

Write your Examination Number here



Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2006

BIOLOGY - HIGHER LEVEL

TUESDAY, 13 JUNE - AFTERNOON, 2.00 TO 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.

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Section A

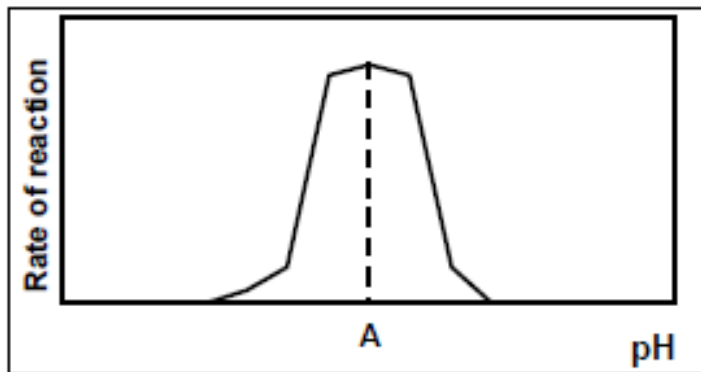
Answer any **five** questions. Each question carries **20** marks.
Write your answers in the spaces provided.

1. Answer **five** of the following by filling in the blank space.
- (a) In the human diet zinc, iron and copper are examples of
 - (b) The walls of xylem vessels are reinforced with
 - (c) Where in a cell would you expect to find phospholipids?
 - (d) Vitamin is an example of a water-soluble vitamin.
 - (e) Name a disorder associated with a deficiency of the vitamin that you have named in (d) or of another **named** vitamin in the human diet
 - (f) What are the final products of the digestion of a protein?
2. Answer the following questions in relation to your study of ecology.
- (a) What is the biosphere?
.....
.....
 - (b) What is meant by a qualitative survey?
 - (c) Construct a grazing food chain containing at least four trophic levels in the space below.
 - (d) In your food chain in (c) identify each of the following.
 - 1. A predator
 - 2. A producer
 - 3. A secondary (second order) consumer
 - 4. A primary (first order) consumer

1.	<i>any five</i>		5(4)
	(a)	minerals or trace elements or inorganic nutrients	
	(b)	lignin	
	(c)	membrane or named membrane	
	(d)	Vitamin C or ascorbic acid / Vitamin B or named	
	(e)	correctly matched disorder	
	(f)	amino acid - [<i>accept peptide</i>]	

2.			
	(a)	where life can exist or all the ecosystems of the earth [<i>must not define habitat</i>]	4
	(b)	descriptive (survey) / species, or organisms, or types, present or implied	4
	(c)	food chain with four organisms	4
	(d)	predator / producer / secondary consumer / primary consumer	4(2)

3. The graph shows how the rate of reaction of a carbohydrate-digesting enzyme in the human alimentary canal varies with pH.



