



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**INTERMEDIATE MATRICULATION LEVEL
2020 FIRST SESSION**

SUBJECT: **Biology**
DATE: 11th September 2020
TIME: 4:00 p.m. to 7:05 p.m.

Directions to Candidates

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions in Section A and **TWO** questions from Section B.
- Write all your answers to questions from Section A in the spaces provided in this booklet. Candidates are advised that under no circumstances should answers to Section A be submitted in the separate answer booklet provided.
- Write all your answers to questions from Section B in the separate answer booklet provided.
- If more than two questions from Section B are attempted, only the first two answers shall be taken into consideration.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.

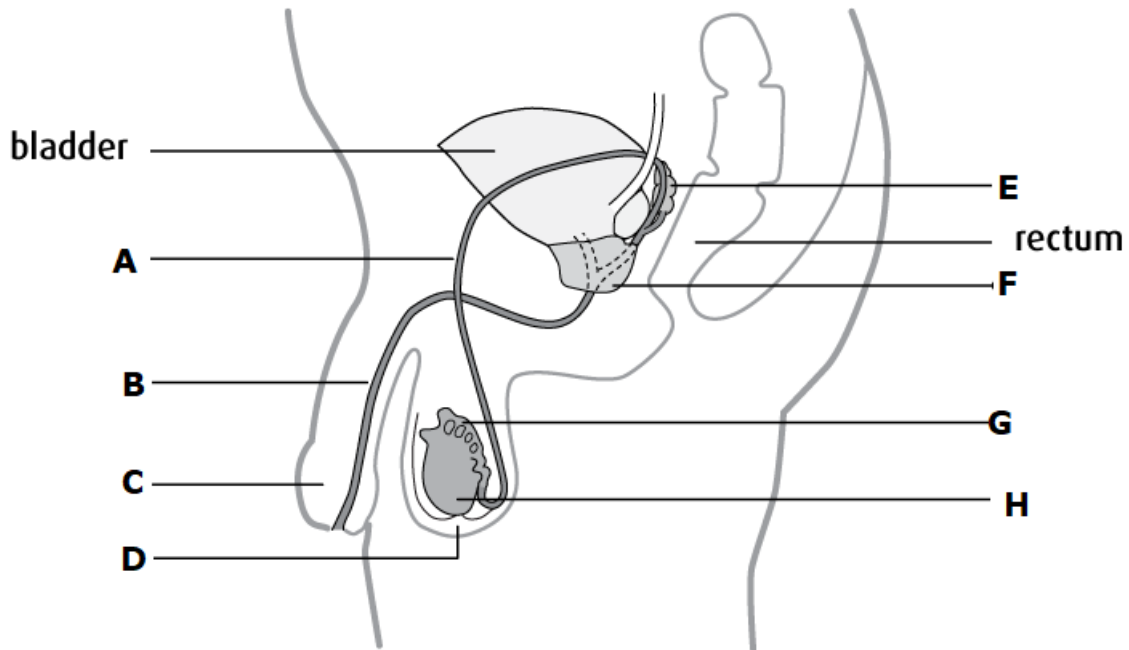
For examiners' use only:

Question	1	2	3	4	5	6	7	8	9	10	11	Total
Score												
Maximum	6	8	10	10	10	6	25	25	25	25	25	100

SECTION A: Answer ALL questions in this section.

1. This question is about the human reproductive system.

Figure 1 shows a cross-section of the male urogenital system.



© Canadian Cancer Society

Taken from: <https://www.cancer.ca/en/cancer-information/>

Figure 1

a. State the letter of the structure that represents the following statement:

Statement	Letter
Cells from this structure undergo meiosis to produce spermatids	
Produces fluid that make up semen	
Contains erectile tissue that fills up with arterial blood	
A duct that allows the passage of semen and urine	

(2)

b. Testosterone is the main reproductive hormone in males. Give **TWO** functions of this hormone.

(2)

c. Distinguish between copulation and fertilisation.

(2)

(Total: 6 marks)

2. This question is about evolution and diversity of life.

a. The following is part of an article on a recent study on pesticide resistance.

Biodiversity slows the spread of pesticide resistance

When pest species are exposed to toxic chemicals, like pesticides, they can evolve genetic changes that confer resistance to the harmful effects. These genetic changes can become widespread in future populations.

Adapted from: <https://ec.europa.eu/environment/integration/research/newsalert>

i. Define the term biodiversity.

(2)

ii. What brings about a genetic change mentioned in the above text?

(1)

iii. Explain how the genetic changes can 'become widespread in future populations'.

(3)

b. The study also found that the increase in the number of pests with pesticide resistance was slowed by predation. Explain.

