# Wednesday 22 May 2019

Afternoon (Time: 1 hour 15 minutes) | Paper Reference **20474E**

# Application of Science

## Unit 8: Scientific Skills

**You must have:**
A calculator, ruler and pencil.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.

## Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question*.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

P 6 0 9 3 8 A 0 1 1 6

Pearson

**1** (a)  Megan chooses some equipment for an investigation.

Draw **one** line from each piece of equipment to its correct use.

(3)

**equipment**

**use**

measures time

electronic balance

measures sound

measures mass

stopclock

measures pH

measures temperature

thermometer

measures distance

measures volume

(b) Megan heats some water in a beaker.

She uses the equipment shown in Figure 1.
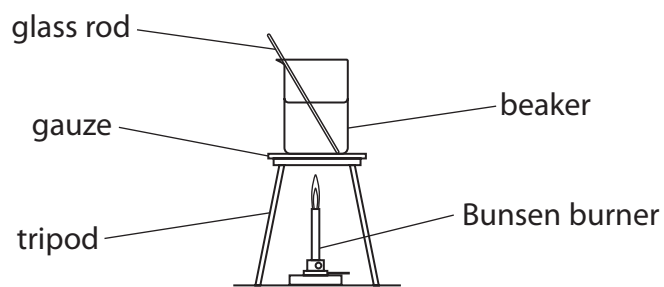


**Figure 1**

(i) The hot tripod is a hazard.

State the risk to Megan when using the hot tripod.

(1)

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(ii) There is a risk of scalding from the hot water.

Give **one** way that Megan can reduce the risk.

(1)

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(iii) State the reason why Megan uses a glass rod.

(1)

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**(Total for Question 1 = 6 marks)**

P 6 0 9 3 8 A 0 3 1 6

**2** Charlotte investigates how the direction of light affects the growth of a plant.

Figure 2 shows that the plant grows towards the light source.

light source
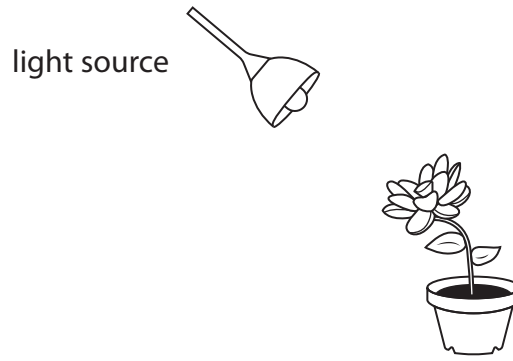
**Figure 2**

(a) State the independent variable in this investigation.

**(1)**

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(b) Charlotte finds this pH scale.

Acidic ──────► Neutral ◄────── Alkaline ──────►
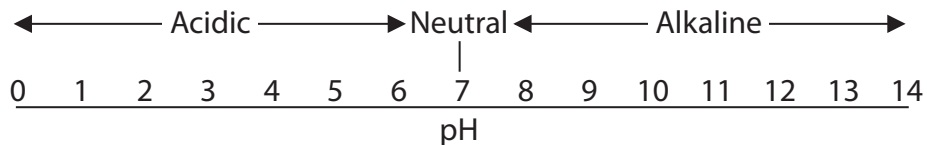
0    1    2    3    4    5    6    7    8    9    10    11    12    13    14

pH

Charlotte uses the pH scale to find out how the pH of the soil affects the growth of plants.

Write a plan for an experiment to find out how the pH of the soil affects the growth of plants.

**(6)**

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**(Total for Question 2 = 7 marks)**

**3** Louis finds some data about radioactive elements and their half-life in days.
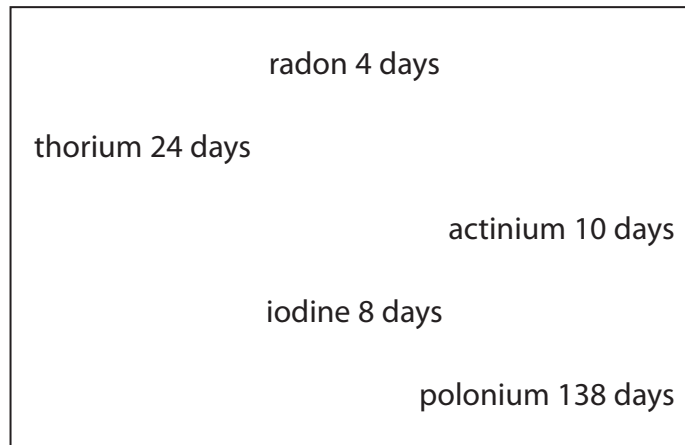
Figure 3 shows his data.

radon 4 days

thorium 24 days

actinium 10 days

iodine 8 days

polonium 138 days

**Figure 3**

(a) Complete the table using the data in Figure 3.

