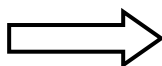


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Coimisiún na Scrúduithe Stáit State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2013

BIOLOGY – HIGHER LEVEL

THURSDAY, 11 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. In the case of any **five** of the following pairs of terms, clearly distinguish between the first term and second term by writing a brief sentence about each.

- (a) Starch. _____
Glucose. _____
- (b) Amino acids . _____
Proteins. _____
- (c) Cellulose. _____
Keratin. _____
- (d) Enzymes. _____
Hormones. _____
- (e) Biuret test. _____
Benedict's (Fehling's) test. _____
- (f) Fats. _____
Oils. _ _____

2. Answer the following questions in relation to food chains.

- (a) Where in a food chain are primary producers found?

- (b) What term is used to describe organisms that feed on primary producers?

- (c) Why are most food chains short (i.e. only consist of a few trophic levels)?

- (d) What deduction may be made if the organisms at the start of the chain are less numerous than those that feed upon them?

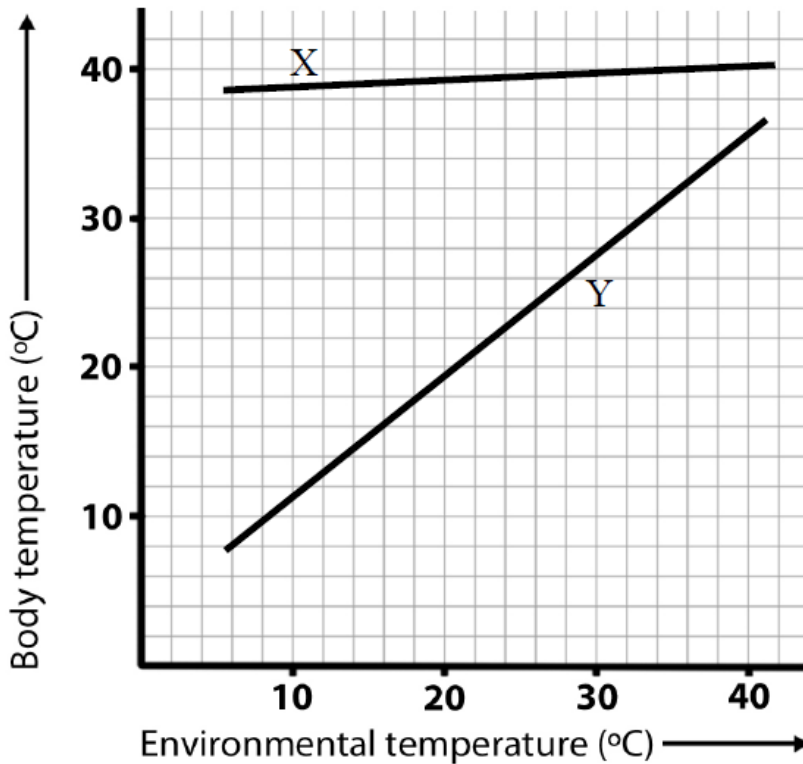
- (e) (i) Can a parasite be the first member of a food chain? _____
(ii) Explain your answer. _____
- (f) Energy enters food chains in the form of light. In which form do you think most energy is lost from food chains?

1.		5(4, 2, 0) i.e. best five answers from (a) – (f)	
	(a)	<i>Starch</i>	– polysaccharide (or explained) or polymer or correct test
		<i>Glucose</i>	– monosaccharide (or explained) or monomer or correct test
	(b)	<i>Amino Acid</i>	– building block of protein or monomer or unit of protein
		<i>Protein</i>	– polymer (of amino acids) or chain of (or many) amino acids
	(c)	<i>Cellulose</i>	– carbohydrate or polysaccharide or (found in plant) cell wall
		<i>Keratin</i>	– protein or (found in human) hair (or nails or skin)
	(d)	<i>Enzyme</i>	– a catalyst (or explained)
		<i>Hormone</i>	– a (chemical) messenger (or explained)
	(e)	<i>Biuret</i>	– (test for) protein
		<i>Benedict's / Fehling's</i>	– (test for) reducing sugar (or glucose or maltose)
	(f)	<i>Fats</i>	– (lipids) solid at room temp
		<i>Oils</i>	– (lipids) liquid at room temp

2.		6(3) + (2)	
	(a)	First (level)	
	(b)	Primary consumer(s) or herbivore(s)	
	(c)	(Large) energy loss (from one level to next) or small energy transfer	
	(d)	Producers are large or primary consumers are parasites	
	(e)	(i)	No
		(ii)	(Parasites) are not producers or (parasites) are consumers (or explained)
	(f)	Heat	

3. The relationship between body temperature and environmental temperature for two animals is plotted below.

One of these animals is a dog and the other is a lizard.



