**1.** Which of the following describes arteries?

A. They have thick muscular walls.

B. They usually contain valves.

C. They carry blood towards the heart.

D. They carry blood from the lungs.

(Total 1 mark)

**2.** Where in a cell are antigens found?

A. In the nucleus

B. In the cytoplasm

C. In the plasma membrane

D. On the surface of the Golgi apparatus

(Total 1 mark)

**3.** What is the difference between the origin of type I and type II diabetes?

|  |  |  |
| --- | --- | --- |
|  | **Type I** | **Type II** |
| A. | caused by an autoimmune reaction | target cells fail to respond to insulin |
| B. | occurs in adults only | starts in childhood |
| C. | too much insulin secreted | too little insulin secreted |
| D. | caused by dietary problems | caused by hereditary factors |

(Total 1 mark)

**4.** Which of the following statements about antibodies is correct?

A. Antibodies are polypeptides.

B. Antibodies are produced by the bone marrow.

C. Antibodies are pathogenic foreign substances.

D. Antibodies kill bacteria but not viruses.

(Total 1 mark)

**5.** What are two effects of HIV on the immune system?

A. Reduction in antibody production and increase in active lymphocytes

B. Increase in antibody production and decrease in red blood cells

C. Reduction in antibody production and decrease in active lymphocytes

D. Increase in antibody production and increase in red blood cells

(Total 1 mark)

**6.** Why are antibiotics effective against bacteria but not viruses?

A. Viruses can hide inside host cells.

B. Bacteria are recognized as pathogens but viruses are not.

C. The enzymes of bacteria can be inhibited by antibiotics.

D. Viruses are resistant to antibiotics.

(Total 1 mark)

**7.** William Harvey discovered that blood flows away from the heart in arteries and back to the heart in veins. What hypothesis could be developed from this discovery?

A. The human body contains both arteries and veins.

B. Blood vessels link up arteries to veins.

C. How blood moves from arteries into veins.

D. Veins are connected to the left side of the heart and arteries to the right side.

(Total 1 mark)

**8.** Which chamber of the heart has the thickest walls?

A. Left atrium

B. Right atrium

C. Left ventricle

D. Right ventricle

(Total 1 mark)

**9.** Which vessel carries deoxygenated blood?

A. The coronary artery

B. The pulmonary artery

C. The aorta

D. The pulmonary vein

(Total 1 mark)

**10.** Which of the following is transported by the blood?

A. Gametes

B. Glycogen

C. Heat

D. Starch

(Total 1 mark)

**11.** What is a role of the pacemaker or sinoatrial node (SAN)?

A. To initiate contraction of the ventricle

B. To pass the excitation through Purkinje fibres

C. To originate excitation in myogenic muscle

D. To cause the relaxation of the atria

(Total 1 mark)

**12.** What processes occur during assimilation and absorption of lipids?

|  |  |  |
| --- | --- | --- |
|  | **Assimilation** | **Absorption** |
| A. | lipids are broken down by enzymes | lipids are egested |
| B. | lipids are incorporated into new membranes | lipids pass into the lacteal |
| C. | lipids pass into the lacteal | lipids are incorporated into new membranes |
| D. | lipids are egested | lipids are broken down by enzymes |

(Total 1 mark)

**13.** The diagram below shows the human heart. What structures are indicated by the labels X, Y and Z?



[Source: http://en.wikipedia.org/wiki/File:Heart\_diagram-en.svg. Image by ZooFari]

|  |  |  |  |
| --- | --- | --- | --- |
|  | **X** | **Y** | **Z** |
| A. | left atrium | aorta | semi-lunar valve |
| B. | left atrium | aorta | atrio-ventricular valve |
| C. | right atrium | pulmonary artery | atrio-ventricular valve |
| D. | right atrium | pulmonary artery | semi-lunar valve |

(Total 1 mark)

**14.** A blood clot forms around a fibrous network of protein. What is the protein?

A. Fibrinogen

B. Fibrin

C. Thrombin

D. Thrombokinase

(Total 1 mark)

**15.** The diagram below shows water in the human body.



Where in the digestive system is the largest volume of water absorbed from?

A. Colon

B. Pancreas

C. Small intestine

D. Liver

(Total 1 mark)

**16.** Which vessel directly supplies the heart muscle with blood?

A. The aorta

B. The pulmonary artery

C. The coronary artery

D. The pulmonary vein

(Total 1 mark)

**17.** Celiac disease causes the destruction of the villi cells. Which of the following is most likely to happen to people with celiac disease?

A. Incomplete digestion of fats

B. Poor absorption of calcium

C. Increased levels of glucose in blood

D. Damage in the esophagus caused by increase in acid content of the stomach

(Total 1 mark)

**18.** Is the blood in the aorta, left ventricle and pulmonary artery oxygenated or deoxygenated?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Aorta** | **Left ventricle** | **Pulmonary artery** |
| A. | oxygenated | deoxygenated | deoxygenated |
| B. | deoxygenated | oxygenated | oxygenated |
| C. | oxygenated | oxygenated | deoxygenated |
| D. | oxygenated | oxygenated | oxygenated |

(Total 1 mark)

**19.** (a) Outline mechanisms used by the ileum to absorb amino acids.

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(2)

(b) State **two** materials which are not absorbed in the ileum.

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(1)

(Total 3 marks)

**20.** Alcohol is known to increase the risk of cardiovascular disease (CVD). An investigation was undertaken to look at the effects of drinking different amounts of alcohol in men and women.

C-reactive protein (CRP), fibrinogen and total white blood cell count (WBC) were measured. These are markers that can be used to measure the risk of cardiovascular disease (CVD).