(2)

(Total: 8 marks)

3. This question is about enzymes.
 Urease is an enzyme which catalyses the breakdown of urea to ammonia and carbon dioxide. An experiment was carried out into the effect of pH on the activity of urease. 5 cm³ of pH 3 buffer solution was mixed with 1 cm³ of urease solution. The mixture was then added to 5 cm³ of urea solution and the concentration of ammonia in the mixture was measured after 30 minutes. This procedure was repeated using buffer solutions of pH 4, 5, 6, 7, 8 and 9.

The results are shown in the graph below.

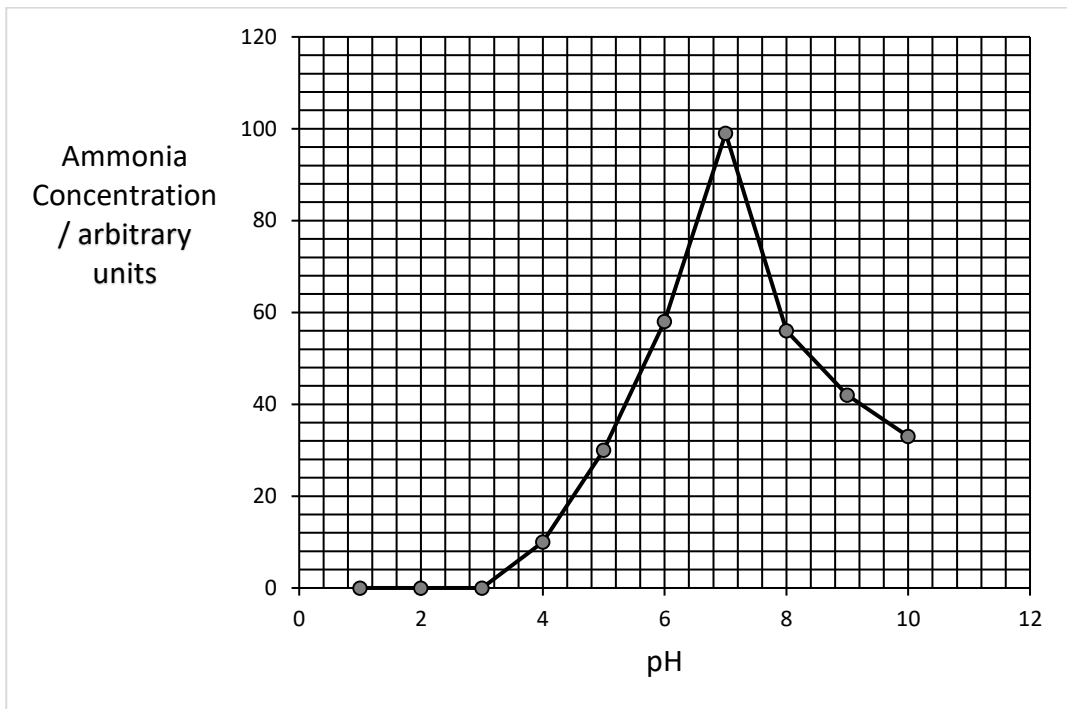


Figure 2: A graph of pH against the ammonia concentration

- a. From the graph above, indicate the optimum pH of urease. Give a reason for your answer.

_____ (2)

- b. Explain why **no** ammonia was produced below pH 3.

 _____ (2)

c. Explain why ammonia concentration decreased at pH 9 and 10.

(2)

d. Other factors have an affect on the rate of enzyme catalysed reaction. Mention and describe the effect of **ONE** other factor.

(4)

(Total: 10 marks)

4. This question is about genetic engineering.

The number of people with diabetes is estimated to be over 370 million. In 2030, it will increase to 552 million. Despite the appearance of insulin analogues on the pharmaceutical market, insulin delivery is still the most effective method of pharmacotherapy in cases of extremely high hyperglycemia. Recombinant DNA Technology remains a very important field.

(Adapted from: <https://www.sciencedirect.com/science/article/pii/S1046592818305862>)

a. Define recombinant DNA technology.

(2)

b. Give a brief description of the use of the following in the production of human insulin.

i. restriction endonuclease enzymes;

(2)

This question continues on next page.

ii. ligase;

(2)

iii. sticky ends;

(2)

iv. plasmid.

(2)

(Total: 10 marks)

5. This question is about defence against disease.

a. Briefly describe the role of the following in the human immune system:

i. antibodies;

(2)

ii. phagocytic leucocytes;

(2)

iii. mucous membranes.

(2)

b. Explain the following statements:

i. Antibiotics are used to treat bacterial infections.

(2)

ii. People suffering from AIDS are generally more susceptible to infections.