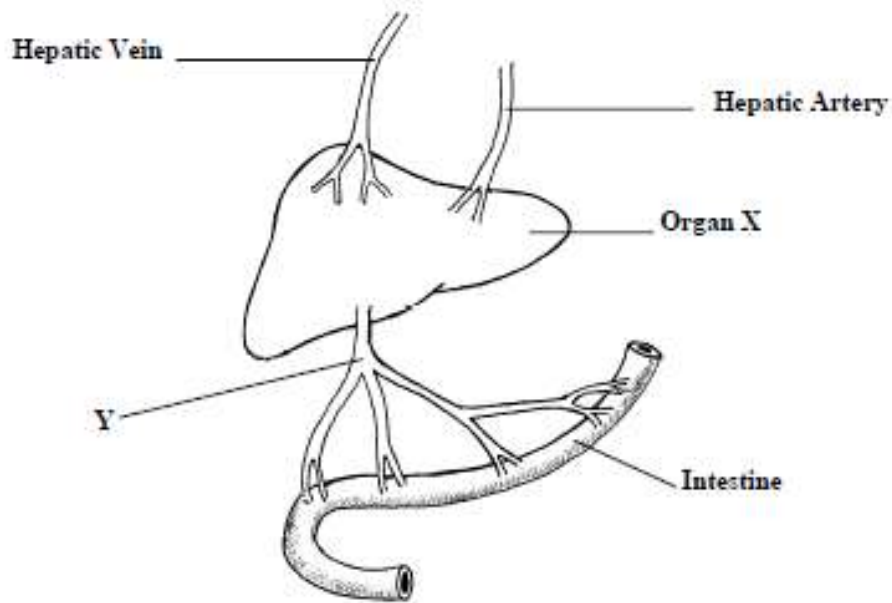
- (a) Name a carbohydrate-digesting enzyme in the human alimentary canal
- (b) Where in the alimentary canal does this enzyme act?
- (c) State the enzyme's product (s)
- (d) What is the pH at A?
- (e) A is said to be the enzyme'spH
- (f) Suggest a temperature at which human enzymes work best.....
- (g) What term best describes the shape of an enzyme?.....
4. (a) What is the first stage process of respiration called?
- (b) In this first stage there is a release of ATP as glucose is converted to another substance.
Name this other substance
- (c) To what is the substance you have named in (b) converted under anaerobic conditions in:
1. Yeast?
 2. A human muscle cell?.....
- (d) Under aerobic conditions the substance that you have named in (b) is converted to an acetyl group and in the process a small molecule is released.
Name this small molecule.
- (e) The acetyl group now enters a cycle of reactions.
What name is given to this cycle?
- (f) Where in the cell does this cycle take place?

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3.		6(3)+2
	(a) amylase [<i>accept any correct enzyme</i>]	
	(b) mouth / small intestine or named part	
	(c) matching carbohydrate product	
	(d) pH 7 - 9	
	(e) optimum	
	(f) 35 °C - 40 °C	
	(g) folded or described	

4.		6(3)+2
	(a) glycolysis	
	(b) pyruvic acid or pyruvate	
	(c) 1. ethanol 2. lactic acid or lactate	
	(d) carbon dioxide	
	(e) Krebs or citric acid or tricarboxylic acid (cycle)	
	(f) Mitochondrion	

5. Study the diagram and then answer the following questions.



- (a) Name X and Y
 X Y
- (b) Place arrows on Y, the hepatic artery and the hepatic vein to indicate the direction of blood flow.
- (c) State the precise location of organ X in the human body
- (f) State a role that organ X plays in the digestive process

6. Distinguish between the members of each of the following pairs by making a brief comment on each.

- (a) Tuber and bulb
- (b) Ureter and urethra
- (c) Hypha and mycelium
- (g) Thigmotropism and chemotropism
- (e) Antigen and antibody

5.			6(3)+2
	(a)	X: liver Y: (hepatic) portal vein or portal system	
	(b)	Arrow 1 – Arrow 2 – Arrow 3 –	
	(c)	upper abdomen or under diaphragm or correctly related to stomach	
	(d)	(produces) bile or emulsification or (produces) NaHCO ₃ or neutralizes acid	

6.			5(2+2)
	(a)	<i>tuber</i> : stem or root [2 for all who attempt question] <i>bulb</i> : leaf or bud	
	(b)	<i>ureter</i> : from kidney or to bladder <i>urethra</i> : from bladder or to outside	
	(c)	<i>hypha</i> : a filament or described <i>mycelium</i> : a mass of hyphae or described	
	(d)	<i>thigmotropism</i> : a growth or response to touch <i>chemotropism</i> : a growth or response to substances or chemicals	
	(e)	<i>antigen</i> : substance on cell membrane or surface of virus or bacteria or causes antibody production or foreign substance <i>antibody</i> : produced in response to antigen or destroys antigen or defence protein or produced by lymphocytes	

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) State a use of each of the following in the biology laboratory.
- (i) Biuret test (copper sulphate and sodium hydroxide solutions).....
.....
 - (ii) Benedict's (or Fehling's) test
.....
- (b) In the case of each of the following state:
- 1. An investigation in which you used it,
 - 2. The precise purpose for its use in the investigation that you have indicated.
- (i) IAA
1.....
2.....
.....
.....
 - (ii) Starch or skimmed milk agar plates.
1.....
2.....
.....
.....
 - (iii) Cold alcohol (ethanol)
1.....
2.....
.....
.....
 - (iv) Alkaline pyrogallol or anaerobic jar
1.....
2.....
.....
.....

