**Q1.**(a) Give **two** ways in which pathogens can cause disease.

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2 .....

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**(2)**

(b) Putting bee honey on a cut kills bacteria. Honey contains a high concentration of sugar.

Use your knowledge of water potential to suggest how putting honey on a cut kills bacteria.

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**[Extra space]** .....

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**(3)**
**(Total 5 marks)**

**Q2.**Read the following passage.

Low-density lipoprotein (LDL) is a substance found in blood. A high concentration of LDL in a person's blood can increase the risk of atheroma formation. Liver cells have a receptor on their cell-surface membranes that LDL binds to. This leads to LDL entering the cell. A regulator protein, also found in

blood, can bind to the same receptor as LDL. This prevents LDL entering the liver cell. People who have a high concentration of this regulator protein in their blood will have a high concentration of LDL in their blood. Scientists have made a monoclonal antibody that prevents this regulator protein working. They have suggested that these antibodies could be used to reduce the risk of coronary heart disease.

A trial was carried out on a small number of healthy volunteers, divided into two groups. The scientists injected one group with the monoclonal antibody in salt solution. The other group was a control group. They measured the concentration of LDL in the blood of each volunteer at the start and after 3 months. They found that the mean LDL concentration in the volunteers injected with the antibody was 64% lower than in the control group.

Use the information in the passage and your own knowledge to answer the following questions.

(a) The scientists gave an injection to a mouse to make it produce the monoclonal antibody used in this investigation (line 7).

What should this injection have contained?

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**(1)**

(b) LDL enters the liver cells (lines 3−4).

Using your knowledge of the structure of the cell-surface membrane, suggest how LDL enters the cell.

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**(2)**

(c) Explain how the monoclonal antibody would prevent the regulator protein from working (lines 7−8).

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**(2)**

(d) Describe how the control group should have been treated.

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**(2)**
**(Total 7 marks)**

**Q3.** Scientists studied the rate of carbon dioxide uptake by grape plant leaves. Grape leaves have stomata on the lower surface but no stomata on the upper surface.

The scientists recorded the carbon dioxide uptake by grape leaves with three different treatments:

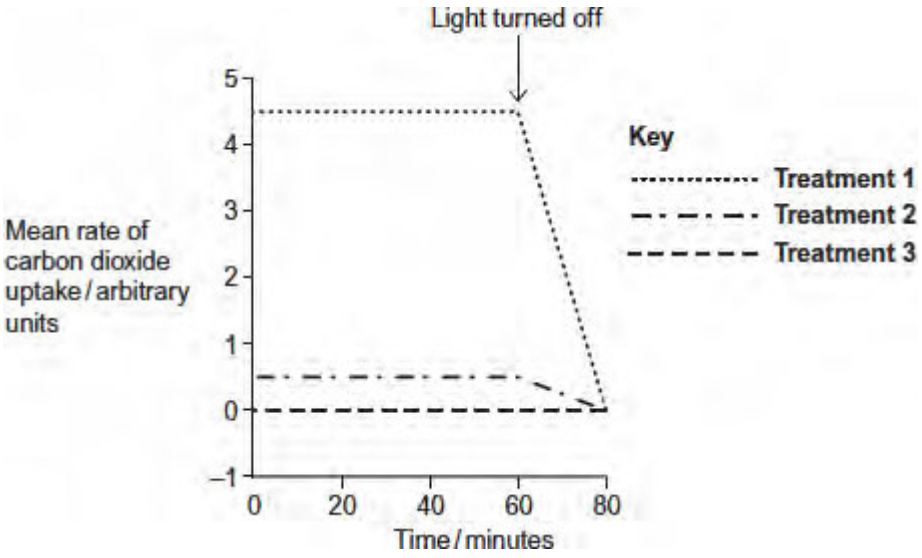
**Treatment 1** − No air-sealing grease was applied to either surface of the leaf.

**Treatment 2** − The lower surface of the leaf was covered in air-sealing grease that prevents gas exchange.

**Treatment 3** − Both the lower surface and the upper surface of the leaf were covered in air–sealing grease that prevents gas exchange.

The scientists measured the rate of carbon dioxide uptake by each leaf for 60 minutes in light and then for 20 minutes in the dark.

The scientists' results are shown in the diagram below.




(a) Suggest the purpose of each of the three leaf treatments.

**Treatment 1** .....

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**Treatment 2** .....

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**Treatment 3** .....

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**(3)**

(b) (i) Describe the results shown for **Treatment 1**.

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**(2)**

(ii) The stomata close when the light is turned off.

Explain the advantage of this to the plant.

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**(2)**

(c) (i) **Treatment 2** shows that even when the lower surface of the leaf is sealed there is still some uptake of carbon dioxide.

Suggest how this uptake of carbon dioxide continues.

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**(1)**

(ii) In both **Treatment 1** and **Treatment 2**, the uptake of carbon dioxide falls to zero when the light is turned off.

Explain why.

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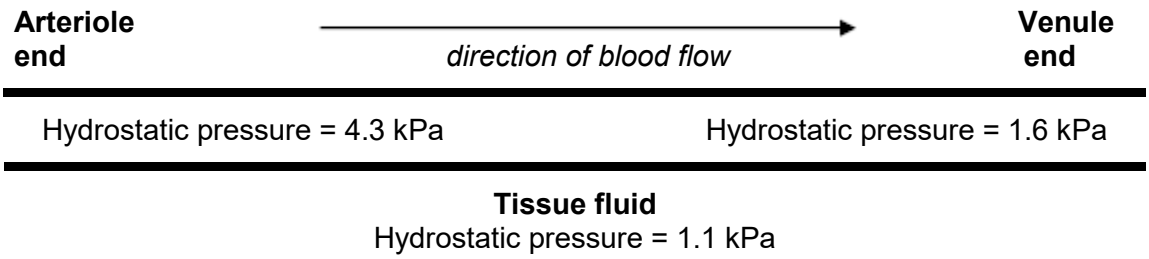
**(2)**
**(Total 10 marks)**

**Q4.** The figure below represents a capillary surrounded by tissue fluid.
The values of the hydrostatic pressure are shown.




