FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**BIO1203: Biology 1**
Date of Examination	:	30 July 2021 (Friday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.
All questions carry equal marks.

Materials permitted :

Non-programmable calculator

Materials provided :

Nil

Examiner(s)	:	**Dr. Khor Soo Ping**
Chief Moderator	:	Ms. Tan Ai Lian

*This paper consists of **11** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
BIO1203: BIOLOGY 1
FINAL ALTERNATIVE ASSESSMENT: APRIL 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL FOUR (4)** questions. All questions carry equal marks.

Question 1

(a) Mammoths are extinct mammals related to elephants. About three million years ago, the ancestors of mammoths migrated from Africa into Europe and Asia. There, about 1.7 million years ago, the steppe mammoth evolved and became adapted to the cooler conditions. Then, about 700,000 years ago, as the climate changed and the Arctic became much colder, the woolly mammoth evolved. Woolly mammoths showed a number of obvious adaptations to reduce heat loss, including thick fur, small ears and small tails.
Explain how variation and natural selection may have brought about the evolution of the woolly mammoth from the steppe mammoth.

(4 marks)

(b) An experiment is being done to determine how amount of fertilizer affects the growth of plants.

(i) State the control group for this experiment.

(1 mark)

(ii) State **ONE (1)** importance of having a control group in an experiment.

(1 mark)

(c) Figure Q1(c) below shows a dipeptide formed from two amino acids, glycine and alanine.

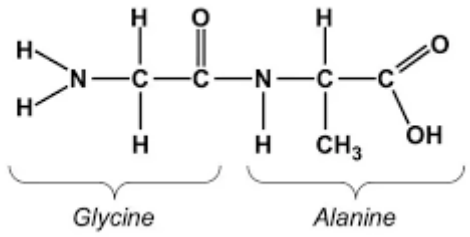

Figure Q1(c)

(i) Which part of the amino acid distinguishes glycine and alanine from one another?

(1 mark)

(ii) Explain what is meant by the primary structure of protein.

(1 mark)

(d) Figure Q1(d) shows four biological molecules labelled **P**, **Q**, **R** and **S**. Select the biological molecule from Figure Q1(d) that matches each of the statements below.

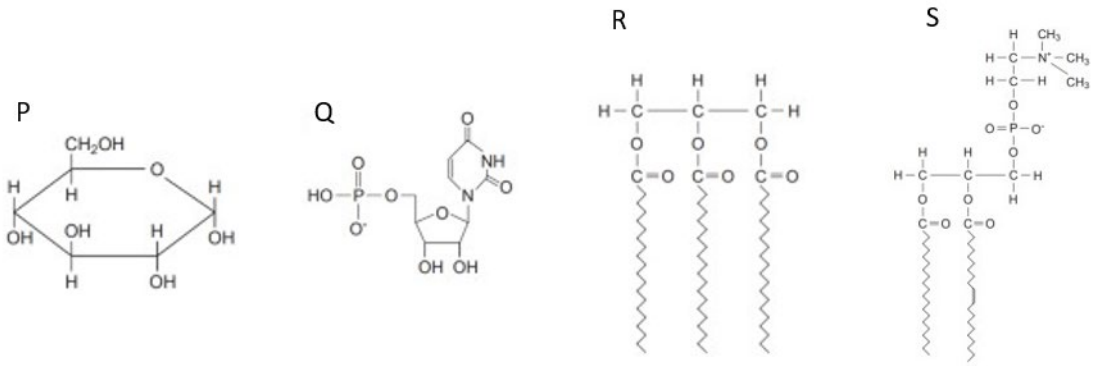

Figure Q1(d)

(i) A component of RNA.

(1 mark)

(ii) A molecule that is polymerized to form glycogen.

(1 mark)

(iii) An important store of energy, insoluble in water.

(1 mark)

(iv) A molecule with hydrophilic and hydrophobic regions.

(1 mark)

(v) Describe the structural difference between molecule **R** and **S**.