(a) Which of the plots, X or Y, relates to the dog? _____

Explain your answer. _____

(b) In relation to body temperature, what term is used to describe animals such as the dog?

(c) What is the main source of the dog's body heat?

(d) Suggest a value to dogs of the relationship between their body temperature and environmental temperature.

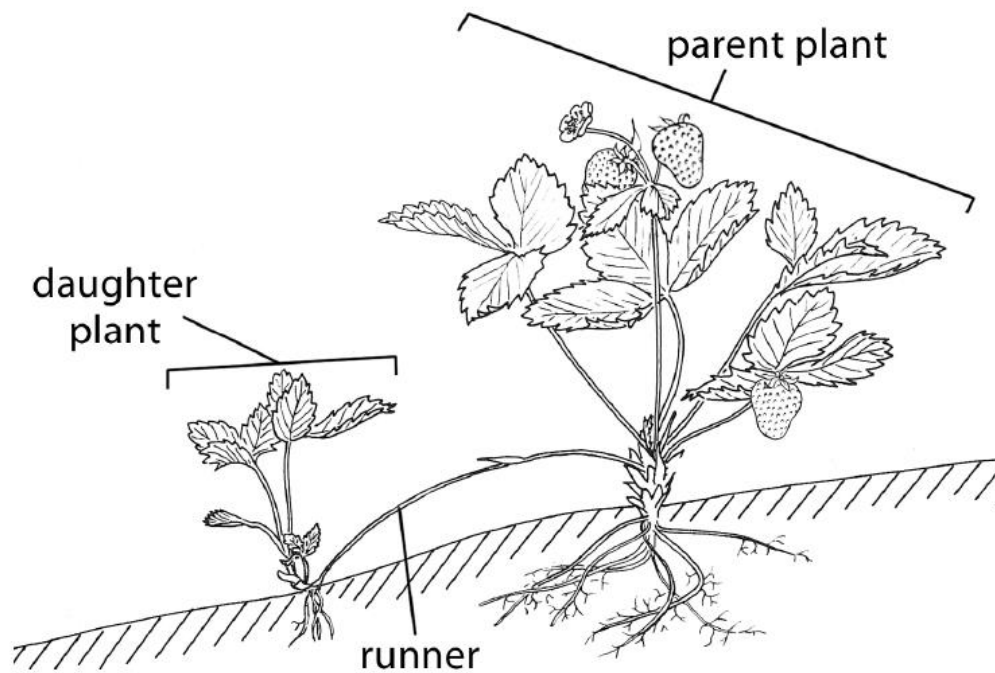
(e) In relation to body temperature, what term is used to describe animals such as the lizard?

(f) What is the main source of the lizard's body heat?

[OVER

3.	6(3) + (2)	
	(a)	X
		Dog's body temperature is (relatively) stable or correct reference to graph
	(b)	Endothermic
	(c)	Respiration or metabolism or carbohydrate (or named carbohydrate) or fat (or named fat)
	(d)	(Temperature always suitable) for good enzyme activity or metabolism or activity independent of environment
	(e)	Ectothermic
	(f)	Environment or the sun or metabolism

4. The diagram shows a strawberry plant from which a runner has given rise to a daughter plant.



- (a) The runner is a modified stem. How could you tell this from
1. external observation? _____
 2. viewing a thin section of it under the microscope? _____
- (b) What term is used for the type of asexual reproduction that produced the daughter plant?

- (c) Would you expect the daughter plant to be haploid or diploid? _____
Explain your answer. _____
- (d) What evidence is there in the diagram that sexual reproduction has also taken place?

- (e) Give one method, other than runners, and not involving seeds, that is used by horticulturists to produce new plants.

4.	6(3) + (2)		
	(a)	1.	Bud(s) or node(s) or leaf
		2.	Vascular bundles [<i>plural only</i>]
	(b)	Vegetative propagation	
	(c)	Diploid	
		Product of mitosis or genetically identical (to parent) or clone	
	(d)	Fruit or (straw)berries or seeds	
	(e)	Cuttings or layering or grafting or micro-propagation or tissue culture	

5. (a) (i) In relation to structures such as the cell membrane, explain the term *selective permeability*.

(ii) Suggest an advantage to the cell of having a selectively permeable membrane.

(iii) Name **two** substances that enter a human muscle cell by diffusion.

(b) (i) Explain the term *turgor*.

(ii) Give a feature of a plant cell that allows it to remain turgid for long periods.

