1 Weever fish are small fish that live in sand in shallow waters on some of Britain's beaches.

They have poisonous spines on their back.

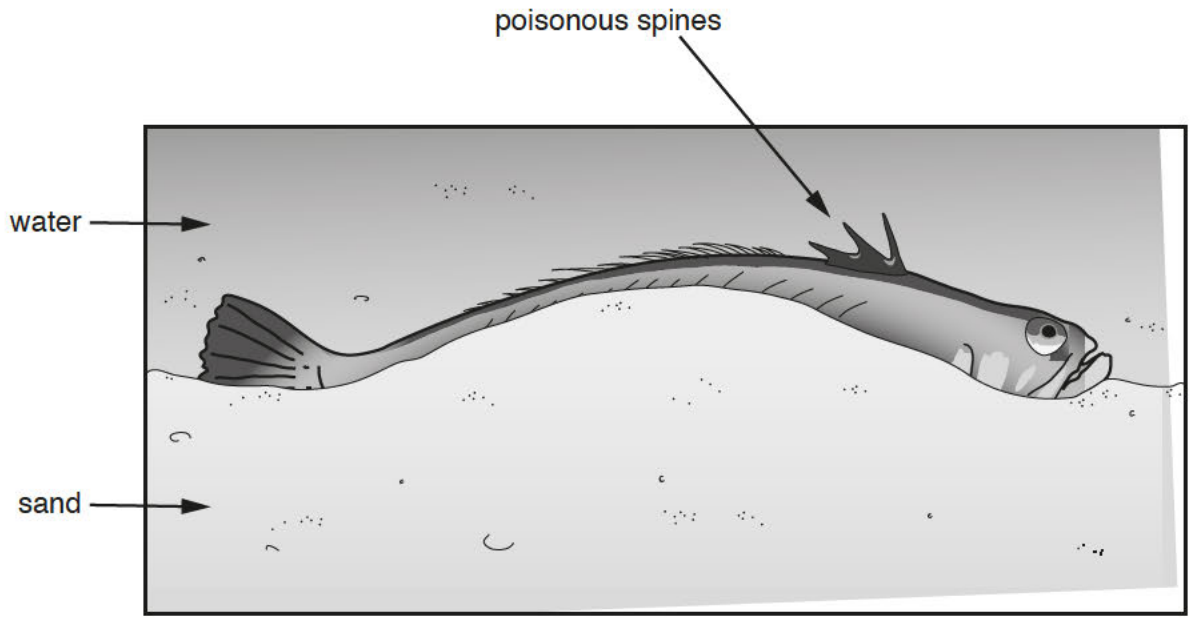
Anyone touching the spines can get a painful sting.

The spines inject a nerve poison made of protein.

The first aid treatment is to put the affected area in hot water, as hot as the victim can bear.

The pain will start to ease after a few minutes.

Although the sting is very painful, it does not usually cause any lasting harm.



(a) The weever fish poison is made of protein.

What are proteins made of?

..... **[1]**

(b) The treatment involves hot water, the hotter the better.

Suggest why.

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..... **[2]**

(c) The information for making the poison is coded in the fish's DNA and is in every cell.

However, the poison is only produced in the spines.

Explain why the poison is **not** produced in every cell.

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..... **[1]**

(d) On Britain's beaches in 2011, over 1000 holiday-makers were stung by weever fish.

Some people want to close the beaches where people have been stung.

Should the beaches be closed?

Explain your answer.

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..... **[2]**

2 Mangroves are trees that grow on the coasts of many tropical countries.



Mangroves grow in mud.

The mud is low in oxygen and nutrients.

(a) (i) Suggest why the lack of oxygen makes the nutrient content low.

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..... **[2]**

(ii) Some mangroves grow structures from their roots to absorb oxygen from the air for respiration.



Why do mangrove roots need to respire?

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..... **[3]**

(b) Mangroves absorb water from sea water (salt water).

Most plants **cannot** absorb water from sea water.

Mangroves have high levels of salts in their roots.

Suggest why.

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..... **[2]**

(c) Mangrove forests show zonation.

sea	**front zone** of mangrove forest	**mid zone** of mangrove forest	**back zone** of mangrove forest	dry land

(i) Different mangrove species are found in each zone of mangrove forest.

Suggest why.

