AQA Examination-style questions

Unit 1 questions: Biology and disease

1 An increased concentration of cholesterol in the blood is one factor increasing the risk of myocardial infarction (heart attack). **Figure 1** shows the relationship between death from myocardial infarction and blood cholesterol concentration.

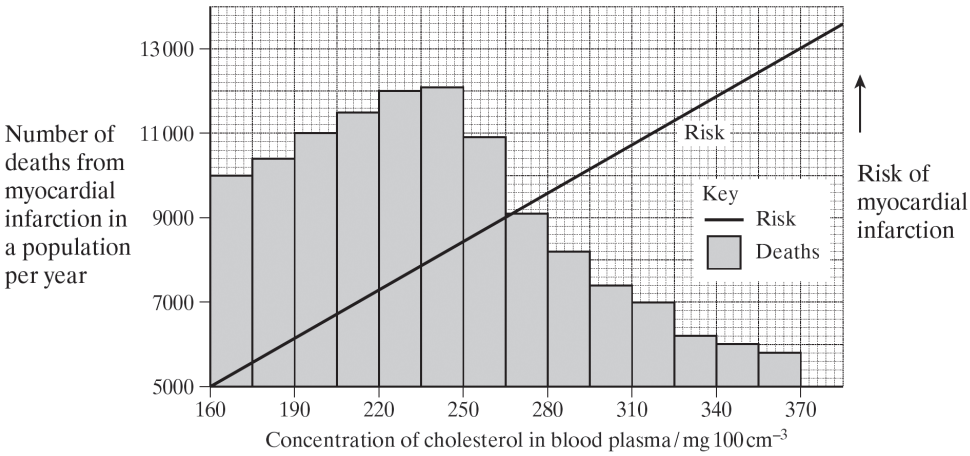


Figure 1

(a) (i) Describe how high concentrations of cholesterol in the blood can lead to disease of the blood vessels supplying the heart.

(ii) Explain how disease of these blood vessels may lead to death from myocardial infarction. *(5 marks)*

(b) The number of deaths from myocardial infarction decreased at concentrations of cholesterol above 250 mg 100 cm^{-3} blood, whereas the risk of myocardial infarction continued to rise. Suggest an explanation for this difference. *(2 marks)*

AQA, 2005

2 **Figure 2** shows the changes in pressure which take place in the aorta of a mouse during several heartbeats.

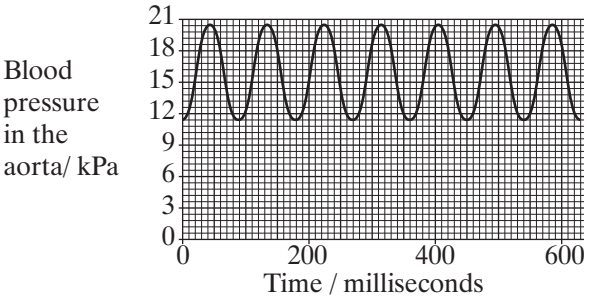


Figure 2

(a) Which chamber of the heart produces the increase in pressure recorded in the aorta? *(1 mark)*

(b) The pressure of blood in the aorta decreases during each heartbeat but does not fall below 10 kPa. Explain what causes the pressure of blood to:

(i) decrease during each heartbeat

(ii) stay above 10 kPa. *(3 marks)*

AQA, 2005

3 Cholera is a water-borne disease caused by the intestinal pathogen *Vibrio cholerae*. The pathogen produces an exotoxin which acts specifically on the epithelial cells of the small intestine causing changes in membrane permeability. Individuals with cholera suffer from severe diarrhoea which may result in death.

(a) Suggest **two** precautions which could be used to prevent the transmission of cholera. *(1 mark)*

(b) Explain how the effects of diarrhoea on the body can be treated. *(2 marks)*

(c) Suggest why the cholera exotoxin is specific to the epithelial cells of the small intestine. *(2 marks)*

(d) The cholera exotoxin affects the movement of ions through the intestinal wall. It causes the loss of chloride ions from the blood into the lumen of the small intestine. This prevents the movement of sodium ions from the lumen of the small intestine into the blood.