Samples were taken from populations in three different countries and their drinking habits were determined and their blood was analysed.



[Imhof, A, Woodward, M, Doering, A, Helbecque, N, Loewel, H, Amouyel, P, Lowe, G D O, and Koenig, W. 2004. “Overall alcohol intake, beer, wine, and systemic markers of inflammation in western Europe: results from three MONICA samples (Augsburg, Glasgow, Lille)”. *European Heart Journal*. Vol 25. Pp 2092–2100. By permission of Oxford University Press.]

(a) State the overall trend for CRP for men and women over the range of alcohol consumption.

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(1)

(b) Evaluate, using all the data, whether drinking small amounts of alcohol reduces the risk of CVD.

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(3)

(c) Deduce which is the best marker to measure the risk of CVD.

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(1)

(d) Outline atherosclerosis and the causes of CVD.

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(2)

(Total 7 marks)

**21.** (a) Outline how coronary thrombosis can be caused.

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(2)

(b) The oxygen dissociation curve is a graph that shows the percentage saturation of hemoglobin at various partial pressures of oxygen. Curve A shows the dissociation at a pH of 7 and curve B shows the dissociation at a different pH.



[Used with Permission. From: Basic Skills in Interpreting Laboratory Data, Fourth Edition. Copyright 2009, American Society of Health-System Pharmacists.]

(i) State the possible cause of the curve shifting from A to B.

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(1)

(ii) On the graph, draw the curve for myoglobin.

(2)

(c) Describe the breakdown of hemoglobin in the liver.

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(2)

(Total 7 marks)

**22.** Backflow is the return of blood to the heart. In legs, backflow is enhanced by the pumping action of leg muscles during movement. When this does not occur efficiently, serious health problems can arise. The backflow speed of 40 patients was measured during the application of different therapy methods. The lying position is the control.



[Source: Adapted from postdoctoral thesis of Erich Meyer, Medical Faculty of the University of Erlangen-Nürnberg.]

(a) (i) State which activity reduces backflow speed in relation to the control.

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(1)

(ii) Suggest a reason why backflow speed is reduced by the activity stated in (a)(i).

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(1)

(b) Determine the difference in backflow speed between the lying position and pedal exercise.

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(1)

(c) Discuss the benefits of exercising to promote high backflow speed.

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(3)

(Total 6 marks)

**23.** The electron micrograph below shows cells from the intestine.



[Source: C Candalh, Inserm, magnification ×10 000]

(a) In the electron micrograph above, state the name of the

(i) structure labelled X.

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(1)

(ii) type of cells labelled Y.

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(1)

(b) Define *hormone*.

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(2)

(c) Outline the circulation of blood through liver tissue.

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(3)

(Total 7 marks)

**24.** (a) Label the section of healthy liver tissue below.



[Photo by Paul Billiet. Reproduced with permission.]

I. ..................................................................................................................................

II. .................................................................................................................................

III. ................................................................................................................................

(3)

(b) Outline **two** roles of the liver.

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(2)

(c) List **two** materials that are not absorbed but are egested by the body.

1. ..................................................................................................................................

2. ..................................................................................................................................

(1)

(d) State an example of a protein hormone.

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(1)

(Total 7 marks)

**25.** (a) State the missing source, optimum pH requirement, substrate and product of the human enzymes in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Enzyme** | **Source** | **Optimum pH** | **Substrate** | **Products** |
| Amylase | Salivary gland | 7 |  |  |
| Lipase |  |  | Lipids | Fatty acids and glycerol |

(2)

(b) Explain the need for enzymes in digestion.

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(2)

(c) Draw a labelled diagram to show the interconnections between the gall bladder, pancreas and small intestine.

(3)

(Total 7 marks)

**26.** *Helicobacter pylori* infection is a cause of stomach ulcers. It affects SLC26A9, which is a membrane protein present in the epithelial lining of the stomach. SLC26A9 takes part in the reversible transport of chloride and hydrogen carbonate ions into and out of the epithelial cells in order to raise the pH at the membrane to neutral levels. Entry of chloride ions into epithelial cells and removal of hydrogen carbonate ions both cause extracellular pH to increase.

To assess the function of SLC26A9, this process was reversed by artificially raising the external pH. The rate of change of extracellular pH was measured with normal epithelial cells and with modified cells with extra SLC26A9. The tests were also performed in the presence of DIDS, an inhibitor of SLC26A9.



[Reproduced with permission of the American Physiological Society from American Journal of Physiology. J Xu et al. 2005. *Cell Physiology*. Vol 289. Pp 493–505.]

(a) Calculate the difference in the rate of decrease of pH between the control cells and the modified cells without DIDS.

..................................... pH min–1

(1)

(b) State the effect of DIDS on the rate of decrease of the extracellular pH.

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(1)

(c) Scientists hypothesized that *Helicobacter pylori* alters the ability to maintain neutral pH at the epithelial cell surface by inhibition of SLC26A9. Evaluate this hypothesis.

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(2)

(d) In further experiments, scientists observed that the levels of mRNA of SLC26A9 increased in epithelial cells when infected by *Helicobacter pylori*. Suggest a possible explanation for this increase.

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(1)

(e) Predict, with a reason, the effect of DIDS on stomach pH if given to an experimental subject.

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(2)

(Total 7 marks)

**27.** *Up to two additional marks are available for the construction of your answers.*

**(2)**

(a) Draw a labelled diagram of the heart showing the chambers, associated blood vessels and valves.

(4)

(b) Describe the processes involved in blood clotting.

(6)

(c) Discuss the benefits and risks associated with vaccination programmes.

(8)

(Total 20 marks)