Woodland Survey

A Level

A conservationist wishes to collect data on the number of trees in a woodland nature reserve that have been parasitised by mistletoe. The reserve consists of birch, aspen and oak trees.

Part A Conducting a census

Why would it be impractical to conduct a census to collect data from every tree in the woodland?

- It would be very time-consuming and expensive.
- The population would need to be classified into distinct strata.
- A sampling frame would be needed.
- The act of collecting data from a tree would destroy it.
- Collecting this data might spread the mistletoe

Part B Type of sample

The conservationist wishes to determine if any particular species of tree is more likely to be parasitised by mistletoe. To do so, they decide to survey the first 10 birches, 10 aspen and 10 oak trees that they come across in the reserve.

What type of sample are they collecting?

Part C Disadvantage of sampling

What is a disadvantage of the type of sampling described in Part B?

- This non-random sampling could introduce bias.
- It is very time-consuming and expensive.
- A sampling frame is needed in order to select the sample.

Part D Species data type

What type of data is the species of a tree?

Part E Number of trees data type

What type of data is the number of trees that have been parasitised by mistletoe?

- Discrete quantitative data.
- Continuous quantitative data.
- Discrete qualitative data.
- Continuous qualitative data.

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Researcher Survey

A Level

A research institute wishes to collect data from its employees on the methods by which they travel to work. The institute has an alphabetised list of its 450 employees.

Part A Systematic sample

Describe how they could take a systematic sample of size 30.

Assign numbers from 1 to [ ] to the employees on the alphabetised list. Calculate $450 \div$ [ ] $=$ [ ]. Generate a random number between 1 and [ ]. Select the employee corresponding to that number and then select every [ ]th employee on the list after that.

Items:

30 450 15

Part B Alternative method

One researcher suggests that it would be much easier to collect a sample by speaking to the first 30 employees in the canteen.

What type of sampling would this be?

Give one disadvantage of this type of sampling.

- This method is likely to introduce bias towards employees who use the canteen.
- This method requires the use of a sampling frame.
- The sample is unlikely to be representative of the different groups among the employees.
- This method would be time-consuming to carry out.
- Increasing the size of the sample can be very expensive.

Part C Stratified sample

The research institute also wishes to gather data from its research staff as to which new pieces of lab equipment will be required over the next year. The research staff within the institute consist of 40 geneticists, 25 ecologists and 55 epidemiologists. It is thought that the different types of staff will have different requirements for lab equipment.

Describe how the institute could collect a stratified sample of size 20 from its research staff.

There are a total of 120 research staff. The sample is $\square \div 120 = \square$ of the research staff.

The institute should survey $40 \times \square \approx \square$ geneticists, $25 \times \square \approx \square$ ecologists and $55 \times \square \approx \square$ epidemiologists. The staff should be selected randomly from each group, by generating random numbers from 1 to $\square$ for geneticists, 1 to $\square$ for ecologists and 1 to $\square$ for epidemiologists and selecting the corresponding members of staff, discarding and replacing any duplicate numbers within each group.

Items:

6 10 $\frac{5}{24}$ $\frac{1}{6}$ $\frac{1}{3}$ 4 $\frac{11}{24}$ 25 55 9 20 5 7 40

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Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Data Analysis 3.8

A Level

Consider the following data set:

$3.91, 4.29, 3.75, 4.28, 3.68, 4.13, 3.61, 4.19, 4.18, 4.01.$

Find the median, interquartile range, mean and standard deviation of the data set.

Part A The median

Find the median of the data set.

Part B The interquartile range

Find the interquartile range of the data set.

Part C The mean

Find the mean of the data set. Give your answer to 3 sf.

Part D The standard deviation

Find the standard deviation of the data set. Give your answer to 3 sf.

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Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Essential GCSE Maths 55.11

GCSE C C C A Level P P P

A technician is given a list of measurements in cm, correct to the nearest $0.1\,\mathrm{cm}$. He is told that the mean of the values is $3.3\,\mathrm{cm}$, but when he checks the calculation he finds a different value. Here is the list:

$$3.6, 3.4, 3.2, 2.9, 3.8, 3.4, 3.6, 3.2, 3.3, 3.6$$

Part A What is the mean of the values?

