



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2020

Biology

Sections A and B and Answerbook

Higher Level

Three hours

400 marks

Examination Number

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Day and Month of Birth

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For example, 3rd February
is entered as 0302

Centre Stamp

Instructions

Write your Examination Number and your Day and Month of Birth in the boxes on the front cover.

Write your answers to all parts of the examination into this answerbook. This answerbook will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write your answers in blue or black pen. You may use pencil for sketches, graphs and diagrams only.

There are three sections to this examination. Questions for Section **C** are supplied separately but your answers must be written in this answerbook.

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**.

Section **A** Answer any **five** questions from this section.
Each question carries 20 marks.

Section **B** Answer any **two** questions from this section.
Each question carries 30 marks.

Section **C** Answer any **four** questions from this section.
Each question carries 60 marks.

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

1. Answer any **five** of the following parts (a) to (f):

(a) Give **one** example of a trace element in the human diet.

(b) Name the **three** chemical elements found in all lipids.

(c) Name the basic unit that makes up lipids.

(d) Respiration is an example of a metabolic pathway in organisms. What type of metabolic pathway is in question?

(e) What is meant by the term *polysaccharide*?

(f) Name a storage polysaccharide found in animals.

2. Answer this question in relation to the principles of experimentation.

A scientist carried out a trial, to investigate the effect of herbal (plant) extract on the rate of recovery from the common cold.

Ten friends suffering from the common cold were chosen to participate in the trial. These were divided into two groups of five. Everyone in group A was given a glass of herbal extract to drink and everyone in group B given a glass of water to drink. Their rate of recovery was monitored over a 24 hour period.

(a) What is the purpose of carrying out an experiment?

--

(b) Why is a control normally used when carrying out an experiment?

--

(c) Which group was the control group?

--

(d) Give **two** reasons why the method of selecting the participants reduces the reliability of the results.

1.
2.

(e) Using examples from the text, other than the selection of participants, give **two** ways to show how the experimental design could be improved.

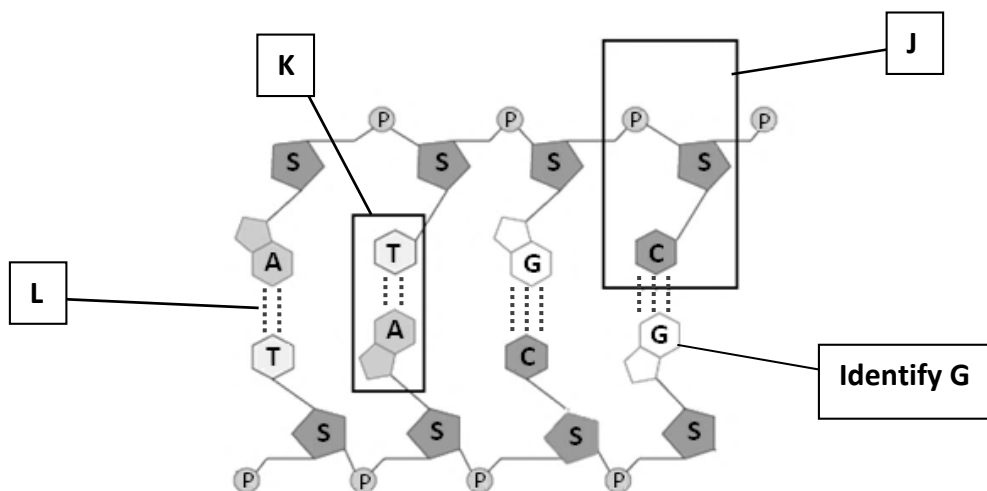
1.
2.

3. Indicate whether the following statements are true or false by placing a tick (✓) in the appropriate box in **each** case.

- (a) Spindle fibres contract during metaphase of mitosis.
- (b) Glucose is produced by yeast cells during fermentation.
- (c) The process of translation results in a protein being made.
- (d) Prokaryotic cells contain a nucleus.
- (e) Darwin and Wallace proposed the Theory of Natural Selection.
- (f) A mutation to a cell's DNA always has a negative impact for the cell.
- (g) The ribosome of the cell contains the chromosomes.

True	False

4. The diagram shows part of the structure of DNA.



- (a) What do the letters DNA stand for?

- (b) Identify molecule **G**.

- (c) The structure labelled **J** is a sub-unit of DNA. Identify the structure labelled **J**.

- (d) Name the part labelled **K**.

- (e) What type of bonding occurs at **L**?

- (f) State **one** structural difference between DNA and RNA, other than the number of strands.

- (g) Give **one** non-nuclear location of DNA in cells.

5. Give **one** function of each of the following structures in the human body:

(a) Cones in the eye.

(b) The optic nerve.

(c) Iris in the eye.

