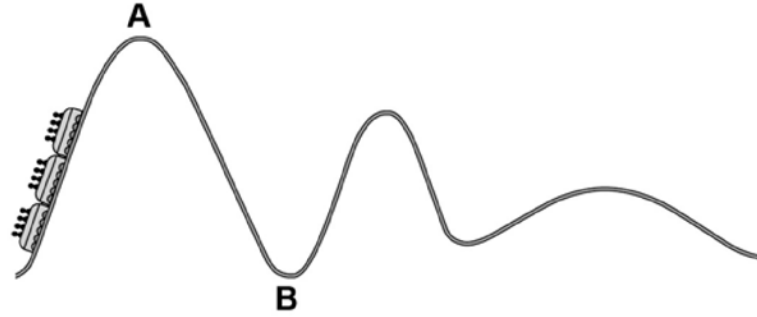


Figure 7 shows a rollercoaster.

Figure 7



The rollercoaster car is raised a vertical distance of 35 m to point **A** by a motor in 45 seconds.

The mass of the rollercoaster is 600 kg.

The motor has a power rating of 8 000 W.

The rollercoaster rolls from point **A** to point **B**, a drop of 35 m.

Calculate the speed of the rollercoaster at point **B**.

[6 marks]

Assume that the decrease in potential energy store is equal to the increase in kinetic energy store.

It is claimed that burning wood chip is a renewable, carbon-neutral method of obtaining energy.

Read the statements about burning wood chips.

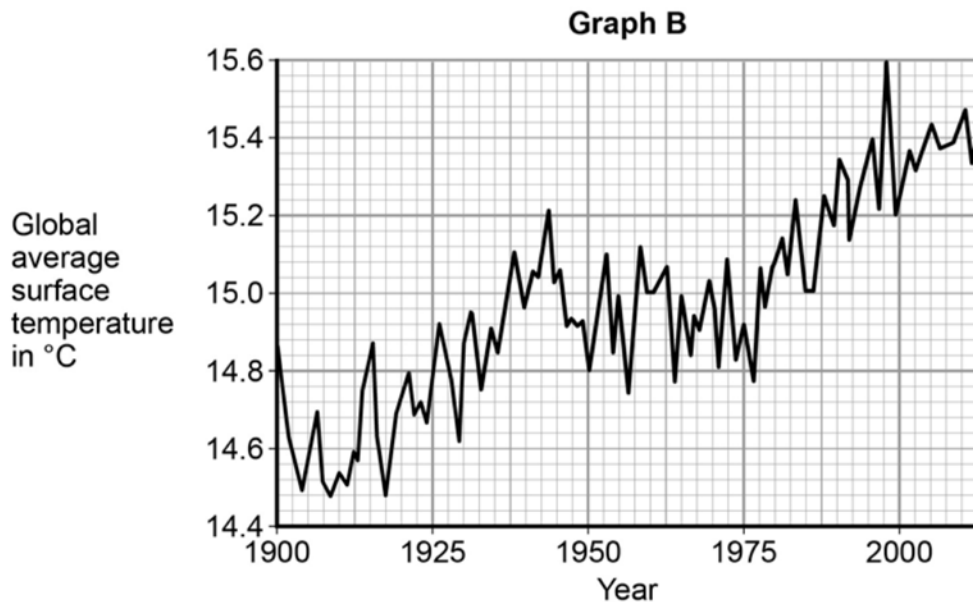
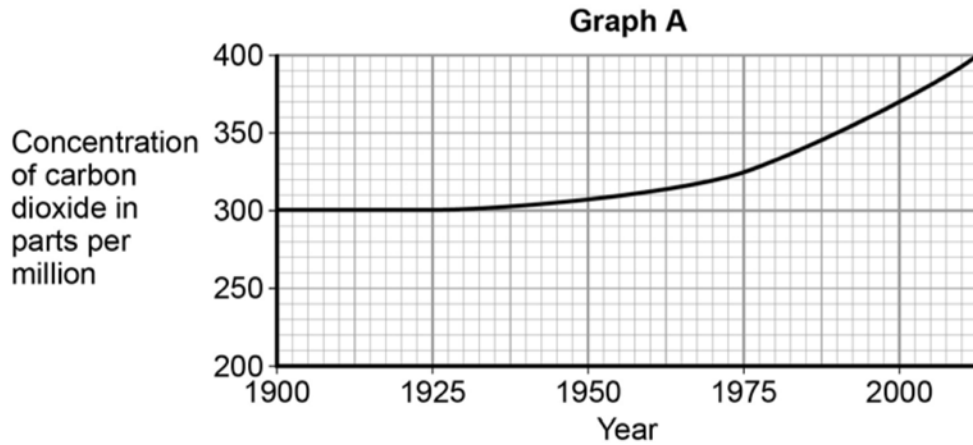
- It is estimated that the UK will burn 15–25 million tonnes of wood chip a year by 2017.
- Most of the wood chip burned in the UK comes from ancient hardwood forests in the USA, which have taken centuries to grow and are biodiverse.
- The wood chip is transported to the UK in bulk carrying ships, which burn fuel oil.
- Demand for wood chip is greater than supply.
- Exhaust gases from burning wood chip are at least as polluting as gases from burning coal.