What is the mean of these values?

Part B What is the value of the missing numbers?

To find the source of the discrepancy, the technician checks the list he was given against the original data for the experiment, and finds two identical numbers are missing. What is the value of these numbers?

Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Data Analysis 3.1

A Level

Nine measurements were made of the time taken by a pendulum to perform six swings. The mean of the values was $10.240\,\text{s}$ with a standard deviation of $0.073\,\text{s}$. A tenth measurement was included changing the mean to $10.253\,\text{s}$. Find (a) the value of the tenth measurement and (b) the new value of the standard deviation.

Part A The value of the tenth measurement

Find the value of the tenth measurement; give your answer to 3 decimal places.

Part B The new value of the standard deviation

Find the value of the new standard deviation; give your answer to 2 sf.

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Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Essential GCSE Maths 56.5

GCSE A Level

x	Frequency
$0 \leqslant x < 5$	4
$5 \leqslant x < 10$	5
$10 \leqslant x < 20$	13
$20 \leqslant x < 30$	25
$30 \leqslant x < 35$	6

Part A Construct a histogram

Construct a histogram for these data.

Choose the figure which is drawn correctly.

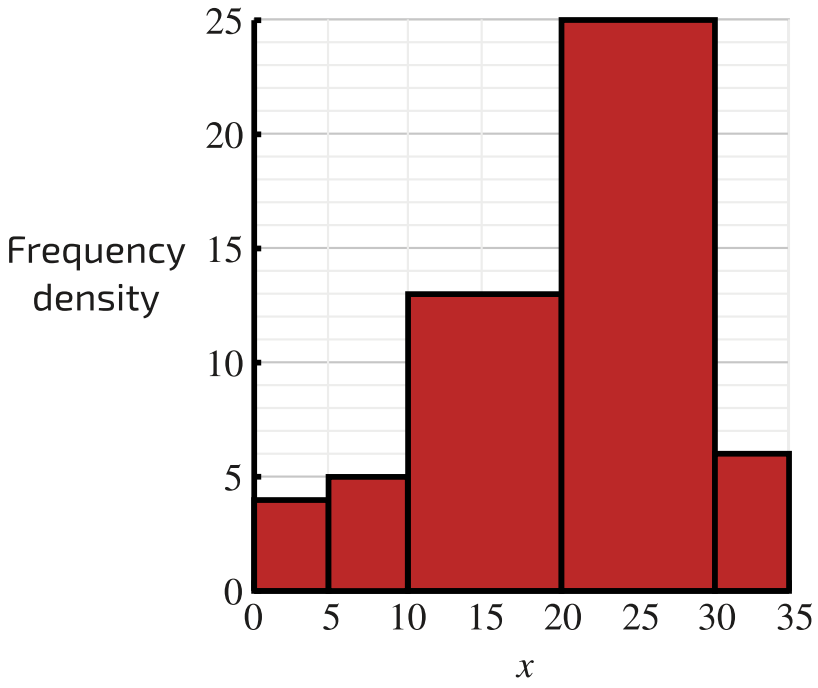

Figure 1: Option A.

