?.....
 (f) Is oxygen required for the second stage of aerobic respiration?
 (g) Suggest a situation in which some cells in the human body may not be able to engage in the second stage of aerobic respiration.....

6. The diagram shows the female reproductive system.



- (a) Identify parts A, B and C.
 A
 B
 C
- (b) Using the letters X, Y and Z and arrows, identify each of the following on the diagram:
 endometrium (X), where fertilization normally occurs (Y), where meiosis occurs (Z).
- (c) Which part of the system is influenced by both FSH and LH?
- (d) Give **two** biological advantages of breastfeeding.
 1.....
 2.....

| | | | |
|----|-----|---|--|
| 5. | | 6(3) + 2 | |
| | (a) | $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+energy) | |
| | (b) | cytoplasm minus organelles (or structures or particles) or liquid part of cytoplasm | |
| | (c) | Small | |
| | (d) | anaerobic respiration or <u>respiration</u> that produces alcohol or <u>respiration</u> that produces lactic acid | |
| | (e) | Mitochondrion | |
| | (f) | Yes | |
| | (g) | lack of oxygen or exercise or restricted blood supply | |

| | | | |
|----|-----|---|------|
| 6. | (a) | A = ovary B = Fallopian tube (oviduct) C = uterus (womb) | 3(2) |
| | (b) | locations of X, Y, Z | 3(2) |
| | (c) | Ovary or A or follicle | 2 |
| | (d) | (transfer of) antibodies / balanced diet / bonding / contraception / correct temperature/ milk sterile / uterus recovers more quickly / reduced cancer risk / psychological wellbeing | 2(3) |

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) What is a habitat?
- (ii) What is an ecosystem?.....

(b) Answer the following questions by reference to a named ecosystem that you have investigated.

Name of ecosystem.....

(i) List **three** abiotic factors that you investigated.

1. 2. 3.

(ii) For each of the three abiotic factors that you have listed describe how you carried out the investigation.

Factor 1

.....
.....
.....
.....

Factor 2

.....
.....
.....
.....

Factor 3.....

.....
.....
.....
.....

(iii) In the case of a named organism give an adaptation feature that you noted.

Name of organism

Adaptation feature

.....
.....

(iv) Briefly explain how the adaptation feature that you have given in (iii) is of benefit to the organism.

.....
.....

| | | | | |
|----|-----|--------------------|--|------|
| 7. | (a) | (i) | (place) where organism (or species) lives | 3 |
| | | (ii) | organisms and their environment | 3 |
| | | | | |
| | (b) | name of ecosystem: | | 3 |
| | | (i) | any three abiotic factors | 3(1) |
| | | (ii) | how investigated (what used or how) | 3(3) |
| | | (iii) | organism name matching ecosystem | 3 |
| | | | adaptation feature matching organism | 3 |
| | | (iv) | benefit | 3 |

| | | | | |
|----|-----|-------|---|------|
| 8. | (a) | (i) | auxin or IAA or NAA or ethylene (ethene) | 3 |
| | | (ii) | auxin or IAA or NAA or abscisic acid or ethylene (ethene) | 3 |
| | | | | |
| | (b) | (i) | name of plant | 3 |
| | | (ii) | investigative procedure: different concentrations / add regulator to / part of plant / how added / replicates described / control described / suitable time reference | 4(3) |
| | | (iii) | safety precaution | 3 |
| | | (iv) | result of experiment and result of control or result of two different concentrations (or plant parts) | 6,0 |

| | | | | |
|----|-----|-------|--|-------------------|
| 9. | (a) | (i) | (pH at which enzyme) works best | 3 |
| | | (ii) | Loss of (enzyme) function (or activity) | 3 |
| | | | | |
| | (b) | (i) | name of enzyme | 3 |
| | | (ii) | name of substrate (must match if enzyme named) | 3 |
| | | (iii) | how activity measured (must match enzyme or match substrate) other procedures: how heated / how long / addition (of or to substrate) / control <u>described</u> / suitable condition or example (for both experiment and control) | 3 3(3) |
| | | (iv) | Result of experiment <u>and</u> result of control | 6,0 |