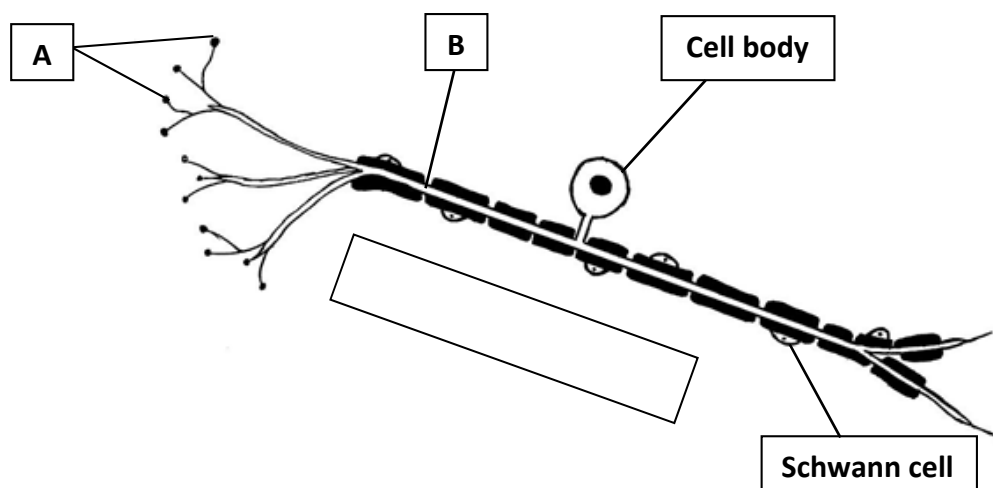
(d) The Eustachian tube in the ear.

(e) The semi-circular canals in the ear.

(f) Ligaments in joints.

(g) Cartilage around the ends of bones.

6. The diagram shows the structure of a sensory neuron in the human body.



- (a) Identify the part of the neuron labelled **B**.

--

- (b) Name the substance (or group of substances) released by **A** during a nerve impulse.

--

- (c) Name the substance produced by the Schwann cell.

--

- (d) What is the function of this substance named at (c) during a nerve impulse?

- (e) **Draw an arrow**, in the box provided near the diagram, to show the direction of the impulse.

- (f) Parkinson's disease and paralysis are two disorders of the human nervous system. Choose either Parkinson's disease **or** paralysis and suggest how it may be caused and treated.

Disorder:
Cause:
Treatment:

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 an immobilised enzyme?

--

- (ii) Give **one** advantage of using immobilised enzymes.

--

- (b) Answer the following questions in relation to an investigation that you carried out to immobilise an enzyme or cell and examine its application.

Name the enzyme or cell that you used.

--

- (i) Describe how you immobilised that enzyme or cell.

- (ii) Outline how you used the immobilised enzyme or cell to examine its application.

8. (a) (i) What is meant by the term *germination*?

--

- (ii) State **three** factors necessary for successful germination.

--

- (b) Answer the following questions in relation to an investigation you carried out to show digestive activity during seed germination.

State whether you used starch agar or skimmed milk (protein) agar.

--

- (i) Why were the seeds soaked in water prior to the investigation?

--

- (ii) Describe how you further prepared the seeds and added them to the agar plate(s).

- (iii) Under what conditions did you store the plate(s) containing the seeds to allow germination to occur?

- (iv) How did you test to show that digestion had occurred?

- (v) State the result that showed digestion had occurred.

9. (a) (i) Why is the blood in the right side of the heart kept separate from the blood in the left?

--

- (ii) In relation to the heartbeat, what is meant by the term *diastole*?

--

- (b) Answer the following in relation to an investigation you carried out to dissect, display and identify the parts of a sheep's or an ox's heart.

- (i) How did you identify the right hand side from the left hand side of the heart?

- (ii) On which surface of the heart did you observe the coronary artery (groove)?

--

- (iii) Describe how you dissected the heart to identify the bicuspid valve.

- (iv) State the precise location of **one** semilunar valve **and** describe how you further dissected the heart to locate this valve.

Answerbook for Section C

Instructions

Questions for Section C are supplied separately.

Start each question on a new page. Write the question number in the box at the top of each page.
Use the left-hand column to label each part, as shown below.

Part <i>Cuid</i>	Question <i>Ceist</i>	Start each question on a new page <i>Cuir tús le gach ceist ar leathanach nua</i>
(a)	0 4	
(b)(i)		
(b)(ii)		

Four pages of graph paper are provided at the back of this answerbook. On pages with graph paper, the box for the question number is at the bottom of the page.

You do not need to use all of the pages in this answerbook. If you run out of space in this answerbook, you may ask the superintendent for more paper or graph paper.

Write your answers in blue or black pen. You may use pencil for sketches, graphs and diagrams.

