

1 In sexual reproduction, an egg fuses with a sperm cell.

1 (a) (i) How many chromosomes do human egg and sperm cells each have? _____

1 (a) (ii) How many chromosomes will the resultant 1 cell embryo have? _____

1 (a) (iii) In which organ are the eggs produced? _____

1 (a) (iv) What is the name of the type of cell division by which the embryo will grow?

(4 marks)

1 (b) Eggs and sperm cells both contain the structures listed in the box.

| | | |
|---------|------|------------|
| nucleus | gene | chromosome |
|---------|------|------------|

List the three structures from the box in size order. Begin with the smallest.

1 _____ (smallest)

2 _____

3 _____

4 _____ sex cell _____ (largest)

(2 marks)

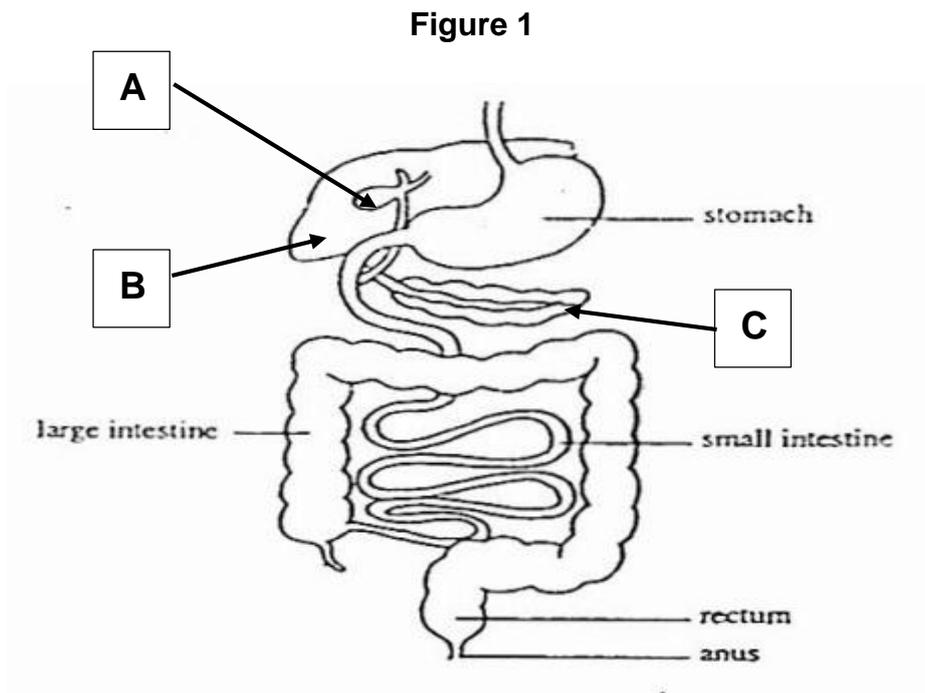
1 (c) Embryonic stem cells have the ability to divide to form any kind of body cell. How many chromosomes do embryonic stem cells contain? _____

(1 mark)

Total for question

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| 7 |
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2. **Figure 1** shows a diagram of the human digestive system.



- 2 (a)** Draw one line from each part of the human body to the letter representing the correct label for the diagram.

| | |
|---|--------------|
| A | pancreas |
| B | gall bladder |
| C | liver |

(2 marks)

- 2 (b) (i)** Which part shown on the diagram is where soluble food molecules are absorbed?

