TEMASEK JUNIOR COLLEGE
PROMOTIONAL EXAMS 2023
Higher 1

CANDIDATE NAME	

CIVICS GROUP			/	2	3

BIOLOGY 8876
SECTION B
FRIDAY, 22 SEPTEMBER 2023
STRUCTURED QUESTIONS
2 hours 10 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show any working or if you do not use appropriate units.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	**/ 15**
Section B	
1	**/ 6**
2	**/ 8**
3	**/ 8**
4	**/ 13**
Section C	
Essay	**/ 15**
Total	**/ 65**

Answer **all** questions**.**

1 Fig.1.1 shows a cell releasing insulin in response to glucose uptake.

The uptake of glucose through Glucose Transporter 2 (GLUT2) causes a rise in ATP levels in the cell.

This closes the potassium channel and in turn causes calcium channel to open. The influx of calcium ions leads to the release of insulin.

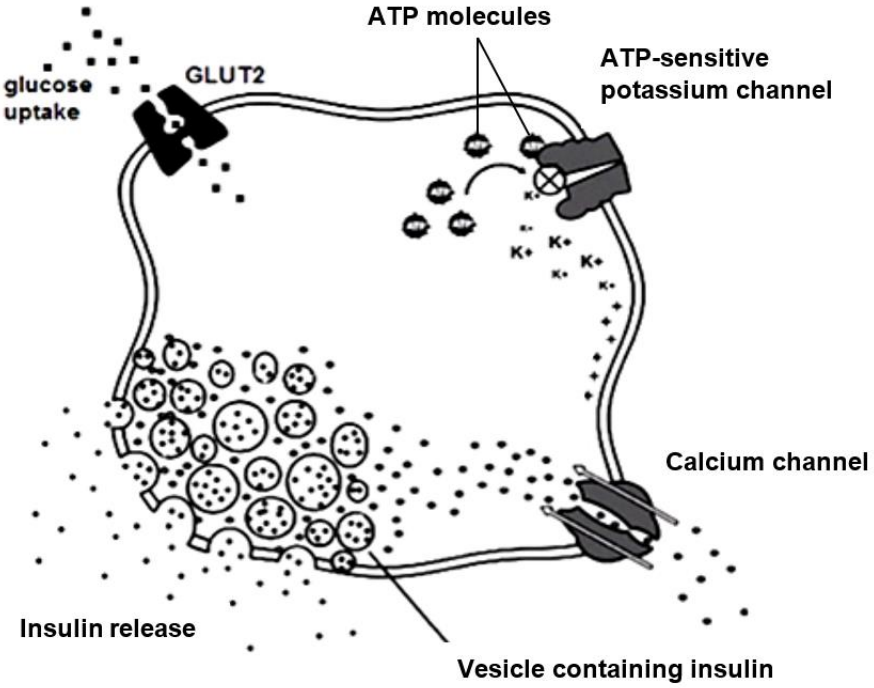

Fig. 1.1

(a) **(i)** With reference to Fig. 1.1., describe **two** differences in the way insulin and glucose are transported across the cell surface membrane.

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…… [2]

(ii) Explain how the membrane proteins in Fig. 1.1 are able to transport the substances across the cell surface membrane.

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…… [2]

(b) Suggest with a reason how a secretory cell will differ in terms of organelles from a non-secretory cell.

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…… [1]

Fig. 1.2 shows an organelle in a eukaryotic cell.

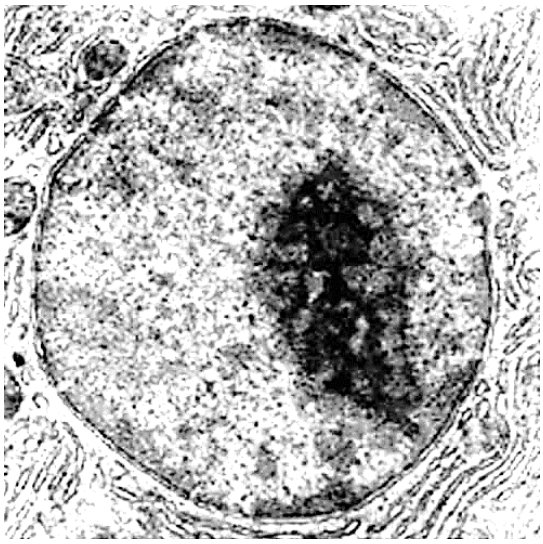

Fig. 1.2

(c) With reference to Fig. 1.2; explain why the organelle cannot be a lysosome.