(iii) Suggest a way in which turgor is of value to plants.

6. (a) (i) In DNA, nitrogenous bases occur in complementary pairs. Explain the term *complementary* as used here.

(ii) In each case, name the complementary base **in RNA** for:

1. Adenine _____

2. Cytosine _____

(iii) Name a carbohydrate that is a component of nucleotides.

(iv) Name a component of a nucleotide that is neither a carbohydrate nor a nitrogenous base.

(b) (i) What does the 'm' stand for in mRNA? _____

(ii) Give **one** difference between RNA and DNA, other than the nitrogenous bases.

(iii) Give the role of the enzyme RNA polymerase.

[OVER

5.	1 + 1 + 8 + 6 + 4(1)		
	(a)	(i)	Only certain substances (or named) allowed through
		(ii)	Substances can be kept in (or out) or substances can be let in (or out)
		(iii)	Oxygen / glucose / water / amino acids / phosphate (or P) / iron Any two
	(b)	(i)	Pressure / of cell contents (or described) / on cell wall Any two
		(ii)	Vacuole or cell wall or cell sap
		(iii)	Support (or described)

6.	1 + 1 + 8 + 6 + 4(1)		
	(a)	(i)	Each base has a (different) corresponding (or matching) (base)
		(ii)	1. Uracil or U
			2. Guanine or G
		(iii)	Ribose or deoxyribose
		(iv)	Phosphate (group) or P
	(b)	(i)	Messenger
		(ii)	RNA has ribose or RNA is single stranded or DNA has deoxyribose or DNA is double stranded
		(iii)	Joins nucleotides together (to give mRNA product) or to make RNA

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) Distinguish between the terms *habitat* and *ecosystem* by writing a sentence about each.
- (i) Habitat. _____
- (ii) Ecosystem. _____
- (b) Answer the following questions in relation to a **named** ecosystem which you have investigated.
- Ecosystem. _____
- (i) How did you investigate a **named** abiotic factor, other than temperature or pH?
- Abiotic factor. _____
- How investigated. _____
- _____
- _____
- (ii) How were you able to identify the animals that you found in the ecosystem?
- _____
- (iii) When conducting a quantitative survey of plants, how did you ensure that your sample was random?
- _____
- _____
- _____
- (iv) In the case of a **named** animal **and** a **named** plant give an example of an adaptation to its habitat that you observed.
- Animal. _____ Adaptation. _____
- Plant. _____ Adaptation. _____
- (v) As part of your study of your selected ecosystem you constructed a pyramid of numbers. Name the species that occupied the top of your pyramid.
- _____
- (vi) What is the main prey of the species referred to in part (v)?
- _____

7.	(a)	(i)	Where an organism (or plant and animal) lives	3
		(ii)	Organisms (interacting) with their environment	3
	(b)	(i)	Factor	3
			How investigated	3
		(ii)	Key or (guide) book or illustrations	3
		(iii)	Method described must demonstrate randomness	3
		(iv)	Named animal + adaptation	3
			Named plant + adaptation	3
		(v)	Named (species) of carnivore or of omnivore or of parasite	3
		(vi)	Matching named prey	3

8. (a) (i) What term is used for the substance(s) that result(s) from the action of an enzyme on its substrate? _____
- (ii) In relation to an enzyme, explain the term *optimum activity*.

- (b) Answer the following in relation to an activity that you carried out to investigate the effect of heat denaturation on the activity of an enzyme.
- (i) Name the enzyme **and** the substrate that you used.
- Enzyme. _____
- Substrate. _____
- (ii) Describe how you carried out the investigation.
In your description outline how you measured the activity of the enzyme.
- _____

- (iii) Using suitably labelled axes, draw a graph of the results that you obtained.

[OVER

8.	(a)	(i)	Product(s)	3
		(ii)	Working at maximum rate	3
	(b)	(i)	Named enzyme	3
			Matching substrate	3
		(ii)	Temperature $\geq 60^{\circ}\text{C}$ for ≥ 5 min or boil / water bath or described / untreated enzyme / as control / no activity in denatured enzyme / (matching method of) observe activity / control result / named factor (kept constant) / how kept constant	5(3)
		(iii)	Any attempt	3

9. (a) (i) Explain the importance of *double-blind* testing in scientific experimentation.

(ii) How does a *hypothesis* differ from a *theory*?

(b) Answer the following in relation to investigations that you carried out in the course of your practical studies.