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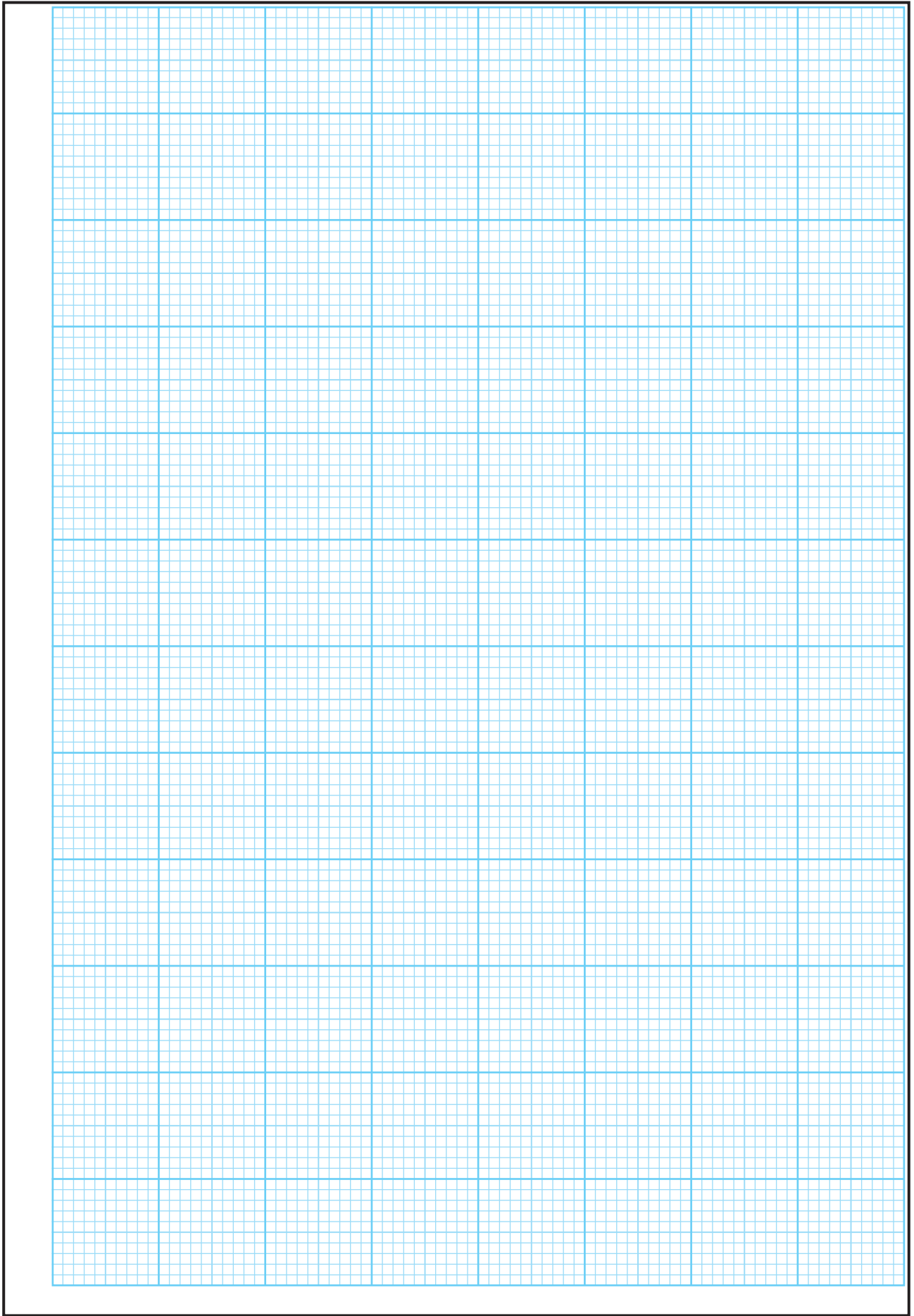
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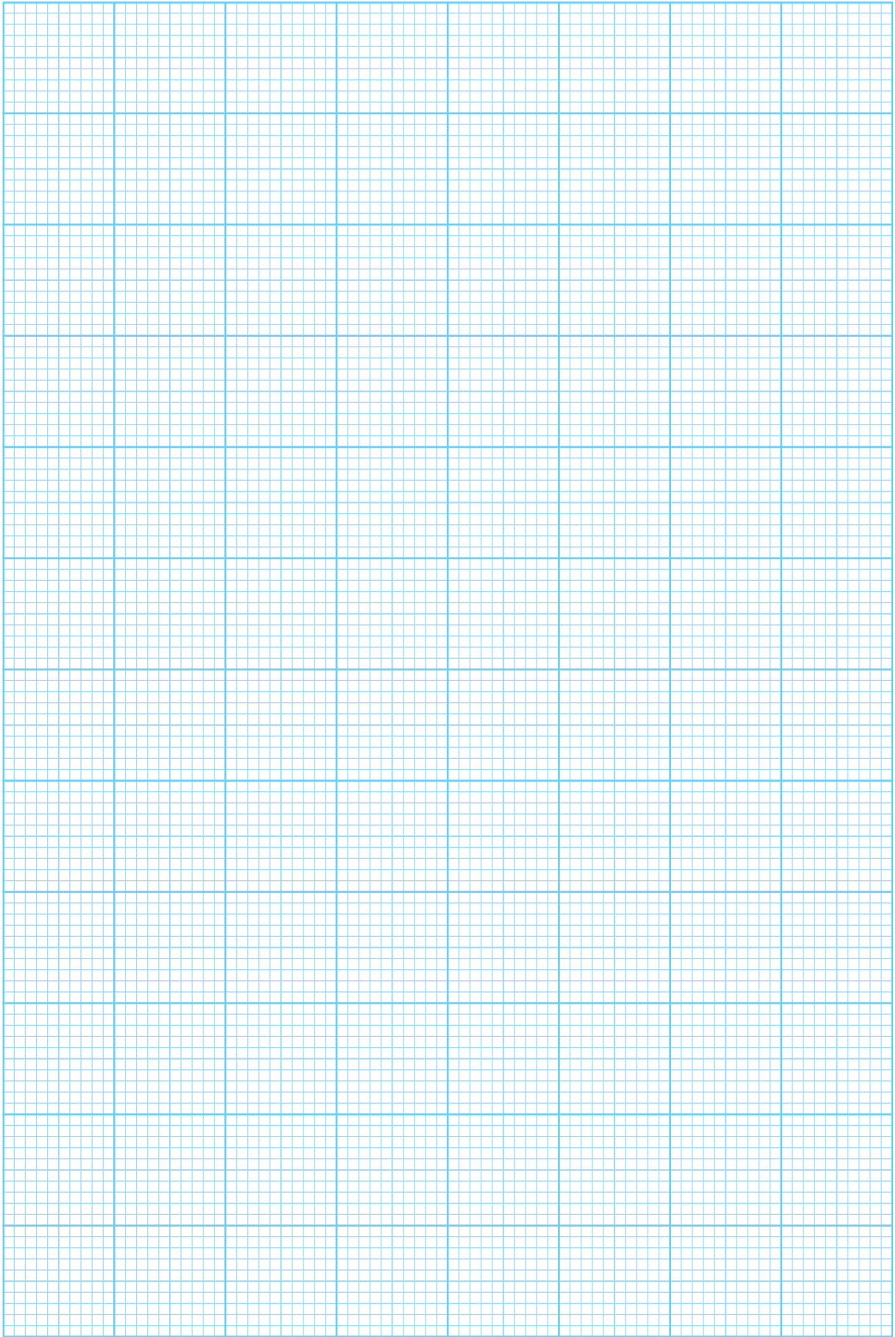