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…… [1]

[Total: 6]

2 **(a)** Fig. 2.1 shows the photomicrograph during one stage of mitosis occurring in a root tip cell of a diploid flowering plant. The diploid number is 14.

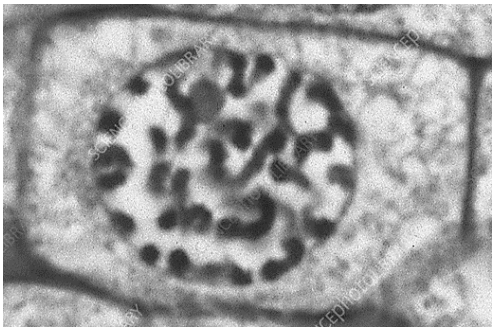

Fig. 2.1

Complete Table 2.1 to show the number of chromosomes found in the cell at the end of a given stage of the cell cycle.

Table 2.1

stage	no. of chromosomes per cell
G1	14
S phase	
cytokinesis	

[2]

(b) Outline **one** difference between a pair of homologous chromosomes and sister chromatids of a chromosome.

……..……..

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……..…… [1]

(c) **(i)** Describe the characteristics of embryonic stem cells.

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…… [2]

(ii) State the challenges of using embryonic stem (ES) cells for research or medical treatment and explain how induced pluripotent stem cells (iPSCs) may overcome each of these challenges.

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…… [3]

[Total: 8]

3 A student carried out an investigation into the mass of product formed in an enzyme-controlled reaction at three different temperatures. Only the temperature was different for each experiment. The results are shown in Fig. 3.1.

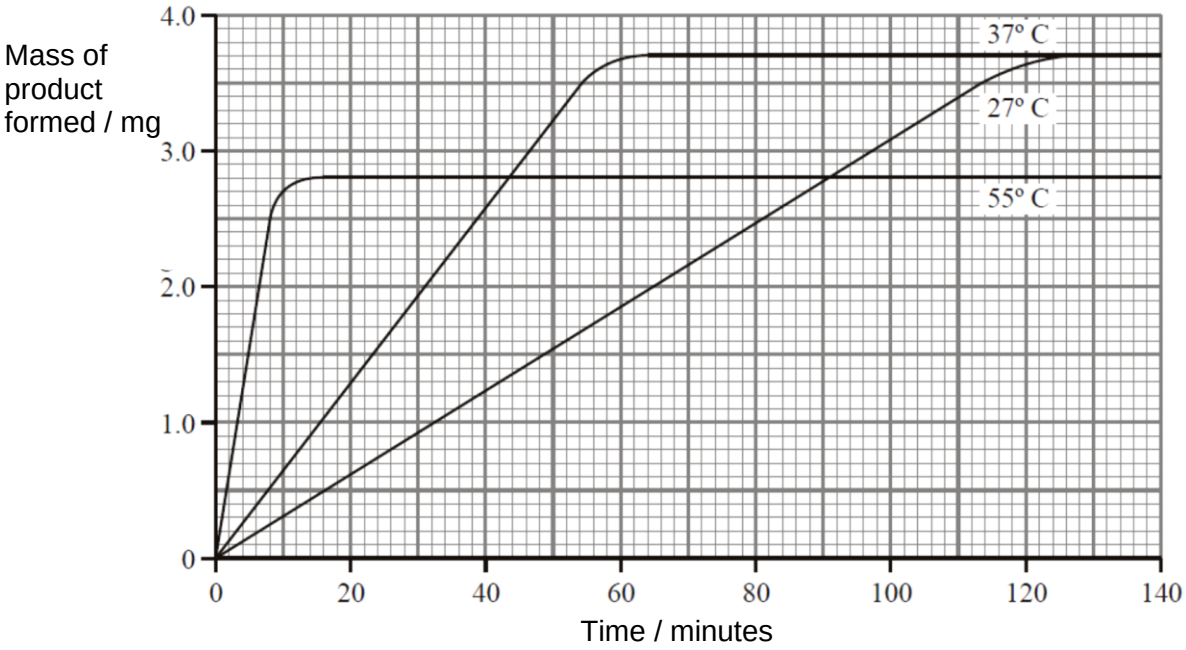

Fig. 3.1

(a) Use your knowledge of enzymes to explain

(i) why the initial rate of reaction was highest at 55 °C;

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…… [2]

(ii) the shape of the curve for 55 °C after 20 minutes.

