



2010. M44

Write your Examination Number here



# Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2010

## BIOLOGY – HIGHER LEVEL

THURSDAY, 17 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.**

## 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) In relation to the human diet, what is meant by a trace element? .....
- .....
- (b) Give an example of a trace element.....
- (c) State **one** way in which an oil differs from a fat .....
- (d) Vitamins may be divided into two groups depending upon their solubility.  
Name these **two** groups.
- (i).....
- (ii) .....
- (e) What is a triglyceride? .....
- (f) Give an example of a catabolic reaction in a cell .....

2. In each of the following cases read the information provided and then, **from the list below**, choose the correct percentage chance of obtaining the indicated offspring in each case.

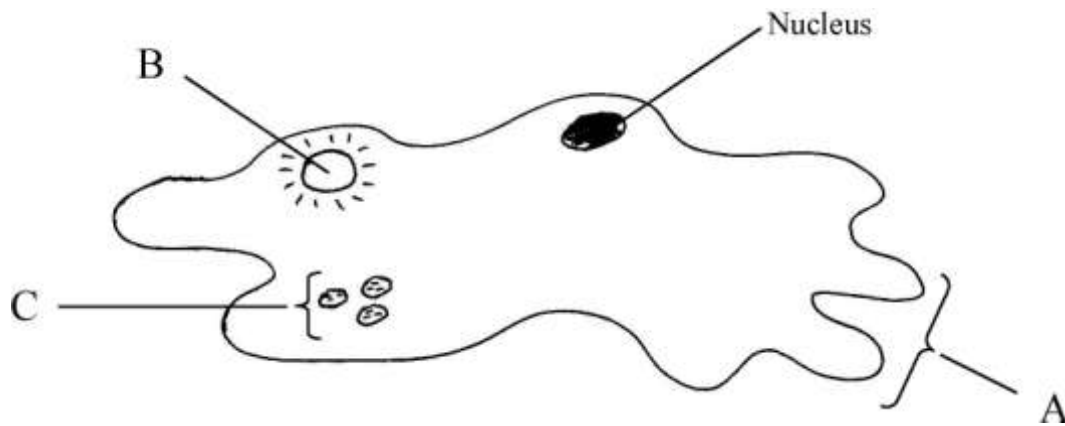
0%      10%      25%      50%      75%      100%

- (a) In the fruit fly *Drosophila* the allele for full wing is dominant to the allele for vestigial wing. One parent was homozygous in respect of full wing and the other parent was heterozygous.  
What is the % chance of obtaining offspring with **full** wing?      % =
- (b) In roses there is incomplete dominance between the allele governing red petals and the allele governing white petals. Heterozygous individuals have pink petals. A plant with pink petals was crossed with a plant with white petals.  
What is the % chance of obtaining offspring with **white** petals?      % =
- (c) In Dalmatian dogs the allele for brown spots is recessive to the allele for black spots. The two parents were heterozygous in respect of spot colour.  
What is the % chance of obtaining offspring with **black** spots?      % =
- (d) Red hair in humans is recessive to all other hair colours. A red-haired woman and a black-haired man, whose own father was red-haired, started a family.  
What is the % chance of obtaining offspring with **red** hair?      % =

<b>1.</b>		<b>5(4) any FIVE points out of SIX</b>	
	(a)	Small amount (needed) or indication of e.g. < 0.01%	
	(b)	e.g. Fe, Cu, Zn or other correct	
	(c)	Oil is liquid (at room temperature) or fat is solid or oils are unsaturated or explained	
	(d)	Fat-soluble Water-soluble	(4, 2, 0)
	(e)	Fat (or lipid or oil) unit (or molecule) or glycerol and three fatty acids or ester	
	(f)	Respiration or fermentation or glycolysis [ <i>allow digestion</i> ]	

<b>2.</b>		<b>4(5)</b>	
	(a)	100%	
	(b)	50%	
	(c)	75%	
	(d)	50%	

3. The diagram shows the structure of *Amoeba*.



- (a) Name the parts labelled A, B and C.  
 A ..... B ..... C .....
- (b) To which kingdom does *Amoeba* belong? .....
- (c) Is the cell of *Amoeba* prokaryotic or eukaryotic? .....
- (d) Give a reason for your answer to part (c) .....
- (e) Give one function of A in *Amoeba* .....
- (f) 1. Give one function of B in *Amoeba* .....
- 2. Suggest **one** reason why B is more active in freshwater amoebae than in marine amoebae.  
 .....