(i) Describe how sodium ions normally enter the blood from the cells of the intestinal wall against a concentration gradient.

(ii) Use the information provided to explain why individuals with cholera have diarrhoea. *(4 marks)*

AQA, 2004

4 **Figure 3** shows a bacterium.

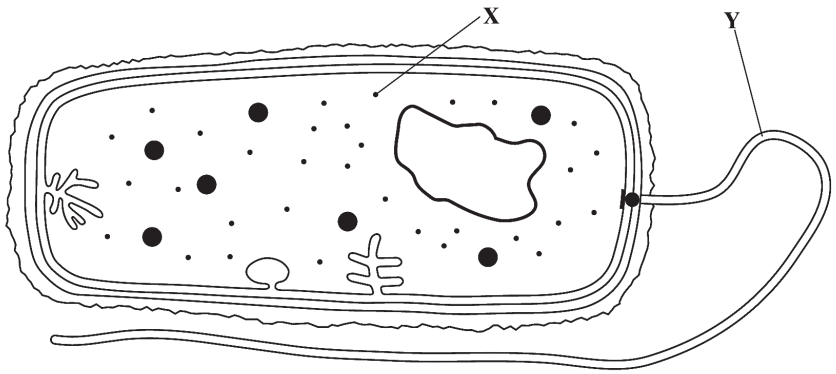


Figure 3

(a) Give the function of:

(i) organelle **X**

(ii) organelle **Y** *(2 marks)*

(b) (i) Give **two** ways in which the structure of this bacterium is similar to the structure of a cell lining the human small intestine.

(ii) Give **two** ways in which the structure of this bacterium differs from the structure of a cell lining the human small intestine. *(4 marks)*

AQA, 2005

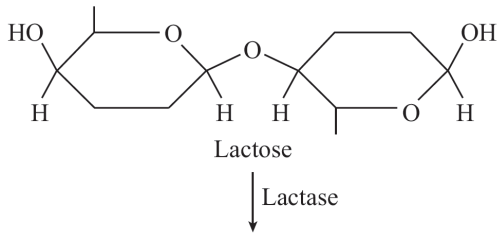
5 (a) What is an antigen? *(2 marks)*

(b) Describe how B cells respond when they are stimulated by antigens. *(4 marks)*

(c) A number of different species of bacteria can cause outbreaks of food poisoning. Explain how using monoclonal antibodies would enable a scientist to identify the species of bacterium involved in a particular outbreak of food poisoning. *(2 marks)*

6 Lactose is a disaccharide found in milk. In the human small intestine, the enzyme lactase catalyses the hydrolysis of lactose to the monosaccharides galactose and glucose. These monosaccharides are then absorbed into the blood.

(a) Copy and complete the diagram in **Figure 4** to show the hydrolysis of lactose to galactose and glucose.



(2 marks)

Figure 4

(b) Some people are lactose intolerant because they do not produce enough lactase enzyme in the small intestine. Lactose accumulates in the intestines and either remains unhydrolysed or is converted into other soluble substances by bacteria in the intestine. Explain how this could lead to diarrhoea in a lactose-intolerant individual. *(2 marks)*

AQA, 2006

7 Some enzymes digest protein. They hydrolyse the peptide bonds between amino acids. The extent to which a protein is digested is called the degree of hydrolysis (DH). The DH value may be calculated from the equation:

$$\text{DH} = \frac{100 \times \text{Number of peptide bonds hydrolysed}}{\text{Total number of peptide bonds present}}$$

(a) (i) A protein molecule contains 151 amino acids. What is the total number of peptide bonds in this molecule?