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…… [3]

(b) Explain why the curves for 27 °C and 37 °C level out at the same value.

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…… [1]

The enzyme is found to have the structure as shown in Fig. 3.2.

Fig. 3.2

(c) Describe structure **A** found in the enyzme.

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…… [2]

[Total: 8]

4 A diagram of a chromosome from a dividing cell is shown in Fig. 4.1.

Fig. 4.1

(a) Before a cell divides, DNA replication takes place via semi-conservative replication.

State **two** ways how DNA replication differs from transcription.

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…… [2]

(b) The chromosome shown in Fig. 4.1 consists of one long DNA molecule associated with histone proteins.

Name one stage of mitosis in which a chromosome would have the same general structure as the chromosome shown in Fig. 4.1.

…… [1]

(c) Name the stage in the cell cycle during which the cell divides to produce two genetically identical daughter cells.

…… [1]

Blood stem cells are actively dividing cells found in the bone marrow of a human being.

(d) State **one** role of blood stem cells in a human body.

……

…… [1]

(e) Lung cancer can be caused by carcinogens. Benzopyrene, a compound found in tar from tobacco smoke is known to interfere with DNA replication.

It brings about gene mutation via transversion mutation or transition mutation. Both cause the newly synthesised strand to have an incorrect base.

(i) A transversion mutation is when a pyrimidine is used in the newly synthesised strand instead of a purine, or the other way round.

Name the **two** possible bases that could be used instead of cytosine in a transversion mutation.

……. [1]

(ii) A transition mutation is when a purine is replaced by an incorrect purine or a pyrimidine is replaced by an incorrect pyrimidine.

Suggest why transversion mutations are less likely to occur than transition mutations.

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……. [2]

(iii) It has been observed that the carcinogens in cigarette smoke can also cause the deletion of a nucleotide base from the promoter of a gene.

State the role of promoter in a gene.

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……. [1]

The process of protein synthesis takes place in both cancerous and non-cancerous cells. Many types of nucleic acids are involved in the process.

(f) State **one** way in which the structure of DNA differs from the structure of messenger RNA.

…… [1]

(g) At the start of translation, amino acid activation takes place whereby an amino acid attaches to its specific tRNA molecule. This process requires an enzyme, aminoacyl tRNA synthetase.

Explain why a particular amino acid needs to be linked to a specific tRNA molecule.

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…… [2]

(h) Suggest **one** possible effect of gene mutation in the cell during the synthesis of proteins.

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…… [1]

[Total: 13]

End of Section B

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CANDIDATE NAME	
CIVICS GROUP	/ 2 3

BIOLOGY 8876
SECTION C
FRIDAY, 22 SEPTEMBER 2023
FREE-RESPONSE QUESTION
2 hours 10 minutes

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Circle the essay question that you have selected in the box below.

For Examiner's Use	
Section C	
Essay* **5 / 6** **circle*	**/ 15**

Section C

Answer **one** question in this section.

Write your answers on the lined paper provided at the end of this Question Paper.

Your answers should be illustrated by large, clearly labelled diagrams, where appropriate.

Your answers must be in continuous prose, where appropriate.

Your answers must be set out in parts **(a)** and **(b)**, as indicated in the question.

5 **(a)** Outline how photosynthesis converts light energy to chemical energy stored in the form of carbohydrates. [10]

(b) Distinguish between transcription and translation. [5]

[Total: 15]

6 **(a)** Explain the significance of mitosis and meiosis. [10]

(b) Distinguish between gene and chromosomal aberration. [5]

[Total: 15]

End of Section C

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