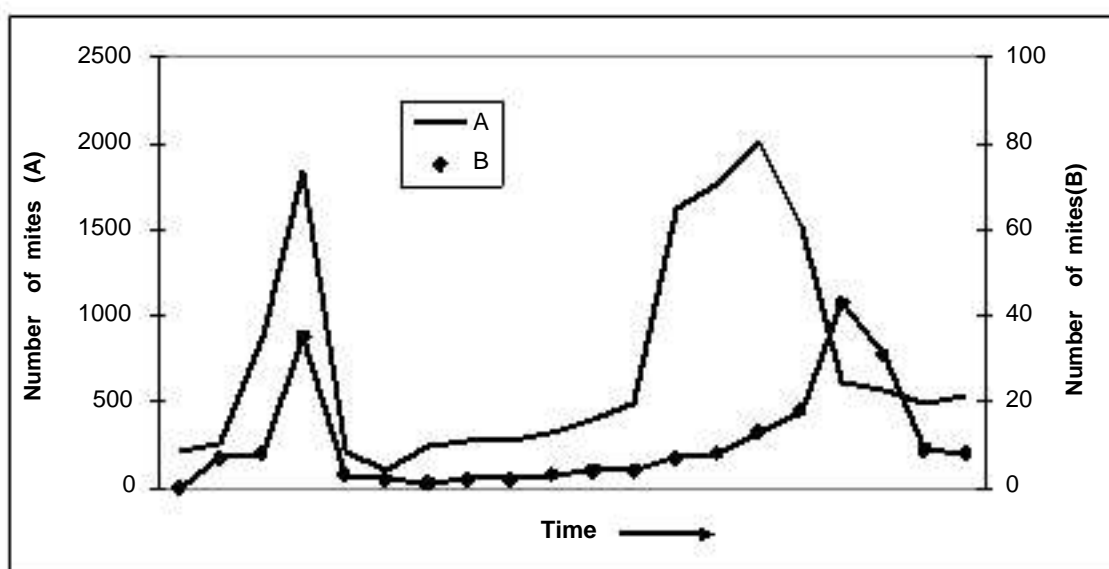
Section C

Answer **four** questions.

Write your answers in the answer book.

10. (a) (i) What does an ecologist mean by competition?
(ii) Distinguish clearly between contest competition and scramble competition. (9)

- (b) Read the following extract, study the graph below and answer the questions that follow.
"The application of pesticides to strawberry plants in an attempt to destroy cyclamen mites that were damaging the strawberries killed both the cyclamen mites and the carnivorous mites that preyed on them. But the cyclamen mites quickly re-invaded the strawberry fields while the mites that preyed on them returned much more slowly. The result was that the cyclamen mites rapidly increased in density and did more damage to the strawberries than if the pesticide had never been applied."
(Adapted from W.T. Keeton and J. L. Gould. *Biological Science*. New York: W.W. Norton & Co., 1993)

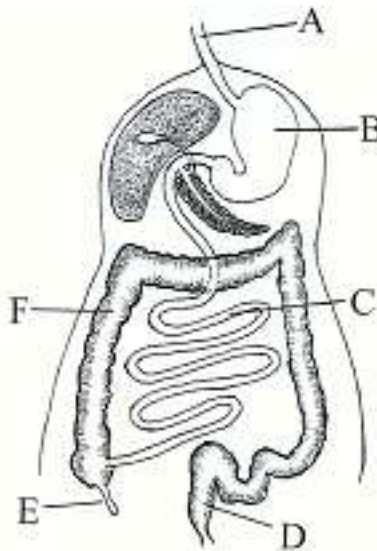


- (i) Which graph, A or B represents the carnivorous mites? Explain your answer.
(ii) What term is used to describe the relationship between the cyclamen mites and the carnivorous mites?
(iii) Suggest **two** reasons why the cyclamen mite managed to quickly re-invade the strawberry fields.
(iv) Suggest an alternative to the use of pesticides for controlling the cyclamen mite population.
(v) Draw a pyramid of numbers to include each of the organisms mentioned in the extract above.
(vi) Apart from competition and the factor illustrated in the above example, state another factor that limits population growth. (27)
- (c) (i) Waste management is a matter of growing concern in Ireland as the population expands. Outline **three** problems associated with waste disposal.
(ii) Give an example of waste produced in agriculture or fisheries or forestry and describe how it is managed.
(iii) Suggest **two** methods of waste minimisation.
(iv) Give one example of the use of micro-organisms in waste management. (24)

