DEPARTMENT FOR CURRICULUM,
LIFELONG LEARNING AND EMPLOYABILITY
Directorate for Learning and Assessment Programmes
Educational Assessment Unit

Track 3

Annual Examinations for Secondary Schools 2021

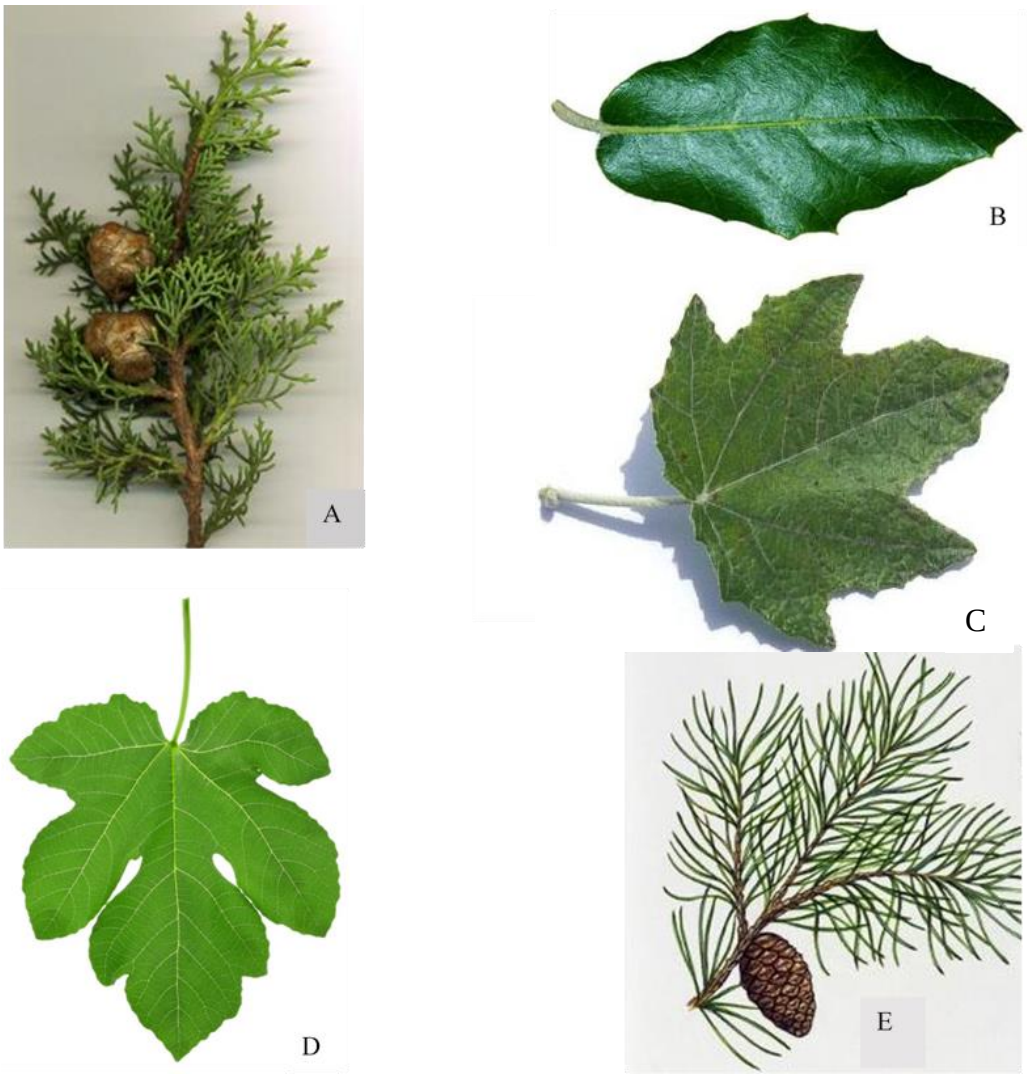
YEAR 11 BIOLOGY TIME: 2 hours

Name: _____ Class: _____

Question No.	Section A							Section B					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	
Max. mark	8	5	10	9	7	8	8	15	15	15	15	15	
Actual mark													**TOTAL MARK**

Section A: Answer all questions in this section.