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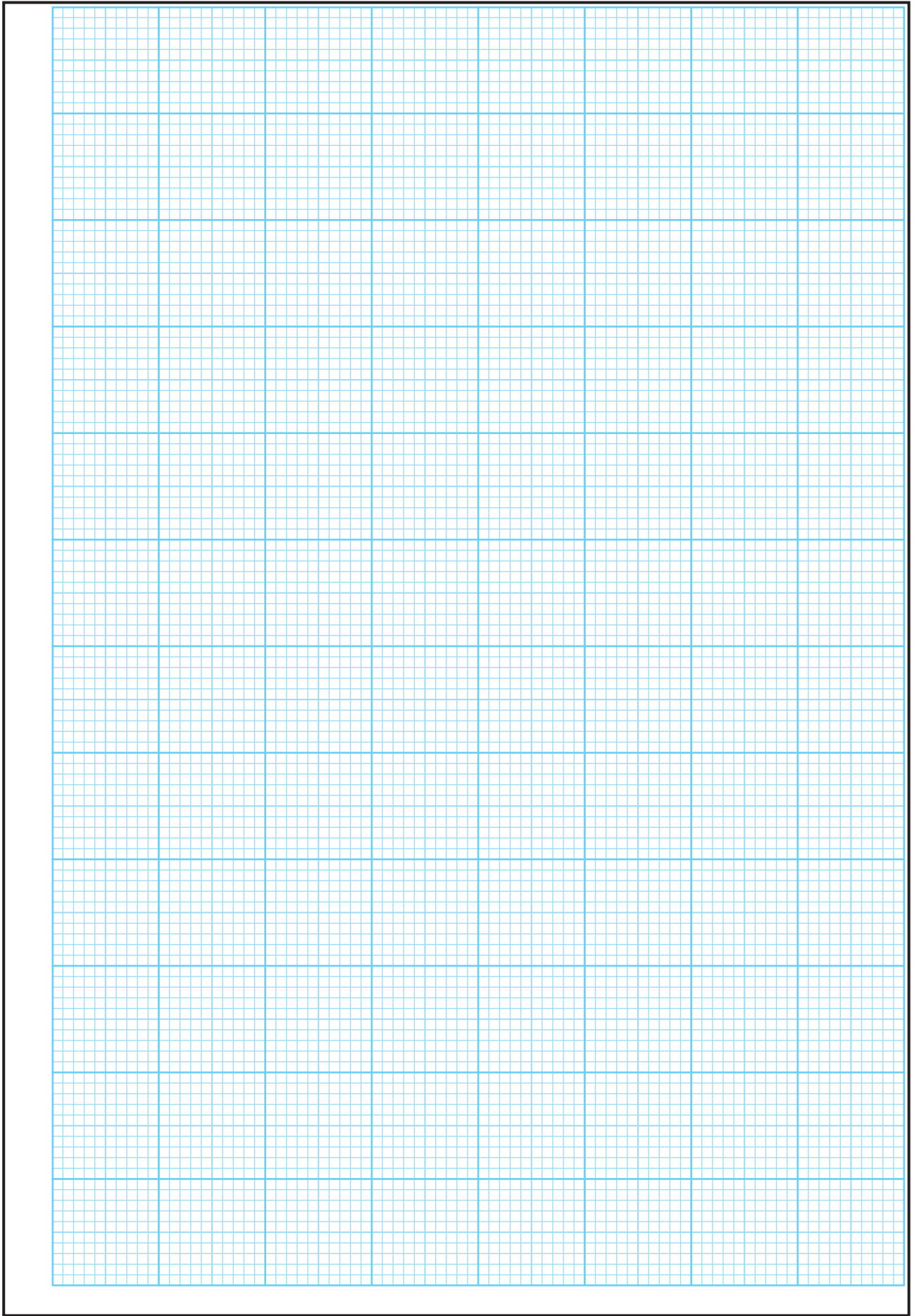
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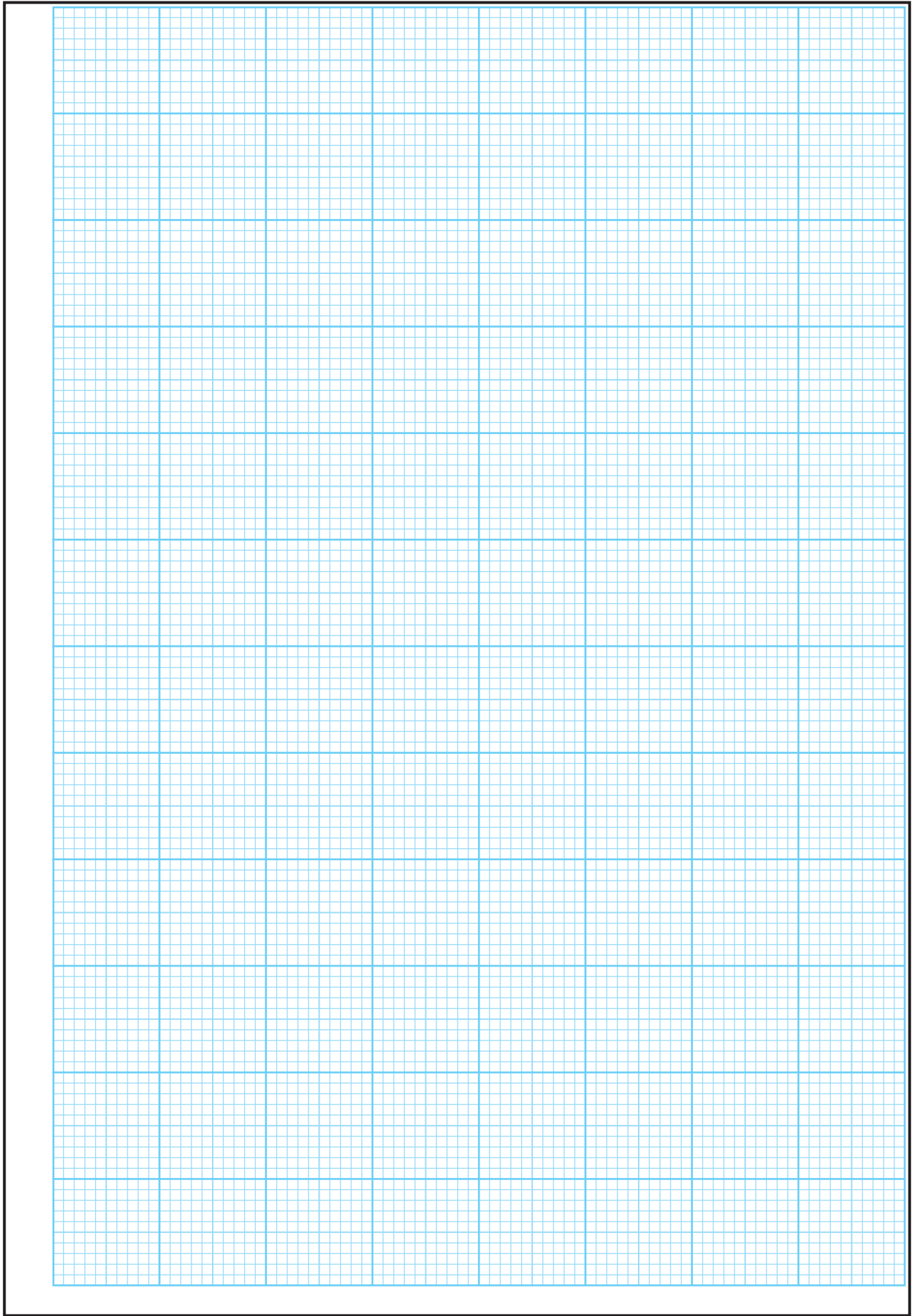
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Question