| | | | | |
|-----|-----|-------|---|--------|
| 10. | (a) | (i) | struggle between organisms (animals or plants) for resource or for named resource (in short supply) | 3 |
| | | (ii) | (contest) - one organism loses the resource and (scramble) - each organism gets some of resource | 6 |
| | | | | |
| | (b) | (i) | B smaller numbers or B peak occurs after A peak | 3 3 |
| | | (ii) | predator-prey (relationship) or predation | 3 |
| | | (iii) | reduced competition / predator eliminated or reduced / food available / development of resistance (to pesticide) / immigration | 2(3) |
| | | (iv) | biological control or genetically modified (GM) plant or example or crop rotation or example | 3 |
| | | (v) | Pyramid: strawberry plants at base cyclamen mites and carnivorous mites in correct order and shape | 3 3 |
| | | (vi) | disease or parasitism or food availability or pollution or other valid named factor | 3 |
| | | | | |
| | (c) | (i) | disease / pollution / toxins / smell / unsightly / other valid named problem | 3(3) |
| | | (ii) | waste described or named matched management described | 3 3 |
| | | (iii) | reduce consumption / reduce packaging / recycle / reuse | 2(3) |
| | | (iv) | landfill sites / sewage treatment plants / digesters / compost heaps | 3 |

11. (a) Explain the following terms which are used in genetics: homozygous, recessive, phenotype. (9)
- (b) In the fruit fly, *Drosophila*, the allele for grey body (**G**) is dominant to the allele for ebony body (**g**) and the allele for long wings (**L**) is dominant to the allele for vestigial wings (**l**). These two pairs of alleles are located on different chromosome pairs.
- (i) Determine all the possible genotypes and phenotypes of the progeny of the following cross: grey body, long wings (heterozygous for both) X ebony body, vestigial wings.
- (ii) What is the significance of the fact that the two allele pairs are located on different chromosome pairs? (27)
- (c) Haemophilia in humans is governed by a sex-linked allele. The allele for normal blood clotting (**N**) is dominant to the allele for haemophilia (**n**).
- (i) What is meant by sex-linked?
- (ii) Determine the possible genotypes and phenotypes of the progeny of the following cross: haemophilic male X heterozygous normal female. (24)
12. (a) (i) Distinguish between mechanical and chemical digestion.
- (ii) Name a structure in the human digestive system, other than teeth, which is involved in mechanical digestion. (9)

- (b) The diagram shows the human digestive system.



- (i) Name the parts A, B, C, D, E and F.
- (ii) Describe **two** functions of bile in relation to digestion.
- (iii) Answer the following in relation to a lipase:
1. Where is it secreted?
 2. Where does it act?
 3. What is the approximate pH at its site of action? (27)
- (c) (i) What are symbiotic bacteria?
- (ii) Give **two** activities of symbiotic bacteria in the human digestive system.
- (iii) Name the part(s) of the digestive system in which the following are absorbed into the blood.
1. the products of digestion,
 2. water.
- (iv) Name a process involved in the passage of the products of digestion into the blood.
- (v) Explain how the structure that you have named in (iii) 1. is adapted for the absorption of the products of digestion. (24)