1a. Below is a dichotomous key of leaves from some local trees.



Taken from various sources

Figure 1: Dichotomous Key

1a	Leaves reduced to needles……	Go to 2
1b	Have broad leaves……	Go to 3
2a	Have long needles in pair clusters……	**Aleppo Pine**
2b	Have short scale like needles……	**Italian Cypress**
3a	Leaves are lobed……	Go to 4
3b	Leaves are not lobed and with rough pointed edges..	**Holm Oak**
4a	Leaf with deep lobes……..	**Fig**
4b	Leaf with shallow lobes……	**While Poplar**

i) Name the tree represented by the letter: (2)

B_____ E_____

ii) Write the letter of each of the two gymnosperm trees represented above. (1)

_____

iii) Identify **one** characteristic feature of the trees listed in aii) that made you recognise them as gymnosperms. (1)

_____

b. The leaves of D are broad and have a network of veins. Explain the importance of these adaptations in photosynthesis. (2)

_____

_____

_____

c. The underside of the leaves of plant C have small hairs that make them look white. Discuss the role of these hairs and whitish underside. (2)

_____

_____

Total 8 marks

2a. The table below shows features of a bacterium and a virus. Complete the table by putting a tick (✓) in the relevant box where a feature is present.

	Bacterium	**Virus**
Genetic Material		
Cell wall		
Capsomeres		
Cytoplasm		

(2)

b. Protists, fungi, animals and plants are all eukaryotes.

i) Name **one** organelle present in eukaryotic cells. (1)

_____

ii) Both fungi and plant cells have a cell wall surrounding the cell. Distinguish between the cell walls of fungi and plants. (1)

_____

iii) Some single cell protists have permanent structures that allow them to move about in their habitat. Name this structure. (1)

_____

Total 5 marks

3. A student investigated the breakdown of starch by an enzyme produced by the human digestive system.

a. i) Name the human enzyme that breaks down starch. (1)

_____

ii) Give the product of this reaction. (1)

_____

b. The student added the enzyme to a starch solution and measured the concentration of the disaccharide produced in the reaction mixture every 5 minutes.
Below are the results obtained and processed in the form of a graph.

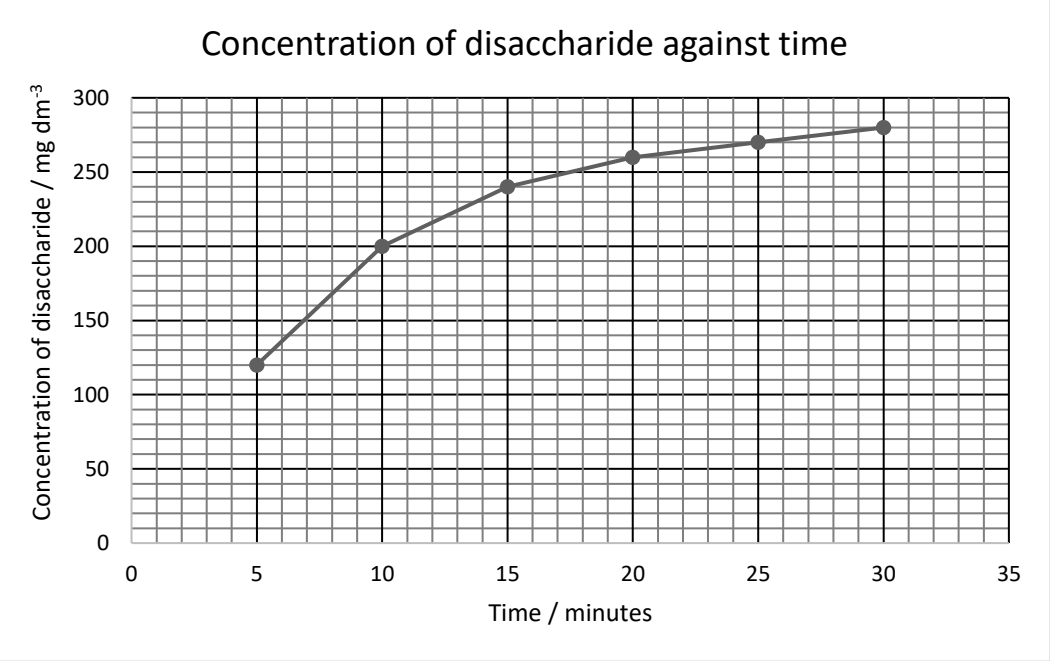


Figure 2: Graph of disaccharide concentration against time

i) Explain the results shown in the graph. (2)