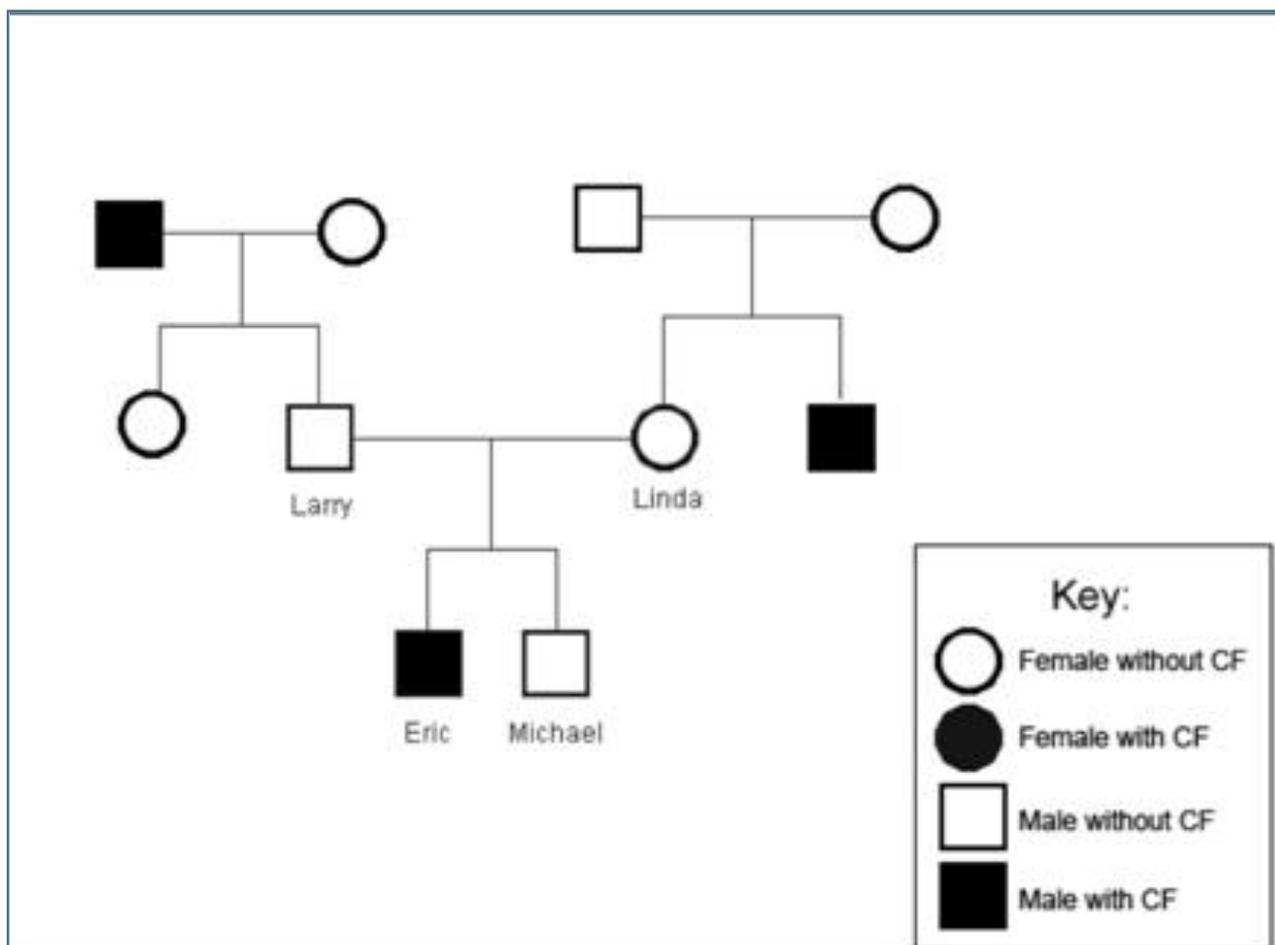
(1 mark)

- 2 (b) (ii)** Which part shown on the diagram produces bile?

(1 mark)

- 3 **Figure 1** shows part of a family tree where some of the individuals carry and inherit cystic fibrosis (CF).

Figure 1



- 3 (a) Larry and Linda are both carriers of CF. What is meant by the term “carrier”?

(1 mark)

- 3 (b) (i) CF is caused by a recessive allele. What can we conclude about the alleles that Eric has inherited? _____

(1 mark)

- 3 (b) (ii) If Eric were to have children with a woman who did not carry the CF allele what is the probability that their children would be sufferers? Explain your answer.

(2 marks)

- 3 (c)** What is the probability that any further children that Larry and Linda have are normal? Construct a genetic diagram to show how you arrived at your answer if you wish. Show the Normal (dominant) allele as **N** and the (recessive) allele for CF as **n**.

The probability of Larry and Linda having a Normal child is: _____

(4 marks)

- 3 (d) (i)** Doctors tell Larry and Linda that it is possible that they can undergo a process during IVF that determines whether any future embryos will inherit the CF allele. What do we call this process?

(1 mark)

- 3 (d) (ii)** What does IVF stand for?