Evaluate the economic, social, ethical and environmental issues associated with the use of wood chip as a renewable energy source.

[6 marks]

The graphs in **Figure 10** show the concentration of carbon dioxide in the atmosphere and global average surface temperature since 1900.

Figure 10



Calculate the percentage increase in the concentration of carbon dioxide from 1975 to 2000.

[1 mark]

_____ %

What was the global average surface temperature in 1980?

[1 mark]

Global average surface temperature = _____ °C

A student stated: 'The graphs show that increasing the concentration of carbon dioxide in the atmosphere causes global temperature increases.'

Discuss why this statement is only partially true.

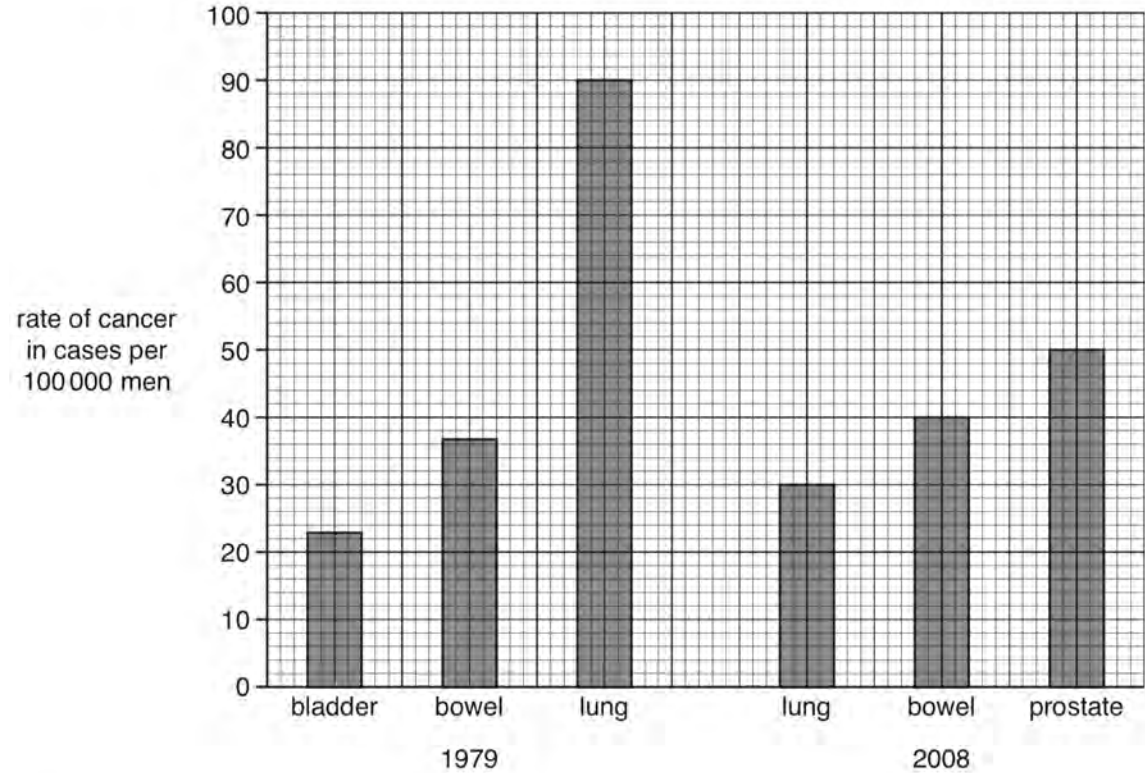
[4 marks]