_____

_____

_____

ii) Using your biological knowledge, justify the trend shown by the graph. (3)

_____

_____

_____

_____

iii) State the independent variable of this investigation. (1)

_____

c. The product of the breakdown of starch is a reducing sugar. Describe a chemical test used to test for a reducing sugar. (2)

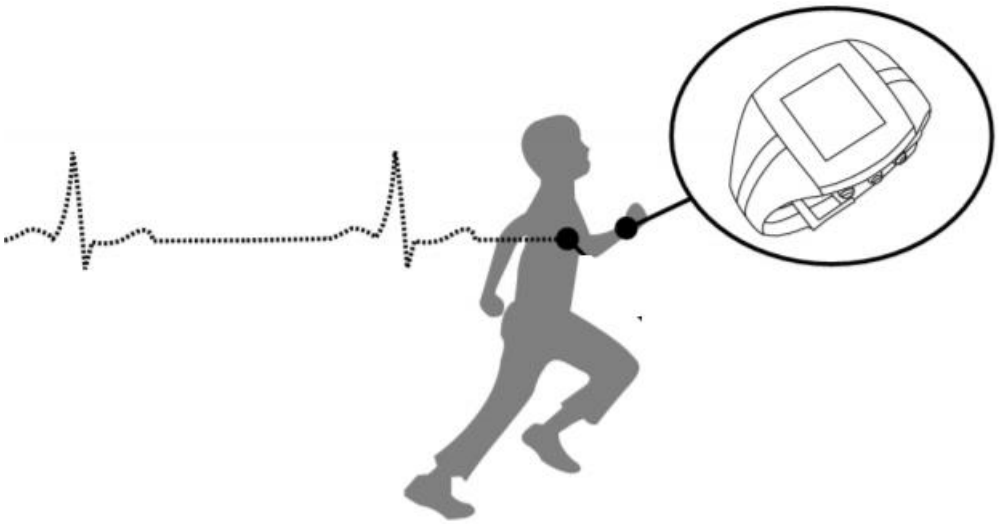
_____

_____

_____

Total 10 marks

4. Wrist heart rate monitors are fitness trackers that sense the pulse rate in real time. They are used to gather heart rate data during several forms of physical exercise.



https://www.polar.com/sites/default/files/b2b/pe/lessons_for_life_e-version.pdf

Figure 3: Heartbeat and heart rate monitors

a. Describe how the heart rate changes from a person being at rest to exercising for half an hour. (2)

_____

_____

_____

b. Athletes train to improve the efficiency of delivering oxygen to the muscles.
i) Describe **two** adaptations of red blood cells for the transport of oxygen. (2)

_____

_____

ii) Before competitions, athletes train at high altitudes where the oxygen concentration in air is less than that at sea level. Explain the benefit of training at high altitudes. (3)

_____

_____

_____

_____

c. The human circulatory system is a double system. Explain. (2)

_____

_____

_____

Total 9 marks

5. The global COVID-19 cities lockdown affected the environment both positively and negatively.

a. Describe the positive impact on the environment of the following:

i) Beaches, both the seawater and the surrounding land are cleaner. (2)

_____

_____

_____

_____

ii) There was a decrease in noise pollution. (1)

_____

_____

_____

b. Describe the negative impact on the environment of the following:

i) The overall household waste increased. (2)

_____

_____

_____

_____

ii) Certain cities stopped waste recycling. (2)

_____

_____

_____

_____

Total 7 marks

6. In a research study on the effect of soil pH on the common ragweed plant, the following results were obtained.

Soil pH	Effect on plant	
	% Germination	No. of inflorescence (flowers on a plant)
5	58	7
6	50	12
7	55	0

Results taken from https://www.frontiersin.org/articles/10.3389/fpls.2018.01335/full

a. Other data on % germination shows that at pH 3 and pH 9 the % germination was 15% and 18% respectively. Explain why different pH levels affect germination. (2)