- 4. (a) What is a tissue? .....
- (b) Name a tissue found in plants .....
- (c) Give a function of the tissue referred to in part (b) .....
- (d) Name a tissue found in animals.....
- (e) Give a function of the tissue referred to in part (d).....
- (f) Explain what is meant by the term *tissue culture* .....
- .....
- (g) Give **one** application of tissue culture .....

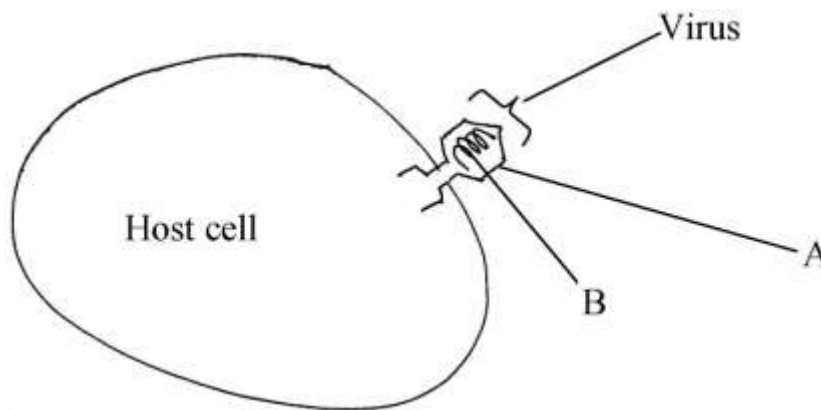
<b>3.</b>	(a)	A = pseudopods (false feet); B = contractile vacuole; C = food vacuoles	<b>3, 2, 1, 0</b>
	(b)	Protista <b>or</b> Protoctista	<b>3</b>
	(c)	Eukaryotic	<b>3</b>
	(d)	Membrane-bound organelles <b>or</b> named membrane-bound organelle [allow nucleus]	<b>3</b>
	(e)	Feeding (or explained) <b>or</b> movement	<b>3</b>
	(f)	1. Osmoregulation or explained [allow excretion or homeostasis] 2. Freshwater more hypotonic <b>or</b> more H <sub>2</sub> O intake <b>or</b> reference to concentration difference	<b>3</b> <b>2</b>

<b>4.</b>		<b>6 (3) + 2</b>	
	(a)	Cells with common function (or with common structure)	
	(b)	Dermal <b>or</b> ground <b>or</b> vascular (or xylem or phloem) <b>or</b> meristematic	
	(c)	Function relevant to tissue named in (b)	
	(d)	Epithelial <b>or</b> Muscular <b>or</b> Connective <b>or</b> Nervous <b>or</b> named example	
	(e)	Function relevant to tissue named in (d)	
	(f)	Cells grown on (or in) medium <b>or</b> cells grown outside organism	
	(g)	Appropriate application	

5. Explain each of the following terms from your study of ecology.

- (a) Biosphere .....
- (b) Ecosystem .....
- (c) Habitat .....
- (d) Symbiosis .....
- (e) Biotic factor .....
- (f) Food Web .....
- (g) Fauna .....

6. The diagram shows a virus attached to a host cell.



- (a) (i) What is part A made of ? .....
- (ii) What is part B made of ? .....
- (b) Briefly describe how viruses reproduce .....
- (c) During 2009 swine flu spread through the population of many countries. Younger people were more at risk of becoming ill with swine flu than older people. Using your knowledge of the immune system, suggest a reason for this.

