SKILLS AND APPLICATIONS TASK

SUMMATIVE ASSESSMENT TASK

TOPIC 2: Cells as the Basis of Life

Purpose and Background Information of the Assessment Task: To have the opportunity to show your in-depth knowledge and understanding of the concepts taught in the Topic 2: Cells as the Basis of Life.

TASK DESCRIPTION:

The test will be conducted under supervision.

Time: 50 minutes + 5 mins reading time

The test will contain the following questions:

Part A: Multiple Choice Questions

Part B: Short Answer Questions including Science as an Inquiry and Science as a Human Endeavour

Part C: Extended Response

The amount of space and marks allocated (for reference) arean indicator on how much you should write.

You may use a calculator.

| - | Investigation, Analysis, and Evaluation | Knowledge and Application |
| --- | --- | --- |
| A | Designs a logical, coherent, and detailed biological investigation.Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.Critically and logically evaluates procedures and their effect on data. | Demonstrates deep and broad knowledge and understanding of a range of biological concepts.Develops and applies biological concepts highly effectively in new and familiar contexts.Critically explores and understands in depth the interaction between science and society.Communicates knowledge and understanding of biology coherently, with highly effective use of appropriate terms, conventions, and representations. |
| B | Designs a well-considered and clear biological investigation.Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.Logically evaluates procedures and their effect on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of biological concepts.Develops and applies biological concepts mostly effectively in new and familiar contexts.Logically explores and understands in some depth the interaction between science and society.Communicates knowledge and understanding of biology mostly coherently, with effective use of appropriate terms, conventions, and representations. |
| C | Designs a considered and generally clear biological investigation.Obtains, records, and represents data, using generally appropriate conventions and formats with some errors but generally accurately and effectively.Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.Evaluates procedures and some of their effect on data. | Demonstrates knowledge and understanding of a general range of biological concepts.Develops and applies biological concepts generally effectively in new or familiar contexts.Explores and understands aspects of the interaction between science and society.Communicates knowledge and understanding of biology generally effectively, using some appropriate terms, conventions, and representations. |
| D | Prepares the outline of a biological investigation.Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.Describes data and undertakes some basic interpretation to formulate a basic conclusion.Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of biological concepts.Develops and applies some biological concepts in familiar contexts.Partially explores and recognises aspects of the interaction between science and society.Communicates basic biological information, using some appropriate terms, conventions, and/or representations. |
| E | Identifies a simple procedure for a biological investigation.Attempts to record and represent some data, with limited accuracy or effectiveness.Attempts to describe results and/or interpret data to formulate a basic conclusion.Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of biological concepts.Attempts to develop and apply biological concepts in familiar contexts.Attempts to explore and identify an aspect of the interaction between science and society.Attempts to communicate information about biology. |

Part A: Multiple Choice Questions. Put the correct letter corresponding to each question in the answer box provided at the end of the section. Each multiple choice question is worth one mark.

1. Refer to the diagram below which is a flowchart of the life cycle of a mammal.



IV: Growth and Differentiation

I: Formation of Gametes

III: Growth and Differentiation

II: Fertilisation

Gametes

1. Which one of the following process (es) enables genetic variation in the genotype of the offspring?

J. I only

K. I and II

L. III and IV

M. IV only

1. The movement of chloroplasts within the cytoplasm of some green plant cells maximises the exposure of the chloroplasts to sunlight.

Which one of the following cell structures enables this movement of chloroplasts to occur?

J. Endoplasmic reticulum.

K. Cytoskeleton.

L. Golgi body.

M. Cell membrane.

1. Refer to the following electron micrograph of a cellular structure.



The arrow is indicating which one of the following correctly identifies a cellular structure and its function?

|  |  |  |
| --- | --- | --- |
|  | Cellular Structure | Function |
| J. | mitochondrion | Latter stages of aerobic respiration |
| K. | ribosome | Catalyses chemical reactions |
| L. | nucleolus | Site of rRNA synthesis |
| M. | lysosome | Storage of substances |