(2 marks)

(e) Figure Q1(e) below shows the process of DNA replication.

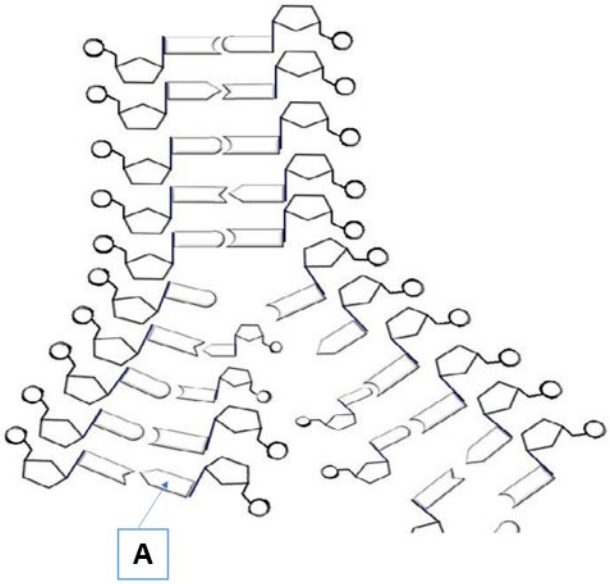

Figure Q1(e)

(i) State the structure labelled **A**.

(1 mark)

(ii) State **ONE (1)** enzyme involved in DNA replication and describe its function.

(2 marks)

(iii) State the model of DNA replication as shown in Figure Q1(e). Suggest why DNA replication is described as this model.

(2 marks)

(f) (i) *Gerridae lacustris*, more commonly known as pond skaters, are able to rest on the surface of a pond. Which properties of water enable this? Explain the science behind this phenomenon based on water's polarity.

(4 marks)

(ii) Besides the water property mentioned in Q1(f)i above, describe another **TWO (2)** properties which render water to be an important medium for life.

(2 marks)

Question 2

(a) Figure Q2(a) shows a scheme for the metabolism of glucose. The pathway I, II and III are used by an organism according to certain environment conditions.

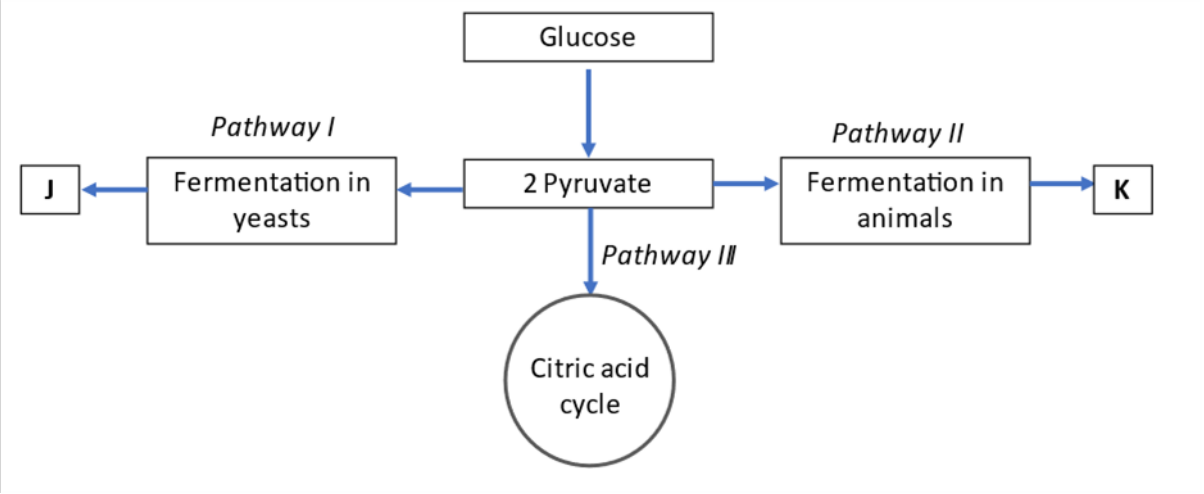

Figure Q2(a)

(i) State the condition and location in which the pathways I and II occur.
Condition:
Location:

(2 marks)

(ii) State the condition and location in which the pathway III occurs.
Condition:
Location:

(2 marks)

(iii) State the end products of pathways I and II represented by **J** and **K**.