<b>5.</b>		<b>6 (3) + 2</b>	
	(a)	Part(s) of earth that supports life	
	(b)	Organisms and their (interactions with) environment	
	(c)	(Place) where a species (or an organism) lives	
	(d)	Relationship between (different) species in which at least one benefits	
	(e)	Living (organism's influence on another organism)	
	(f)	Interconnected food chains <b>or</b> more than one species at each trophic level	
	(g)	Animals	

<b>6.</b>	(a)	A = protein; B = Nucleic acid or DNA or RNA	<b>3</b> <b>3</b>
	(b)	Attachment / (viral) nucleic acid into (host) cell / uses host structures (or described) / part(s) replicated / virus assembly / release (or lysis) <i>Any three</i>	<b>3(3)</b>
	(c)	(Older people) previous exposure / antibodies (or active immunity or memory cells)	<b>3 + 2</b>

## 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 the cavity of the body in which the heart and lungs are located.....  
(ii) State **one** way in which heart muscle differs from other muscles in the body.....  
.....

- (b) Answer the following questions in relation to a dissection that you carried out to investigate the structure of an ox's or a sheep's heart.

- (i) Describe the steps that you followed in order to identify and display the inner structures of the heart. Use suitably labelled diagrams if necessary

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

- (ii) What did you do in order to expose a semi-lunar valve?  
.....  
.....

- (iii) In the space below draw and label sufficient of your dissection to show the tricuspid valve, the right atrium and the right ventricle.



<b>7.</b>	<b>(a)</b>	<b>(i)</b>	Thoracic <b>or</b> chest	<b>3</b>
		<b>(ii)</b>	Doesn't tire [ <i>allow involuntary</i> ]	<b>3</b>
	<b>(b)</b>	<b>(i)</b>	Identify front (or back or left or right) / how identified / named cutting instrument / location of first cut / second cut described / locate (find or flag label) named structure / safety precaution described ( <i>any of the above points can be got from labelled diagrams</i> )	<b>4(3)</b>
		<b>(ii)</b>	Cut open aorta <b>or</b> cut open pulmonary artery	<b>3</b>
		<b>(iii)</b>	Diagram of dissection	<b>3, 0</b>
			Labels: Right atrium, tricuspid valve, right ventricle	<b>3(2)</b>

8. (a) Answer parts (i) and (ii) in relation to the scientific method.
- (i) What is a hypothesis? .....
- .....
- .....
- (ii) Why is a control normally used when carrying out an experiment?
- .....
- .....
- (b) For which purpose did you use each of the following in the course of your practical studies?
- (i) Methylene blue or iodine solution when examining cells with the microscope.
- .....
- (ii) An aquatic plant such as pondweed rather than a terrestrial plant when investigating the rate of photosynthesis.
- .....
- (iii) 1. Washing-up liquid or other detergent while extracting DNA from plant tissue.
- .....
2. Freezer-cold ethanol while extracting DNA from plant tissue.
- .....
- (iv) 1. Antiseptic wash solution in the investigation of the growth of leaf yeast on agar plates.
- .....
2. Petroleum jelly in the investigation of the growth of leaf yeast on agar plates.
- .....
- (v) 1. Biuret solution or alkaline copper sulphate in food testing.
- .....
2. Brown paper or Sudan III in food testing.
- .....

<b>8.</b>	(a)	(i)	Educated guess <b>or</b> (possible) explanation	<b>3</b>
		(ii)	Comparison (with experiment)	<b>3</b>
	(b)	(i)	As a stain <b>or</b> to see more clearly	<b>3</b>
		(ii)	To see (or measure ) gas (or bubbles) [ <i>negative for terrestrial plants</i> ]	<b>3</b>
		(iii)	1. (Detergent) breaks down membranes	<b>3</b>
			2. To separate (or see) the DNA	<b>3</b>
		(iv)	1. To prevent contamination <b>or</b> described	<b>3</b>
			2. Attach leaves (or leaf parts)	<b>3</b>
		(v)	1. Test for (soluble) protein	<b>3</b>
			2. Test for fat (or lipid or oil)	<b>3</b>

9. (a) (i) What is a tropism? .....

(ii) What is a plant growth regulator? .....

(b) Answer the following in relation to an investigation that you carried out into the effect of the growth regulator IAA on plant tissue.

(i) What plant tissue did you use? .....