Question



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Leaving Certificate – Higher Level

Biology Sections A and B and Answerbook

Three hours



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2020

Biology

Section C
Higher Level

240 marks

Do not hand this question paper up

Section C

Answer **any four** questions.

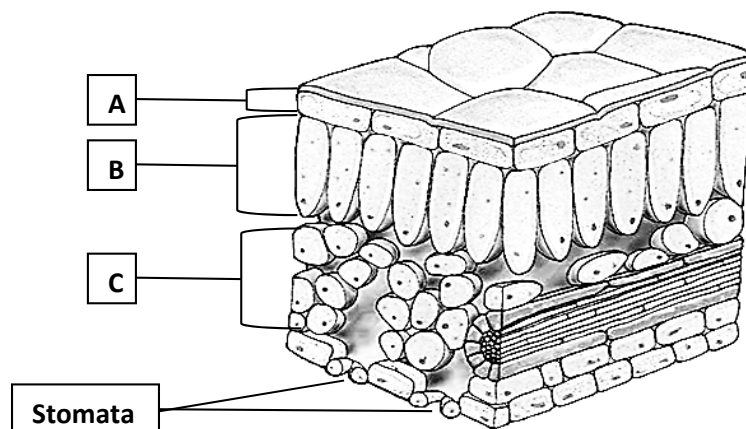
Write your answer in the answerbook containing Sections **A** and **B**.