(3)

| | |
|---|---|
| | |

(b) (i) Louis uses a Geiger counter to measure the radiation level in a laboratory.

Louis measured the radiation level four times.

Figure 4 shows his results.

| test | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| radiation level (counts / hr) | 362 | 374 | 367 | 385 |

**Figure 4**

Calculate the average radiation level.

Show your working.

**(2)**

average radiation level = ........................................................ counts/hr

(ii) Louis measures the radiation level again in the laboratory on a different day.

Figure 5 shows his data.

| test | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| radiation level (counts / hr) | 368 | 372 | 363 | 367.66666 |

**Figure 5**

His teacher tells him that he has incorrectly recorded the average.

Explain what average value Louis should have recorded.

**(2)**

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**(Total for Question 3 = 7 marks)**

**4** (a) Kim finds some data on the boiling points of six alcohols.

Each alcohol has a different number of carbon atoms in its molecule.
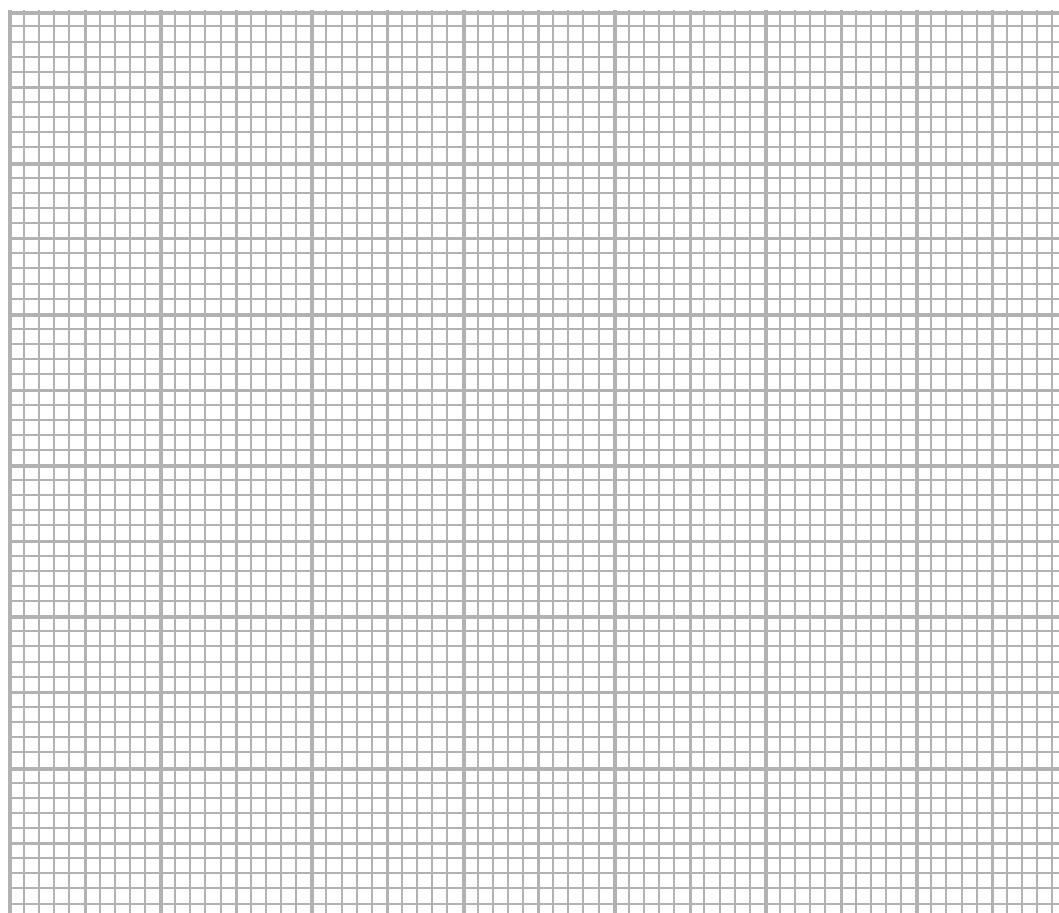
Figure 6 shows the data.

| number of carbon atoms | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| boiling point (°C) | 78 | 96 | 117 | 138 | 157 | 176 |

**Figure 6**

Draw a bar chart for this data on the graph paper.