(ii) Describe how you carried out the investigation.

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

(iii) Describe the control that you used.

.....  
.....

(iv) Compare the results that you obtained in the experiment and in the control.

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

<b>9.</b>	(a)	(i)	Growth of a plant in response to a stimulus	<b>3</b>
		(ii)	Controls the growth (of a plant)	<b>3</b>
	(b)	(i)	Named plant tissue (or part)	<b>3</b>
		(ii)	Tissue or part(s) placed in apparatus / different concentrations / how IAA used / leave for time ( <i>min 2 days</i> ) / then measure (or observe) tissue or part(s) / replicates	<b>4(3)</b>
		(iii)	Water <b>or</b> no IAA	<b>3</b>
		(iv)	Test results described / control results described	<b>2(3)</b>

## Section C

Answer any four questions.

Write your answers in the answer book.

10. Part (a) deals with DNA structure and replication.

- (a) (i) Name the base in DNA that pairs with cytosine.  
(ii) What are the two main events in the replication of DNA? (9)

Part (b) deals with protein synthesis.

- (b) (i) Explain the terms *transcription* and *translation*.  
(ii) In which structures in the cell does translation occur?  
(iii) How many bases in sequence make up a codon in mRNA?  
(iv) Each mRNA codon specifies one of three possible outcomes during protein synthesis. Name these **three** possible outcomes.  
(v) What does the letter 't' stand for in tRNA?  
(vi) During translation one end of a tRNA molecule attaches to an mRNA codon. What is usually attached to the other end of the tRNA molecule? (27)

(c) Distinguish between the terms in the following pairs by writing **one** sentence about **each** member of **each** pair.

- (i) *Haploid* and *diploid*  
(ii) *Homozygous* and *heterozygous*  
(iii) *Genotype* and *phenotype*  
(iv) *Segregation* and *independent assortment*. (24)

11. (a) (i) Name a disorder of the human nervous system.  
(ii) In the case of the disorder referred to in part (i) state:  
1. A possible cause.  
2. A means of prevention **or** a treatment. (9)

- (b) (i) What is a reflex action?  
(ii) Give **one** example of a reflex action.  
(iii) Suggest an advantage of reflex actions.  
(iv) The parts of the nervous system involved in a reflex action make up a reflex arc.  
1. Draw a large labelled diagram to show the structures involved in a reflex arc.  
2. Place arrows on your diagram to show the direction of impulse transmission in the reflex arc. (27)

(c) (i) What term is used to describe the glands that secrete hormones in the human body?

- (ii) 1. Name a hormone-producing gland in the human body.  
2. Where in the body is the gland located?  
3. Name a hormone that this gland secretes.  
4. State a role of this hormone.  
5. Describe what happens if the body experiences a deficiency of this hormone.

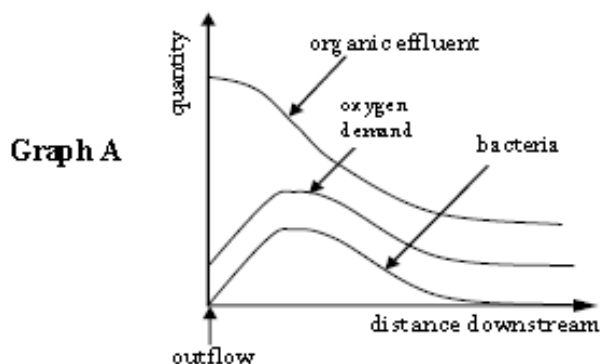
(iii) Give **two** examples of the use of hormone supplements. (24)