(2 marks)

(iv) Give the importance of the pathways I and II in the cellular respiration process for the organisms concerned.

(2 marks)

(v) Describe how pyruvate enters Citric acid cycle through pathway III.

(3 marks)

(b) Figure Q2(b) shows a scheme for the light-dependent reaction of photosynthesis.

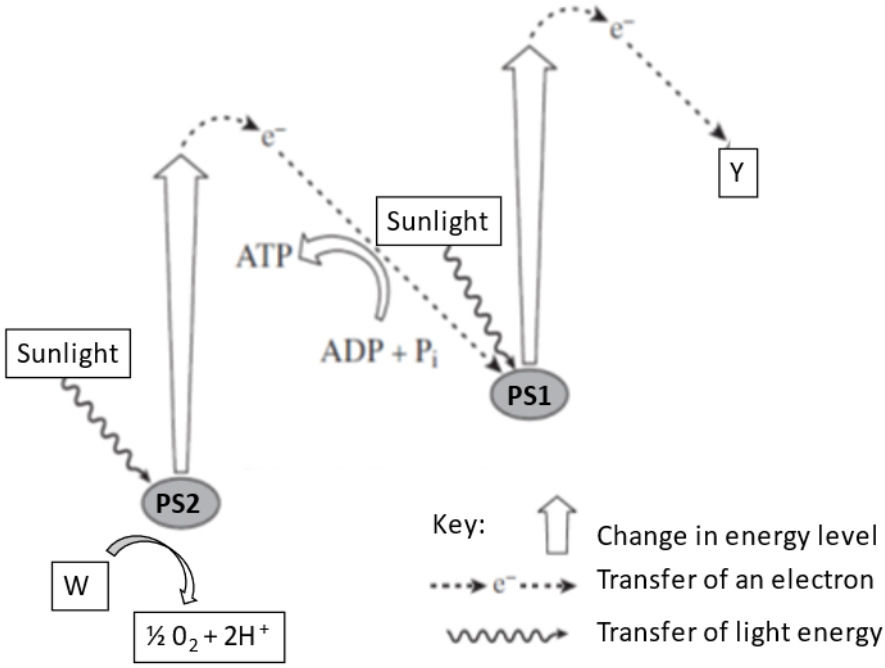

Figure Q2(b)

(i) Name the substance labelled **W** and **Y**.

(2 marks)

(ii) During light-dependent reaction, substance **W** is broken down to yield oxygen, electrons and hydrogen atom. Name the process in which substance **W** is broken down and briefly describe what happens to the electrons produced in this light-dependent reaction.

(2 marks)

(iii) State the precise location of photophosphorylation in chloroplast.

(1 mark)

(c) State **TWO (2)** ways in which oxidative phosphorylation in mitochondria resembles photophosphorylation in chloroplast.

(2 marks)

(d) Briefly describe carbon fixation in CAM plants in order to prevent photorespiration.

(2 marks)

(e) Figure Q2(e) below shows the graph of an enzymatic reaction.

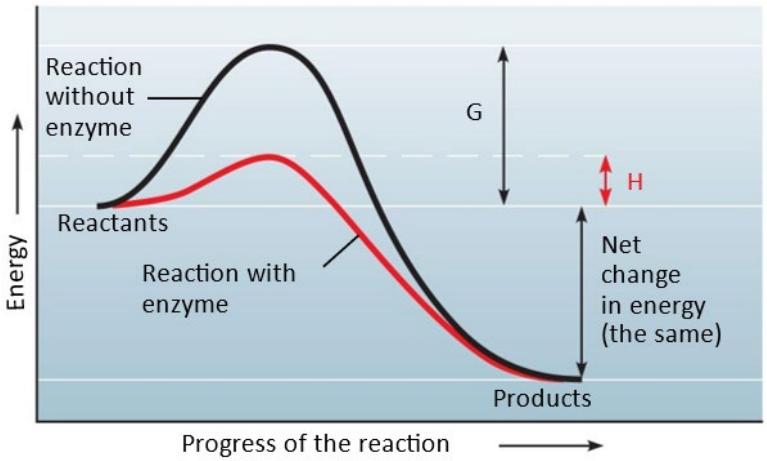

Figure Q2(e)

(i) Name **G** and **H**.

