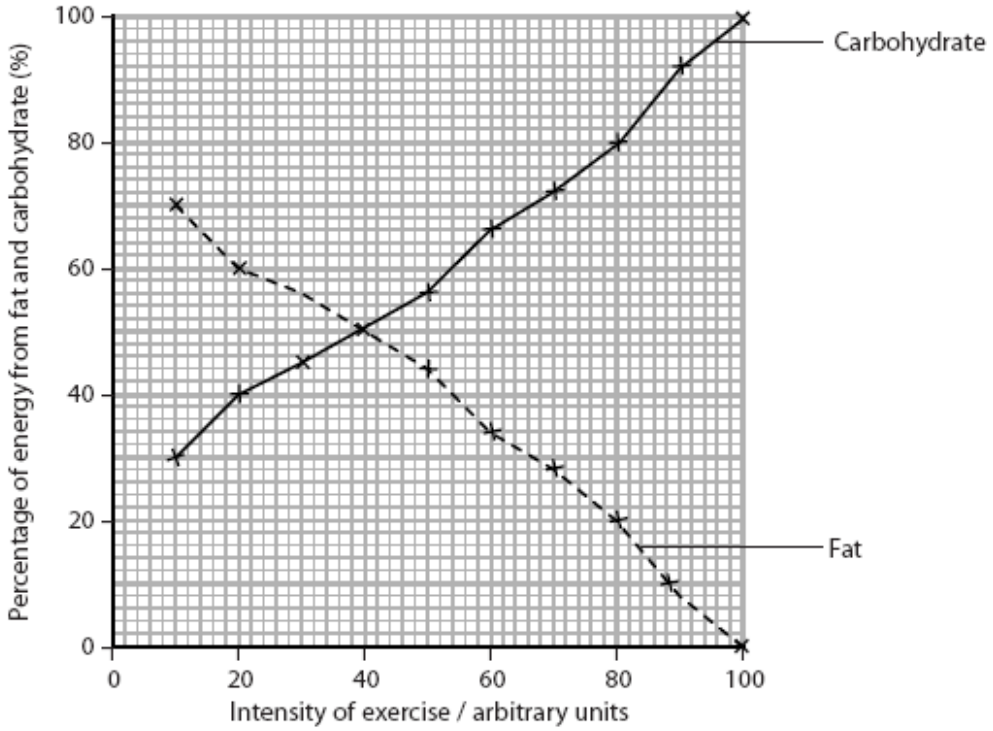
1)

Fats and carbohydrates such as glycogen are important energy storage molecules. These are broken down during exercise.

(a) Describe the structure of glycogen and explain why it is a suitable molecule for storing energy.

(4)

(b) The graph below shows how the percentage of energy obtained from fat and carbohydrate varies according to the intensity of exercise being carried out.



(i) Using the information in the graph, describe how the source of energy used depends on the intensity of exercise.

(3)

(ii) A carbohydrate-loading diet is used by athletes in preparation for some athletic events. This diet involves increasing carbohydrate intake and decreasing activity, several days before the event.

Carbohydrate-loading is not a suitable method of preparation for all athletic events.

Using the information in the graph and your knowledge of glycogen, explain what type of athletic event could be prepared for using a carbohydrate-loading diet.

(3)

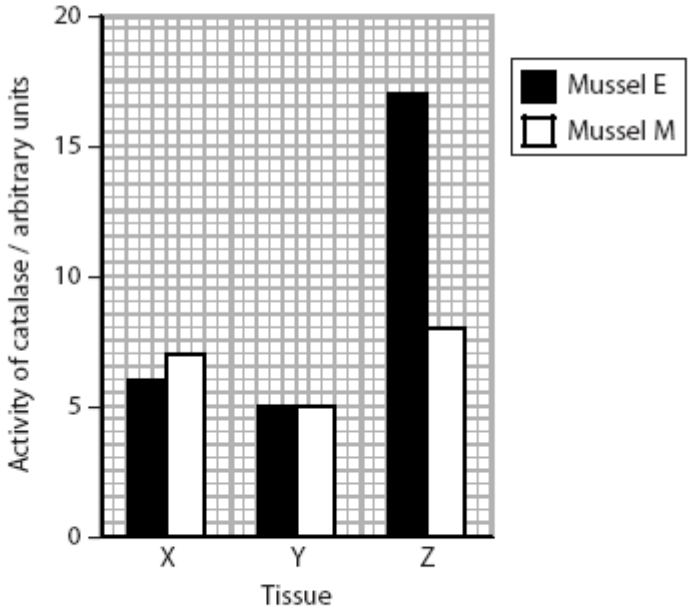
2)

Catalase is an enzyme present in many tissues of most living organisms. Its role is to break hydrogen peroxide down into oxygen and water. Hydrogen peroxide is produced by cells and is very harmful if it is not broken down.

(a) A study compared the activity of catalase in the tissues of freshwater mussels. Mussels from two different rivers: mussel E from the river Eo and mussel M from the river Masma were studied.

The catalase activity was measured in three tissues, X, Y and Z, taken from each type of mussel.

The graph below shows the results of this study.



(i) Use the information in the graph to state the conclusions that can be made about the activity of catalase in the tissues of mussel E.