**(6)**

(b) Kim finds a graph showing how the boiling point of water changes with height above sea level.

Figure 7 shows the graph.
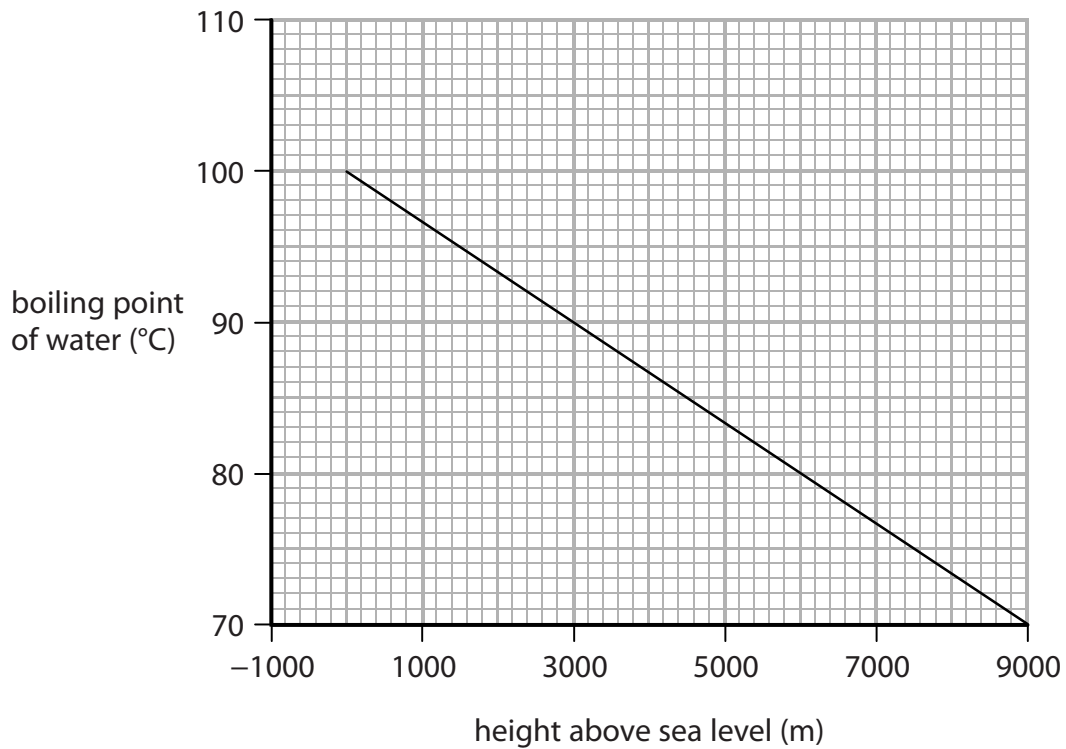


**Figure 7**

(i) State the boiling point of water when the height above sea level is 3000 m.

**(1)**

boiling point of water = ........................................................ °C

(ii) Describe the pattern shown in Figure 7.

**(2)**

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**(Total for Question 4 = 9 marks)**

P 6 0 9 3 8 A 0 9 1 6

**5** (a) Ted measures the time taken for a ball to fall through oil in a measuring cylinder.

He places two rubber bands around the measuring cylinder 15 cm apart.

He uses a stopwatch to record the time the ball takes to fall between the two rubber bands.

He uses the time to calculate the average speed of the ball.