(2 marks)

(ii) What is meant by activation energy?

(1 mark)

(iii) Some membrane proteins act as enzyme that function to catalyze chemical reaction in the cell while some other membrane proteins have different functions. State and describe any **TWO (2)** functions of membrane proteins other than function as enzyme.

(2 marks)

Question 3

(a) Figure Q3(a) shows a cell of a female fruit fly, *Drosophila melanogaster*, during a stage of mitosis.

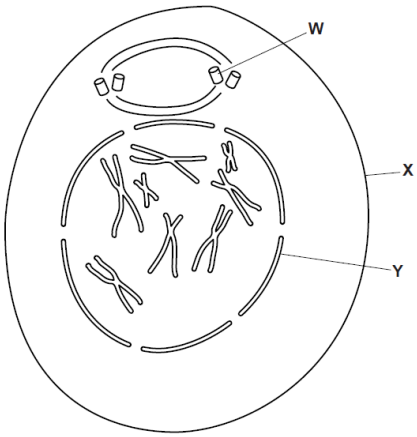

Figure Q3(a)

(i) Name the stage of mitosis shown in Figure Q3(a).

(1 mark)

(ii) Name the structure labelled **W** and state its function during mitosis.

(2 marks)

(iii) State the diploid chromosome number of the cell based on Figure Q3(a).

(1 mark)

(iv) State the structure **X** and **Y**. Describe what happen to structure **X** and structure **Y** between the mitosis stage shown in Figure Q3(a) and the end of the cell division.

(4 marks)

(v) State **TWO (2)** components in structure **X** that contributes to its fluidity and flexibility.

(2 marks)

(vi) State **TWO (2)** roles of mitosis in plants and animals **other than growth**.

(2 marks)

(b) The photograph shows the karyotype from a body cell of a person. This person has a rare condition that affects their chromosome numbers.

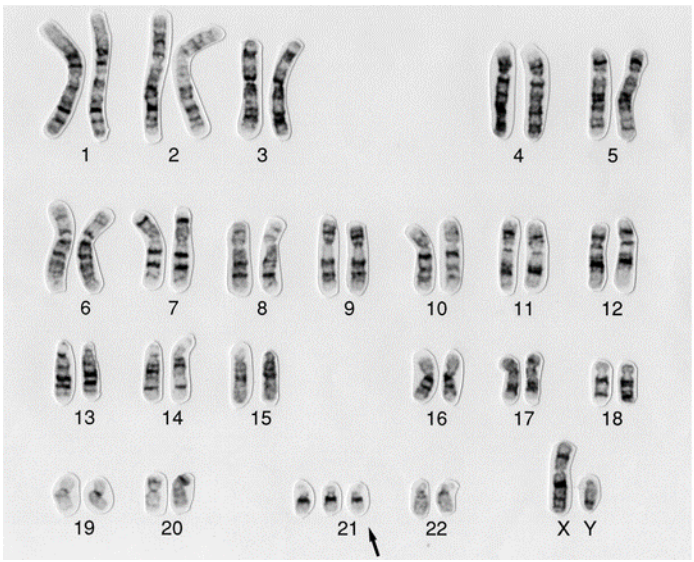

Figure Q3(b)

(i) State the genetic disorder of the person based on the karyotype shown in Figure Q3(b).

(1 mark)

(ii) Suggest how an individual with the karyotype shown in Figure Q3(b) could be produced.