4

Radioactive isotopes are used to treat different types of cancer.

(a) The graph shows the rates of cancer in men aged 40–50 in Great Britain.

It shows the rates for the three most common types of cancer in these men in 1979 and the three most common types of cancer in these men in 2008.



(i) What can you conclude about the rate of bladder cancer in 2008?

..... [1]

(ii) In 2008 there were 4 million men aged between 40 and 50 in Great Britain.

Calculate how many of these men would be expected to have prostate cancer.

You should show your working.

The data about cancers in each year is given as a **rate per 100 000 men**.

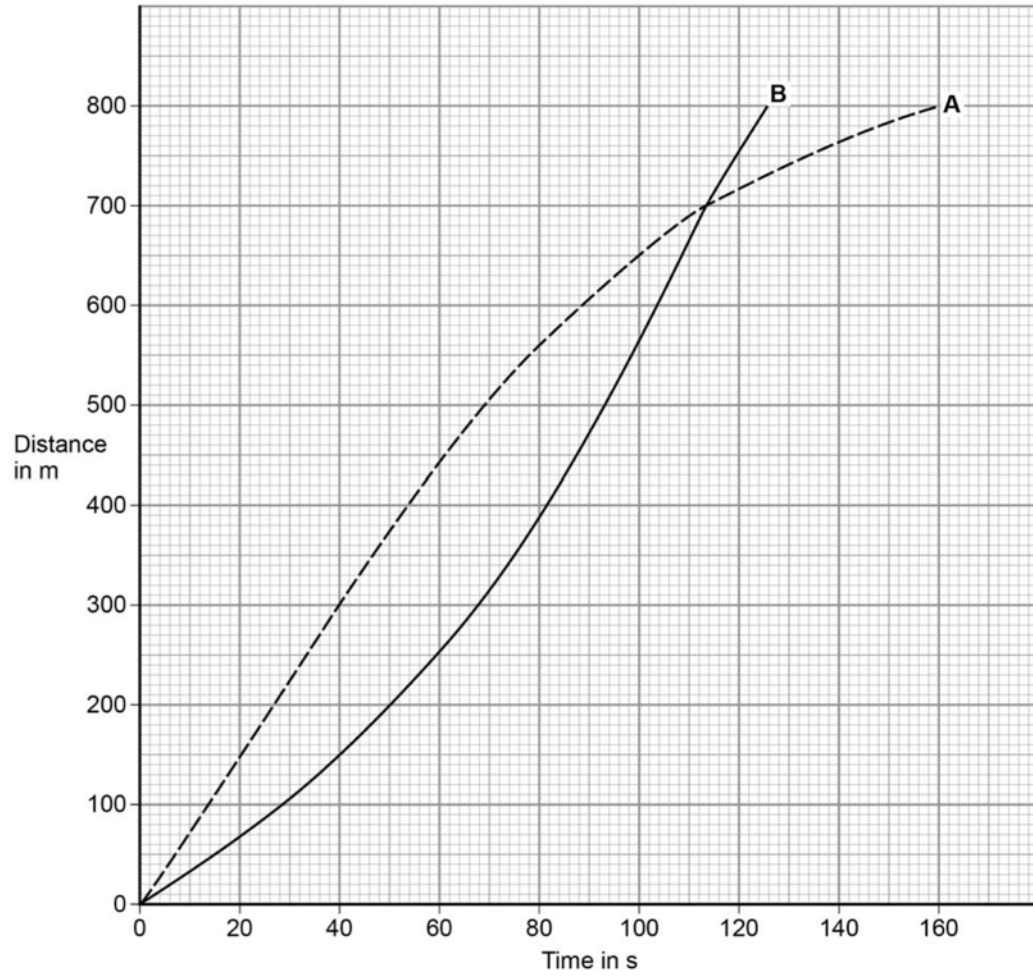
The rate is often used rather than giving the **actual number** of cancer cases.