_____

_____

b. Soil pH is known to affect plant growth as it influences the uptake of nutrients such as nitrates and magnesium. Explain how these two nutrients support plant growth. (2)

Nitrates _____

Magnesium _____

c. There are separate male and female flowers on a ragweed plant. Name the reproductive organs present on a male flower and on a female flower. (2)

Male flower_____ Female flower_____

d. Ragweed pollen causes respiratory allergies such as hay fever. A plant may produce millions of pollen grains in one season. These pollen grains are transported by wind.

i) Mention **one** characteristic of pollen that is dispersed by wind. (1)

_____

ii) Suggest what can be done to reduce the amount of pollen produced by this plant. (1)

_____

Total 8 marks

7a. Describe the daughter cells (products) of the process of mitosis. (1)

_____

b. Give **one** reason why gametes are produced by the process of meiosis. (2)

_____

_____

c. Incontinentia pigmenti is a rare X-linked disorder that stops the production of a protein in skin cells resulting in blisters and warts from infancy. The mutated allele is dominant. The mutated allele causes lethality in boys i.e. the boy foetus dies before it is born.
The mother of a family had three pregnancies of which a girl and a boy were born. The girl has incontinentia pigmenti, the son is normal. The third pregnancy resulted in the birth of a dead boy. Only one parent has incontinentia pigmenti.
Determine the genotype of the parents showing with a genetic diagram the reasons behind the genotypes given. (5)

Total 8 marks

Section B: Answer Question 1 and any other two questions from this section on the foolscaps provided. Graph paper is needed for Question 1.

1. A group of students investigated the effect of light intensity on the rate of photosynthesis. The students set up a pondweed in a test tube filled with water and moved a lamp at regular distances. For each distance, the number of gas bubbles produced in 2 minutes was recorded. This investigation was tried at two different temperatures: 20°C and 30°C.

   Below are the results obtained.

Distance from lamp (cm)		10	20	30	40	50
No. of gas bubbles in 2 minutes	At 30°C	78	32	12	6	6
	At 20°C	67	23	7	4	4

a. Draw a graph of number of gas bubbles against distance from lamp at 20°C and 30°C on the same axes. (6)
b. Describe the pattern observed of the effect of distance on the rate of photosynthesis. (2)
c. Give **one** reason for pattern listed in b. (2)
d. State **one** reason for the higher rate of photosynthesis at 30°C. (2)
e. Identify **one** source of error of this experiment. (1)
f. Instead of counting the bubbles produced, the gas could be collected and its volume measured. Why would this improve the accuracy of the investigation? (2)

Total 15 marks

2. The nervous system is a complex network of nerves and cells that carry messages to and from the brain and spinal cord to various parts of the body.

a. Describe the 'messages' that are carried by nerve cells (neurones). (1)

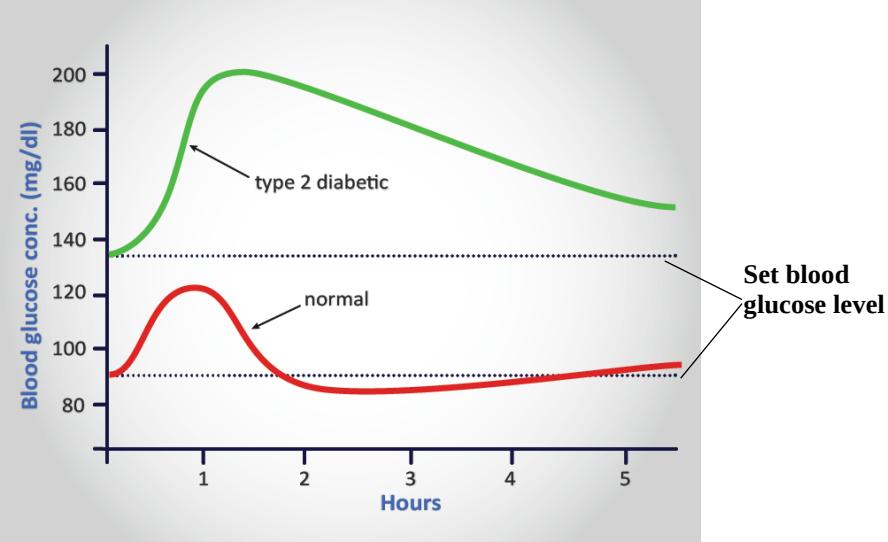
b. The spinal cord is also part of the central nervous system.
   i) Describe the path taken by these 'messages' as they travel along a reflex arc in the spinal cord. You may use diagrams to help in your description. (5)