(1 mark)

- 3 (d) (iii)** During IVF the fertilised egg divides to form an embryo by cell division. Name this type of cell division.

(1 mark)

Total for question

4 Scientists investigated how exercise affects blood flow to different organs in the body.

The scientists made measurements of blood flow to different organs of:

- a person resting in a room at 20°C
- the same person, in the same room, doing vigorous exercise at constant speed on an exercise cycle.

The table shows the scientists' results.

| Organ | Blood flow in cm ³ /minute whilst: | |
|---------|---|-----------------------|
| | Resting | Exercising vigorously |
| Brain | 750 | 750 |
| Heart | 250 | 1100 |
| Muscles | 1200 | 22200 |
| Skin | 500 | 650 |
| Other | 3100 | 300 |

4 (a) The scientists decided that it was better to carry out the experiments inside a laboratory on an exercise bicycle rather than outside on the road.

Suggest two reasons why. **Do not include safety** as either of your answers.

(2 marks)

4 (b) Calculate the change in cm³/minute in blood flow to the muscles during exercise?

Answer _____ cm³/min

(2 marks)

4 (c) Give two changes to the action of the heart that the scientists might observe in the subject during exercise.

(2 marks)

- 4 (d)** The scientists conclude that there is an increase in aerobic respiration in the subject's muscles during the period of exercise.

Give the word equation that summarises aerobic respiration in the space below:



(2 marks)

- 4 (e) (i)** The scientists noticed that the subject continued to have an increased blood supply to her muscles for some time after exercise was ceased. They concluded that this was to remove waste materials produced during exercise.

Name two waste materials that would be removed from the muscles during and after exercise.

(2 marks)

- 4 (e) (ii)** The subject also continued to breath more rapidly for some time after the exercise was completed. Explain why.

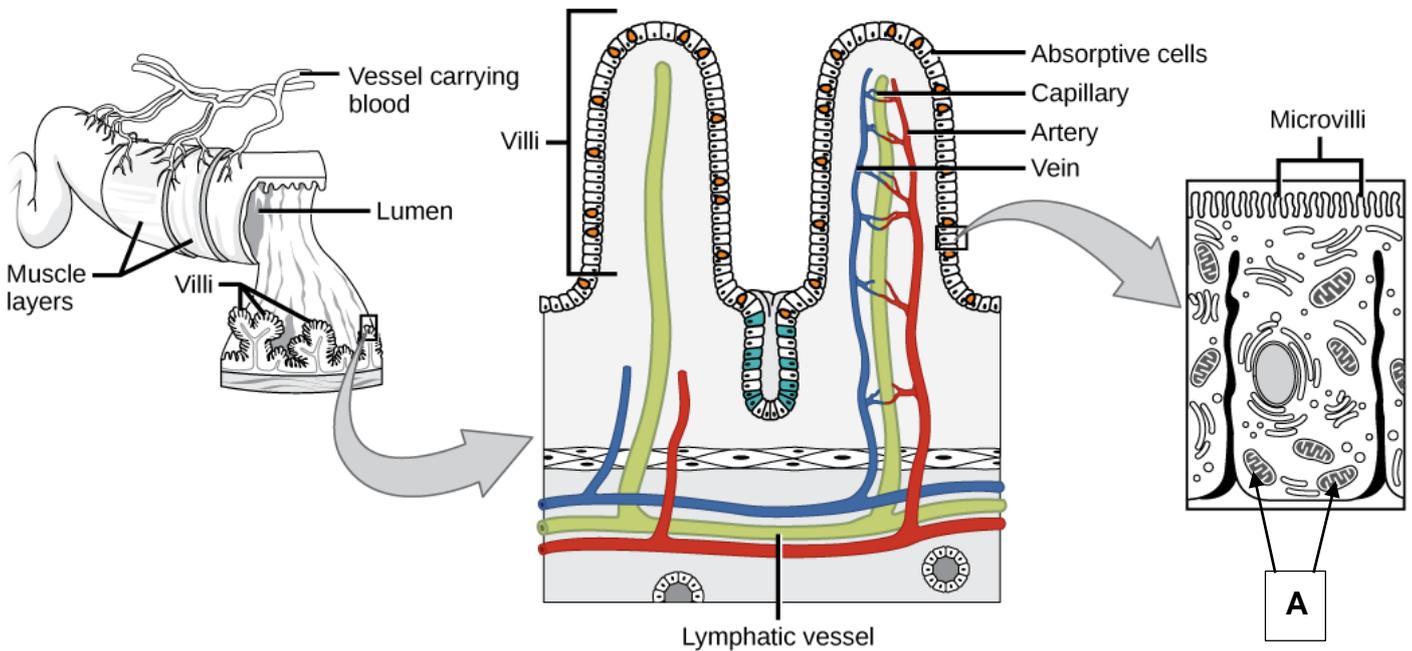
(2 marks)