(2 marks)

(c) The seed of the sweet corn plant have various colours and shapes. Red (R) and non-shrunken (S) are dominant over white (r) and shrunken (s). For parental generation, a cross was done between homozygous red, non-shrunken and homozygous white and shrunken.

(i) Following the law of Mendelian genetics, draw a Punnett square to predict the genotypic ratio and phenotypic ratios of the cross mentioned above for its F2 generation.

(5 marks)

(ii) After several months, the sweet corn progeny produced were observed as follow:

Phenotype	Number of plants
Red, non-shrunken	289
Red, shrunken	22
White, non-shrunken	21
White, shrunken	58

Table Q3(c)ii

Does the observation above follow the Mendelian ratio? If not, explain how the situation in Table Q3(c)ii occurs.

(3 marks)

(d) ABO blood group system is an example of codominant alleles.

(i) Give the definition for the term codominant alleles.

(1 mark)

(ii) Name the codominant alleles in the blood group system.

(1 mark)

Question 4

(a) Figure Q4(a) below shows the transfer of a useful gene from a donor plant cell to the production of a transgenic plant.

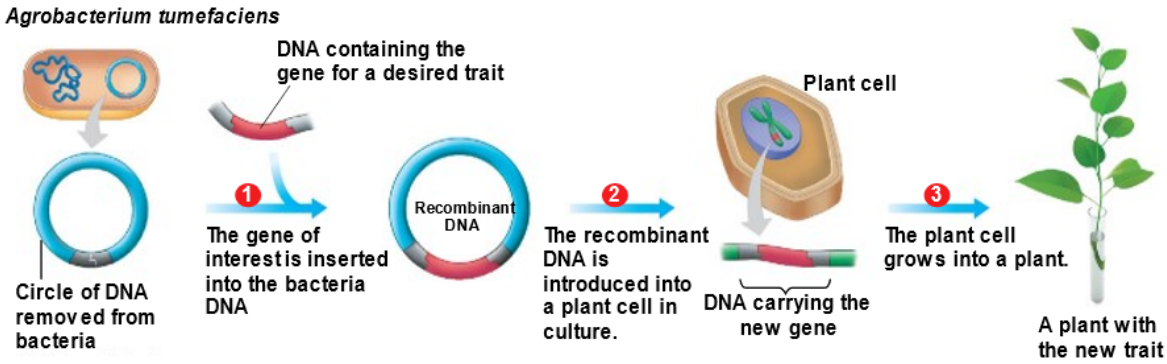

Figure Q4(a)

(i) State the name for the circle of DNA found in the bacterium *Agrobacterium tumefaciens*.

(1 mark)

(ii) The same enzyme was used to cut the circle of DNA of the bacterium and the DNA of the plant cell. State the name of the enzyme used to cut those DNA.

(1 mark)

(iii) Explain why it is important to use the same enzyme to cut those DNA.

(2 marks)

(iv) State the name of the enzyme used to combine the gene into the circle of DNA.

(1 mark)

(v) Explain the advantage of asexual reproduction in bacteria by genetic engineering.

(1 mark)

(b) Figure Q4(b) shows the operon structure and the basic process in the control of protein synthesis.

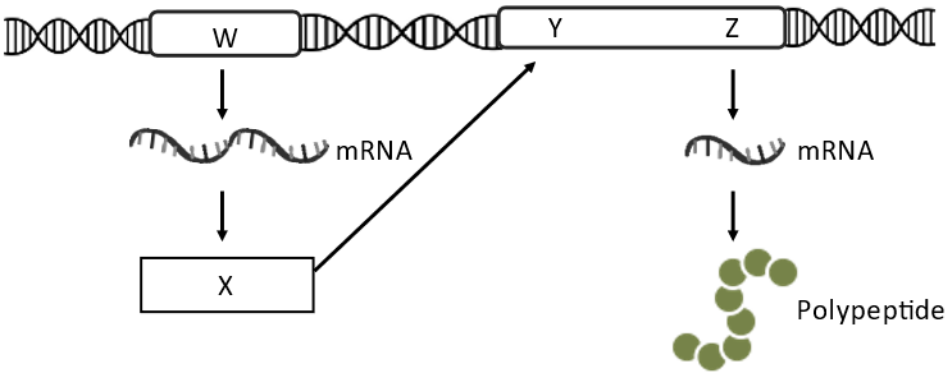

Figure Q4(b)

(i) Name the structure labelled **W**, **X**, **Y** and **Z** in Figure Q4(b).