Figure 8 shows a diagram of the equipment Ted uses.
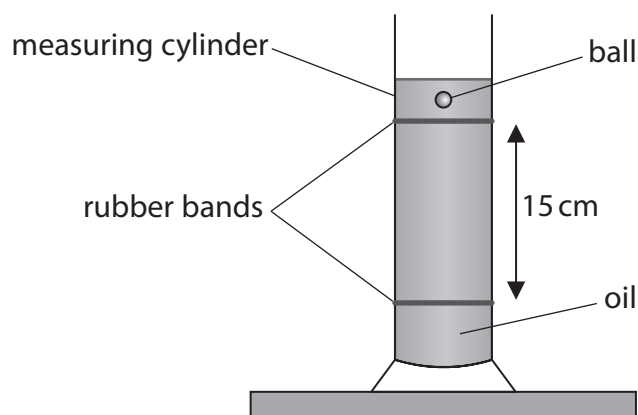


**Figure 8**

Figure 9 shows Ted's results.

| time taken to fall 15 cm (s) | speed of the ball (cm/s) |
|:---:|:---:|
| 0.60 | 25 |
| 0.56 | 27 |
| 0.38 | 40 |
| 0.62 | 24 |

**Figure 9**

Ted circles an anomalous result.

(i) Give **two** ways that Ted should deal with the anomalous result.

**(2)**

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

(ii) Explain **two** factors that might have caused the anomalous result.

**(4)**

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(b) Ted repeats the experiment without oil in the tube.

The ball has an average speed of 10 m/s.

The ball has 5 J of kinetic energy.

Calculate the mass of the ball using the equation:

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{average speed}^2$$

$$\text{(J)} \qquad\qquad \text{(kg)} \qquad \text{(m/s}^2)$$

Show your working.

**(3)**

mass of ball = ....................................................... kg

(c) Ted drops three balls, A, B and C, from the same point on a tall building.

He plots a graph of how the speed of each ball changes with time.

Figure 10 shows his results.
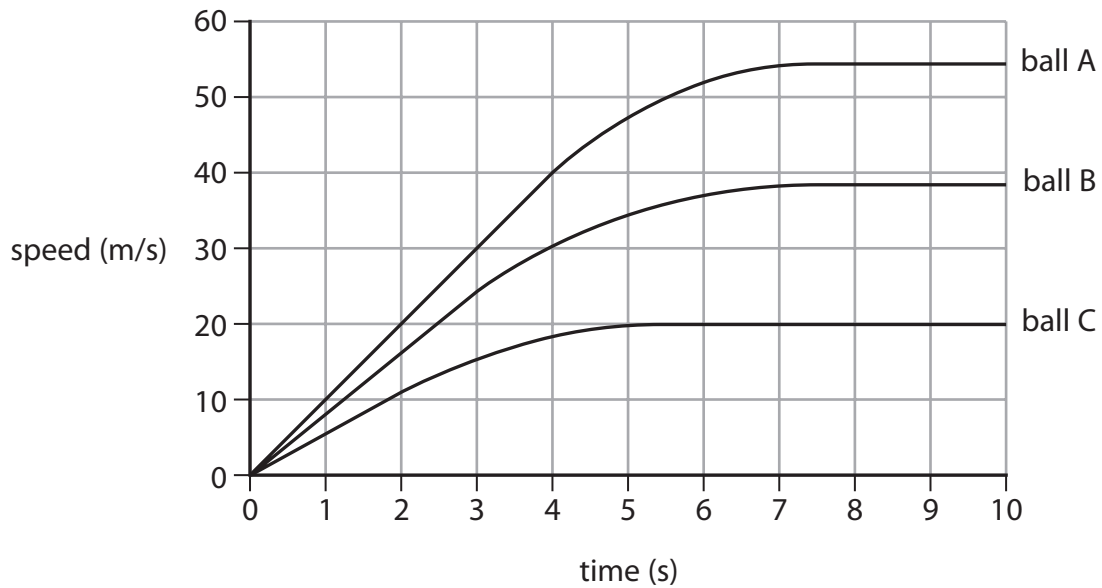


**Figure 10**

Analyse the evidence to conclude which ball reached the highest steady speed.

(2)

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**(Total for Question 5 = 11 marks)**

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**6** Wahida investigates how the concentration of an acid affects the speed at which a piece of magnesium ribbon reacts.

Wahida uses this method for her experiment.

- cut a piece of magnesium ribbon
- add some acid and start timing
- stop timing when the reaction finishes
- repeat with different concentrations of the acid

Explain **two** improvements that she could make to her method.

(4)

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**(Total for Question 6 = 4 marks)**

**7** Sanjay researches the link between type 2 diabetes and body mass index (BMI) in men and women.

Figure 11 shows a graph he found.



