1)

(a) Cholera bacteria are prokaryotic cells. Give **three** structures found in prokaryotic cells but not in eukaryotic cells.

1 .....

2 .....

3 .....

(3 marks)

(b) Cholera bacteria cause an increase in the secretion of chloride ions into the small intestine. Use your knowledge of water potential to explain how the increased secretion of chloride ions causes diarrhoea.

.....

.....

.....

.....

(2 marks)

(c) People with diarrhoea suffer fluid loss. They can use oral rehydration solutions (ORS) to replace the lost fluid. The mixture used to make an oral rehydration solution is stored as a powder. The powder can be made into a solution with boiled water.

(c) (i) Why must boiled water be used to make an ORS?

.....

.....

(1 mark)

(c) (ii) The mixture used to make the ORS contains glucose. Give **one** other substance that must be present in the mixture.

.....

.....

(1 mark)

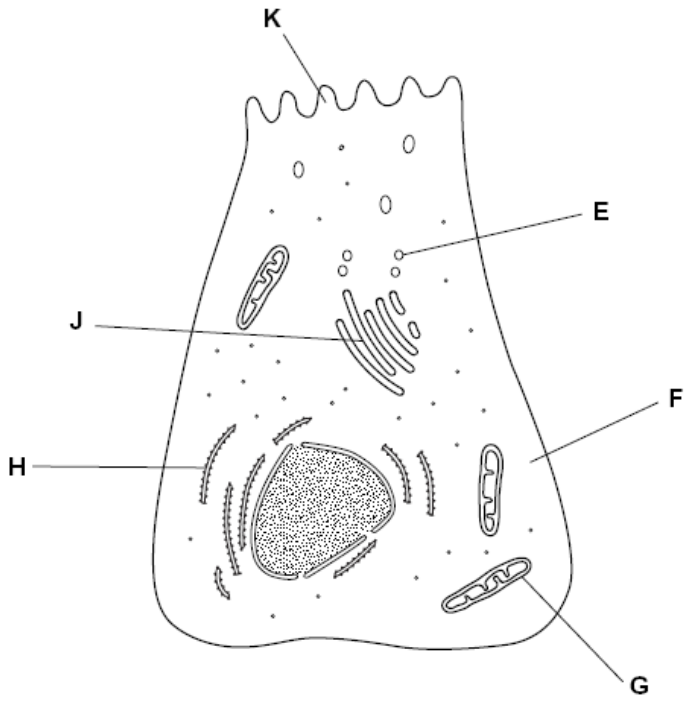
2)

(a) Name the type of bond that joins amino acids together in a polypeptide.

.....

(1 mark)

The diagram shows a cell from the pancreas.



(b) The cytoplasm at **F** contains amino acids. These amino acids are used to make proteins which are secreted from the cell.

Place the appropriate letters in the correct order to show the passage of an amino acid from the cytoplasm at **F** until it is secreted from the cell as a protein at **K**.

F				K

(2 marks)

(c) There are lots of organelle **G** in this cell. Explain why.

.....

(2 marks)

(d) A group of scientists homogenised pancreatic tissue before carrying out cell fractionation to isolate organelle **G**.

Explain why the scientists

(d) (i) homogenised the tissue

.....

.....

(1 mark)

(d) (ii) filtered the resulting suspension

.....

.....

(1 mark)

(d) (iii) kept the suspension ice cold during the process

.....

.....

(1 mark)

(d) (iv) used isotonic solution during the process.

.....