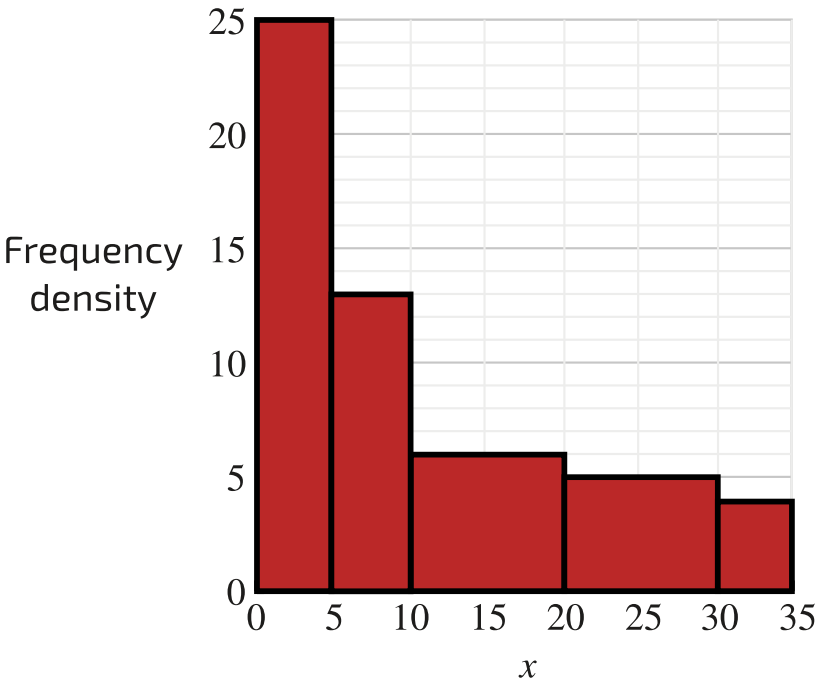

Figure 2: Option B.

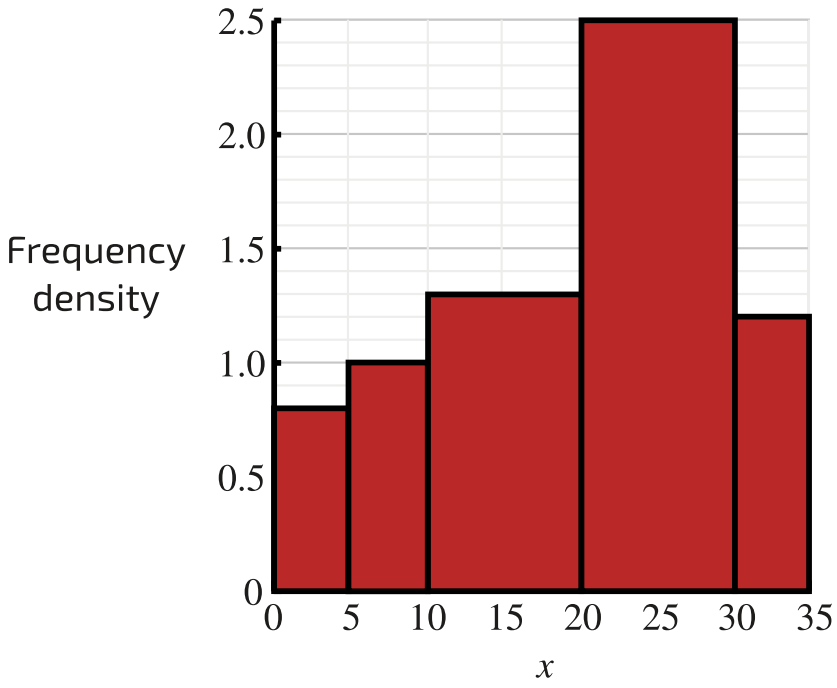

Figure 3: Option C.

- Option A
- Option B
- Option C

Part B What is the modal class?

What is the modal class?

- $30 \leqslant x < 35$
- $5 \leqslant x < 10$
- $0 \leqslant x < 5$
- $20 \leqslant x < 30$
- $10 \leqslant x < 20$

Part C Estimate the mean value of x

Estimate the mean value of x for these data to 3 s.f..

Part D Construct a cumulative frequency diagram

Construct a cumulative frequency diagram for these data.

Choose the figure which is drawn correctly.

