1.1 Cells: Theory

Question Paper

Course	DP IB Biology
Section	1. Cell Biology
Topic	1.1 Cells: Theory
Difficulty	Medium

Time allowed: 50

Score: /41

Percentage: /100

Question 1a

a)   A patient with a spinal cord injury was healed using stem cell therapy by the following process:

1. Stem cells collected from the patient's own tissues.
2. Stem cells cultured in laboratory for one month to increase their numbers.
3. Stem cells injected into injury site of patient.
4. Stem cells develop into nerve cells and replace damaged nerve tissue.

Suggest **two** properties of the stem cells that made this therapy possible.

[2 marks]

Question 1b

b)   Explain why the stem cells used in part (a) were taken from the patient and not from a stem cell donor.
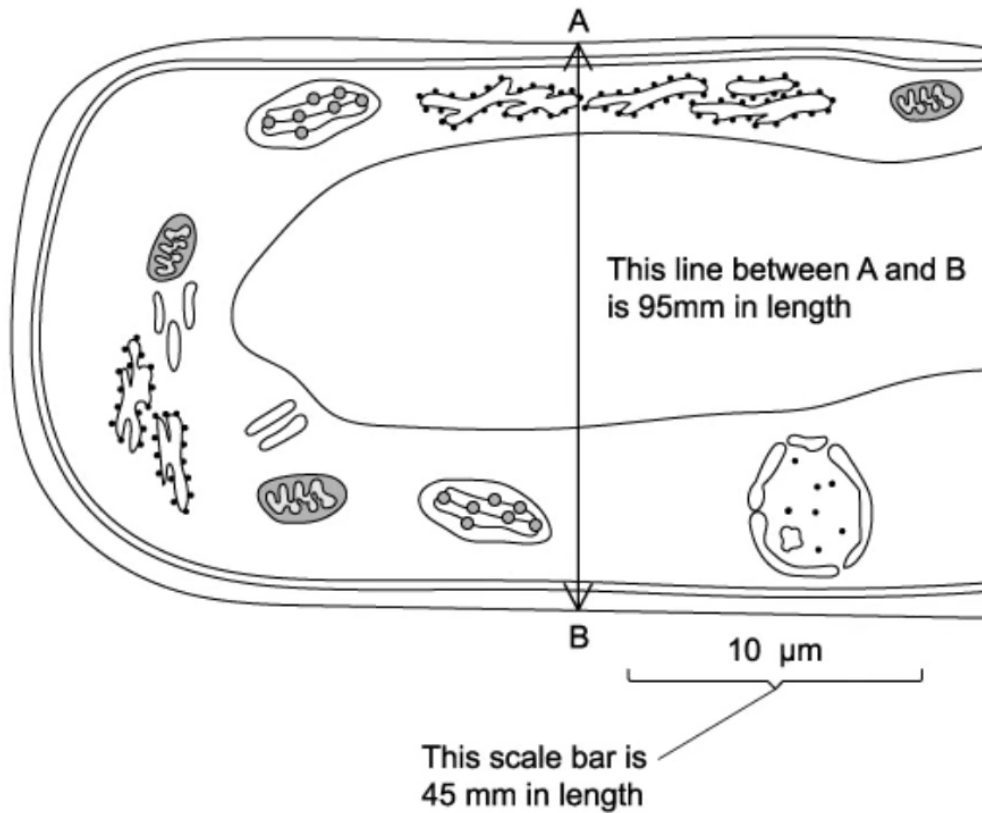
[2 marks]

Question 1c

c)   Although it would also be possible to use embryonic stem cells from embryos created by IVF to treat the patient in part (a), this is a controversial method. Explain why.

[2 marks]

Question 2a

a)   The drawing below shows part of a plant cell as seen with an electron microscope. The scale bar (measuring 45 mm in length) on this drawing represents a length of 10 μm.

This line between A and B is 95mm in length

10 μm

This scale bar is 45 mm in length

Calculate the magnification of the drawing. Show your working.

[2 marks]

Question 2b

b)   Calculate the actual width of the cell in part (a) from A to B. Give your answer in micrometres (μm) and show your working.

[2 marks]

Question 2c

c)   Identify **two** ways in which striated muscle fibres (fused muscle cells) differ from the cell shown in part (a).

[2 marks]

Question 3a

a)   Calculate the surface area to volume ratio of a cube with each edge measuring 2 cm. Show your working.

[2 marks]

Question 3b

b)   When first hatched, the young tadpoles of some frog species are less than 1.5 mm long and have not yet developed gills.

Explain how these young tadpoles are able to get enough oxygen to their cells without developed gills.
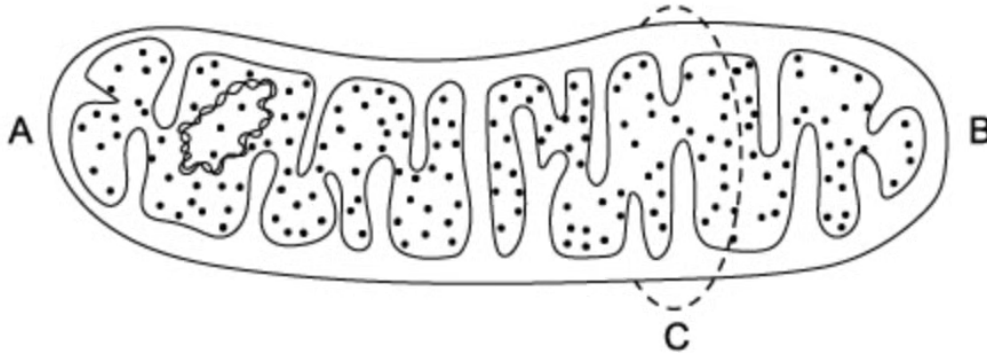
[2 marks]

Question 3c

c)   A researcher calculated the surface area of a large number of frog eggs. She calculated the mean surface area to be 10.12 mm^2. Frog eggs are generally spherical. She calculated the surface area using the following equation: $4\pi r^2$.

i) Rearrange this equation to find r^2 and use it to calculate the mean r^2 of these frog eggs.

ii) Calculate the mean diameter of these frog eggs. Give your answer to 3.s.f.

[3 marks]

Question 4a

a)   The diagram below is of a mitochondrion at a magnification of ×20 000. The distance between points **A** and **B** in the diagram is 6.4 cm.

Calculate the actual length of this mitochondrion in micrometres (μm). Show your working.

[2 marks]

Question 4b

b)   The circumference of a mitochondrion, labelled C in the diagram in part (a), is 1.5 μm. A student is making an accurate scale model of a mitochondrion for a school science project and wants to magnify a mitochondrion 50,000 times.

In centimetres (cm), what will be in the circumference of the student's model?

[2 marks]

Question 4c

c)   The mitochondrion in part (a) is responsible for the process of cell respiration to release energy. Which 'function of life' is this set of chemical reactions a part of?

[1 mark]

Question 4d

d)   Briefly outline the key ideas that make up cell theory.

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)   Discuss the advantages of the use of adult stem cells.

[3 marks]

Question 5b

b)   You are given a sample of plant tissue. Describe how you would prepare and view a sample of cells from this tissue using a light microscope.

[5 marks]

Question 5c

c)   Explain why surface area to volume ratio is an important factor in limiting cell size.

[7 marks]