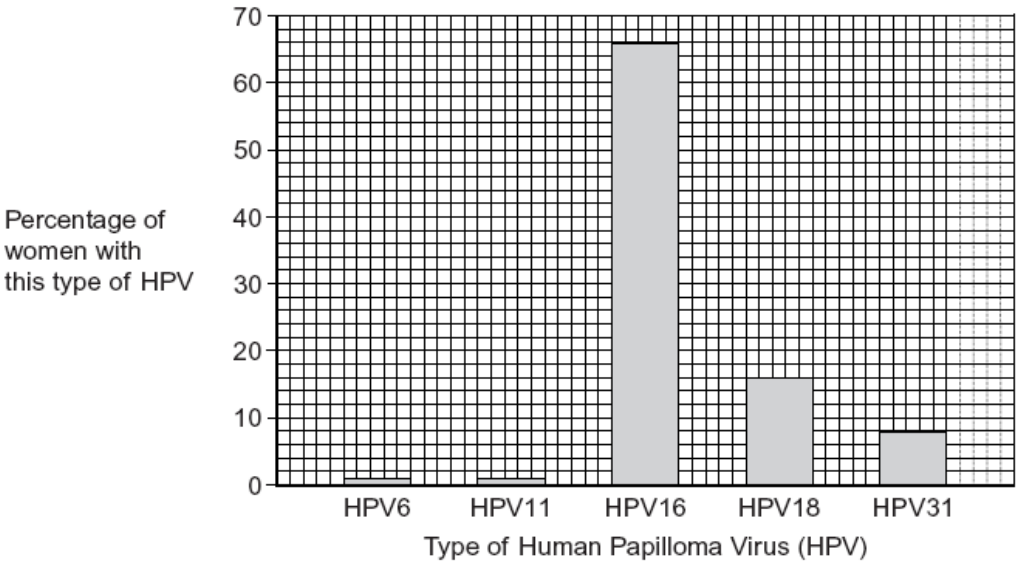
(2 marks)

3)

Cervical cancer occurs in the neck of the uterus.

Scientists investigated the link between cervical cancer and infection with some types of Human Papilloma Virus (HPV).

The graph shows the frequency of five different types of HPV in women who had cervical cancer.



(a) A local newspaper published an article about cervical cancer with the headline 'HPV causes cervical cancer'.

Do the data shown in the graph support this claim? Explain your answer.

.....

(3 marks)

.....

(b) Scientists have developed vaccines against HPV. One of the vaccines contains HPV antigens.

(b) (i) What is an HPV antigen?

.....

(2 marks)

.....

(b) (ii) A vaccine can be used to produce immunity to HPV. Describe how memory cells are important in this process.

.....

(3 marks)

(Extra space) .....

.....

.....

(c) Some doctors suggested offering the vaccine to young men. Explain the advantage of vaccinating young men as well as young women.

..... *(2 marks)*

4)

Gangliosides are lipids found in the cell surface membranes of nerve cells.
Hexosaminidase is an enzyme present in blood that breaks down gangliosides.
If gangliosides are not broken down, they damage nerve cells.

(a) Hexosaminidase only breaks down gangliosides. It does not break down other lipids. Explain why this enzyme only breaks down gangliosides.

.....

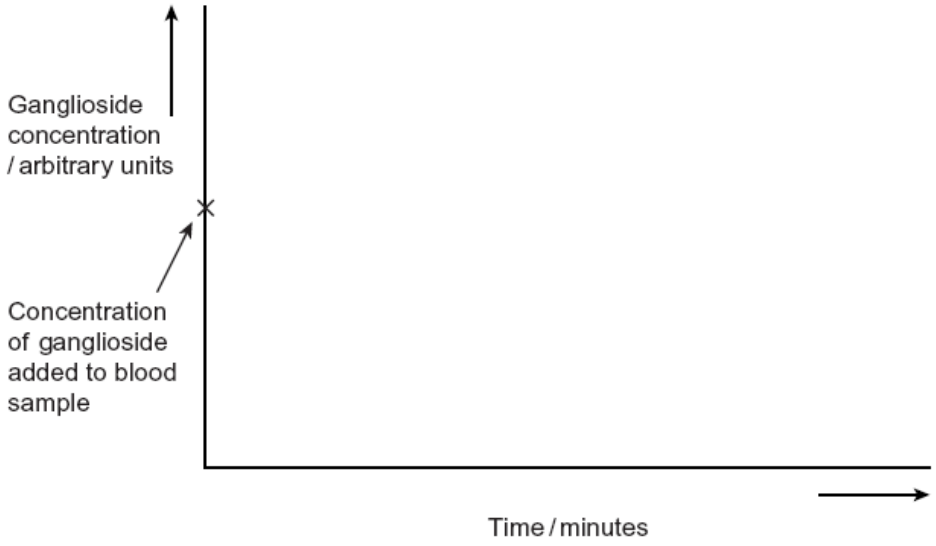
(3 marks)

(b) Hexosaminidase is found in the blood of healthy people. People with Tay Sachs disease do not have this enzyme in their blood.