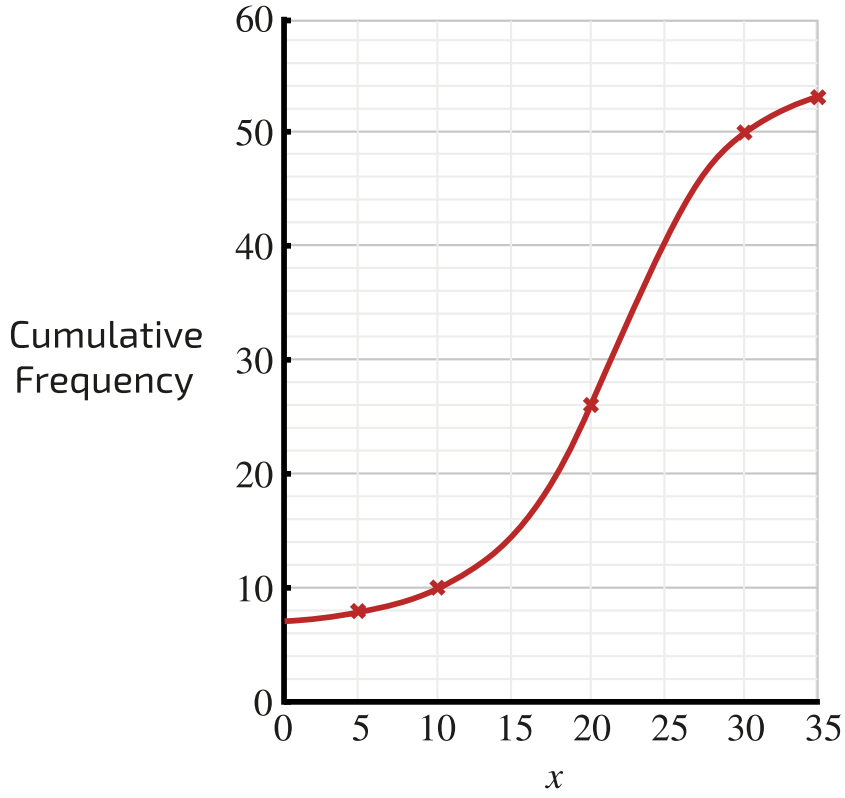

Figure 4: Option A.

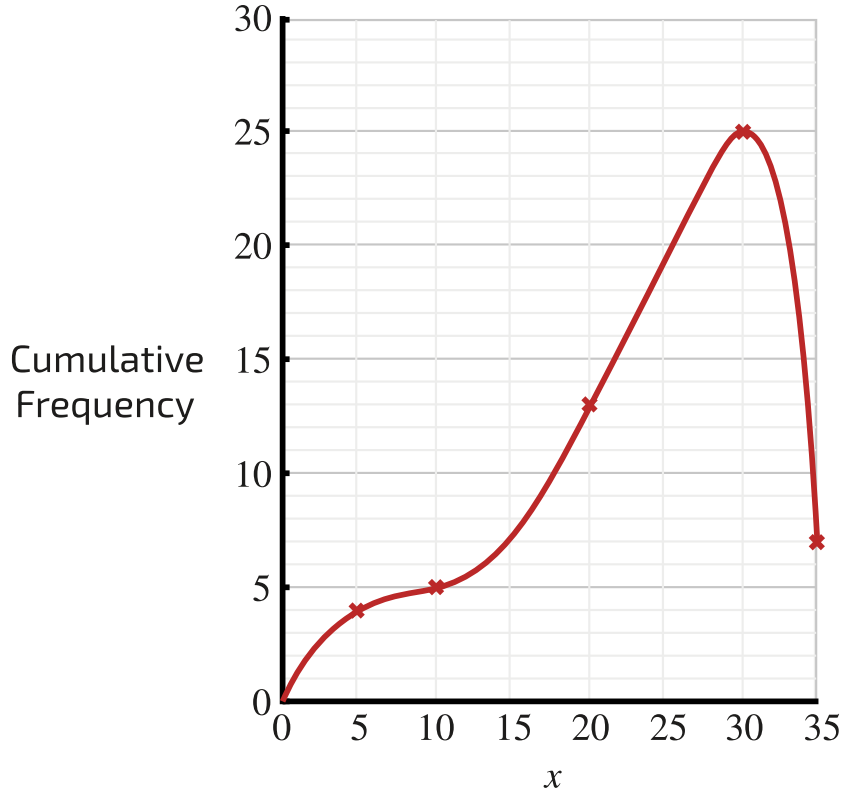

Figure 5: Option B.