Suggest a reason why the rate is used.

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

5

Figure 11



Compare the motion of runners **A** and **B**.

Include data from **Figure 11**.

[6 marks]

6

Figure 4 shows an electric car being charged.

Figure 4



A driver wishes to buy a new car.

Table 1 gives some data about an electric car and one with a petrol engine.

Table 1

	Electric car	Petrol engine car
Cost (£)	27 000	15 000
Running cost per year (£)	250	2 000
Average lifetime (years)	12	12

Which car would be the most economic over its 12 year lifetime?

Use data from Table 1 to support your answer.

You should include the difference in cost in your answer.

[4 marks]

James finds this headline in a newspaper.

Butter or margarine: which is really healthier?

James thinks that margarine is healthier as it contains less saturated fat.

He decides to do some research about butter and margarine.

(a) James finds this table of data on the internet.

The data shows the average amount of fat eaten as butter or margarine each day and how many men have heart disease.

Amount of fat eaten per day in g	Number of men with heart disease per 1000	
	Eat butter	Eat margarine
< 4	340	295
> 4 and < 16	320	330
> 16	300	400

(ii) James eats an average of 18g of margarine a day.

He uses the data to predict he has a 40% probability of getting heart disease.

Calculate the probability of getting heart disease if he ate **less than** 4g of margarine each day.

answer %

[2]

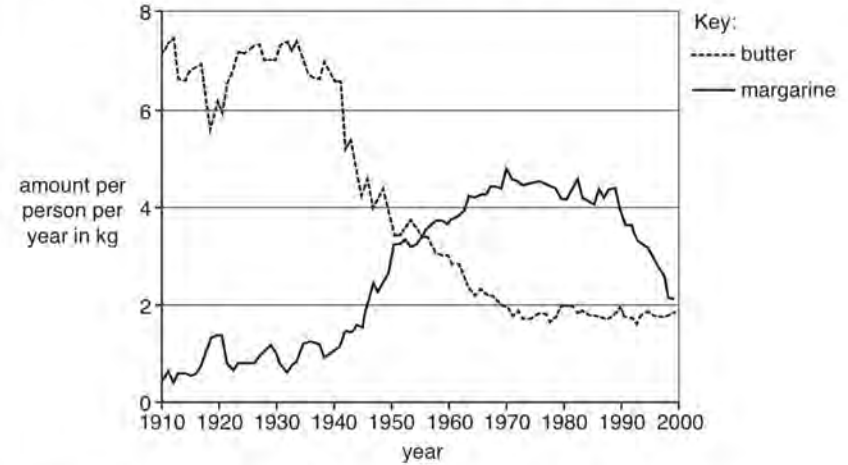
(iii) Does the **data** answer the question in the headline?

Write down **two** reasons for your answer.

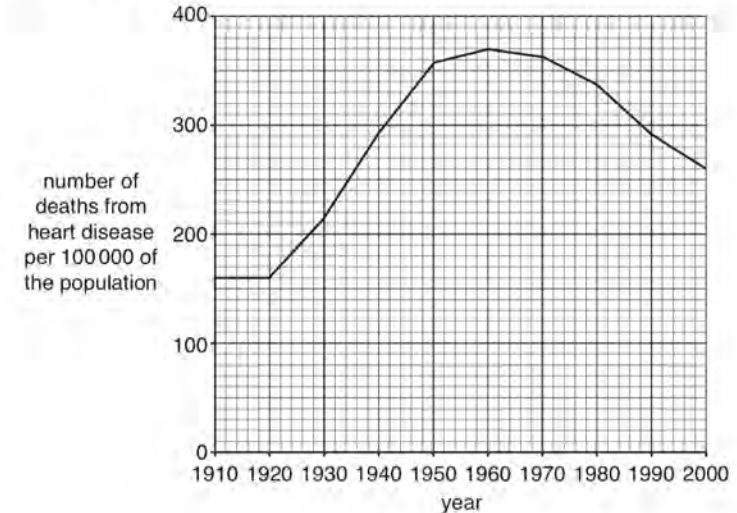
.....