10. (a) (i) Why is it necessary for an organism to possess an adaptation to its habitat?
(ii) Name **two** types of adaptation that an organism can exhibit. (9)
- (b) *Gunnera* (*Gunnera tinctoria*), known as giant rhubarb is an ornamental plant native to Chile. It has umbrella-like leaf blades up to two metres high and great numbers of tiny flowers.
- 
- This huge plant has been recorded at 1,168 locations on Achill Island and creeps invasively along cliffs, streamsides, roadsides and damp meadows, shading out native vegetation and building up huge seed banks which crowd out everything else.
- Gunnera* spreads largely by its creeping surface rhizomes (horizontal stems) and the scatter of plant fragments, rather than by birds eating the seeds.
- Eradication schemes by county councils have proved difficult, as fresh leaves sprout from rhizomes that have been partially poisoned with glyphosate herbicide and the layered seed banks wait their turn to take over.
- Gunnera* is one of the few flowering plants to fix its own nitrogen through hosting a toxic cyanobacteria in its cells. The plant's need for water, humidity and frost-free winters has kept it largely to the west coast of Ireland and its hinterland.
- (Adapted from 'Gunning for *Gunnera*: ornamental wonder or ecological menace?', *The Irish Times*, 15th March, 2013.)
- (i) Give **two** methods by which *Gunnera* outcompetes native Irish plants.
(ii) What method is usually used to control the population of *Gunnera*?
(iii) Suggest **one** reason why *Gunnera* is so successful at growing in poor quality soil.
(iv) Biological control, using herbivores, might not be successful at controlling the population of *Gunnera*. Suggest **one** reason why.
(v) Suggest **two** ways how *Gunnera* may invade and colonise new areas.
(vi) Name **two** abiotic factors that have limited the spread of *Gunnera* in Ireland. (27)
- (c) (i) State **one** reason why ecological surveying is important.
(ii) Organisms' roles in energy transfer in an ecosystem can be represented using different methods.
1. Name the ecosystem you studied.
 2. Draw a food chain from this named ecosystem containing four members (trophic levels).
 3. Why are food chains mostly limited to four or five members?
 4. Draw a pyramid of numbers to represent this food chain.
 5. Indicate on your pyramid of numbers, the position of
1. the producer **and** 2. the secondary consumer.
 6. Give **one** limitation of the use of pyramids of numbers. (24)

11. (a) (i) Name the type of nutrition exhibited by organisms that carry out photosynthesis.
(ii) Write a balanced chemical equation to summarise photosynthesis.

(9)

- (b) The diagram is that of a transverse section (T.S.) of a leaf growing in a sunny area.



- (i) What is the role of the stomata in photosynthesis?
(ii) Which of the labelled part (A, B or C) would you expect to contain the most chloroplasts?
(iii) Chloroplasts contain chlorophyll molecules. What is the role of the chlorophyll molecules in photosynthesis?
(iv) What particles are released from chlorophyll during the light dependent stage of photosynthesis.
(v) These particles enter one of two pathways.
Give an account of the events of **pathway 2**.

(27)

- (c) Answer the following questions in relation to the second stage of aerobic respiration.

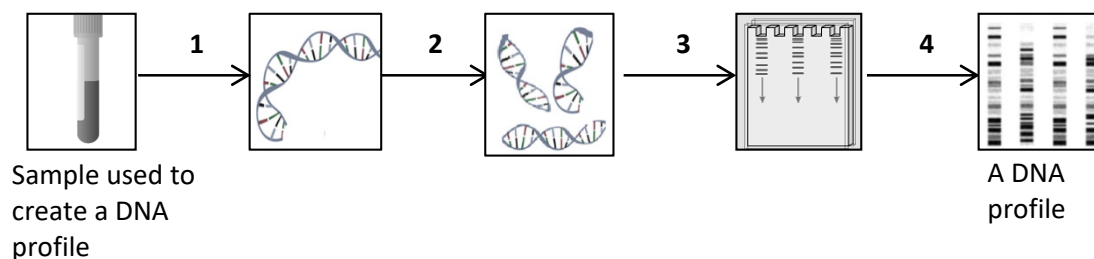
- (i) Name the 3-carbon molecule which enters the mitochondrion.
(ii) Name the **two** carbon containing molecules produced when the 3-carbon molecule at (i) above is broken down.
(iii) One of these carbon containing molecules formed at (ii) above enters a series of reactions. Name this series of reactions.
(iv) Outline the events that take place in the electron transport chain (system).

(24)

12. (a) (i) What is meant by the term *heredity*?
(ii) State Mendel's Law of Independent Assortment (2nd Law).

(9)

- (b) The series of images below represents the four main stages of the DNA profiling technique invented by Sir Alec Jeffreys in 1984.



- (i) Distinguish between *DNA profiling* and *genetic screening*.
(ii) Explain **each** of the Stages, **1 to 4**, of DNA profiling shown above.
(iii) Give any **two** applications of DNA profiling.
(iv) Identical twins have the same DNA profile. Explain why this is so.