10.	(a)	(i)	*Guanine	3
		(ii)	(DNA) opens (or unzips) / new strands (made)	2(3)
	(b)	(i)	<i>Transcription:</i> making of (m)RNA using DNA (template)	3
			<i>Translation:</i> making a protein using (m)RNA (code)	3
		(ii)	*Ribosome(s)	3
		(iii)	*Three	3
		(iv)	Start;	3
			Adding an amino acid;	3
		Stop	3	
	(v)	*Transfer	3	
	(vi)	*An amino acid	3	
	(c)	(i)	<i>Haploid:</i> (A nucleus having) one set of chromosomes (or one copy of each chromosome)	3
			<i>Diploid:</i> (A nucleus having) Two sets of chromosomes (or two copies of each chromosome)	3
(ii)		<i>Homozygous:</i> alleles the same	3	
		<i>Heterozygous:</i> alleles different	3	
(iii)		<i>Genotype:</i> genetic make-up <b>or</b> genes (alleles) present	3	
		<i>Phenotype:</i> expression of genotype (and environment) <b>or</b> physical make up	3	
(iv)		<i>Segregation:</i> only one (member) of a pair of alleles (or chromosomes) enters a gamete	3	
		<i>Independent assortment:</i> Either member of a pair of alleles (or chromosomes) can combine (or transmit) with either member of another pair (in gamete formation)	3	

11.	(a)	(i)	Paralysis or Parkinson's . . .	3
		(ii)	1. Relevant cause	3
			2. Relevant means of prevention or treatment	3
	(b)	(i)	automatic / response to a stimulus / involuntary (or not controlled by brain) <i>Any two</i>	2(3)
		(ii)	e.g. coughing, blinking, sneezing etc.	3
		(iii)	Protection <b>or</b> fast (response)	3
		(iv)	1. Diagram (sensory neuron, motor neuron, spinal cord and correct position of cell bodies for 6 marks) Labels: receptor (or named), sensory neuron, inter neuron, motor neuron, cell body, effector (or named) <i>Any three</i>	6, 3, 0
	2. Arrow in (dorsal) + arrow out (ventral)		3(2) 3	
	(c)	(i)	*Endocrine (or ductless)	3
		(ii)	1. Name of a hormone-producing gland	3
			2. Location of named gland	3
			3. Hormone secreted by named gland	3
			4. Role of hormone	3
5. Description of deficiency symptom [Accept named condition]	3			
(iii)	e.g. 1. Treatment of diabetes 2. Contraception	2(3)		

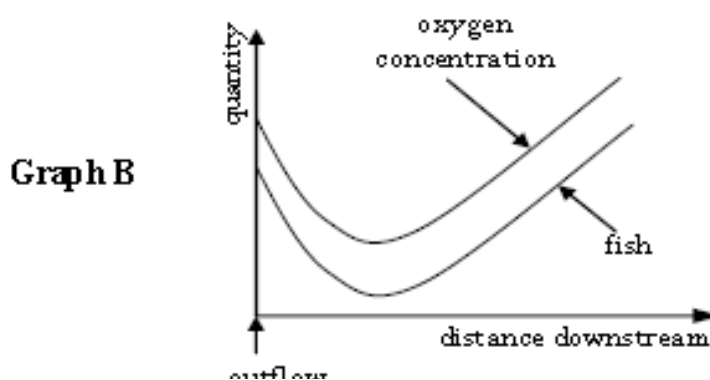
12. (a) (i) Where are primary producers found in a pyramid of numbers?  
(ii) Using named examples, construct a simple **inverted** pyramid of numbers. (9)
- (b) A paper factory pumps liquid effluent into a river. The effluent contains sugar. Oxygen demand is the amount of oxygen needed by organisms living in a river. Oxygen concentration is the amount of oxygen dissolved in the river water.

**Graph A** shows changes in water conditions for several kilometres downstream from the factory outflow.



- (i) To which kingdom do bacteria belong?  
(ii) Give **one** reason why the number of bacteria increases immediately downstream from the outflow.  
(iii) Give **one** reason why the number of bacteria then decreases further downstream from the outflow.  
(iv) Describe how the oxygen demand changes as the number of bacteria in the water changes.  
(v) Give a reason for your answer to part (iv).

**Graph B** shows the changes in oxygen concentration and the number of fish in the same river.



- (vi) Explain why the curve for fish numbers is the same shape as that for oxygen concentration.  
(vii) The oxygen concentration in the river water eventually increases with distance from the outflow. Suggest **two** ways by which this oxygen may enter the water.