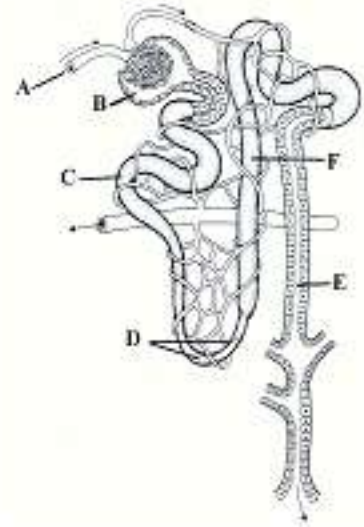
[OVER

| | | | | |
|-----|-----|------|---|------|
| 11. | (a) | | homozygous: identical alleles [<i>accept</i> identical genes] | 3 |
| | | | recessive: allele whose expression is masked by dominant allele | 3 |
| | | | phenotype: physical appearance or expression of genotype | 3 |
| | | | or result of genotype + environment | |
| | (b) | (i) | * GgLl / Ggll / ggLl / ggll | 4(3) |
| | | | grey, long / grey, vestigial / ebony, long /ebony, vestigial | 4(3) |
| | | (ii) | they assort independently or greater variation | 3 |
| | (c) | (i) | located on sex- chromosome or on X- chromosome or on Y-chromosome | 4 |
| | | (ii) | * $X^N X^n / X^n X^n / X^N Y / X^n Y$ | 4(3) |
| | | | normal (carrier) female/haemophilic female/ normal male/haemophilic male | 4(2) |

| | | | | |
|-----|-----|-------|---|------|
| 12. | (a) | (i) | mechanical: | 3 |
| | | | physical or grinding or cutting or churning or chewing or emulsifying | |
| | | | | (ii) |
| | | | enzyme or acidic action or molecular breakdown | 3 |
| | | | tongue or oesophagus or stomach or small intestine or named part of small intestine | 3 |
| | (b) | (i) | A = oesophagus B = stomach C = small intestine or ileum D = rectum E = appendix F = large intestine or colon | 6(2) |
| | | (ii) | emulsification or explained | 3 |
| | | | neutralisation or raises pH or makes alkaline | 3 |
| | | (iii) | 1. pancreas [<i>allow</i> duodenum] | 3 |
| | | | 2. duodenum or small intestine or ileum | 3 |
| | | | 3. 7 - 9 inclusive | 3 |
| | (c) | (i) | (bacteria that) live in (or on) another organism involving benefit | 6 |
| | | (ii) | digestion / production of vitamins / benefit immune system / compete with other micro-organisms [<i>allow</i> one reference to harmful activity] | 2(3) |
| | | (iii) | 1. ileum or villi [<i>allow</i> duodenum or small intestine] | 3 |
| | | | 2. Colon [<i>allow</i> any named part from stomach onwards] | 3 |
| | | (iv) | diffusion or passive transport | 3 |
| | | (v) | large surface area (folding) or good blood supply or lymph supply or (lining) one cell thick or long or villi or microvilli | 3 |

13. (a) (i) What is meant by excretion?
(ii) Urea and carbon dioxide are excretory products of the human body. In the case of each product name a substance from which it is derived. (9)
- (b) The diagram shows the structure of a nephron and its associated blood supply.

- (i) Name the parts A, B, C, D, E and F.
(ii) From which blood vessel is A derived?
(iii) Where in the kidney is B located?
(iv) Give the part of the nephron in which each of the following takes place:
1. filtration, 2. reabsorption of amino acids.
(v) Give **two** features of the nephron that aid filtration.
(vi) Name a group of biomolecules in the blood which are too large to pass through the filtration system of the nephron. (27)



- (c) (i) Suggest **two** situations which may result in a drop in the water content of the blood.
(ii) When the water content of the blood drops a hormone is released. Name this hormone and the endocrine gland from which it is secreted.
(iii) Give a precise target area for this hormone. How does the hormone reach the target area?
(iv) Explain the role of the hormone at its target area, when the water content of the blood is low. (24)

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

- (a) (i) Name the openings in the leaf which allow the entry of carbon dioxide for photosynthesis. State a factor which influences the diameter of these openings.
(ii) During photosynthesis oxygen is produced.
1. From what substance is oxygen produced?
2. In which stage of photosynthesis is oxygen produced?
3. Give **two** possible fates of oxygen following its production.
(iii) Give an account of the role of each of the following in photosynthesis:
1. ATP, 2. NADP.
- (b) (i) DNA is made of units called nucleotides. Draw a labelled diagram of a nucleotide to show its three constituent parts.
(ii) Which of the labelled parts in your diagram in (i) may vary from nucleotide to nucleotide?
(iii) The genetic code is contained within the DNA of chromosomes. Briefly describe the nature of this code.
(iv) What is meant by non-coding DNA?
(v) Give **one** structural difference between DNA and RNA.
(vi) Name a cell organelle, apart from the nucleus, in which DNA is found.
- (c) (i) Draw a large labelled diagram of a transverse section through a young root.
(ii) Water enters the outermost cells of the root by osmosis. What does this tell you about the cell sap of these outermost cells?
(iii) Osmosis has been described as a special case of diffusion. Explain why.
(iv) Describe an investigation that you carried out to demonstrate osmosis.
(v) Describe how minerals such as nitrates enter the root of a plant from the soil.