(a) Use the information in the figure above to explain how tissue fluid is formed.

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**(2)**

(b) The hydrostatic pressure falls from the arteriole end of the capillary to the venule end of the capillary. Explain why.

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**(1)**

(c) High blood pressure leads to an accumulation of tissue fluid. Explain how.

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**(Extra space)** .....

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**(3)**

(d) The water potential of the blood plasma is more negative at the venule end of the capillary than at the arteriole end of the capillary. Explain why.

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**(Extra space)** .....

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**(3)**
**(Total 9 marks)**

**Q5.**(a) Describe how you would test a piece of food for the presence of lipid.

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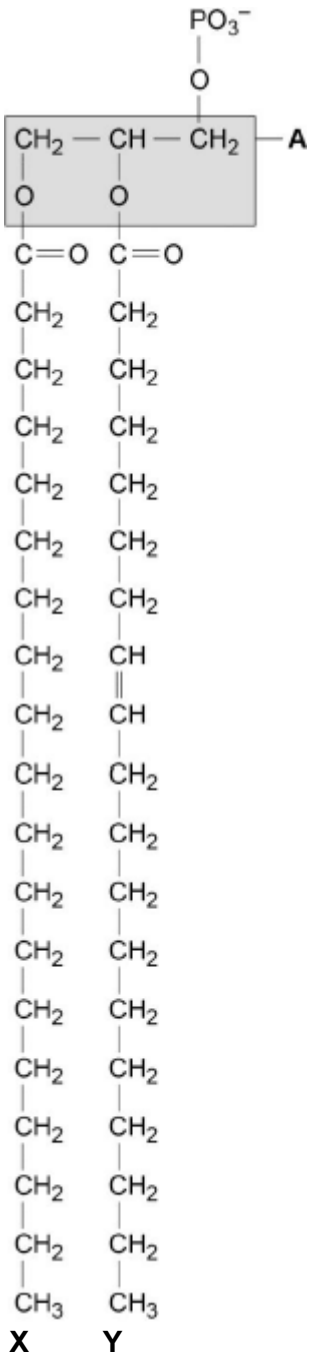
**(2)**

The figure below shows a phospholipid.




(b) The part of the phospholipid labelled **A** is formed from a particular molecule. Name this molecule.

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**(1)**

(c) Name the type of bond between **A** and fatty acid **X**.

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**(1)**

(d) Which of the fatty acids, **X** or **Y**, in the figure above is unsaturated? Explain your answer.

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**(1)**

Scientists investigated the percentages of different types of lipid in plasma membranes from different types of cell. The table shows some of their results.

| **Type of lipid** | **Percentage of lipid in plasma membrane by mass** | | |
|---|---|---|---|
| | **Cell lining ileum of mammal** | **Red blood cell of mammal** | **The bacterium *Escherichia coli*** |
| Cholesterol | 17 | 23 | 0 |
| Glycolipid | 7 | 3 | 0 |
| Phospholipid | 54 | 60 | 70 |
| Others | 22 | 14 | 30 |

(e) The scientists expressed their results as **Percentage of lipid in plasma membrane by mass**. Explain how they would find these values.

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**(2)**

Cholesterol increases the stability of plasma membranes. Cholesterol does this by making membranes less flexible.

(f) Suggest **one** advantage of the different percentage of cholesterol in red blood cells compared with cells lining the ileum.

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**(1)**

(g) *E. coli* has no cholesterol in its cell-surface membrane. Despite this, the cell maintains a constant shape. Explain why.

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**(2)**
**(Total 10 marks)**

**Q6.** A group of students carried out an investigation to find the water potential of potato tissue.

The students were each given a potato and 50 $cm^3$ of a 1.0 mol $dm^{-3}$ solution of sucrose.

- They used the 1.0 mol $dm^{-3}$ solution of sucrose to make a series of different concentrations.
- They cut and weighed discs of potato tissue and left them in the sucrose solutions for a set time.
- They then removed the discs of potato tissue and reweighed them.

The table below shows how one student presented his processed results.

| **Concentration of sucrose solution / mol $dm^{-3}$** | **Percentage change in mass of potato tissue** |
|---|---|
| 0.15 | +4.7 |
| 0.20 | +4.1 |
| 0.25 | +3.0 |
| 0.30 | +1.9 |

| | |
|---|---|
| 0.35 | −0.9 |
| 0.40 | −3.8 |

(a) Explain why the data in the table above are described as **processed** results.

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**(1)**

(b) Describe how you would use a 1.0 mol $dm^{-3}$ solution of sucrose to produce 30 $cm^3$ of a 0.15 mol $dm^{-3}$ solution of sucrose.

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**(2)**

(c) Explain the change in mass of potato tissue in the 0.40 mol $dm^{-3}$ solution of sucrose.

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**(2)**

(d) Describe how you would use the student's results in the table above to find the water potential of the potato tissue.

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**(Extra space)** .....

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**(3)**
**(Total 8 marks)**