Total for question

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|-------------------|
| <u> </u> 12 |
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5 **Figure 1** shows a section through part of the small intestine which is then magnified to show the structure of the wall of the intestine and a villus.

Figure 1



5 (a) (i) The (epithelial) cells that line the small intestine have on their surface microvilli as shown in the diagram. What is their purpose?

(1 mark)

5 (a) (ii) The epithelial cells also contain lots of the cell structures **labelled A** in the diagram. What is the name given to structure A?

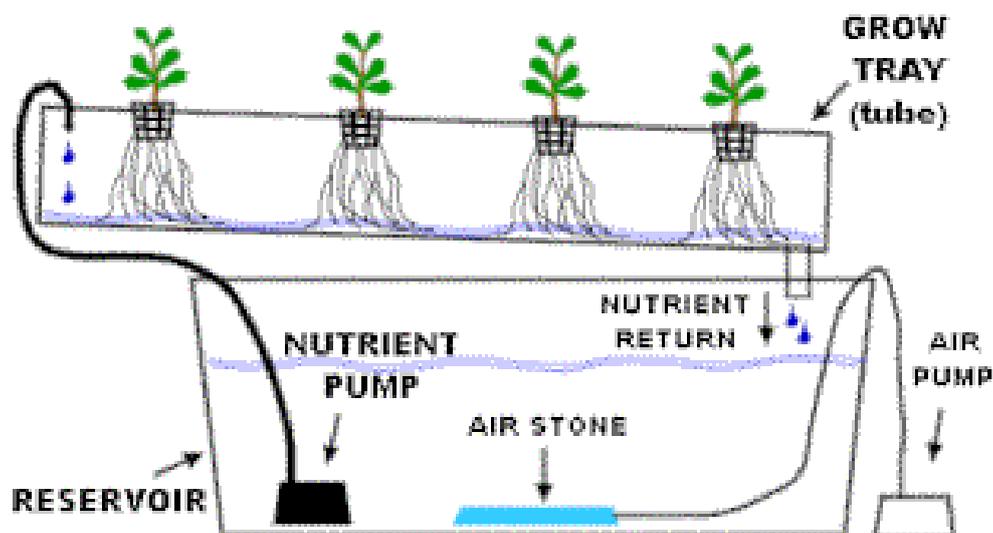
(1 mark)

5 (b) (i) How does the oxygen required for respiration get to the epithelial cells?
Use information from the diagram to explain how.

(3 marks)

- 6 **Figure 1** shows the hydroponic system a grower is using for tomatoes in his commercial greenhouse.

Figure 1



- This system allows the plants to grow without the use of soil.
- The nutrient pump sends water and ions to the plant roots.
- The solution slowly bathes the roots and returns to the reservoir.
- The concentration of ions in the solution and its pH are controlled.

- 6 (a) (i) Give **one advantage** to the grower of using this system rather than growing the plants in soil.

(1 mark)

- 6 (a) (ii) The air pump and air stone introduce bubbles of air into the solution of ions. Oxygen from the air dissolves in the solution.

Explain why the plants need the oxygen.

(2 marks)

- 6 (b)** Besides what is shown in the diagram, **give two other conditions** the grower would need to control in the greenhouse?

(2 marks)

- 6 (c) (i)** The tomato plants produce glucose from photosynthesis. Some of this glucose is used to make proteins.

Give one other use that is made of the glucose by the plant.

(1 mark)

- 6 (c) (ii)** As well as the glucose, what other element do the plants need in order to make proteins and in what form do they get it?

(2 marks)

Total for question

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|----------------|
| <hr/> 8 |
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END OF QUESTIONS