[Adapted from *Biology for You* by Gareth Williams; Stanley Thomas (Publishers) Ltd, 2<sup>nd</sup> edition 2002.] (27)

- (c) **In your answer book**, say whether **each** of the following statements is true or false **and** give a reason for your choice in each case:

- (i) Food chains are usually short.  
(ii) The herbivores in an ecosystem normally live long lives.  
(iii) The only remaining natural ecosystems in Ireland, for example mountain land above the heather line and salt marsh, are ones for which mankind has no use.  
(iv) HIV / AIDS has orphaned many children in sub-Saharan Africa. (24)



12.	(a)	(i)	Base <b>or</b> bottom	3
		(ii)	Pyramid showing any inversion ( <i>at least two levels</i> ) Any two named organisms in inverted relationship	3 3
	(b)	(i)	Monera <b>or</b> Prokaryotae	3
<b>Graph A</b>		(ii)	Availability of organic effluent <b>or</b> sugar <b>or</b> more food	3
		(iii)	Decrease of organic effluent <b>or</b> sugar decreased <b>or</b> less food	3
		(iv)	(Oxygen demand) increases as bacteria increase (Oxygen demand) decreases as bacteria decrease <i>[allow 6 marks for relationship is directly proportional]</i>	3 3
		(v)	More bacteria need more O <sub>2</sub> <b>or</b> fewer bacteria need less O <sub>2</sub>	3
<b>Graph B</b>		(vi)	Fish need O <sub>2</sub> (for respiration)	3
		(vii)	Agitation (weirs, waterfalls) / photosynthesis / from atmosphere	2(3)
	(c)	(i)	True Energy lost at (or between) levels <b>or</b> described	3 3
		(ii)	False Usually eaten by 2 <sup>nd</sup> level consumers (or carnivores)	3 3
		(iii)	True Use causes change <b>or</b> no abuse <b>or</b> no economic value <b>or</b> False Valid reason	3 3
		(iv)	True Premature death of parents <b>or</b> poor living conditions <b>or</b> poor health care (or example) <b>or</b> poor education <b>or</b> an example of a cultural reason	3 3

13. (a) Give a role for each of the following parts of a flower: sepals, anther, stigma. (9)
- (b) (i) Describe the development of pollen grains from microspore mother cells.  
(ii) What is meant by the term *fertilisation*?  
(iii) Give a brief account of the process of fertilisation in flowering plants. (27)
- (c) (i) What is meant by the *dormancy* of seeds?  
(ii) Give **one** way in which the dormancy of seeds is of benefit to plants.  
(iii) Suggest **one** way in which a knowledge of dormancy is useful to farmers and gardeners.  
(iv) Water, oxygen and a suitable temperature are all required for the germination of seeds. In the case of **each** of these factors describe its effect on the process of germination.  
(v) Which part of the embryo in a germinating seed gives rise to each of the following parts of the seedling?  
1. The root  
2. The shoot. (24)
14. Answer any **two** of (a), (b), (c). (30, 30)
- (a) (i) Where in a plant cell does photosynthesis take place?  
(ii) Give the alternative name of the first stage of photosynthesis.  
(iii) During the first stage of photosynthesis energised electrons enter two pathways.  
1. Where do the energised electrons come from?  
2. Briefly describe the main events of **each** of these pathways.  
(iv) 1. In the second stage of photosynthesis compounds of the general formula  $C_x(H_2O)_y$  are formed. What name is given to this group of compounds?  
2. From which simple compound does the plant obtain the H used to make compounds of general formula  $C_x(H_2O)_y$ ?  
(v) Name the simple compound that supplies the necessary energy for the second stage reactions.
- (b) (i) What is an enzyme?  
(ii) What is meant by the *specificity* of an enzyme?  
(iii) Explain how the Active Site Theory may be used to explain the specificity of enzymes.  
(iv) Bioprocessing often involves the use of immobilised enzymes in a bioreactor.  
1. What does the term *immobilisation* refer to when used about enzymes?  
2. Explain the term *bioreactor*.  
(v) Give **one** example of the use of immobilised enzymes in bioreactors. In your answer name the enzyme, the substrate and the product.
- (c) (i) In relation to membranes in cells, explain what is meant by *selective permeability*.  
(ii) Give two locations in a cell at which there is a selectively permeable membrane.  
(iii) 1. What is diffusion?  
2. In the case of a named molecule, give a precise location at which it diffuses in the human body.  
(iv) Explain the biological basis for the use of high sugar or high salt concentrations in the preservation of food.