(b) James finds this graph.

It shows the amount of butter and margarine eaten in a year by people living in America.



Look at the graph. It shows the number of deaths from heart disease in America.



Together, the graphs in part (b), **seem** to show a surprising link between eating margarine and heart disease.

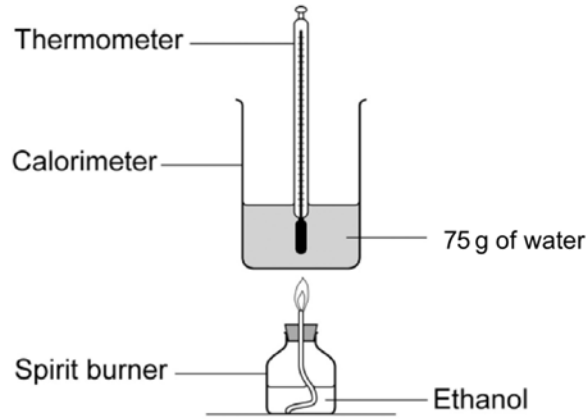
Write about this link between eating margarine and heart disease.

Use evidence from **both** graphs in part (b) in your answer.

Ethanol is a liquid fuel which can be used as an alternative to gasoline.

- (a) All fuels release energy when they are burned. A student did an experiment to find out how much heat energy is produced when ethanol is burned.

She used the apparatus shown in the diagram.



The student's results are shown in the table.

Experiment number	Mass of ethanol used in g	Temperature change of water in °C	Energy used to heat water in kJ	Energy given out by 1.00 g of fuel in kJ
1	0.78	52	16.4	21.0
2	0.64	43	13.5	21.1
3	0.68	45	14.2

- (a) (i) Complete the table to show the energy given out by 1 g of ethanol in experiment number 3.

.....
(1 mark)

- (a) (ii) What measurements must the student have made during the experiment to be able to record the temperature change of the water and the mass of ethanol used?

.....

(2 marks)

- 3 (a) (iii) The student used the same burner and calorimeter in each experiment.

Give **two** other variables that the student should have controlled.

.....

(2 marks)

- (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Ethanol for fuel can be made by fermentation of plant materials. Ethanol that is produced by this process is a biofuel.

Evaluate the advantages and disadvantages of using ethanol made by fermentation as an alternative to gasoline. Remember to give a conclusion in your answer.

.....

9

Two alleles control the body colour of carp:

- brown (**B**)
- blue (**b**).

The brown allele is dominant to the blue allele.

Two carp that are heterozygous for colour are crossed and produce 2.6×10^5 offspring.

Approximately how many of the offspring are expected to be blue?

Draw a genetic diagram to explain your answer.

Give your answer in standard form.

[5 marks]

A scientist wanted to find out whether a brown carp has the genotype **BB** or **Bb**.