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..... **[1]**

(ii) Compared with a tropical inland rainforest, mangrove forests have a much smaller plant biodiversity.

Suggest why.

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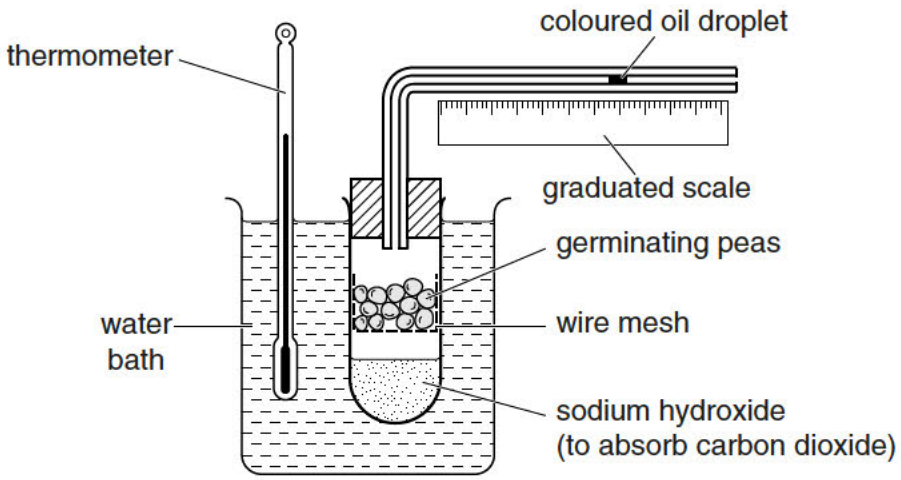
..... **[1]**

[Total: 9]

3 This question is about respiration.

Look at the diagram of a respirometer.

It can be used to investigate the gases involved in aerobic respiration.



(a) Complete the **balanced symbol** equation for aerobic respiration.

$C_6H_{12}O_6$ + ... → ..... + $6H_2O$ **[1]**

(b) Look at the tables.

The first table shows the respiratory quotient (RQ) of three food types.

Food type	Respiratory quotient (RQ)
carbohydrate	1.0
fat	0.7
protein	0.9

The second table shows the results from an experiment investigating aerobic respiration in two types of seed.

Type of seed	Volume of oxygen absorbed in cm^3	Volume of carbon dioxide produced in cm^3	Respiratory quotient (RQ)
Pea	0.6	0.6	.....
Peanut	16.3	13.0	.....

Respiratory quotient (RQ) is calculated using the formula:

$$RQ = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

Calculate the RQ for the two types of seed and use your answers to **suggest** how the food type used is different for the two types of seed.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(c) During respiration, food is broken down by enzymes.

The temperature of the water surrounding the seeds is increased from 25 °C to 50 °C.

This stops respiration.

Explain why.

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..... **[2]**

[Total: 9]

4 Carl is an athlete.

He competes in the 200 m sprint.



(a) Muscle contraction during the sprint needs energy.

Aerobic respiration is a process that occurs in living cells.

Complete the symbol equation for aerobic respiration.

..... + ... → ..... + ...

[2]

(b) The circulatory system has parts that help transport substances around the body.

Arteries are part of the circulatory system.

How do arteries help transport substances around the body?

Put a tick (✓) in the box next to the correct statement.

arteries carry blood at low pressure away from the heart	☐
arteries carry blood at high pressure away from the heart	☐
arteries carry blood at low pressure and have valves to prevent backflow	☐
arteries carry blood at high pressure back to the heart	☐
arteries join veins to capillaries	☐

[1]

(c) (i) Look at the table of data.

It shows the maximum oxygen consumption for males of different fitness levels.

The males are aged between 13 and 29 years old.

maximum oxygen consumption in cm^3 per kg per minute						
age in years	fitness levels					
	very poor	poor	fair	good	excellent	superior
13–19	less than 35	35–38	39–45	46–50	51–55	more than 55
20–29	less than 33	33–35	36–42	43–46	47–52	more than 52

Carl is 25 years old.

He has a maximum oxygen consumption of 44 cm^3 per kg per minute.

Carl wants to improve his fitness level to excellent.