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7.			
	(a)	(i)	(for) protein
		(ii)	(for) reducing sugar or named
	(b)	(i)	1. investigate effect on plant growth 2. to determine its effect on growth
		(ii)	1. digestive or other enzyme activity [accept culturing leaf yeasts or micro-organisms or bacteria] 2. supplies substrate or explained [accept medium]
		(iii)	1. isolation of DNA 2. to separate DNA
		(iv)	1. to investigate conditions for germination 2. to remove oxygen [accept 'without oxygen']

8. (a) State a function of each of the following components of a cell.
- (i) Ribosome.....
 - (ii) Cell membrane.....
- (b) Answer the following questions in relation to the preparation, staining and microscopic observation of a slide of an animal cell.
- (i) What type of animal cell did you use?.....
How did you obtain the cell?
 - (ii) Name the stain that you used
 - (iii) Describe how you applied the stain
 - (iii) After staining, a cover slip is placed on the slide. Give a reason for this
 - (iv) How did you apply the cover slip?.....

Why did you apply it in this way?
.....
 - (v) Describe the difference in colour or depth of colour, if any, between the nucleus and cytoplasm when the stained cell was viewed under the microscope.
.....

8.			
	(a)	(i)	protein synthesis
		(ii)	selectively permeable or explained or containment or antigenicity or 'barrier' qualified or has receptors
	(b)	(i)	type of cell how obtained
		(ii)	name of stain – methylene blue how applied
		(iii)	to prevent drying out or to protect lens or easier to view or keeps cells in place
		(iv)	at an angle or described to prevent trapping air or bubbles
		(v)	cytoplasm paler or nucleus darker or nucleus blue

9. (a) (i) What is meant by the term 'fauna'?.....
- (ii) In ecological studies what is a key?
- (b) (i) Name **five** plants in the ecosystem that you have studied.
1.
 2.
 3.
 4.
 5.
- (ii) In the space below draw up a simple key which could be used to identify each of these plants.

- (iii) Name **five** animals in the ecosystem that you have studied.
1.
 2.
 3.
 4.
 5.
- (iv) In the space below draw up a simple key which could be used to identify each of these animals.

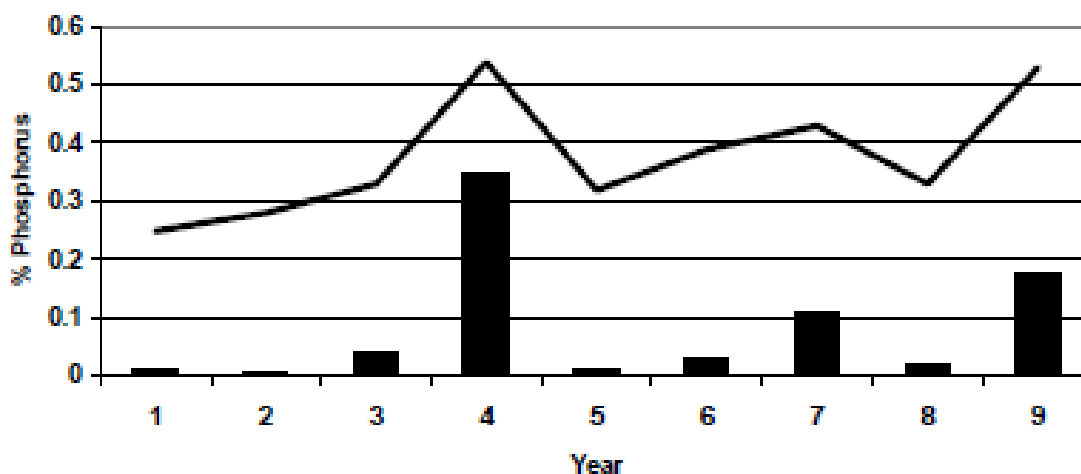
9.			
	(a)	(i)	animals
		(ii)	a guide to identification or explained
	(b)	(i)	five plants
		(ii)	reasonable attempt at key design [or distinguishing features shown or stated 5(1)]
		(iii)	five animals
		(iv)	reasonable attempt at key design [or distinguishing features shown or stated 5(1)]