1. A prokaryotic cell can be identified by the:

J. presence of a cell wall.

K. absence of a nucleus.

L. presence of ribosomes.

M. absence of ribosomes.

1. Which one of the following groups of cellular structures do plants and animal cells have in common?

J. Golgi body, circular chromosomes, endoplasmic reticulum

K. chloroplasts, ribosomes, nucleus

L. vacuoles, chloroplasts, ribosomes

M. mitochondria, lysosomes, Golgi body

1. As a cell grows, its

J. efficiency in exchanging materials across the cell membrane increases.

K. surface area increases.

L. surface area to volume ratio increases.

M. volume decreases.

1. Refer to the following diagram of the transport of a small sugar molecules through the cell membrane.



Sugar molecules

The diagram represents the process of:

J. active transport.

K. diffusion.

L. facilitated diffusion.

M. osmosis.

1. Refer to the following graph, which shows changes in the concentrations of various chemical substances in the thigh muscles of a person exercising vigorously on a bicycle.



Which one of the following statements is correct?

J. Line J represents ATP.

K. Line K represents CO2.

L. Line L represents O2.

M. Line M represents C3H6O3.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Answer |  |  |  |  |  |  |  |  |

Total: /8

Part B: Short Answer Questions.

Please answer all questions in the space provided.

1. Refer to the following diagram of a cell undergoing meiosis.



1. Draw three labelled diagrams to show the events before, during and after the

crossing over events between chromosomes during meiosis. [6]

Before During After

1. Explain why crossing over does not occur during mitosis. [3]
2. Explain how the products of mitosis and meiosis differ. [3]

Bacteria replicate quickly when optimal growth conditions are provided.

1. State the name of the process used by bacteria to replicate. [1]
2. Explain why the amount of DNA in the cell doubles before division. [4]
3. Photosynthesis is of fundamental importance to life on Earth.
4. State the name of the group of organisms that are able to photosynthesise. [1]
5. State the name of the organelle, found in the cells of some organisms, which is the site of photosynthesis. [1]
6. Explain how the structure of the internal membranes in this organelle facilitates the process of photosynthesis. A diagram may be used as part of your explanation. [3]
7. *Chaetoceros* sp. is a single celled alga. In a study of the effect of silica on the growth of *Chaetoceros* sp. cultures were set up with and without silica in the culture medium. On Day 0 each culture had 400,000 *Chaetoceros* cells per mL.

The table and graph below show the cell numbers in each culture at intervals during an eight day period.

Number of *Chaetoceros* cells (millions per mL)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Day 1 | Day 4 | Day 7 | Day 8 |
| *Chaetoceros* with silica | 1.105 | 3.510 | 5.200 | 5.210 |
| *Chaetoceros* without silica | 1.005 | 2.050 | 2.250 | 2.300 |

1. i. State one hypothesis that the investigators may have been testing in this study. [2]

ii. Name the independent variable. [1]

1. Write a justified conclusion from these data on the effect of silica on the growth of *Chaetoceros* sp. [2]
2. Suggest an appropriate explanation for the patterns in the data during the periods: Day 0 to Day 4; Day 7 to Day 8. [4]
3. i. Name two factors that would need to be controlled in this investigation [2]

ii. Explain how one of these would be controlled [2]

iii. Explain why the factor in part ii) would need to be controlled. [2]

iv. State one factor that may not be able to be controlled in this investigation [1]

1. State two potential sources of random error and explain why it is important to minimise the effect of random error. [4]
2. The use of silica is common. However, recent studies by scientists working for both occupation health and safety agencies and industry suggest that it is not safe for humans and animals and may have other negative consequences for the environment. Alternatives are being developed; however, more research into the safety of these materials is necessary before they can be used. The development of alternative materials may reduce both the environmental and health costs of using silica on a large scale in some applications. However, the cost of developing the new alternatives will require significant investment and careful consideration of the applications it might replace.

Choose at least one of the key concepts of Science as a Human Endeavour, and discuss how the development of alternative materials to silica may benefit the environment and/or humans. [4]

Part C: Extended Response Question

1. Cell division cycle is regulated by internal and external factors. Some of these factors are gene products, including hormones, which require energy in order to be synthesised.

Explain, using an example, how hormones regulate cell division and describe one cellular process that uses glucose to provide the ATP that is needed to synthesise gene products.

(1 ½ pages of lines provided) [9]

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