(i) When investigating the effect of either carbon dioxide concentration **or** light intensity on the rate of photosynthesis:

1. How did you vary your chosen factor?

2. Using suitably labelled axes, draw a graph of the results that you obtained.

(ii) When demonstrating osmosis:

1. For what purpose did you use Visking tubing, potato tissue or some similar material?

2. At the end of the demonstration, how did you conclude that osmosis had occurred?

(iii) In the microscopic examination of a plant cell:

1. Name the stain that you used **and** the colour it imparted to the cell wall.

2. How did you apply the stain to the cells on the slide?

(iv) When investigating digestive activity during seed germination:

1. How did you supply a substrate suitable for the digestive enzymes?

2. How did you ensure that no digestive enzymes were available on the control plate?

9.	(a)	(i)	Avoidance of bias	3
		(ii)	Hypothesis can develop into a theory or explained	3
	(b)	(i)	1. CO_2 – vary $NaHCO_3$ conc.	3
			OR	
			<i>Light</i> – vary lamp (or plant) distance or vary lamp wattage	
			2. Graph with labelled axes (rate on y-axis) + rise	3
		(ii)	1. As a selectively permeable membrane	3
			2. Change (increase or decrease) in mass (volume) or described	3
		(iii)	1. e.g. Iodine → yellow (or orange or brown)	3
			2. Dropper or use of filter paper	3
		(iv)	1. Milk agar or starch agar	3
			2. Boiled seeds	3

Section C

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

10. (a) (i) What term is used for glands that secrete hormones?
- (ii) How do these glands differ from those that do not secrete hormones?
- (iii) Explain why the pancreas may be described as a *dual-function* gland.
- (b) Answer the following by reference to hormones, other than sex hormones, which you have encountered in the course of your studies.
- (i) What is the chemical nature of many hormones?
- (ii) In the case of **each** of **two named** hormones secreted in the human body state:
1. The precise location of the gland that secretes it.
 2. A function of the hormone.
- (iii) In the case of **one** of the hormones referred to in part (b) (ii):
1. Give a deficiency symptom.
 2. Give a symptom of excess secretion.
 3. Give a corrective measure for **either** its deficiency **or** its excess, clearly stating which you have chosen.
- (iv) Explain why hormonal responses are slower than nervous responses.
- (c) (i) State **two** ways in which growth regulators in plants are similar to hormones in animals.
- (ii) Name a plant growth regulator that promotes growth **and** give a precise location for a site of its action.
- (iii) Through which part of a stem are growth promoters transported?
- (iv) Outline **two** uses of growth promoters in horticulture.
- (v) Give an example of a growth regulator that inhibits growth.

[OVER

10.	(a)	(i)	*Endocrine		3
		(ii)	Ductless		3
		(iii)	Hormone (or insulin) secretion & non-hormone (enzyme) secretions or has endocrine and exocrine function (or described)		3
	(b)	(i)	Protein		3
		(ii)	Hormone name		2(2)
			1.	Gland location	2(2)
			2.	Hormone function	2(2)
		(iii)	1.	Deficiency symptom	2
			2.	Excess symptom	2
			3.	Corrective measure	2
		(iv)	Hormones travel in blood or are chemical electrical transmission in nerves		3 3
	(c)	(i)	Made at one site & function at another / Transport slow / in vascular tissue or in blood and phloem (or xylem) / chemical (nature)		2(3)
		(ii)	e.g. IAA (auxin) Just behind shoot (or root) tip or meristem or zone of elongation		3 3
		(iii)	Vascular bundles or vascular tissue or phloem or xylem		3
		(iv)	(Encourage) rooting (in cuttings) / promote ripening / weed killer / seedless fruit / micro-propagation or tissue culture		2(3)
		(v)	IAA / auxin / ethene (ethylene) / abscisic acid		3

11. (a) (i) Give a source of evidence for evolution.
- (ii) Briefly outline the evidence from the source referred to in (i).
- (b) (i) Human males and females differ in one of their twenty three pairs of chromosomes. What name is given to this pair of chromosomes?
- (ii) Draw this pair of chromosomes for a human male **and** for a human female and label them appropriately.
- (iii) Using the chromosomes referred to in part (b) (ii), show, using a Punnett square or otherwise, that a child stands an equal chance of being male or female.
- (iv) 1. What is meant in genetics by the term *sex linkage*?
2. Name **two** common sex-linked traits.
- (c) Answer the following questions, which relate to events in the cell cycle.
- (i) What name is applied to the period of the cell cycle in which division is **not** taking place?
- (ii) Give a cellular process that occurs during this period in which the nucleus is not dividing.
- (iii) Draw a labelled diagram to show the position of the chromosomes during metaphase of mitosis in a nucleus in which $2n = 6$.
- (iv) 1. State a function of one of the structures, other than chromosomes, that you have labelled in your diagram of metaphase.
2. How does the structure carry out this function?
- (v) What term is used for the group of disorders in which control has been lost over the rate of mitosis?