_____ (2)

(Total: 10 marks)

6. The figure below shows the initial stages of a synaptic transmission when an impulse arrives at the synaptic knob.

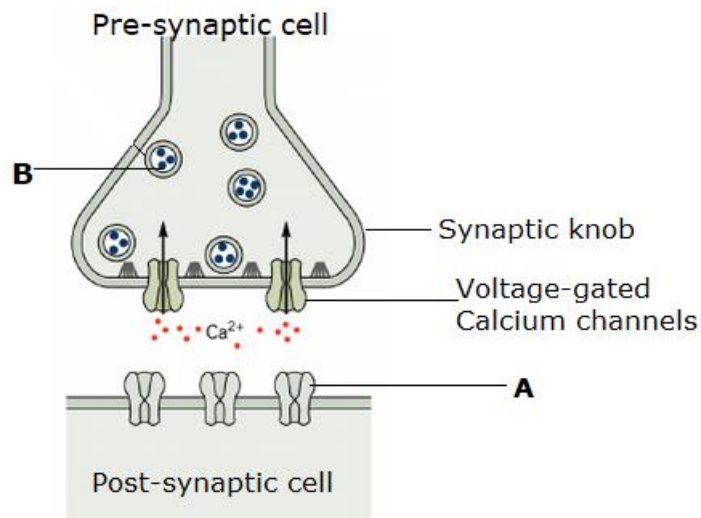


Figure 3

Taken from: <https://www.cancer.ca/en/cancer-information/>

a. Label parts A and B.

A: _____

B: _____ (2)

b. Explain the stages of a synaptic transmission from when an impulse arrives at the synaptic knob until an impulse is fired in the post-synaptic cell.

_____ (4)

(Total: 6 marks)

SECTION B:

Answer any TWO questions from this section; each question carries 25 marks. If more than two questions are attempted, only the first two answers shall be taken into consideration.

Write all your answers to questions from this section in the separate answer booklet provided.

7. This question is about biomolecules.

What is the most abundant large molecule on Earth? We are most likely to come across this molecule in the natural world – walking through a forest, for example. That’s because this molecule is the substance produced by plants for structural support. Earth’s plants produce at least 100 billion tonnes of this molecule each year – hundreds of times greater than the amount of plastics produced in the same time. As well as being hugely abundant, the molecule produced by plants is extremely useful.

Adapted from: Science in school, issue 41: Autumn 2017.

- a. The molecule indicated in the text refers to a polysaccharide. What is a polysaccharide? (2)
- b. Name the molecule referred to in the text above. (1)
- c. Name the monomer that makes up this polysaccharide and draw its structure. (4)
- d. Name and give **ONE** function of:
 - i. another **TWO** polysaccharides found in living organisms; (4)
 - ii. **TWO** monosaccharides found in living organisms; (4)
 - iii. **ONE** disaccharide found in living organisms. (2)
- e. Briefly explain how monosaccharides form disaccharides and how disaccharides can form monosaccharides. (5)
- f. Plastic is a synthetic polymer that is harmful to the environment. Give **THREE** ways how plastic can have a negative impact on the environment. (3)

(Total: 25 marks)

8. This question is about homeostasis in humans.

- a. Define the term homeostasis. (4)
- b. Prolonged exercise causes the blood glucose levels to decrease. Describe the changes in the human body that take place to keep the blood glucose levels within a range. (10)
- c. A person reaches a state of exhaustion when doing exercise quicker in hot weather than in cold weather. Explain why. (3)
- d. Describe the physiological changes noted in the human body when there is a drop in environmental temperature. (8)

(Total: 25 marks)

9. This question is about ecology.
- a. Distinguish between the following ecological terms:
 - i. population and community; (4)
 - ii. food chain and food web. (4)
 - b. Most populations follow a sigmoid (S-shaped) population growth curve. Sketch this graph and label it fully. (5)
 - c. Describe and explain the phases of growth identified in the graph you have drawn in part (9.b). (8)
 - d. i. Describe the carrying capacity of a species in an environment. (3)
 - ii. On the graph you have drawn in part (9.b), label the carrying capacity. (1)
- (Total: 25 marks)**
10. This question concerns DNA.
- a. Draw a labelled section of a DNA molecule. (6)
 - b. DNA replication is a semi-conservative process. Explain. (3)
 - c. Describe the process of DNA replication. (8)
 - d. Using a table, list **FOUR** differences between transcription in protein synthesis and DNA replication. (8)
- (Total: 25 marks)**
11. This question is about cellular respiration and photosynthesis.
- a. Compare and contrast the structure of the mitochondrion and the chloroplast. (9)
 - b. Briefly outline the pathways of aerobic respiration in the mitochondrion. Refer to the structures of the mitochondrion in your answer. (8)
 - c. The process of photosynthesis takes place into two sequential steps: the light dependent reactions followed by the light independent reactions.
 - i. Describe the role of the grana in chloroplasts in the light dependent process. (5)
 - ii. List the molecules needed for the light independent reactions and the main product of these reactions. (3)
- (Total: 25 marks)**