Doctors confirm Tay Sachs disease by using a blood test. The technician carrying out the test adds a solution containing a high concentration of gangliosides to a sample of blood from the person being tested. The technician then measures the concentration of gangliosides in the person's blood at regular intervals.

(b) (i) Complete the graph below by sketching a curve to show the results you would expect for a person with Tay Sachs disease. Label this curve **T**.

(1 mark)



(b) (ii) Sketch a curve on the same graph to show the results you would expect for a healthy person who does **not** have Tay Sachs disease. Label this curve **H**.

(1 mark)

(c) Scientists are trying to find a way to give the missing enzyme to people with Tay Sachs disease. Suggest why they cannot give the enzyme as a tablet that is swallowed.

(2 Marks)

.....

5)

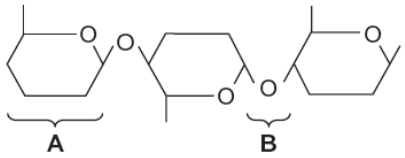
(a) Give **one** feature of starch and explain how this feature enables it to act as a storage substance.

Feature .....

Explanation .....

(2 marks)

(b) The diagram shows part of a cellulose molecule.



b) (i) Name part **A**.

.....

(1 mark)

b) (ii) Name bond **B**.

.....

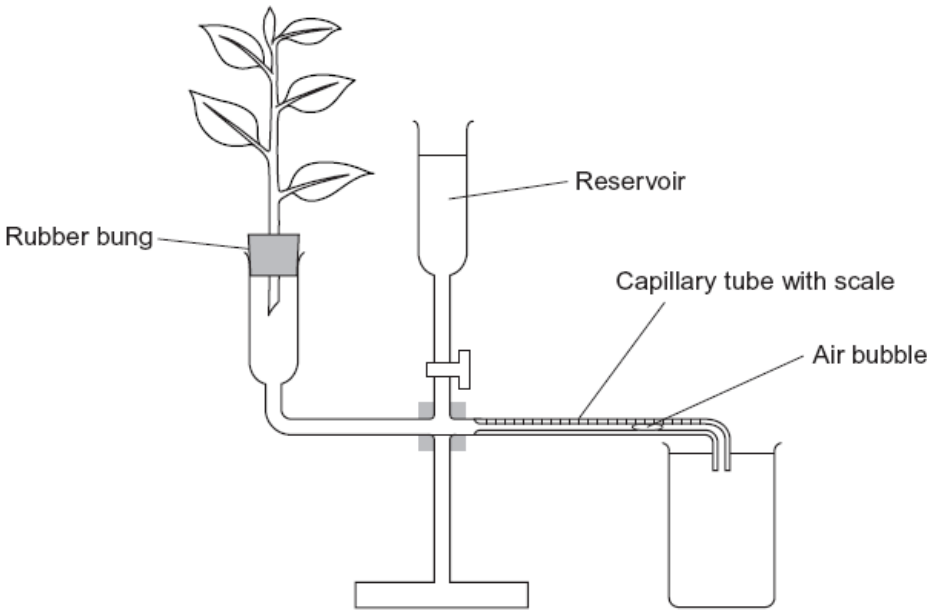
(1 mark)

(c) The structure of cellulose is related to its role in plant cell walls. Explain how.

..... *(3 marks)*

6)

A student investigated the rate of transpiration from a leafy shoot. She used a potometer to measure the rate of water uptake by the shoot. The diagram shows the potometer used by the student.



(a) Give **one** environmental factor that the student should have kept constant during this investigation.

.....

(1 mark)

(b) The student cut the shoot and put it into the potometer under water. Explain why.

.....

.....

(1 mark)

(c) The student wanted to calculate the rate of water uptake by the shoot in cm^3 per minute. What measurements did she need to make?

.....

