**Stage 2 Biology**

**Formative CELLS Test (2.1 – 2.5) - ANSWERS**

**Section A: Multiple Choice:**

1-L 2-M 3-M 4-L 5-M 6-L 7-J 8-K 9-M 10-J

**Section B: Short Answer**

**Question 1**

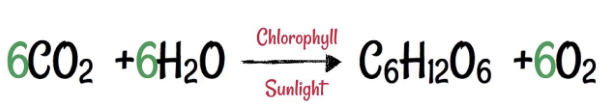
(a)

Chlorophyll

(b)

Carbon dioxide; water

(c)



(d)

This is too deep for sunlight to be accessible for photosynthesis, so they will not be ablet o produce glucose for survival.

(e)

1. Chloroplasts have a large surface area which allows for much more efficient photosynthesis.

2. Chloroplasts use their own DNA so they can run independently of main genome of the organism.

(f)

i. binary fission

ii. the parent cell copies is single circular chromosome; elongates; and physically divides while giving an exact copy of the DNA to each new cell that is produced. This means, through the semi-conservative replication of DNA, that each cell has exactly the same DNA as the parent cell had.

**Question 2**

(a)

i. Species B

ii. It is unlikely that species D is a photosynthetic cyanobacterium because it seems to be harmed by the presence of oxygen (growth rate is inhibited); since oxygen is a product of photosynthesis it would be producing something that actually kills itself.

(b)

The presence of oxygen allows for respiration to be aerobic. When respiration uses oxygen as part of the pathway, the glucose can be broken down much more and therefore release more of the stored energy for the production of ATP. When oxygen is not present, glucose is not broken down to the same degree and so ATP production dramatically drops.

(c)

1. In order to synthesise DNA it will need to expend ATP

2. In order synthesis new proteins for growth it will need to expend ATP

3. In order to physically divide the cell membrane it will need to use ATP

**Question 3**

(a)

This is the process of exocytosis, where a vesicle containing neurotransmitters in Nerve Cell 1 is moved toward the cell membrane by the cytoskeleton. Here its membrane fuses with the cell membrane and this releases the contents into the synaptic gap.

(b)

Ribosome; ER; vesicle: Golgi body; vesicle; cell membrane

(c)

\*question in 2023 was a little unclear. Question should have been:

*What factors would determine which method of transport would be used to get the neurotransmitter across the cell membrane?*

* Size of molecules
* Polarity of molecules (charge)
* How hydrophobic or hydrophilic the molecule is

**Question 4**

(a)

Meiosis

(b)

\*describing overview of meiosis phases

* DNA condenses and forms tetrads of homologous chromosomes
* Arms of sister chromatids may cross over to create variation
* Homologe pairs line up along the equator of the cell and are then pulled apar from each other.
* The DNA becomes uncondensed, a new nucleus forms in each cell and it physically splits through a process called cytokinesis.
* This produces two cells with half a set of DNA (haploid), but each still has a duplicate copy of the that ½ set.
* Each of these cells now undergoes the following process – DNA condenses into chromosomes
* All chromosomes line up along equator of the cell
* The sister chromatids are then pulled apart to either end of the cells
* The DNA becomes uncondensed and the nucleus forms in each of the 4 forming new cells.
* Cytokinesis occurs which produces 4 new individual cells which all have a haploid amount of DNA.

(c)

It doubles, so that when the cell divides into two in M phase, each new cell can have a complete copy of the genetic instructions

(d)

The molly reproduces by sexual reproduction which can introduce genetic variation for offspring through 4 major ways (mutation, crossing over in Prophase I; independent assortment in Metaphase I, and random fertilization). Bacteria reproduce only by binary fission in which the cell copies its DNA, and then divides in two given a full set of its DNA to each new daughter cell. This means they are genetically identical to the parent cell. The only way they can have genetic variation from this process is through mutation.

(e)

The offspring are identical because they arise from eggs which only have DNA from their mother. The eggs they arise from are not fertilized by a sperm, and so have no way of incorporating new genes into their genome. The egg is also produced by mitosis, which does not introduce genetic variation.

**Section C: Extended Response:**

First section –

* Discuss briefly how 2 of the following may impact cell cycle:
  + Nutrient dependency
  + Anchorage dependency
  + Density dependency
  + hormones

Second section –

* Include the following points for Cdks:
  + They work together with cyclin molecules
  + Together they bind and form a Cdk+cyclin complex in the cells which triggers the cell to progress to the next stage of the cycle when there is enough concentration
  + Cdks are enzymes
  + They are always present in the cell at constant concentrations

Third section –

* Could include some of the following points:
  + Cancer results from mutations in genes that produce proteins which help control the cell cycle
  + When these genes are mutated they can no longer make the gene products that help regulate various cell cycle checkpoints – and so the cell divides out of control forming a tumor
  + Example genes to discuss:
    - Tumor suppressor gene
    - Proto-oncogene