| | | | | |
|-----|-----|-------|--|--------|
| 13. | (a) | (i) | elimination of waste products of metabolism or explained | 3 |
| | | (ii) | Urea: protein or amino acid carbon dioxide: carbohydrate or named example or fat or named example of fat or fatty acids | 3 3 |
| | (b) | (i) | A = arteriole B = Bowman's capsule C = proximal tubule D = Loop of Henle E = collecting duct F = distal tubule or Loop of Henle | 6(1) |
| | | (ii) | renal artery or renal arteriole | 3 |
| | | (iii) | *cortex | 3 |
| | | (iv) | 1. Bowman's capsule or glomerulus or B 2. proximal tubule or C | 3 3 |
| | | (v) | large surface area / porous capillary walls/ (lining) one cell thick / efferent arteriole narrower than afferent arteriole or arterioles in arteriole out or arteriole to capillary network NB not more than one arteriole point. | 2(3) |
| | | (vi) | proteins or named group of proteins | 3 |
| | (c) | (i) | infection / hot conditions or perspiration or exercise / high salt intake / low water intake / diuretic(s) | 2(3) |
| | | (ii) | *ADH (vasopressin) *pituitary | 3 3 |
| | | (iii) | distal tubule or collecting duct in the blood | 3 3 |
| | | (iv) | (makes walls) <u>more</u> permeable (resulting in) <u>more</u> absorption of water | 6 |

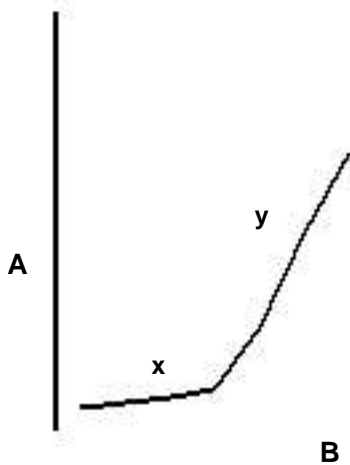
| | | | | |
|-----|---------------------------------|-------|--|------------------|
| 14. | Any two of (a), (b), (c) | | | (30, 30) |
| | (a) | (i) | Stomata light or CO ₂ or potassium ions (K ⁺) or wind or turgidity of guard cells or water availability or high temperature | 3 3 |
| | | (ii) | 1. water 2. light (dependent) stage 3. respiration 3. (diffuses) to atmosphere | 3 3 3 3 |
| | | (iii) | 1. provides or stores energy / reduction of CO ₂ or glucose formation or for dark stage 2. accepts electrons / hydrogen carrier / for the dark stage or glucose formation or for dark stage | 2(3) 2(3) |
| | (b) | (i) | Diagram labels: deoxyribose or ribose, phosphate, base or named base | 3 3(2) |
| | | (ii) | Base or named base | 3 |
| | | (iii) | three bases (triplet or codon) / in sequence / (codes for) one amino acid / (base or triplet or codon) sequence / codes for protein | 3(3) |
| | | (iv) | does not code for a protein or for RNA [allow not part of the genetic code or explained] | 3 |
| | | (v) | (DNA) contains thymine or RNA contains uracil | 3 |
| | | (vi) | Mitochondrion or chloroplast | 3 |
| | (c) | (i) | Diagram Labels: dermal tissue, ground tissue, vascular tissue [<i>accept</i> xylem or phloem for vascular] | 3,0 3(2) |
| | | (ii) | lower water concentration or higher solute concentration | 3 |
| | | (iii) | movement of water (solvent) / along concentration gradient / through a selectively permeable membrane | 2(3) |
| | | (iv) | membrane or plant tissue / 2 solutions indicated / different concentrations / result | 3(3) |
| | | (v) | diffusion or passive transport | 3 |