(2 marks)

(d) The student assumed that water uptake was equivalent to the rate of transpiration. Give **two** reasons why this might **not** be a valid assumption.

.....

(2 marks)

(e) The student measured the rate of water uptake three times.

(e) (i) Suggest how the reservoir allows repeat measurements to be made.

.....

(1 mark)

(e) (ii) Suggest why she made repeat measurements.

.....

(1 mark)

7)

(a) The number of patients infected with the bacterium MRSA has increased in some hospitals. Scientists have suggested ways to reduce the transmission of MRSA in hospitals. Suggest **two** ways to reduce the transmission of MRSA in hospitals.

.....

(2 marks)

(b) The minimum inhibitory concentration (MIC) is the lowest concentration of a substance that prevents the growth of a microorganism.

When antibiotics are prescribed for treating patients, higher doses than the MIC are recommended. Suggest **two** reasons why.

.....

(2 marks)

Scientists tested a new group of drugs for their effectiveness against four species of bacteria. The scientists used MICs to compare the effectiveness of four drugs. The results are shown in the table.

	Minimum inhibitory concentration / $\mu g\,cm^{-3}$			
Drug	*Escherichia coli*	*Staphylococcus aureus*	*Enterococcus faecalis*	*Pseudomonas aeruginosa*
P	0.39	0.049	0.049	3.13
Q	1.54	0.049	0.195	3.13
R	0.39	0.049	0.195	1.56
S	1.56	0.098	0.390	12.50

(c) Which of the four drugs is

(c) (i) most effective against *Enterococcus faecalis*?

☐

(1 mark)

(c) (ii) least effective against all the species of bacteria used?

☐

(1 mark)

(d) The effectiveness of these drugs was tested in double-blind trials using human volunteers. In a double-blind trial neither the volunteers nor the scientists know which treatment a particular volunteer is receiving.

(d) (i) Suggest **two** ways in which a double-blind trial improves reliability.

1 .....

.....

2 .....

.....

(2 marks)

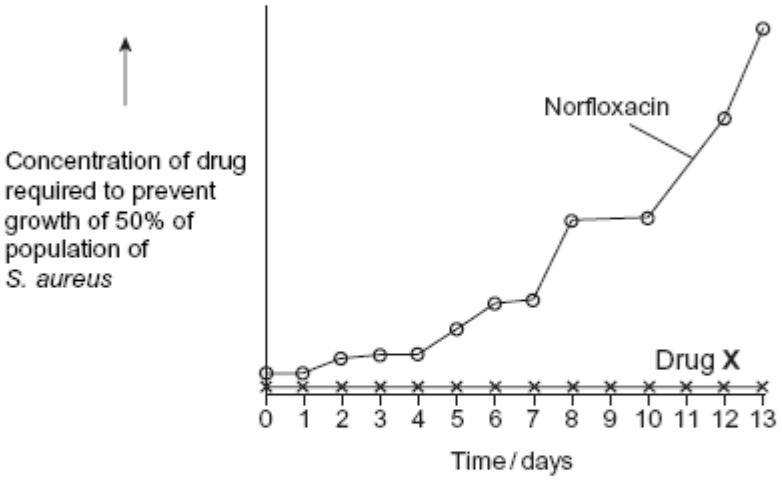
(d) (ii) Suggest **two** factors the scientists should have considered when selecting adult volunteers for this trial.

1 .....

2 .....

(2 marks)

(e) Scientists investigated resistance of the bacterium, *S. aureus* to the antibiotic Norfloxacin. They grew the bacteria in a medium containing a low concentration of Norfloxacin. The concentration of Norfloxacin that they added killed some of the bacteria. It did not kill all of them. Every 24 hours, they removed a sample of the bacteria from the culture. They tested the sample to find the concentration of Norfloxacin that prevented the growth of 50 % of the bacteria in the sample.
The scientists then used the same method to investigate the resistance of *S. aureus* to a new drug, drug **X**. The results of both investigations are shown in the graph.



(e) (i) Describe the results obtained with Norfloxacin.

.....

.....

(1 mark)

(e) (ii) Use your knowledge of resistance to explain the results obtained with Norfloxacin and drug **X**.

.....

(4 marks)