Section C

Answer any **four** questions.

Write your answers in the answer book.

10. (a) The figure below shows the relative sizes of a lemming population (histogram or bars) and the percentage phosphorus in forage (curve) over a number of years.



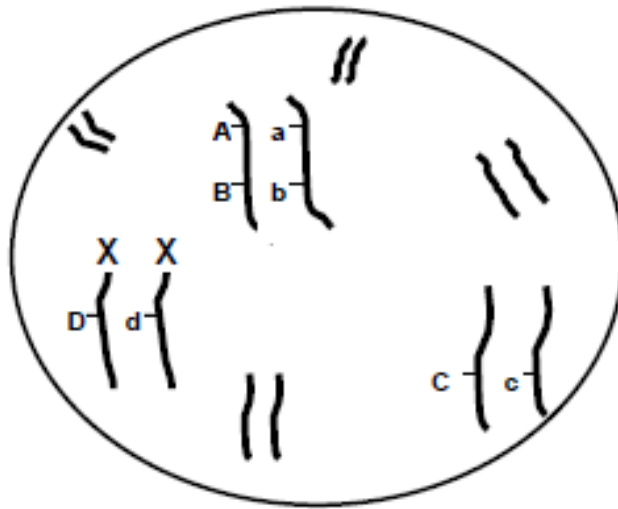
- (i) What relationship is indicated between the percentage of phosphorus in forage and the size of the lemming population?
- (ii) Suggest an explanation for this relationship. (9)
- (b) Describe how you carried out a quantitative survey of a **named** animal in the ecosystem that you have studied. (27)
- (c)
- (i) Explain what is meant by pollution.
- (ii) Give an account of the effects of a **named** pollutant of domestic, agricultural or industrial origin.
- (iii) Describe **one** way in which the pollution that you have indicated in (ii) might be controlled.
- (iv) Outline the problems associated with the disposal of waste. Suggest **two** ways of minimising waste. (24)
11. (a)
- (i) What is the primary role of chlorophyll in photosynthesis?
- (ii) Write an equation to summarize photosynthesis. (9)
- (b) The second stage of photosynthesis is called the dark stage or light-independent stage.
- (i) Why is the dark stage given the alternative name of the light-independent stage?
- (ii) Name a gas that is essential for the dark stage.
- (iii) Two products of the light stage are vital for the dark stage. Name each of them.
- (iv) State the precise role in the dark stage of each of the substances that you named in (iii).
- (v) To what group of biomolecules do the main products of the dark stage belong? (24)
- (c)
- (i) Water is essential for photosynthesis. Briefly outline how water from the soil reaches the leaf.
- (ii) What happens to water molecules when they reach the sites of photosynthesis? (27)