(27)

- (c) In Andalusian chickens the allele for black feathers (B) exhibits incomplete dominance over the allele for white feathers (b). When a black, homozygous rooster (male) is crossed with a white, homozygous hen (female) all the newly hatched chicks will have an intermediate phenotype of speckled colour (Bb) known as "blue".

- (i) Explain the terms underlined in the passage above.
- (ii) Determine all the possible genotypes and phenotypes of the offspring of a cross between the following chickens:
"blue" rooster X "blue" hen
Include in your answer the ratio of the resulting phenotypes.
- (iii) What would be the effect on the offspring phenotype ratio, in the genetic cross at (ii) above, if there was **no** incomplete dominance between the two alleles for feather colour, and if black feather was the dominant trait and white feather was the recessive trait?

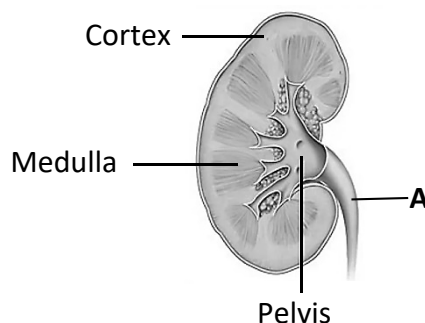
(24)

13. (a) (i) Explain what is meant by the term *homeostasis*.
 (ii) Give **one** reason why homeostasis is important in organisms.
 (iii) Explain what is meant by the term *excretion*.

(9)

- (b) Urine produced by the kidney contains water, salts and urea.

- (i) State the precise location in the body where urea is made.
 (ii) Name the food biomolecule from which urea is derived.
 (iii) A diagram of a human kidney is shown on the right.



1. In which part of the kidney is the Bowman's capsule located?
2. In which part of the kidney is the Loop of Henle located?
3. Name the part labelled 'A'.

- (iv) Draw a large diagram of a nephron and its associated blood supply from a human kidney. Label the following parts:

Bowman's capsule	Loop of Henle	Proximal convoluted tubule
Collecting duct	Distal convoluted tubule	Glomerulus

(27)

- (c) The following table shows the representative composition of blood plasma, glomerular filtrate and urine from a typical adult, (each in g/100 cm³ of fluid).

	Blood Plasma	Glomerular filtrate	Urine
Urea	0.03	0.03	1.8
Glucose	0.1	0.1	0
Proteins	7	0	0

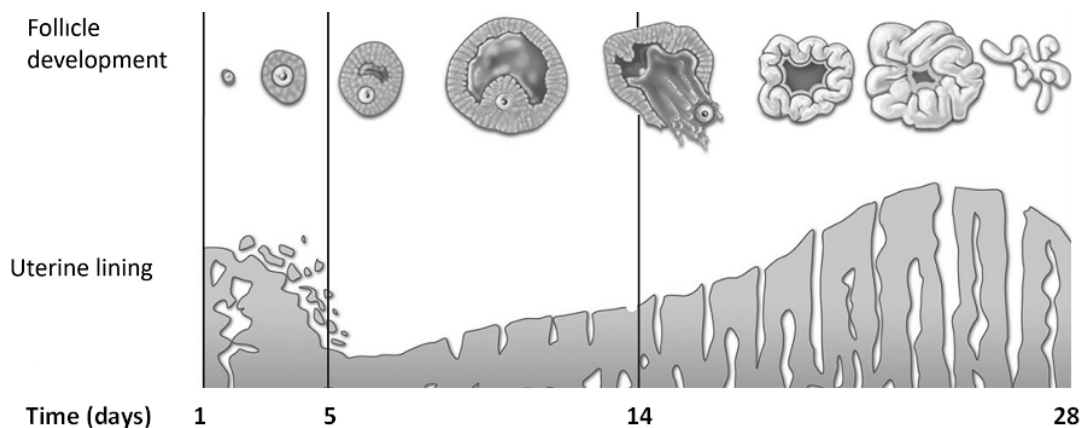
- (i) Using the data from the table above, what is the main difference between the composition of blood plasma and glomerular filtrate? Explain why this is so.
- (ii) Using the data from the table above, in relation to glucose, explain the findings in the composition of the fluids between:
1. Blood plasma and glomerular filtrate.
 2. Glomerular filtrate and urine.
- (iii) Using your knowledge of homeostasis and excretion:
1. State the **effect** on the volume of urine produced by a high salt intake.
 2. Explain your answer to part 1.

(24)

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

(30, 30)

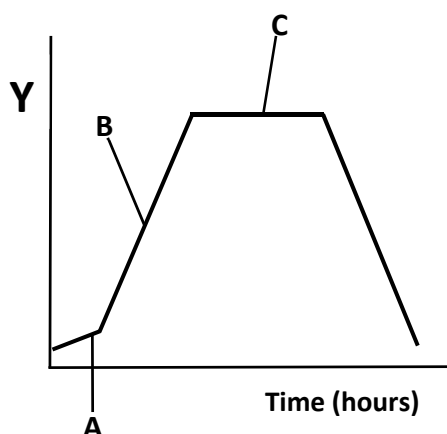
- (a) The diagram below summarises some of the changes that take place in a typical human female during the menstrual cycle. Answer the questions that follow, based on this diagram.