(ii) A molecule of this protein is digested. The DH value of the digested protein is 18. Calculate the number of peptide bonds that have been hydrolysed. *(2 marks)*

(b) What would be the DH value of a protein if it was completely hydrolysed to amino acids? Explain how you arrived at your answer. *(2 marks)*

Enzymes A and B digest protein. **Figure 5** shows the effect of pH on the rates of reaction of these enzymes.

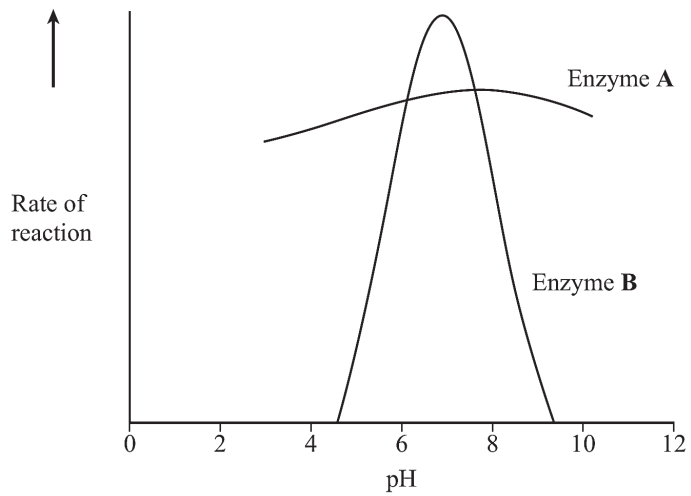


Figure 5

(c) Pepsin is a protein-digesting enzyme found in the stomach. It has an optimum pH of 2 and is fully denatured at pH 6. Sketch a curve on a copy of the graph to show the effect of pH on the rate of reaction of pepsin. *(1 mark)*

(d) Explain why the rate of reaction of enzyme B is low at pH 5. *(3 marks)*

(e) Enzyme A is present in some washing powders used for cleaning clothes. Use the graph to suggest why enzyme A would be of more use in washing clothes than enzyme B. *(1 mark)*

(f) Use your knowledge of protein structure to explain why enzymes are specific and can be affected by non-competitive inhibitors. *(6 marks)*

AQA, 2006

8 Liver was ground up to produce a homogenate. **Figure 6** shows how fractions containing different organelles were produced from the filtered homogenate.

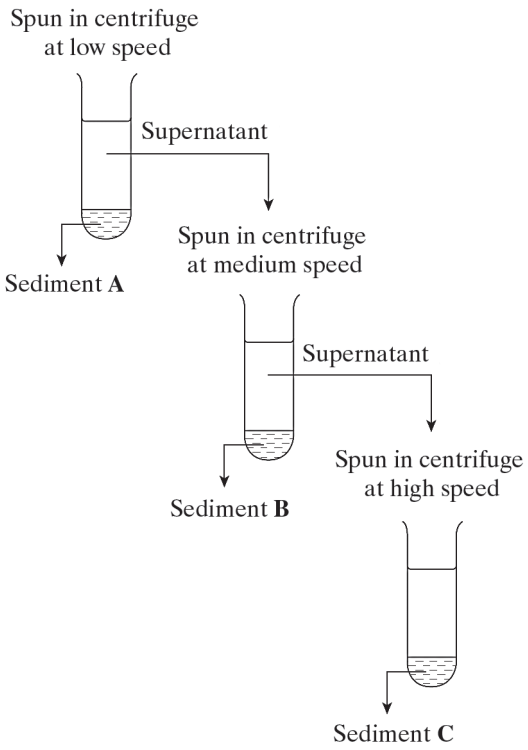


Figure 6

(a) Explain why the homogenate was filtered before spinning at low speed in the centrifuge. *(2 marks)*

(b) The main organelles present in sediment B were mitochondria. Suggest the organelles present in:

(i) sediment A

(ii) sediment C. *(2 marks)*

(c) What property of cell organelles allows them to be separated in this way? *(1 mark)*

(d) Explain why the organelles in sediment C could be seen with a transmission electron microscope but not with an optical microscope. *(2 marks)*

AQA, 2005