11.	(a)	(i)	Fossils or embryology or anatomy or adaptation of plant or animal or genetics	3												
		(ii)	Any two points from evidence selected above : <i>e.g. Fossils</i> : structure / changing / over time / related to environment <i>e.g. Embryology</i> : different organisms / similar embryo / similar development pathways <i>e.g. Anatomy</i> : Named structure / expansion point	2(3)												
	(b)	(i)	Heterosomes or sex chromosomes	3												
		(ii)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Female XX </td> <td style="width: 50%; border: none;">Male XY </td> </tr> </table>	Female XX 	Male XY 	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%; text-align: right;">Male Female</td> </tr> </table>		Male Female	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%; text-align: right;">3,0</td> </tr> <tr> <td style="width: 50%;"></td> <td style="width: 50%; text-align: right;">3,0</td> </tr> </table>		3,0		3,0			
Female XX 	Male XY 															
	Male Female															
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		(iii)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>X</td> </tr> <tr> <td>X</td> <td>XX</td> </tr> <tr> <td>Y</td> <td>XY</td> </tr> </table>		X	X	XX	Y	XY	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Gametes shown</td> <td style="width: 50%; text-align: right;">3</td> </tr> <tr> <td>Cross shown</td> <td style="text-align: right;">3</td> </tr> <tr> <td>F₁ genotypes shown</td> <td style="text-align: right;">3</td> </tr> </table>	Gametes shown	3	Cross shown	3	F ₁ genotypes shown	3
	X															
X	XX															
Y	XY															
Gametes shown	3															
Cross shown	3															
F ₁ genotypes shown	3															
		(iv)	1. Gene(s) on sex or on X or on Y chromosome	3												
			2. Haemophilia / colour blindness	2(3)												
	(c)	(i)	*Interphase	3												
		(ii)	Replication or growth or protein synthesis or respiration or photosynthesis	3												
		(iii)	<i>Diagram</i> : spindle (or outline of cell) + chromosomes on equator + 6 double chromosomes <i>Labels</i> : Chromosome(s) / spindle / centromere(s) / cell membrane	6,3,0 3(1)												
		(iv)	1. Function	3												
			2. How function is carried out	3												
		(v)	Cancer	3												

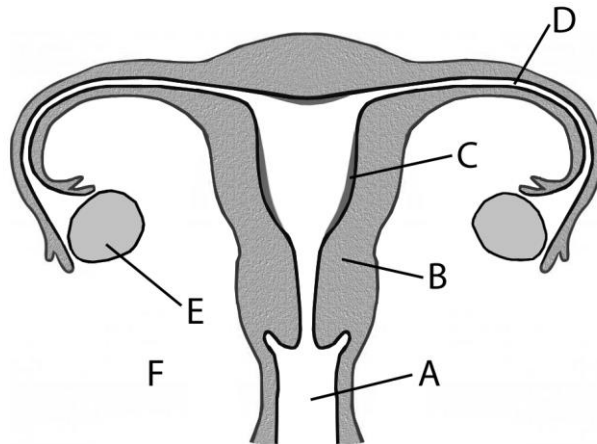
12. (a) (i) A virus has been described as a piece of genetic material that has escaped from a cell. Give one piece of evidence that supports this description.
- (ii) Viruses are examples of obligate parasites. Explain why this is the case.
- (iii) Give an example of how a virus might be beneficial to mankind.
- (b) (i) Name the kingdom to which bacteria belong.
- (ii) Draw a large diagram of a bacterial cell to show:
1. The relative positions of the cell wall, cell membrane and capsule.
 2. A plasmid.
- Label **each** of the above structures.
- (iii) 1. Under what circumstances does a bacterial cell form an endospore?
2. Describe briefly how an endospore forms.
- (iv) Name **two** types of heterotrophic nutrition used by bacteria.
- (c) (i) Distinguish clearly between *antibodies* and *antibiotics* by writing a note about each.
- (ii) In relation to antibodies, distinguish between active and passive immunity.
- (iii) Using your knowledge of antibiotics and bacteria, suggest why a person is more likely to pick up an infection in hospital than at home.