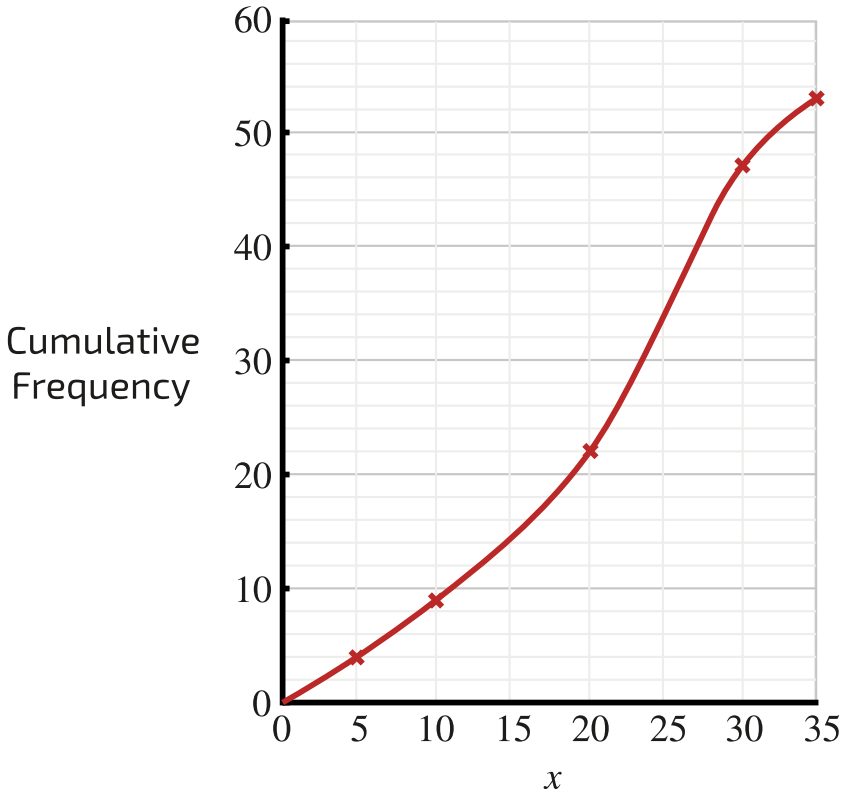

Figure 6: Option C.

- Option A
- Option B
- Option C

Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Essential GCSE Maths 56.7

GCSE C C C A Level P P P

The histogram below summarises the total annual payments (including expenses) made to employees in a company.

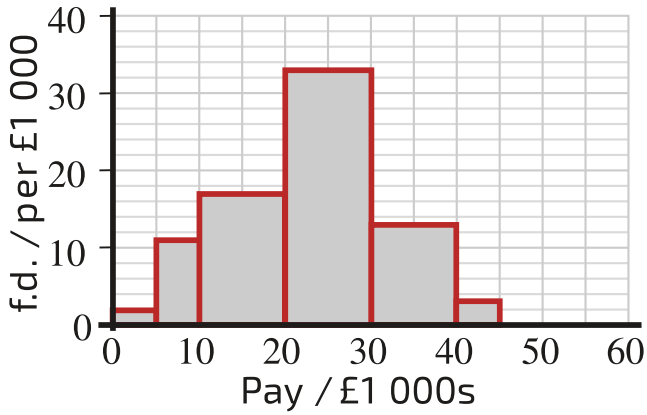

Figure 1: A histogram summarises the total annual payment made to employees.

Part A Make a frequency table

Let the variable for pay be p. Make a frequency table for the data in the histogram.

A partially complete frequency table is given below. Find the missing values A, B and C.

Pay in £1 000, p	Frequency
$0 \leq p < 5$	10
$5 \leq p < 10$	A
$10 \leq p < 20$	B
$20 \leq p < 30$	330
$30 \leq p < 40$	130
$40 \leq p < 45$	C

What is the value of A?

What is the value of B?

What is the value of C?

Part B What is the frequency density of the new class?

An extra class is added for $45 \leq p < 60$. This class has a frequency of 15. What is the frequency density of this class?

Part C Estimate the mean pay

Calculate an estimate of the mean amount payed out to an employee, including the extra class from part B. Give your answer in thousands of pounds to 3 s.f. (e.g. $£32,460$ would be entered as 32.5).

Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Essential GCSE Maths 56.8

GCSE A Level

A company conducts plant growth trials of two varieties of chilli pepper, A and B. The graph shows cumulative frequency plots for the heights of both types of pepper after 13 weeks.

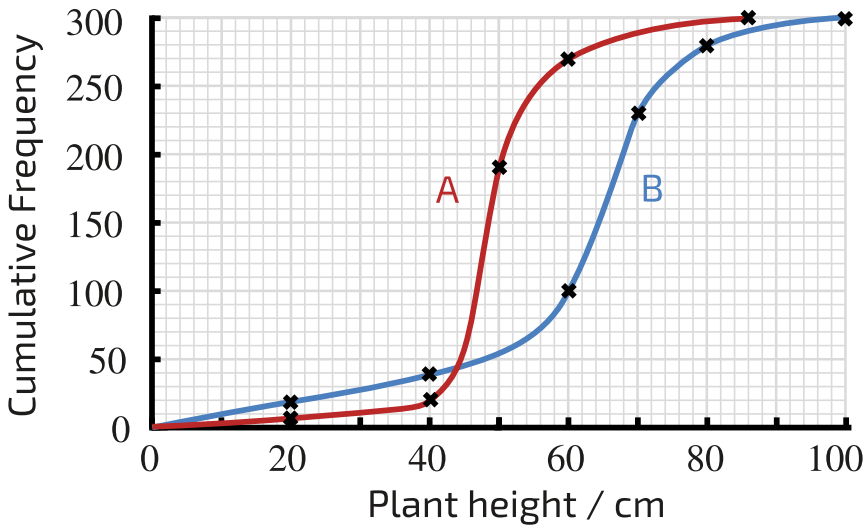

Figure 1: A cumulative frequency plot for the height of two types of chilli pepper.

Part A Create box plots

Create box plots for both varieties of pepper.

Choose the figure which is drawn correctly.

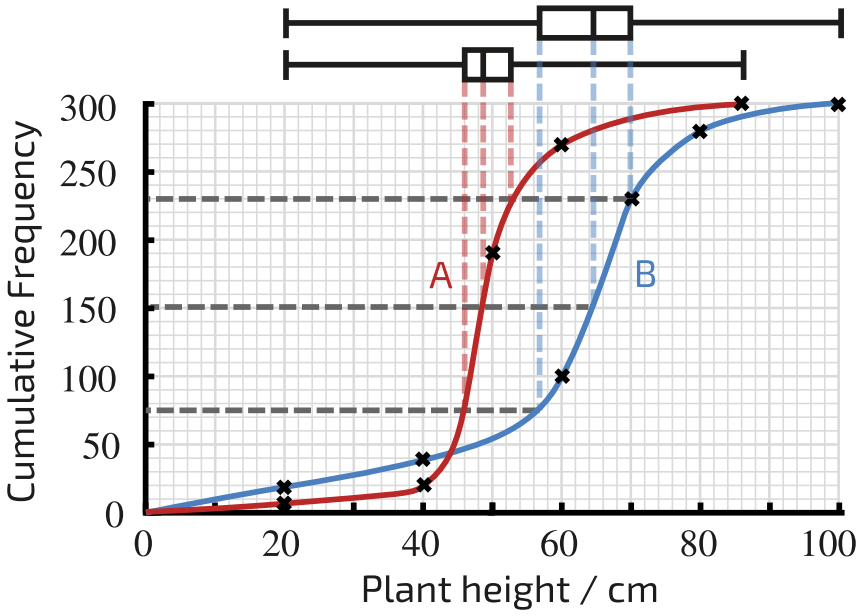

Figure 2: Option A.