- What is the role of the menstrual cycle?
 - Name the event that occurs between days 1-5 of the cycle.
 - The event you have named at (ii) is triggered by a large drop in a certain hormone. Name the hormone.
 - Where is the hormone oestrogen produced?
 - Using the time axis from the graph above, sketch a graph in your answer book, to indicate the changes in oestrogen levels during the cycle.
 - Name the event that occurs at day 14 **and** name the hormone which causes this to happen.
 - Name the structure that the Graafian follicle develops into after day 14.
 - Does the graph indicate that the woman became pregnant during this menstrual cycle? Explain your answer.
- (b) Answer the following questions from your knowledge of sexual reproduction in flowering plants.
- Describe in detail:
 - The development of the pollen grain from a microspore mother cell.
 - The events that happen to a mature pollen grain following pollination up to double fertilisation.
 - Give **two** adaptations of wind-pollinated flowers that increase their chance of successful pollination.
 - State **two** advantages of sexual reproduction versus asexual reproduction in plants.

(c) Multi-antibiotic (drug) resistant *Clostridium difficile* (C.diff) is a species of bacteria, which can form endospores in response to adverse environmental conditions.

- (i) Draw a large labelled diagram of a typical bacterial cell.
- (ii) Name the method of asexual reproduction exhibited by bacteria.
- (iii) Describe the process of this asexual reproduction in bacteria.
- (iv) The diagram below is that of a typical growth curve for microorganisms;
 - 1. Name each of the stages of the growth curve labelled A, B and C.
 - 2. What is a suitable label for axis Y?



- (v) Copy the growth curve in your answer book and indicate on your diagram when endospore formation is most likely to occur.

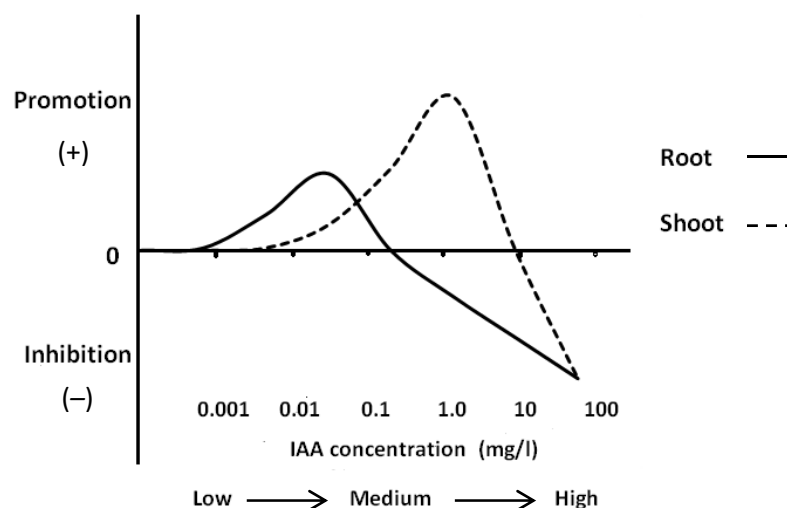
15. Answer any **two** of (a), (b), (c).

(30, 30)

(a) Plants produce chemicals called growth regulators such as auxin to regulate tropisms.

- (i) What is a tropism?
- (ii) Where precisely in plants are auxins produced?
- (iii) What is the precise benefit to the plant that the shoot is positively phototropic?
- (iv) Give **two** uses in agriculture or horticulture of plant growth regulators.
- (v) The graph below shows the result of a student's investigation on the effect of different concentrations of IAA on the growth of plant roots and shoots.

Compare the effects the different concentrations of IAA have on the growth of the roots and the shoots.



- (vi) State **two** reasons why the action of an auxin is considered to be similar to the action of a hormone in the human body.

- (b) Human papilloma virus (HPV) is a virus that can infect cells and cause some cancers in males and females. A vaccine has been produced to prevent infection by the human papilloma virus and is now available to all first year students attending Irish second-level schools. The vaccine contains particles from the coat of the virus only, in a saline solution, and stimulates induced immunity in humans.
- (i) From which biochemical component are viral coats made?
 - (ii) Name the other main chemical component of a virus.
 - (iii) Why can viruses be described as obligate parasites?
 - (iv) Describe how virus particles can infect and replicate in host cells.
 - (v) Immunity is the ability to resist infection. Name the **two** types of induced immunity.
 - (vi) Which of these types of immunity that you have named at (v), occurs after a vaccination with the HPV vaccine?
 - (vii) Give **one** difference between the types of induced immunity that you have named at (v).
- (c) Answer the following questions about a plant root.
- (i) Draw a diagram of the longitudinal section (L.S.) of a typical root.
 - (ii) Label any **three** zones on your diagram.
 - (iii) In which zone is water absorbed from the soil?
 - (iv) Name the process through which water is absorbed from the soil.
 - (v) Name the tissue that transports water in roots.
 - (vi) Give **two** ways in which this tissue is adapted to transporting water.
 - (vii) Two Irish scientists, Dixon and Joly, first proposed the theory of water movement in plants. Using this theory, describe the mechanism by which water moves through this tissue to the leaves in a plant.

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Leaving Certificate – Higher Level

BIOLOGY

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