13.	(a)	<i>Sepals:</i>	protect flower (or bud) <b>or</b> photosynthesis <b>or</b> attract insects	3
		<i>Anthers:</i>	produce pollen	3
		<i>Stigma:</i>	traps (or catches) pollen [ <i>allow where pollen lands if qualified</i> ]	3
	(b)	(i)	Meiosis / 4 (or tetrad ) / haploid / micospores / (divides by) mitosis / tube and generative nucleus / pollen grain matures (or wall forms) <b>Any four</b>	4(3)
		(ii)	Fusion of gametes <b>or</b> formation of zygote	3
		(iii)	Generative nucleus / mitosis / two male gametes (or nuclei) / one fuses with egg / to form zygote / other (male gamete or nucleus) fuses with (two) polar nuclei / to form endosperm <b>Any four</b>	4(3)
(c)	(i)	Period of reduced metabolism (or period of reduced activity) <b>or</b> period of no growth.	3	
	(ii)	Survival <b>or</b> germination delayed until conditions suitable for growth <b>or</b> greater time for embryo development (or greater time for dispersal) <b>or</b> reduced competition	3	
	(iii)	(Optimum) storage conditions <b>or</b> (optimum) sowing (or ploughing) time <b>or</b> (maximise) the growing season <b>or</b> seed treatment before sowing (or examples)	3	
	(iv)	<i>Water:</i>	for enzyme action (or example of enzyme action) <b>or</b> as a solvent <b>or</b> transport of materials <b>or</b> bursting the testa [ <i>allow washing away inhibitors</i> ]	3
		<i>Suitable temp:</i>	required for (optimum or increased) enzyme activity	3
<i>Oxygen:</i>		needed for (aerobic) respiration	3	
(v)	1. *Radicle 2. *Plumule	3 3		

14.	Any two of (a), (b), (c)			(30, 30)
14.	(a)	(i)	Chloroplast	3
		(ii)	*Light (stage)	3
		(iii)	1. Chlorophyll 2. <i>Pathway</i> : (Energised electrons) release energy / ATP formed / (electrons) return to chlorophyll <b>Any two</b>  <i>Pathway</i> : Electrons taken up by NADP / photolysis (or water splits) / NADPH (formed) /electrons from water to chlorophyll /ATP formed <b>Any two</b>	3 2(3) 2(3)
	(iv)	1. *Carbohydrates	3	
		2. *Water (or H <sub>2</sub> O)	3	
	(v)	*Adenosine Triphosphate (or ATP)	3	
	14.	(b)	(i)	Biological (or protein) catalyst (or explained)
(ii)			(Enzyme) acts on only a particular substrate	3
(iii)			Substrate / matching enzyme's active site / active site changes shape / (formation of) enzyme-substrate complex / product(s) formed <b>Any three</b>	3(3)
(iv)			1. <i>Immobilisation:</i> attached to an inert substance (or example of inert substance) <b>or</b> fixed to each other	3
			2. <i>Bioreactor:</i> vessel in which products are made by cells (or organisms)	3
(v)		Enzyme Substrate ( <i>must match enzyme</i> ) Product ( <i>must match enzyme or substrate</i> )	3 3 3	
(c)		(i)	Allowing some substances to pass through	3
		(ii)	Chloroplast / mitochondrion / nucleus / vacuole [ <i>allow cell membrane</i> ] <b>Any two</b>	2(3)
		(iii)	1. Movement of molecules (or substances) from area of high concentration to area of low concentration (or along a concentration gradient)	3
			2. Named molecule and location	3
	(iv)	Bacteria / lose water / by osmosis / inactivity or death <b>Any three</b>	3(3)	

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

(30, 30)