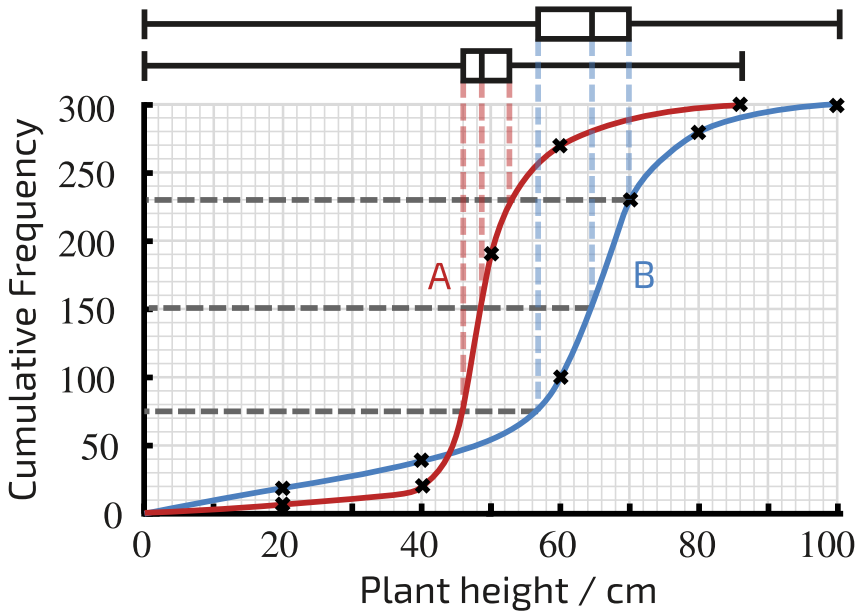

Figure 3: Option B.

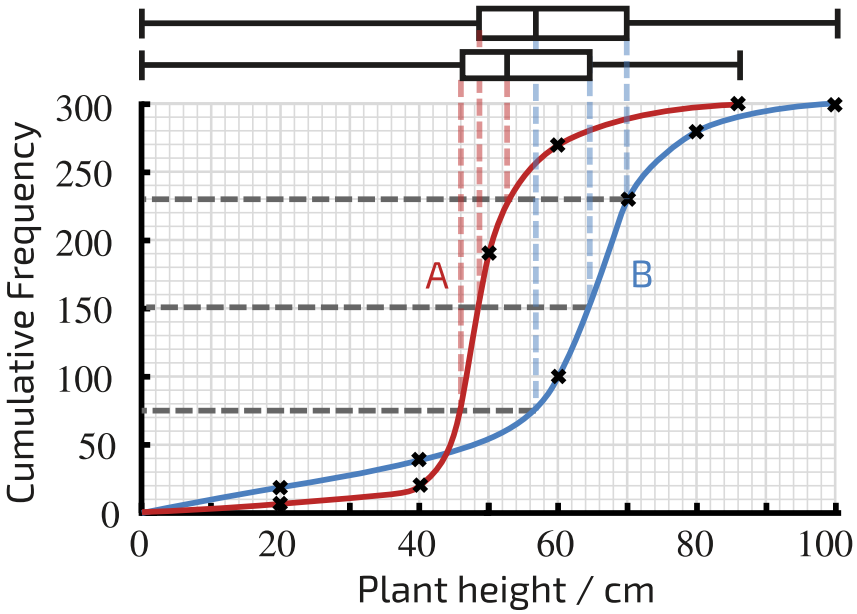

Figure 4: Option C.

- Option A
- Option B
- Option C

Part B Which variety produced fewer failures?

The company defines failures as plants which do not reach $40\,\text{cm}$ in height. Which variety produced fewer failures?

- Type A
- Type B

Part C **For which plant was the spread of plant heights greater?**

For which plant was the spread of plant heights greater? Explain your answer.

- ○ Type A
- ○ Type B

Gameboard:
STEM SMART Double Maths 6 - Data Collection & Analysis

Physics. You work it out.

Essential GCSE Maths 57.4

GCSE C C C A Level P P P

Look at the following sketches and work out which equation describes the line of best fit.

Part A First line of best fit

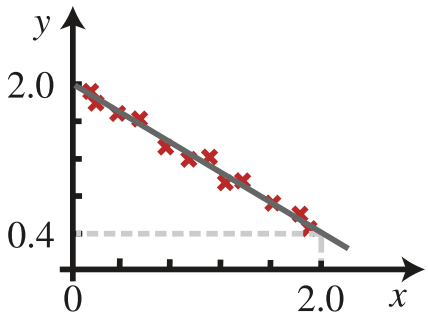

Figure 1: A graph of some data points and a line of best fit.