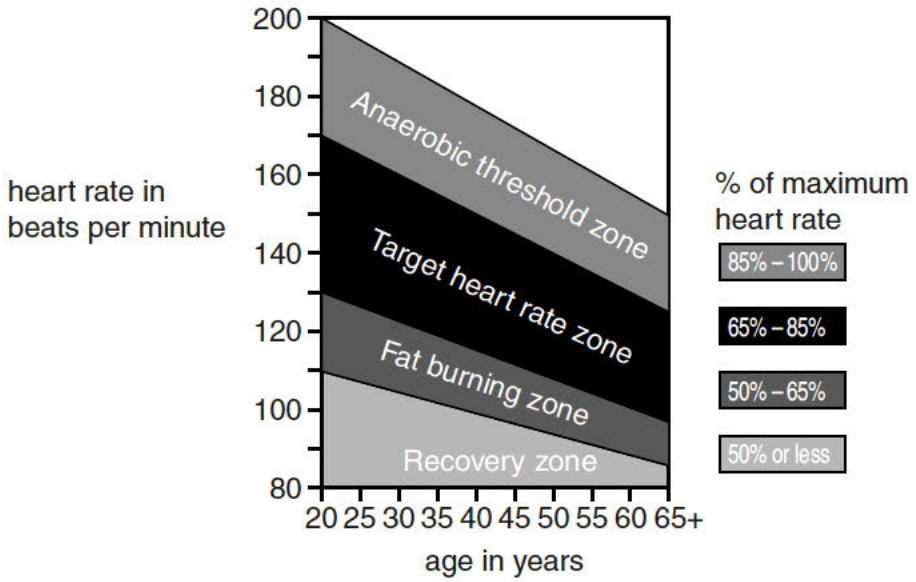
Look at the table.

Calculate Carl's maximum oxygen consumption as a percentage of the lowest excellent value.

answer .....% [1]

(ii) Carl needs to exercise to further improve his fitness level.

Look at the Exercise Target Zone Chart.



Carl's heart rate reaches 180 beats per minute during exercise.

Is Carl training efficiently? .....

Justify your answer.

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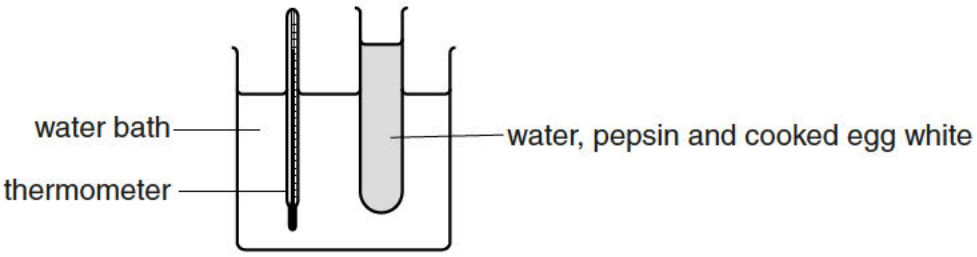
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..... **[3]**

[Total: 7]

5 (a) Egg white contains protein.

Natasha is investigating how a protein-digesting enzyme, called pepsin, breaks down cooked egg white.



The pepsin breaks down the cooked egg white.

This makes the mixture in the test tube change from white to colourless.

Natasha times how long it takes for the mixture to go colourless at different temperatures.

She keeps everything else the same.

The table shows her results.

Temperature in °C	Time for mixture to go colourless in minutes
20	14
25	9
30	6
35	3
40	3
45	6

(i) Look at the results. What is the optimum temperature for the pepsin?

..... °C **[1]**

(ii) Describe and explain what results you would expect as the temperature increases **above** 45 °C.

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..... **[3]**

(b) Proteins have many jobs in the body.

(i) Proteins can be broken down in aerobic respiration.

They have a respiratory quotient (RQ) of 0.9.

$$\text{Respiratory quotient (RQ)} = \frac{\text{volume of carbon dioxide produced}}{\text{volume of oxygen used}}$$

When proteins are used in respiration, how does the volume of carbon dioxide produced compare with the volume of oxygen used?

Put a tick (✓) in the box by the correct answer.

The volume of carbon dioxide is greater than the volume of oxygen. ☐

The volume of carbon dioxide is less than the volume of oxygen. ☐

The volume of carbon dioxide is the same as the volume of oxygen. ☐

[1]

(ii) Apart from being used in respiration, proteins have many other jobs in the body.

Write about other jobs of proteins.

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..... [3]

[Total: 8]