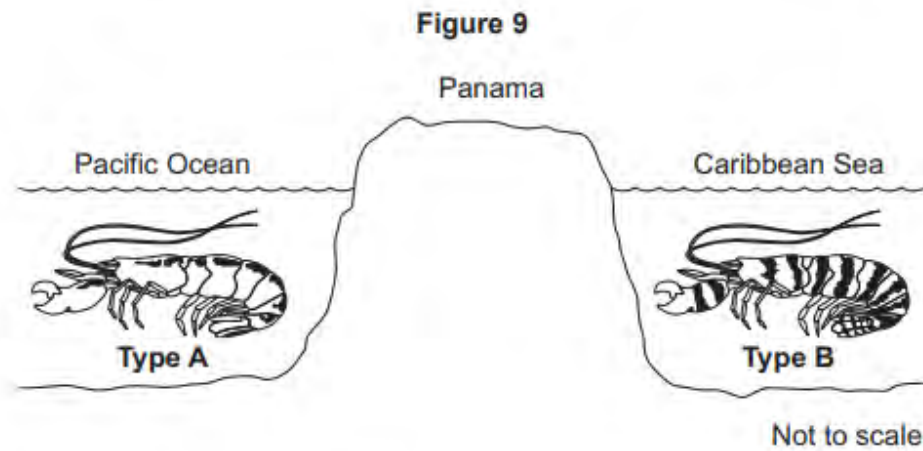
Describe what genetic cross a scientist could do to determine this.

[2 marks]

10

Figure 9 shows two types of pistol shrimp.

The shrimps live in shallow, tropical seas on opposite sides of Panama.



Scientists put one **Type A** shrimp and one **Type B** shrimp together in a tank of seawater.

The two types of shrimp snapped their claws aggressively at each other.

They did not mate.

The scientists said that this was evidence for the **Type A** and **Type B** shrimps being classified as two different species.

Give **one** reason why the scientists' opinion may be correct.

[1 mark]

Suggest **two** reasons why the scientists' opinion may **not** be correct.

[2 marks]

1

.....

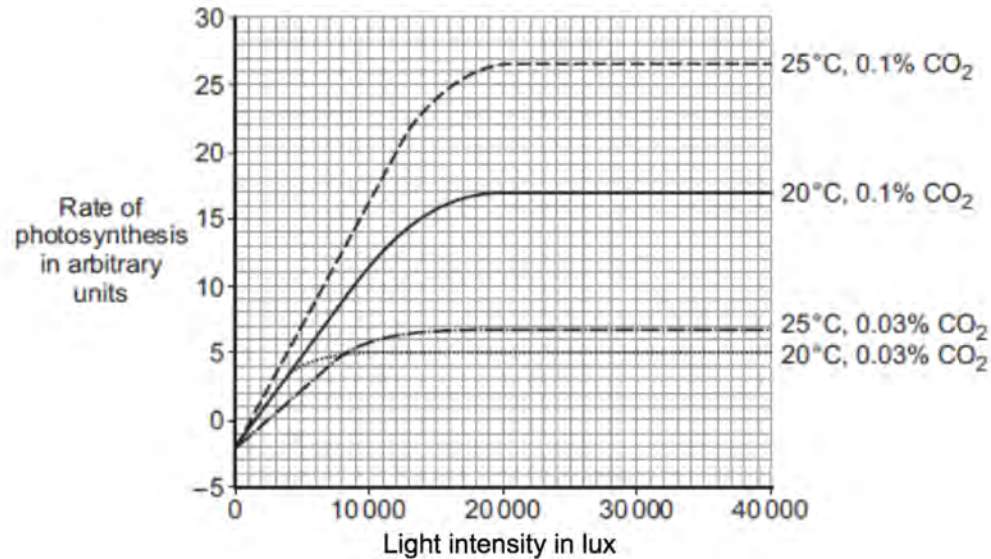
2

.....

Light intensity, temperature and concentration of carbon dioxide are factors that affect the rate of photosynthesis.

Scientists investigated the effects of these three factors on the rate of photosynthesis in tomato plants growing in a greenhouse.

The graph below shows the scientists' results.



- 20°C
- 0.1% CO₂
- no extra lighting.

Suggest why the farmer decided to use these conditions for growing the tomatoes.

You should use information from the scientists' graph in your answer.

.....

A farmer in the UK wants to grow tomatoes commercially in a greenhouse.

The farmer read about the scientists' investigation.

During the growing season for tomatoes in the UK, natural daylight has an intensity higher than 30 000 lux.

The farmer therefore decided to use the following conditions in his greenhouse during the day: