2. Organisation of the organism

2.2 Size of specimens

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 **(b)** Scientists measured the length of a sample of one species of fish.

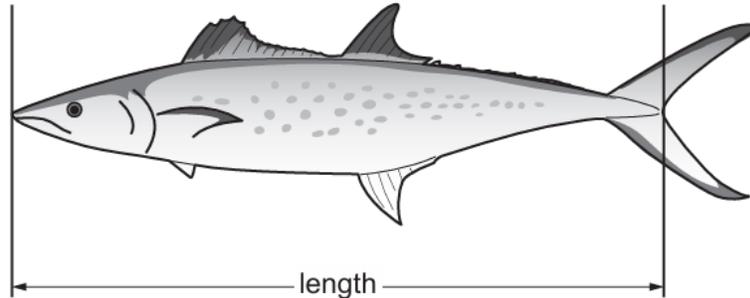Fig. 8.1 shows where the scientists took their measurements to determine the length of each fish.

Fig. 8.1

Table 8.1 shows the results.

Table 8.1

length/cm	number of fish
0–19	8
20–39	162
40–59	1710
60–79	1350
80–99	130
100–119	5

(i) Use the information in Table 8.1 to calculate the total number of fish the scientists measured.

.... [1]

(ii) State the most frequent length shown in Table 8.1.

.... cm [1]

(iii) State the type of variation shown by the data in Table 8.1.

.... [1]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

2 **(b)** Egg cells are contained in follicles in the ovary. **(extended only)**

At the start of the menstrual cycle, a follicle has an average diameter of 29 μm.

Just before an egg is released from the follicle, the follicle has an average diameter of 22 mm.

Calculate the percentage increase in the average diameter of the follicle from the start of the menstrual cycle, until just before an egg is released.

Step 1 Convert the average starting diameter of a follicle to millimetres (mm).

.... mm

Step 2 Calculate the percentage increase.

.... %

Step 3 Give your answer to **three** significant figures.

.... %

[4]

3   A student investigated the species composition of the phytoplankton in a lake.

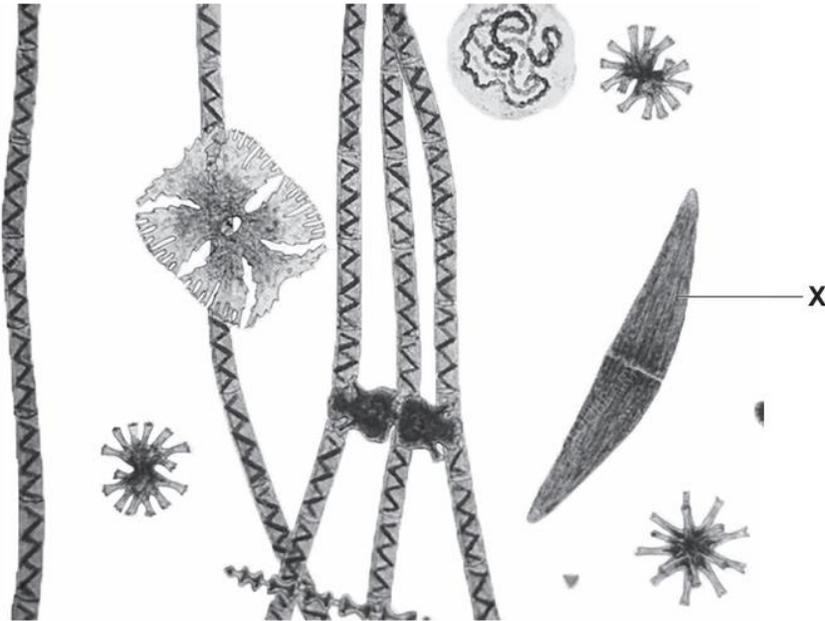Fig. 1.1 shows some of the phytoplankton collected by the student.

Fig. 1.1

(b)   The actual length of alga **X** is 0.19 mm.

Convert the actual length of alga **X** to micrometres.   **(extended only)**

....µm [1]

4   Fig. 1.1 shows a spongy mesophyll cell from the leaf of a plant. The arrows show the net direction
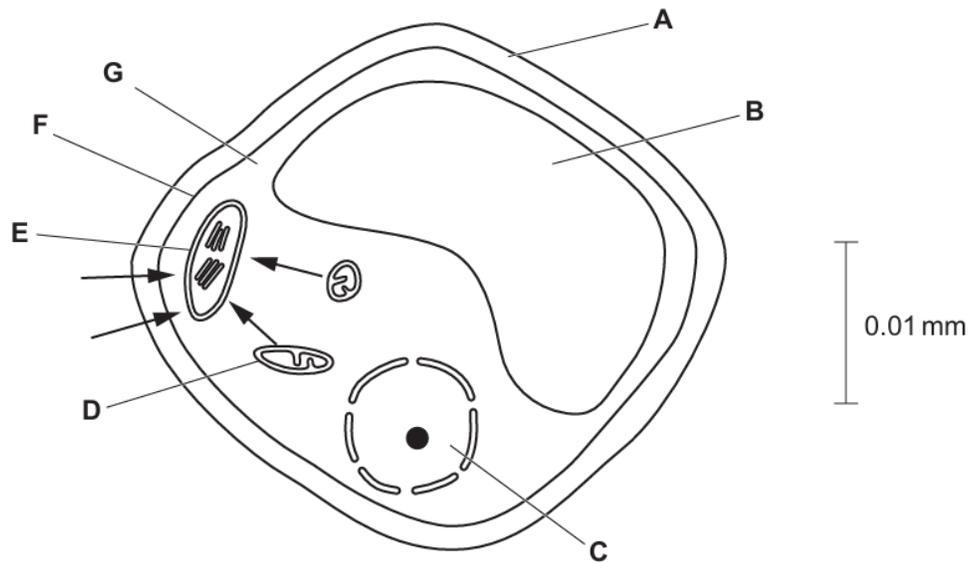   of movement of carbon dioxide molecules during daylight.

Fig. 1.1

(a)   The scale bar in Fig. 1.1 represents 0.01 mm.

      Convert 0.01 mm to micrometres.   **(extended only)**

                                                    .... μm [1]

5 **(b)** A student made a drawing of one *Escherichia coli* bacterium. Fig. 1.2 shows the student's drawing.
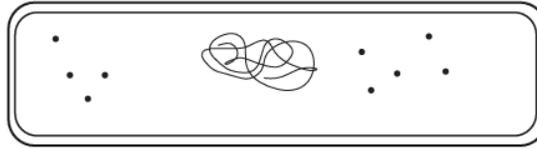

Fig. 1.2

The actual length of the bacterial cell is $2\,\mu m$.

(i) Convert the actual length of the cell to millimetres. **(extended only)**

.... mm [1]

(ii) State the other information that the student needs in order to calculate the magnification of the drawing in Fig. 1.2.

.... [1]

6 (e) One of the functions of the placenta is to provide a barrier to toxins and pathogens. **(extended only)**

A study was done on donated afterbirths. The afterbirth is a placenta with part of the umbilical cord attached.

The purpose of the study was to find the maximum size of particles that can pass through the placenta and enter the umbilical cord.

The researchers inserted beads with a diameter of 0.5 μm into blood vessels in the placenta. Three hours later they recorded the percentage of beads found in the blood in the placenta and in the umbilical cord.

They then repeated the tests using beads with diameters of 0.8 μm, 2.4 μm, 5.0 μm and 8.0 μm.

Their results are shown in Fig. 2.1.

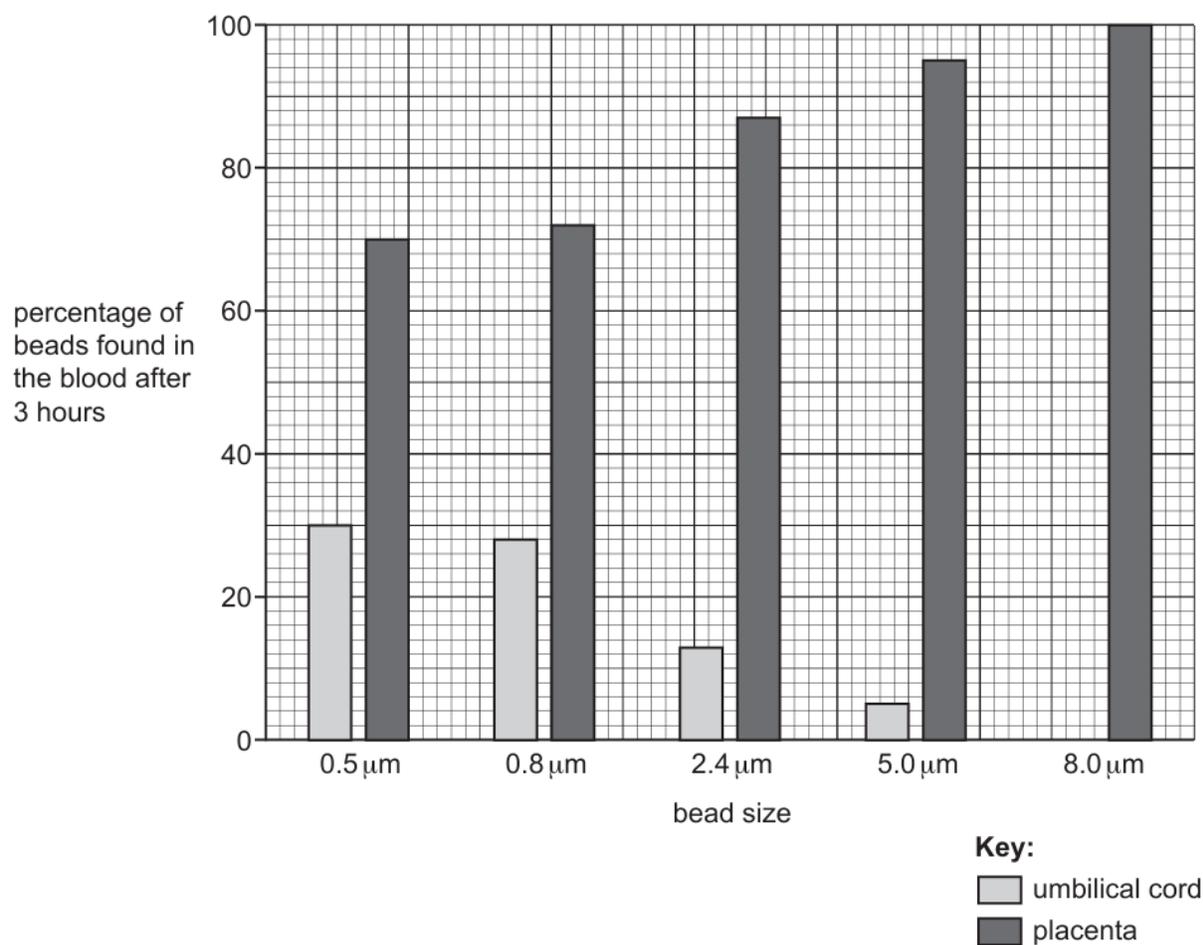**Fig. 2.1**

(i) Convert the diameter of the 5.0 μm beads into millimetres (mm).   **(extended only)**

Space for working.

.... mm [1]

(ii) One million beads with a diameter of 2.4 μm were injected into the placenta.

Calculate the number of these beads in the umbilical cord after 3 hours.

Space for working. **(extended only)**

.... beads
[2]

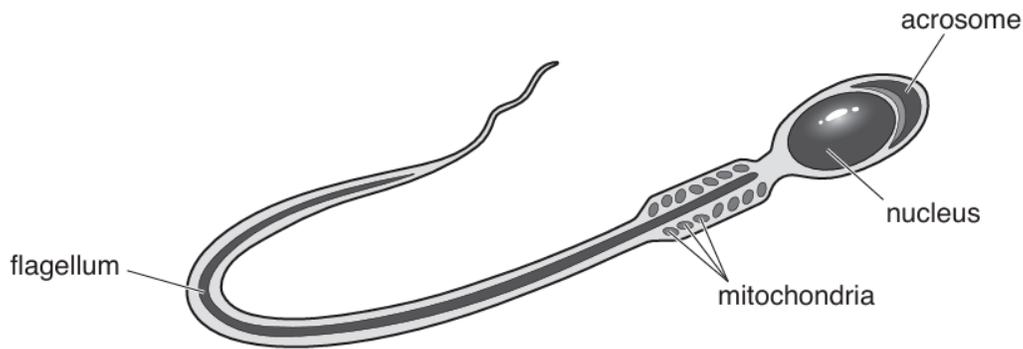**7 (b)** Fig. 6.2 is a diagram of a human sperm cell.

Fig. 6.2

(i) Write the formula that would be used to calculate the magnification of the diagram.

[1]

(ii) The actual length of the sperm cell in Fig. 6.2 is 0.055 mm.

Convert this value to micrometres (μm).

Space for working.　**(extended only)**

.... μm [1]

8 **(b)** **(i)** Write the formula that would be used to calculate the actual width of the bacterium.

[1]

    (ii) The actual width of the bacterium is 0.0008 mm.

        Convert this value to micrometres (μm).

        Space for working.   **(extended only)**

.... μm [1]