- (a) (i) What is semen?  
(ii) Draw a labelled diagram of the reproductive system of the human male.  
On your diagram, indicate clearly **and** name the part at which **each** of the following occurs:
1. Production of sperm cells.
  2. Maturing of sperm cells.
  3. Mixing of fluid with sperm cells.
  4. Transport of semen.
- (iii) State **two** secondary sexual characteristics of the human male.  
(iv) What maintains the secondary sexual characteristics in the adult human male?
- (b) (i) Draw a labelled diagram to show the relationship between the liver, the small intestine and the hepatic portal vein.  
(ii) Name a substance transported to the liver by the blood in the hepatic portal vein.  
(iii) Name the blood vessel that brings oxygenated blood to the liver.  
(iv) Where in the human body is the liver located in relation to the stomach?  
(v) Where is bile stored after it has been made in the liver?  
(vi) Give **one** role that the bile salts play in the digestive process.  
(vii) Give **two** further functions of the liver, other than the manufacture of bile.
- (c) Suggest a biological explanation for **each** of the following observations:
- (i) As long as a baby feeds regularly from its mother's breast (or if a breast pump is regularly used) the milk will continue to flow.
  - (ii) Doctors are reluctant to prescribe antibiotics to patients suffering from common cold-like symptoms.
  - (iii) A person who has suffered from constipation may be advised to increase the amount of wholegrain cereal in her/his diet.
  - (iv) After a long session of heavy exercise, an athlete's urine is likely to be concentrated and low in volume.
  - (v) A person's fingers may turn white when exposed to low temperature for a period of time.

<b>15.</b>	Any <b>two</b> of (a), (b), (c)			<b>(30, 30)</b>
<b>15.</b>	(a)	(i)	Sperm (cells) and (seminal) fluid	<b>3</b>
		(ii)	Diagram ( <i>testis, sperm duct, urethra, penis</i> ) Four parts <u>located</u> and named: 1. Testis 2. Epididymis 3. Sperm duct <b>or</b> prostate gland [allow seminal vesicles] 4. Urethra <b>or</b> sperm duct	<b>6, 3, 0</b> <b>3</b> <b>3</b> <b>3</b> <b>3</b>
		(iii)	Broken voice (or enlarged larynx) / body hair / more muscle / more bone enlargement of testes / enlargement of penis <i>Any two</i>	<b>2(3)</b>
		(iv)	*Testosterone	<b>3</b>

<b>15.</b>	(b)	(i)	Diagram (liver, connection, gut) Labels ( <i>liver, intestine and portal vein</i> )	<b>3, 0</b> <b>3(2)</b>
		(ii)	Named food <b>or</b> CO <sub>2</sub>	<b>3</b>
		(iii)	*Hepatic artery	<b>3</b>
		(iv)	Above <b>or</b> to the right <b>or</b> behind	<b>3</b>
		(v)	*Gall bladder	<b>3</b>
		(vi)	Emulsify fats (or explained) <b>or</b> neutralise (or comment on pH)	<b>3</b>
		(vii)	Storage of (fat-soluble) vitamins (or glycogen or named mineral) / deamination / heat generation / detoxification / plasma protein production / cholesterol production <i>Any two</i>	<b>2(3)</b>

<b>15.</b>	(c)	(i)	(Sucking or pumping) stimulates (pituitary) / production of hormone (or correctly named hormone) / promotes milk flow <i>Any two</i>	<b>2(3)</b>
		(ii)	Common cold is a viral disease / antibiotics do not affect viruses / (overuse of antibiotics) may lead to antibiotic resistance in bacteria (in patients) <i>Any two</i>	<b>2(3)</b>
		(iii)	Adds fibre / fibre absorbs water / peristalsis encouraged / faster digestive transit <i>Any two</i>	<b>2(3)</b>
		(iv)	Water lost by exhaling (or by sweating) / less water in blood / ADH secreted / causes collecting ducts (or distal tubes or kidney) / to reabsorb water <i>Any two</i>	<b>2(3)</b>
		(v)	Arterioles / constrict / less blood (in fingers) / heat loss minimised <i>Any two</i>	<b>2(3)</b>

**Blank Page**