   ii) Define a reflex action. (1)

   iii) A person grabs a hot handle of a pot. The person feels the pain but is unable to release the handle. By referring to the reflex arc, account for this observation. (3)

c. Hormones are chemical messengers. Describe how these messengers bring about a necessary change. (1)

d. The graph below shows the variation of blood glucose concentration over a number of hours for a normal person and one suffering from diabetes.



http://themedicalbiochemistrypage.org/diabetes-type-1-and-type-2/

Figure 4: Variation of blood glucose levels

i) Name the hormone that causes the blood glucose concentration to decrease after the first hour. (1)

ii) This hormone may not be present in sufficient amounts in the diabetic person. Give **one** reason why the blood glucose concentration still decreases over the five hour test period. (1)

iii) Explain why in the normal person, after the second hour, the blood glucose concentration fluctuates slightly along the set level of blood glucose. (2)

Total 15 marks

3. In an article on 'Antifungal symbiotic peptides in legume', the researchers wrote the following:

Statement 1	The fungus *Botrytis cinerea* causing gray mould disease is a major problem for farmers growing strawberries, grapes, raspberries, tomatoes and lettuce. To mitigate the problem, they often resort to applying chemical fungicides which can lose their effectiveness over time.
Statement 2	Scientists at the Pacific Northwest National Laboratory have identified a sub class of peptides in the nodules of the legume, *Medicago truncatula* that proved effective in inhibiting growth of the fungus causing gray mould. The peptide binds to the fungal spores.
Statement 3	The scientists stated 'We are excited about the possibility of developing this class of peptides as a spray-on fungicide that would provide farmers with an environmentally friendly alternative to chemical fungicides for pre- and post-harvest management of fungal diseases.'

Taken from https://www.sciencedaily.com/releases/2020/07/200720103320.htm

a. Define the term peptides. (2)

b. i) Give the species name of the fungus. (1)
ii) Describe the structure of a mould fungus. (3)
iii) Identify why grey mould reduces crop growth. (2)
iv) Explain why chemical fungicides may lose their effectiveness over time. (2)
v) Grapes, raspberries and tomatoes are fruits containing seeds. Describe the structure of a seed. (2)

c. In statement 3, peptides are considered as environmentally friendly alternatives to the chemical fungicides. Explain. (3)

Total 15 marks

4. The production of vinegar using fruit scraps such as apple is a double fermentation process.

a. What is fermentation? (2)

b. This process first involves yeast for alcohol fermentation and then acetobacteria for acetic acid (vinegar) fermentation.
i. Identify **two** structural similarities between yeast and bacteria. (2)
ii. For the alcohol fermentation, name the substrate found in food scraps that is converted to alcohol and state another product of this reaction. (2)
iii. One by-product of the acetic acid fermentation is cellulose that floats to the surface of the fermenting liquid. Describe a cellulose molecule. (2)

c. Some vinegar recipes suggest adding active vinegar before the second fermentation process. If added at the beginning of the first fermentation, the increase in acidity may stop the fermentation process. Explain. (2)

d. Alcohol can be used as a biofuel instead of fossil fuels. This is considered more environmentally friendly. Explain. (2)

e. Apple flowers are insect pollinated and once fertilisation occurs, the apple fruit develops.
i. State **one** characteristic of flowers that are insect pollinated. (1)
ii. Distinguish between pollination and fertilisation. (2)

Total 15 marks

5. Use your biological knowledge to explain the following statements.

a. Plant stems are positively phototropic. (4)
b. Eutrophication may result when leaching of nutrients occurs in heavy rains. (3)
c. The number of contractile vacuoles in a protist such as *Amoeba* decreases when the protist is transferred from a fresh water pond to seawater. (4)
d. Insects go through different stages of development. (4)

Total 15 marks