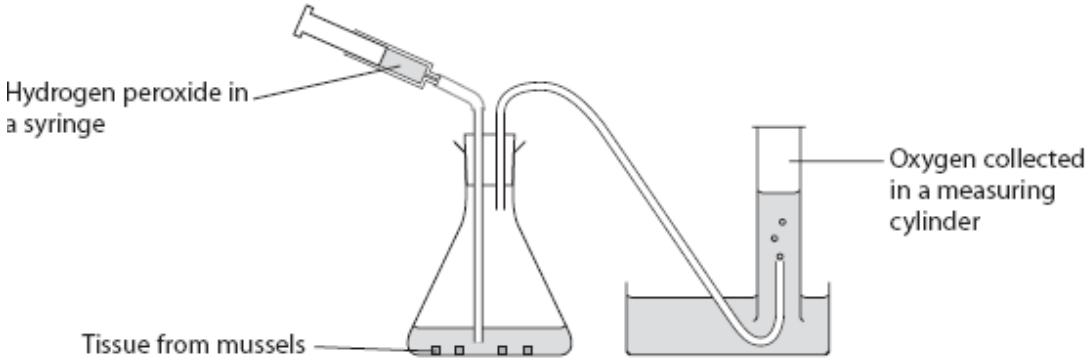
(3)

(ii) Using the information in the graph, compare the activity of catalase in mussel E and mussel M.

(2)

(b) Catalase activity in tissue from mussels can be studied using the apparatus shown below.

Tissue from mussels is placed in the flask and hydrogen peroxide is added using the syringe. The oxygen produced from the breakdown of hydrogen peroxide is collected in the measuring cylinder.



Describe how this apparatus could be used to compare the catalase activity in two different types of mussel.

(4)

3)

Cardiovascular disease (CVD) is responsible for many deaths.

*(a) One cause of CVD is atherosclerosis. Describe how atherosclerosis develops.

(4)

(b) A number of factors have been identified that increase the risk of CVD. One of these factors is genetic.

The genotype of some individuals causes them to be more at risk of developing CVD. One gene that influences this risk is the *KIF6* gene. Carriers of the 719 Arg allele of this gene are more at risk of CVD.

(1)

(i) Explain the meaning of the term **genotype**.

(1)

..... (ii) Explain the meaning of the term **allele**.

(c) Give **two** factors, other than genetic factors, that increase the risk of developing CVD.

(1)

1 .....

2 .....

(d) Trials have shown that plant statin therapy is more effective in 719 Arg carriers than in non-carriers of this allele.

Describe the risks of using plant statins to treat CVD.

(2)

4)

Genetic screening can be used to determine if an embryo has a genetic disorder, such as cystic fibrosis.

(a) The table below refers to the methods used in preimplantation genetic diagnosis and prenatal genetic screening.
If the statement is correct, place a tick (✓) in the appropriate box and if the statement is incorrect, place a cross (✖) in the appropriate box.

(2)

Method of screening	Statement	
	Screening performed during pregnancy	Cells removed from the embryo
Preimplantation genetic diagnosis		
Prenatal genetic screening		

(b) (i) Name **one** method of prenatal genetic screening.

(1)

(ii) Discuss either **one** ethical issue or **one** social issue relating to the use of this method of prenatal genetic screening.

(2)

(c) Gene therapy has the potential to treat some genetic disorders.

(i) Explain why gene therapy has the potential to treat some genetic disorders.

(2)

(ii) Suggest how patients with cystic fibrosis could be treated using gene therapy.

(3)

5)

(a) Read through the following passage on the blood clotting process, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The blood clotting process starts when cell fragments called ..... release molecules of ..... . These molecules are ..... which catalyse the conversion of ..... into ..... , in the presence of calcium ions. As a result, fibrinogen is converted into fibrin and blood cells are trapped to form the clot.

(b) Fibrinogen and fibrin are both proteins.

A protein consists of a chain of amino acids joined together by bonds.

(i) In the space below, draw a diagram to show the structure of an amino acid.

(3)

(ii) Name the covalent bond that joins the amino acids into a chain.

(1)

(iii) Suggest **two** differences between fibrinogen and fibrin.

(2)

6)

DNA is a very important molecule in living organisms as it carries the genetic code. Before a cell divides, the DNA molecule replicates so that each resulting daughter cell is genetically identical to the original parent cell.

(a) Explain the nature of the genetic code.

(2)

***(b) Describe the process of DNA replication.**

(5)

7)

The structure and properties of the cell membrane control which molecules can move into or out of the cell.

(a) The phospholipid bilayer plays an important role in this control of movement of molecules.

Explain why the phospholipid molecules form a bilayer.

(3)

8)

Cystic fibrosis is a genetic disease caused by mutations in the CFTR gene.
This disease can be classified according to the effect of the different gene mutations on the CFTR protein.

The table below shows the classification of cystic fibrosis.

Class	Effect on the CFTR protein
I	CFTR protein is not synthesised.
II	CFTR protein is mis-folded and is not found in the correct location.
III	CFTR protein is mis-folded and is found in the correct location, but does not function properly.
IV	CFTR protein has a faulty opening.
V	CFTR protein is synthesised in smaller quantities than normal.
VI	CFTR protein breaks down quickly after it is synthesised.

(a) For class I cystic fibrosis, suggest how a mutation in the CFTR gene could result in no CFTR protein being synthesised.

(2)

(b) Class II cystic fibrosis results from the CFTR protein being located in the wrong place.

Describe the correct location for the CFTR protein.

(2)

(c) The mutation causing class III cystic fibrosis results in a change in the primary structure of the CFTR protein.

Explain why this would result in the CFTR protein being mis-folded.

(2)

(d) For class IV cystic fibrosis, explain why a faulty opening of the CFTR protein would affect the functioning of this protein.

(2)

(e) For a person with class V cystic fibrosis, describe the effect of having smaller quantities of CFTR protein.

(2)

(f) For class VI cystic fibrosis, suggest how the CFTR protein is broken down.

(2)