(4 marks)

(ii) A geneticist found a particular mutation at structure **W**. Describe what might happen if structure **W** undergo mutation.

(2 marks)

(iii) The geneticist later found out that the mutation does not have very serious effects on the control of protein production in Figure Q4(b). State which type of mutation is involved and explain why is this your answer.

(2 marks)

(c) Collagen is found in the extracellular matrix of muscles, tendons, ligaments and bones. Fibroblast cells in these tissues make collagen by synthesizing polypeptides that form molecules with a triple helix shape. These are secreted from fibroblasts into the extracellular matrix where enzymes assemble them into collagen fibers. Figure Q4(c) below is a diagram summarizing these events.

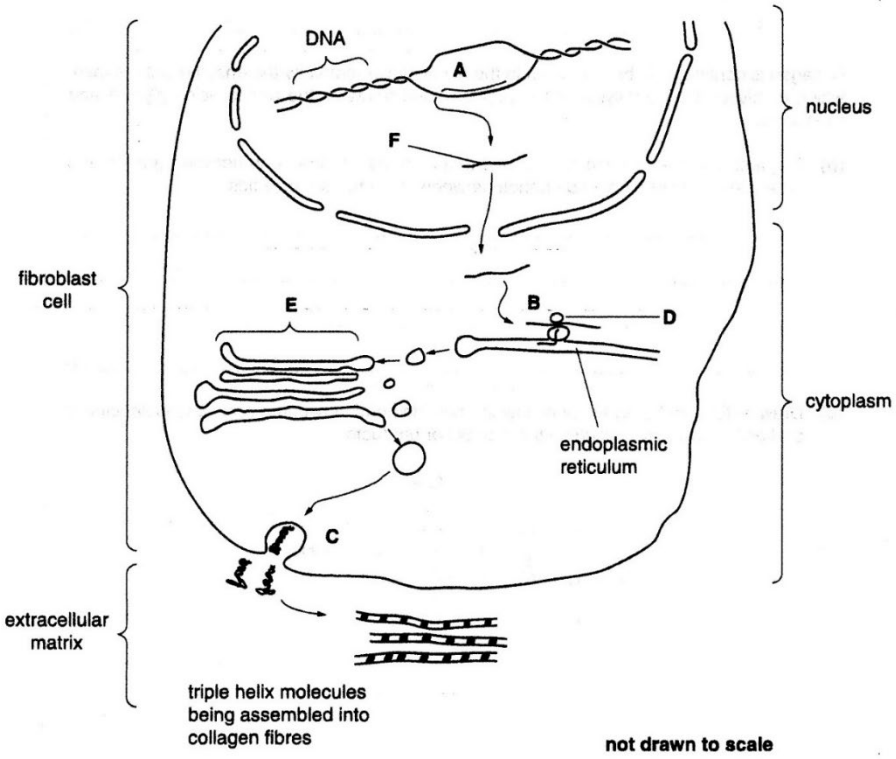

Figure Q4(c)

(i) Name structure **D** and **E**.

(2 marks)

(ii) Describe the role and the connection between endoplasmic reticulum, structure **E** and process **C** during the production of Collagen.

(3 marks)

(iii) A geneticist isolates the structure **F** for research study. Upon comparison, the structure **F** in the nucleus is found to contain 1,000 more bases than structure **B** after exit from the nucleus. Explain why is this happening?

(2 marks)

(iv) Give **TWO (2)** ways and explain how gene expression for collagen production can be regulated within cytoplasm region of the fibroblast cell.

(4 marks)

~ The End ~