10.				
	(a)	(i)	lemmings increase as phosphorus increases lemmings decrease as phosphorus decreases (or phosphorus increases lemmings increase/ phosphorus decreases as lemmings decrease) [<i>population proportional to phosphorus = 6</i>]	3 3
		(ii)	(forage) more nutritious with increased phosphorus / P allows increased survival rate / P allows increased reproductive rate / P important for energy or protein or named structure, or molecule, or process / lemmings releasing phosphorus / dietary requirement	3
	(b)		named animal <i>METHOD</i> matched ecosystem / capture / how / count / mark or tag / how/ release / where/ recapture / count marked ones / formula or calculation shown OR matched ecosystem / chose area or transect / quadrat / type / size or length of line / at random or stations / how or where / count or note presence / several times / calculation / how result expressed <i>any eight</i>	3 8(3)
	(c)	(i)	harmful addition to the environment	3
		(ii)	name effect of named pollutant	3 3
		(iii)	matching control	3
		(iv)	<i>problems</i> – may be toxic/ non-biodegradable/ pollute groundwater/ no land-fill available / costly / incineration (causes toxins) /valid example <i>any two</i> <i>minimising</i> – reduce or example(s) or recycle or example(s) or re-use or example(s) <i>any two</i>	2(3) 2(3)

11.				
	(a)	(i)	traps or uses light or explained	3
		(ii)	balanced equation (<i>one error = 3</i>)	6, 3, 0
	(b)	(i)	light not required	3
		(ii)	CO ₂	3
		(iii)	NADPH ₍₂₎ ATP	3 3
		(iv)	NADPH ₍₂₎ : supplies hydrogen or mention of reduction or e ⁻ ATP: supplies energy	3 3
		(v)	monosaccharides or polysaccharides or carbohydrates	6
	(c)	(i)	concentration gradient /root hair / osmosis / cell to cell / root pressure// xylem / cohesion or explained / adhesion or capillarity or explained / Dixon and Joly / transpiration or evaporation [<i>accept</i> <i>water loss</i>] / tension <i>any six</i>	6(3)
		(ii)	photolysis or split Protons or H ⁺ / electrons / oxygen	3 2(3)

12. (a) (i) Explain the following terms as used in genetics: species, variation. (9)
(ii) Give **one** cause of genetic variation.

- (b) The diagram shows some of the chromosomes in the nucleus of a cell taken from a small mammal.



- (i) What is the sex of this individual?
(ii) How many loci are marked in the diagram?
(iii) "A is linked to B but not to C". Is this statement correct? Explain your answer.
(iv) Is D linked to d? Explain your answer.
(v) What term is used to describe the allele pair Dd?
(vi) Draw a diagram, similar to the one above, but in which A, B, and C are homozygous and the cell is taken from an individual of the opposite sex. (27)
- (c) Give an account of the Theory of Natural Selection. Name the scientists who are associated with the theory and refer to any **one** observation that prompted its development. (24)

13. (a) (i) State a precise location in the human body at which red blood cells are made.
(ii) State **two** ways in which red blood cells differ from typical body cells e.g. from the cheek lining. (9)

- (b) Use your knowledge of the human vascular and excretory systems to answer the following.
(i) Explain the terms, plasma, glomerular filtrate.
(ii) Explain why red blood cells are normally absent from glomerular filtrate.
(iii) The concentration of glucose is the same in plasma and glomerular filtrate. Why is this?
(iv) Why is glucose normally absent from urine?
(v) Following a period of heavy exercise an athlete may produce only a small volume of concentrated urine. Explain this observation and give an account of the process that concentrates the urine. (27)

- (c) (i) Describe the structure of the lymphatic system.
(ii) Give an account of **three** functions of the lymphatic system. (24)

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12.			
	(a)	(i)	<i>species</i> : interbreeding results in fertile offspring <i>variation</i> : difference between members of species or population
		(ii)	sexual reproduction / meiosis / mutation or agent
	(b)	(i)	female
		(ii)	4 [<i>accept 8</i>]
		(iii)	Yes (<i>stated or implied</i>) A and B on the same chromosome or A and C not on same chromosome
		(iv)	No (<i>stated or implied</i>) explained
		(v)	heterozygous
		(vi)	<i>diagram</i> : XY chromosomes AA, BB, CC
	(c)		<i>account</i> : high reproductive rate / variation / example / competition / survival / of the fittest / breeding / offspring survive/ traits passed on / those without advantage die out <i>any five</i> Darwin Wallace <i>one observation</i> : large numbers of offspring / low survival / populations constant / variation in offspring / specific example
			5(3) 3 3 3