15. Answer any **two** of (a), (b) and (c).

(30, 30)

- (a) Answer the following questions in relation to the human musculoskeletal system.
- (i) Give **three** roles of the skeleton.
 - (ii) Explain what is meant by the axial skeleton.
 - (iii) Give a function for each of the following:
1. Red marrow, 2. Cartilage, 3. Tendon.
 - (iv) Explain what is meant by an antagonistic muscle pair and give an example in the human body.
 - (v) Suggest a treatment for a named disorder of the musculoskeletal system.
- (b) Just over fifty years ago the myxoma virus was brought to Ireland. The disease for which it is responsible in rabbits, myxomatosis, quickly decimated the wild population. Now, however, the disease is much less common and is responsible for far fewer deaths.
- (i) Why do you think that the rabbit population was decimated when the myxoma virus was first brought to Ireland?
 - (ii) Suggest a reason why myxomatosis is no longer a major threat to the Irish rabbit population.
 - (iii) The use of one species to control the population of another species is called biological control. Suggest **one** advantage and **one** disadvantage of biological control.
 - (iv) The human immunodeficiency virus (HIV) is responsible for AIDS in the human population. Would you expect a similar trend to that shown by myxomatosis as time passes? Explain your answer.
 - (v) Outline briefly how a virus replicates (reproduces).

(c) The diagram shows a bacterial growth curve.



- (i) **A** and **B** represent the labels on the axes. What does each of them stand for?
- (ii) What term is applied to the part of the curve labelled **x**? What is happening during **x**?
- (iii) What term is applied to the part of the curve labelled **y**? What is happening during **y**?
- (iv) Copy the diagram into your answer book and continue the curve to show the next phase. Explain why you have continued the curve in this way.
- (v) Distinguish between batch and continuous flow food processing using micro-organisms in the food industry.

| | | | | |
|-----|---------------------------------|-------|---|-------------|
| 15. | Any two of (a), (b), (c) | | (30, 30) | |
| | (a) | (i) | support / movement / protection / anchorage for muscle / gives shape / blood production | 3(3) |
| | | (ii) | vertebral column and skull (and rib cage) | 3 |
| | | (iii) | 1. formation of blood cells 2. protection (absorbs shock) or reduces friction or allows bone elongation 3. joins muscle to bone | 3 3 3 |
| | | (iv) | pair of muscles that have opposite effects or explained biceps and triceps or other example | 3 3 |
| | | (v) | treatment of named disorder | 3 |
| | (b) | (i) | no immunity in population / suitable vectors (e.g. fleas) / rapid spread or high population | 2(3) |
| | | (ii) | natural immunity or Natural Selection or virus mutated | 3 |
| | | (iii) | advantage: environmentally friendly or specific or (may be) inexpensive disadvantage: upsets balance of nature (or described e.g. predator population will fall when prey becomes scarce allowing prey to increase again or introduced species may become a pest or predator may change to a different prey) or (may be) expensive. [Note: <i>allow</i> only one cost point] | 3 3 |
| | | (iv) | Yes + plausible answer or No + plausible answer | 6 |
| | | (v) | attaches to (host) cell / introduces nucleic acid (DNA or RNA) / (host) DNA inactivated / viral DNA or RNA replicated / using resources of host cell / protein coat formed / assembly (of virus) | 3(3) |
| | (c) | (i) | A = population (size) of or number (of bacteria) B = time | 3 3 |
| | | (ii) | X = lag (phase) adapting to environment or low reproductive rate | 3 3 |
| | | (iii) | log or exponential (phase) reproducing rapidly | 3 3 |
| | | (iv) | <u>curve</u> showing flattening or falling reproduction slows or some limiting factor mentioned or toxin builds up or space limitations | 3 3 |
| | | (v) | (batch) fixed amount of nutrients added at beginning or (bioreactor) emptied at end of production and (continuous) nutrients continuously fed into bioreactor or product removed continuously | 6 |

Blank Page