**Figure 11**
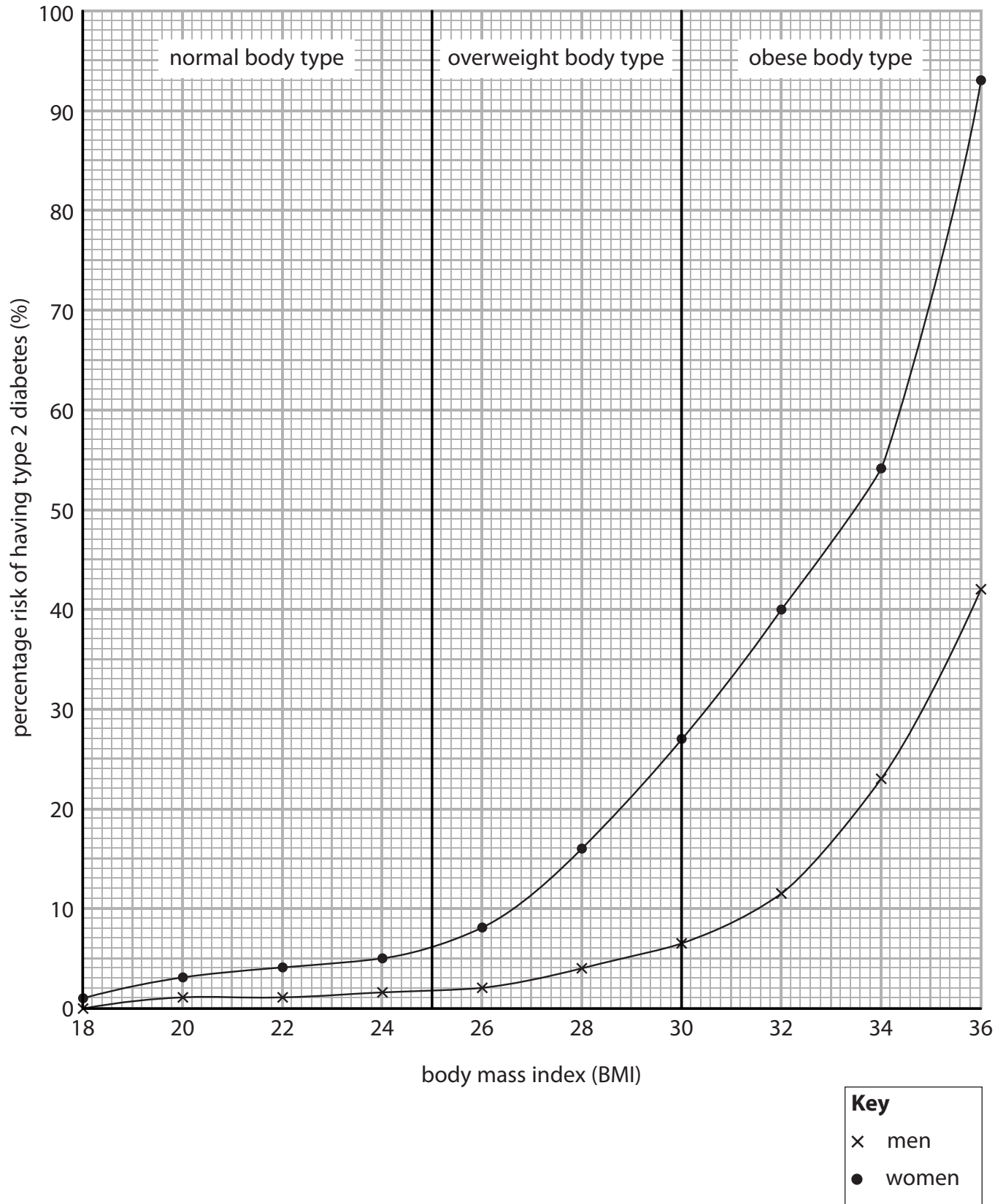
Sanjay makes two conclusions.

'The risk of type 2 diabetes is the same for men and women of all body types.'

'The higher the body mass index, the greater the risk of developing type 2 diabetes.'

Discuss whether the information Sanjay found supports his two conclusions.

**(6)**

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**(Total for Question 7 = 6 marks)**

**TOTAL FOR PAPER = 50 MARKS**

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