13.			
	(a)	(i)	marrow or named bone e.g. skull/ribs/long bones/sternum
		(ii)	no nucleus / haemoglobin / shape comment / size comment / / no mitochondria / carries oxygen or CO ₂ <i>any two</i>
	(b)	(i)	<i>plasma</i> : liquid part of blood <i>glomerular filtrate</i> : (plasma) that has entered Bowman's capsule or has left the glomerulus or plasma less proteins
		(ii)	too big (to pass into Bowman's capsule)
		(iii)	(glucose) small or passes through
		(iv)	reabsorbed or explained
		(v)	sweating or water loss or dehydration / blood volume drops or concentration increases /detected by receptors / brain alerted / ADH secreted / from pituitary / (stimulates) reabsorption of water/ in distal tubule or collecting duct <i>any four</i>
	(c)	(i)	(lymph) nodes / (lymph) vessels
		(ii)	transport / defence / fluid collection / (transport) of fats / (transport) of hormones / (transport) of excretory matter / nodes filter / bacteria or pathogens / produce lymphocytes or antibodies / returns fluid to blood / absorbs fat / at lacteals / <i>any six</i>
			2(3) 2(3) 3 3 3 3 4(3) 2(3) 6(3)

14.

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

(30, 30)

- (a) Answer the following in relation to sexual reproduction in flowering plants.
- State a role for each of the following: sepal, anther, stigma, ovary.
 - Distinguish between pollination and fertilization.
 - The two male gametes in the pollen tube are derived from the generative nucleus. Do these gametes form as a result of mitosis or meiosis? Explain your answer.
 - Describe the fate of each of the male gametes.
 - State **one** method that is used to produce seedless fruits.
- (b)
- What is a neuron?
 - Distinguish between sensory, motor and interneurons (association neurons).
 - Briefly explain the role of neurotransmitter substances.
 - State a function for 1. Schwann cells, 2. Myelin sheath.
 - In relation to Parkinson's disease or paralysis give;
 - A possible cause,
 - A method of treatment.
- (c) The diagram shows part of a transverse section through a dicotyledonous stem.



- Copy the diagram into your answer book and identify each of the following by placing the appropriate letter on your diagram:
phloem P, ground tissue G, xylem X, dermal tissue D.
- In which of the tissues that you have identified are sugars mainly transported?
- State a function of D.
- In the course of your practical work you cut and observed a transverse section of a stem. Answer the following in relation to that procedure.
 - What did you use to cut the section?
 - How did you support the stem while you were cutting the section?
 - How did you transfer the section to a microscope slide?
- State one way in which a transverse section through a monocotyledonous stem differs from the one that you cut.

14.	ANY TWO PARTS			
	(a)	(i)	<i>sepal:</i> protection / photosynthesis / attracts insects 3	
			<i>anther:</i> pollen - production or storage or release) 3	
			<i>stigma:</i> receives pollen 3	
			<i>ovary:</i> produces or contains ovule or embryo sac or female gametes/ becomes fruit / site of fertilisation 3	
			(ii) <i>Pollination v fertilisation:</i> transfer (of pollen) versus fusion 3	
	(iii)	mitosis 3		
		from haploid (generative nucleus) or chromosome number retained or two (daughter cells) produced 3		
	(iv)	one fuses with "egg" (nucleus) 3		
		other fuses with (primary) endosperm nucleus or polar nuclei 3		
	(v)	growth regulator / selective propagation 3		
	(b)	(i)	nerve cell 3	
			(ii)	sensory: towards CNS or named part or from receptor or structural feature 3
				<i>motor:</i> away from CNS or named part or to effector or structural feature 3
				<i>inter:</i> links two neurons 3
			(iii)	carries impulse / across synaptic cleft / triggers impulse in next neuron 2(3) <i>any two</i>
	(iv)	<i>Schwann cell:</i> produces myelin (sheath) 3		
		<i>Myelin sheath:</i> insulation or protection or speeds impulse 3		
	(v)	<i>Disorder:</i> 3		
		<i>Cause:</i> injury / genetic / disease / lack of dopamine / 3 <i>Treatment:</i> physiotherapy / stem cell / dopamine or drugs qualified 3		
	(c)	(i)	4 labels – P (<i>phloem</i>), G (<i>ground tissue</i>), X (<i>xylem</i>), D (<i>dermal tissue</i>) 4(3)	
			(ii)	P (<i>phloem</i>) 3
			(iii)	protection or example of protection e.g. water loss, infection or comment on turgor 3
			(iv)	1. blade or scalpel 3
				2. pith / holder / hand or implied 3
		3. mounted needle or section lifter or forceps or paintbrush 3		
	(v)	<i>Difference:</i> vascular bundles scattered 3		

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

(30, 30)

- (a)
- (i) Draw a diagram to show the structure of a synovial joint. Label **three** parts of the joint that you have drawn, other than bones.
 - (ii) Explain the functions of the three parts that you have labelled.
 - (iii) Name a disorder of the musculoskeletal system.
 - (iv) Give a possible cause of the disorder that you have named in (iii) and suggest a treatment for it.
- (b) Answer the following in relation to bacteria.
- (i) Distinguish between photosynthetic and chemosynthetic bacteria. Give an example of each type.
 - (ii) Name **two** forms of heterotrophic nutrition found in bacteria.
 - (iii) What are antibiotics? For what purpose are they used?
 - (iv) Explain what is meant by antibiotic resistance and suggest how it may develop.
- (c) Write notes on **three** of the following.
- (i) Menstruation and a disorder of menstruation.
 - (ii) Biological benefits of breastfeeding.
 - (iii) Survival times for sperm and ova.
 - (iv) Formation and functions of the placenta.

15.	ANY TWO PARTS		
	(a)	(i)	Diagram labels (<i>cartilage, fluid, capsule or membrane, ligament</i>)
		(ii)	cartilage: absorbs shock or reduces wear or protection or reduces friction synovial fluid: friction-free movement or absorbs shock ligaments: hold bones together synovial membrane or capsule: secretes or contains synovial fluid <i>any three</i>
		(iii)	osteoporosis or arthritis
		(iv)	<i>Disorder:</i> <i>cause:</i> genetic / hormonal / dietary / injury or wear and tear <i>treatment:</i> anti-inflammatory drugs / hormonal or named / dietary supplements / pain killers / muscle relaxants / physiotherapy / exercise
	(b)	(i)	using light to make food or obtain energy Make food or obtain energy using a chemical reaction <i>[accept 'from chemicals']</i> Example 1: role or implied role e.g. volcanic pools Example 2: role or implied role e.g. in soil
		(ii)	parasitic / saprophytic
		(iii)	substances produced by bacteria or fungi [<i>accept micro-organisms</i>] treat infections or correct example
		(iv)	<i>resistance:</i> bacteria or fungi not killed by or inhibited by or immune to (antibiotic) <i>how develops:</i> natural selection has occurred or surviving strains multiply or misuse comment or plasmid transfer
	(c)	ANY THREE TOPICS	
		(i)	<i>menstruation:</i> shedding of endometrium / in absence of fertilisation or low level of progesterone <i>disorder:</i> Endometriosis or fibroids / comment
		(ii)	Antibodies or immunity / less danger of infection/ uterus contracts / may reduce risk of breast cancer / bonding / correct nutrients or easier to digest / suitable temperature / delayed ovulation <i>any three</i>
		(iii)	<i>sperm:</i> up to 7 days <i>ova:</i> up to 2 days one valid comment e.g. sperm nourished in female tract or longer survival time means greater chance of fertilisation
		(iv)	<i>formation:</i> (<i>placenta</i>) formed from embryonic and uterine tissues <i>functions:</i> connected to embryo by umbilical cord / (<i>placenta</i>) produces hormones / example of transfer / example of a barrier <i>any two</i>

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