[OVER

12.	(a)	(i)	Composed of nucleic acid (or DNA or RNA)		3
		(ii)	Can only replicate (or reproduce) inside a cell (or host)		3
		(iii)	Genetic engineering or vaccine (production) or cancer treatment or pest control or disease control		3
	(b)	(i)	*Monera		3
		(ii)	1 + 2	<i>Diagram:</i> wall + membrane + capsule + plasmid shown	5, 3, 0
				<i>Labels:</i>	4(1)
		(iii)	1.	Harsh conditions or example	3
			2.	DNA replicates / thick wall (or described) / encloses / shrinkage (or water loss) / of cytoplasm	2(3)
		(iv)	*Saprophytic		3
			*Parasitic		3
	(c)	(i)	<i>Antibodies</i> – proteins / produced by body / in response to antigen (or to infection)		
			<i>Antibiotics</i> – produced by micro-organisms / kill (or destroy or stop growth of) other micro-organisms / do not affect viruses		4(3)
		(ii)	Active - antibodies produced in body		3
			Passive – antibodies given		3
		(iii)	Antibiotic resistance strains / more pathogens / more people (or poor hygiene) / patients weaker		2(3)

13. (a) (i) In humans, widening of the female hips is one example of *physical changes that distinguish the sexes but are not essential for reproduction*. To what term does the definition in italics refer?
- (ii) What term is used for the time in a young person's life when such changes take place?
- (iii) Name the hormone that maintains such changes throughout the life of a male.

(b) The diagram shows the reproductive system of the human female.



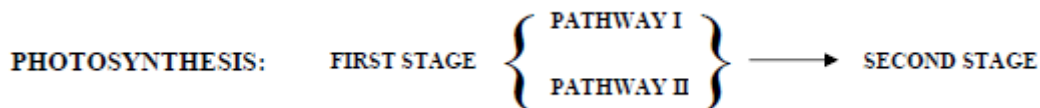
- (i) Name the parts labelled A, B, C, D, E and F.
- (ii) Using the letters from part (i), identify the following locations:
1. Where meiosis occurs.
 2. Where zygote formation occurs.
 3. Where implantation occurs.
- (iii) Describe the role of oestrogen **and** progesterone in the control of the events of the menstrual cycle.
- (c) Answer the following questions in relation to the development of a human zygote.
- (i) By which type of cell division does the zygote divide?
- (ii) Further divisions result in the formation of a morula. What is the next developmental stage after the morula?
- (iii) The placenta forms from tissues of the mother and the foetus. Give **two** roles of the placenta.
- (iv) Give **one** change experienced by the mother that indicates to her that the birth process is starting.
- (v) Give a short account of the birth process.

13.	(a)	(i)	*Secondary sexual characteristics		3
		(ii)	*Puberty		3
		(iii)	*Testosterone		3
	(b)	(i)	A.	Vagina	
			B.	Uterus (or Womb)	
			C.	Endometrium (or lining of uterus or lining of womb)	
			D.	Fallopian Tube (or Oviduct)	
			E.	Ovary	
			F.	Cervix	6(1)
		(ii)	1.	*E	3
			2.	*D	3
			3.	*C	3
		(iii)	<i>Oestrogen</i> : Endometrium repair / stimulates LH / inhibits FSH		2(3)
			<i>Progesterone</i> : Endometrium maintenance / inhibits LH / inhibits FSH		2(3)
	(c)	(i)	*Mitosis		3
		(ii)	*Blastocyst		3
		(iii)	Makes progesterone / barrier or one (barrier) example / material transfer (or one example)		2(3)
		(iv)	(Mucus) show or contractions or waters break		3
		(v)	Contractions or amniotic sac breaks or cervix dilates		3
			Baby delivered		3
			Afterbirth delivered		3

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

(30, 30)

(a) The scheme below summarises the process of photosynthesis.



- (i) Give the name of the first stage.
 - (ii) In the first stage, pathways I and II relate to the passage of energised electrons.
 - 1. Explain what happens to these electrons in pathway I.
 - 2. Describe the events of pathway II.
 - (iii) Give the name of the second stage.
 - (iv) Explain why the second stage is given the name referred to in part (iii).
 - (v) Give **one** reason why the second stage cannot happen without the first stage.
 - (vi) Outline the major events of the second stage.
- (b) Write notes on each of the following topics. You are required to make a minimum of **three** points concerning **each** topic. Marks will **not** be given for word diagrams alone.
- (i) Metabolism.
 - (ii) Krebs Cycle.
 - (iii) ADP.
- (c)
- (i) Explain the term *fermentation*.
 - (ii) Name an organism that is used in industrial fermentation.
 - (iii) To which kingdom does this organism belong?
 - (iv) Name a compound which is used as a carbon source in the fermentation referred to in part (ii).
 - (v) In industrial fermentations bioprocessing with immobilised cells is sometimes used.
 - 1. Explain the terms *bioprocessing* and *immobilised*.
 - 2. Give an advantage of using immobilised cells.
 - 3. Name the compound from which the immobilising beads are formed in the laboratory.
 - 4. Give the general name for the vessel used for such reactions.

[OVER

14.	(a)	(i)	*Light (dependent stage)		3
		(ii)	1.	(electrons) picked up by acceptor / passed through carriers / back to chlorophyll / (electrons) lose energy	2(3)
			2.	H ₂ O split / protons to pool / NADP ⁻ formed / NADPH formed / (electrons) picked up by acceptor / passed through carriers / O ₂ released / ATP produced	2(3)
		(iii)	*Dark (stage) (or *light-independent stage)		3
		(iv)	Light not needed		3
		(v)	Product (or named product) (of 1 st stage) required.		3
		(vi)	Sugar formed from CO ₂		3
			ATP provides energy or NADPH provides hydrogen (or H)		3

14.	(b)	<i>If any 'note' consists only of a word diagram, flow-chart or chemical equation, then a maximum of two scoring points may be awarded.</i>			
		(i)	Metabolism: (The sum of) all reactions in cell (or organism) / controlled by enzymes / catabolism explained or catabolism + example / anabolism explained or anabolism + example		4+2(3)
		(ii)	Krebs Cycle: occurs in second stage of respiration / in mitochondria / when O ₂ present (or aerobic) / starts with Acetyl Co-enzyme A / ATP produced / hydrogen (pairs) produced or energised electrons / CO ₂ produced		4+2(3)
		(iii)	ADP: Adenosine Di-phosphate / a low energy (molecule) / + phosphate (P) / + energy / ATP formed		4+2(3)

14.	(c)	(i)	Anaerobic respiration		3
		(ii)	Yeast		3
		(iii)	*Fungi		3
		(iv)	Any named carbohydrate		3
		(v)	1.	Bioprocessing: using micro-organisms (or enzymes) / to form product(s)	2(3)
				Immobilised: fixed to inert material (or named material) or fixed to each other or trapped in gel (or named material)	3
			2.	Can be re-used (or recovered) or pure product (or described)	3
			3.	Alginate	3
			4.	Bioreactor	3

- (a) Read the article below and answer the questions that follow:

Cigarettes are bad for your health. But that's only if you smoke them. If you use them to line your nest, they might actually do some good. Scientists have recently found that birds that decorate their nests with discarded cigarette butts full of nicotine are less bothered by parasites.* When building a nest, birds tend to make do with the materials at hand. Twigs and leaves are popular choices. Some fresh green leaves give off strong smells. So how can city birds manage? Apparently, some reach for the fibres found in used cigarette filters.

Scientists got to wondering whether this habit might provide the birds with benefits other than bedding. So they investigated the nests of finches and sparrows that were living on the campus of the National University of Mexico, which is in the heart of Mexico City. The scientists used heat traps to lure the parasites and then counted them. Most of the nests contained cellulose fibres from broken cigarette filters. They found that nests with the most used cigarette filter fibres had the lowest number of parasites, in this case, blood sucking mites. For these birds, a butt a day might keep the mites away!

*[Biology Letters: M. Suarez-Rodriguez, I. Lopez-Rull, C. Macias Garcia 'Incorporation of cigarette butts into nests reduces nest ectoparasite load in urban birds: new ingredients for an old recipe.']

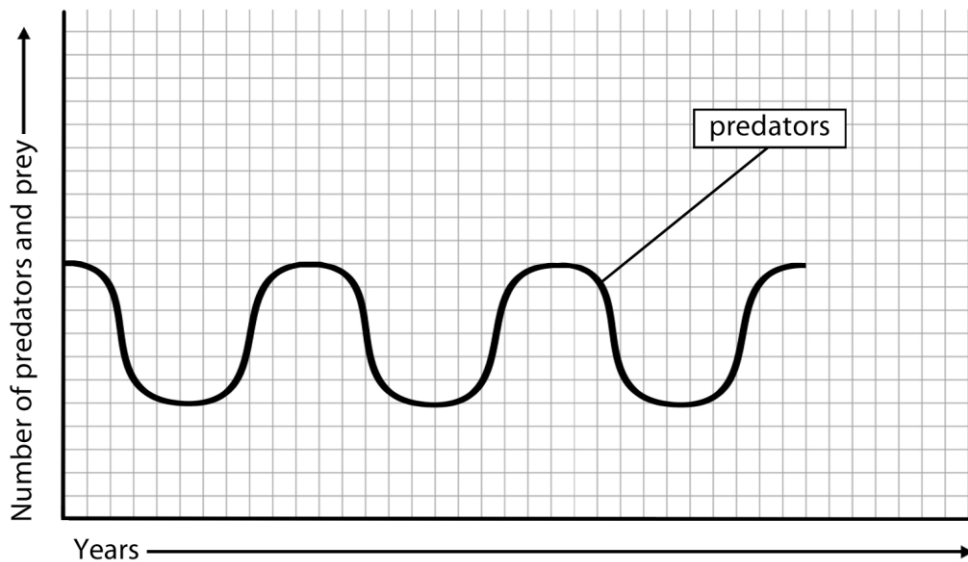
Adapted from Scientific American 60-second podcast by Karen Hopkin 05/12/2012.

- (i) Name **one** bird from the study **and** name its parasite.
- (ii) Explain the term *ectoparasite*.
- (iii) Suggest **one** negative effect on birds or chicks of living in parasite-infested nests.
- (iv) Apart from an effect on parasite numbers, suggest a reason for the use of the filter fibres in nest building.
- (v) State **one** benefit to a plant of giving off strong smells.
- (vi) Suggest what might be trapped in used cigarette filters.
- (vii) Suggest how the scientists might have measured the amount of cigarette filter fibre in one nest.
- (viii) The scientists put unused cigarette filters beside the birds' nests. Suggest a reason for this.
- (ix) The nests containing unused filters showed a normal parasite load. Suggest **one** reason for this observation.
- (b) (i) Draw a large labelled diagram to illustrate the main features of the nitrogen cycle.
- (ii) Outline **two** biological similarities between the nitrogen cycle and the carbon cycle.
- (iii) Suggest why continual monitoring of the environment is valuable.
- (iv) In the case of each of the following pairs of terms, distinguish between the members of each pair by writing a sentence about each term.
1. Contest competition and scramble competition.
 2. Edaphic and aquatic.
 3. Climate and weather.

15.	(a)	(i)	Finch (or sparrow) + (blood sucking) mites	3
		(ii)	(Organism living on) host (or explained) / causing damage	2(3)
		(iii)	Disease or death or weakened (birds)	3
		(iv)	Readily available or shortage of normal material or similar to normal building material or suitable material or insulator	3
		(v)	Repulsion (or described) or attraction (or described)	3
		(vi)	Tar or nicotine (or other named substance) or bacteria	3
		(vii)	By weighing it	3
		(viii)	Control (or explained)	3
		(ix)	No (mite)-repelling (or mite-killing) chemicals or absence of named chemical	3

15.	(b)	(i)	<ul style="list-style-type: none"> • Nitrogen gas to usable compounds / • Plant protein to animal protein / • Excretion releasing N compounds / • Death and decomposition / • Dead matter to Ammonium • Ammonium to nitrite / • Nitrite to nitrate / • Nitrates to plant protein / • Nitrogen compounds to nitrogen gas / • One example of bacterial involvement / • Role of lightning <p style="text-align: right;">Any six</p>	6(2)
		(ii)	fixation (or explained) / bacteria (or micro-organisms) involved / death and decay / nutrition (or described) / excretion	2(2)
		(iii)	To be able to detect change(s) or to remedy effect of change or to detect levels of pollutants (or example)	2
		(iv)	1. <i>Contest:</i> one gets all (of the resource)	2
			<i>Scramble:</i> all get some (of the resource)	2
			2. <i>Edaphic:</i> to do with soil	2
			<i>Aquatic:</i> to do with water	2
			3. <i>Climate:</i> Long-term (prevailing) conditions	2
			<i>Weather:</i> Short-term (atmospheric) conditions	2

(c) The graph below shows the fluctuations in the population of a predatory species over many years.



- (i) **Copy the graph into your answer book.**
Then, on the same axes and using a dashed line (- - -), show how you think the population of the predator's main prey species might vary over the same timespan.
- (ii) Give an explanation of the graph that you have drawn for the **prey** species.
- (iii) Do you think that population graphs for a host species and its main parasite would show similar fluctuations? Explain your answer.
- (iv) Suggest a role for parasites in the overall scheme of nature.
- (v) 1. Name **two** predators.
2. Give **one** adaptive technique in the case of **each** predator.

15.	(c)	(i)	<i>Graph:</i>	Out of sync	3
				most prey peaks higher than predator peaks	3
		(ii)	Explanation of time lag		3
			Explanation of bigger prey numbers		3
		(iii)	Yes (or No) + Explanation		3
		(iv)	Population control		3
		(v)	Name predator 1		3
			Adaptive technique		3
			Name predator 2		3
			Adaptive technique		3

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