- $y = -1.8x + 4.0$
- $y = -0.8x + 2.0$
- $y = 0.8x - 2.0$

Part B Second line of best fit

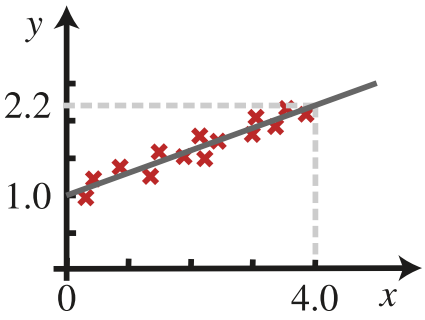

Figure 2: A graph of some data points and a line of best fit.

- $y = 0.4x - 1.5$
- $y = 0.4x + 1.5$
- $y = 0.3x + 1.0$

Part C Third line of best fit

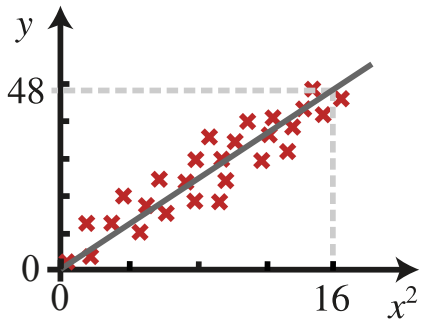

Figure 1: A graph of some data points and a line of best fit.

- $y = 3.0x^2$
- $y = 3.0x$
- $y = (3.0x)^2$

Essential GCSE Maths 57.5

GCSE C C C A Level P P P

The nuclei of atoms contain protons and neutrons. In this question p is the number of protons and n is the number of neutrons.

Part A Graph of n against p: light nuclei

Plot a graph with p on the x-axis and n on the y-axis for the following selected light nuclei. Then choose which of the options below is the best.

Element	He	Be	C	N	F	Mg	Cl	Ca
p	2	4	6	7	9	12	17	20
n	2	5	6	7	10	12	18	20

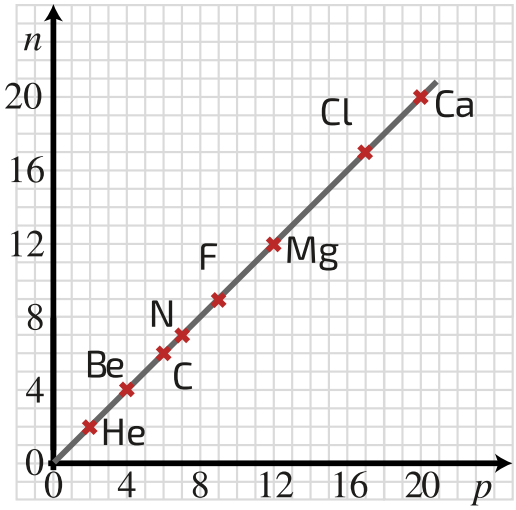

Figure 1: Option A.

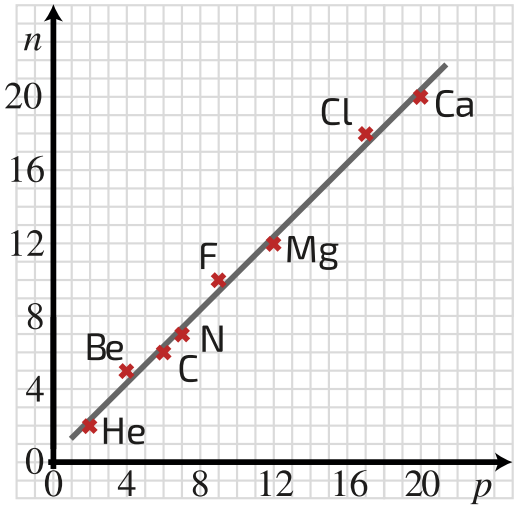

Figure 2: Option B.

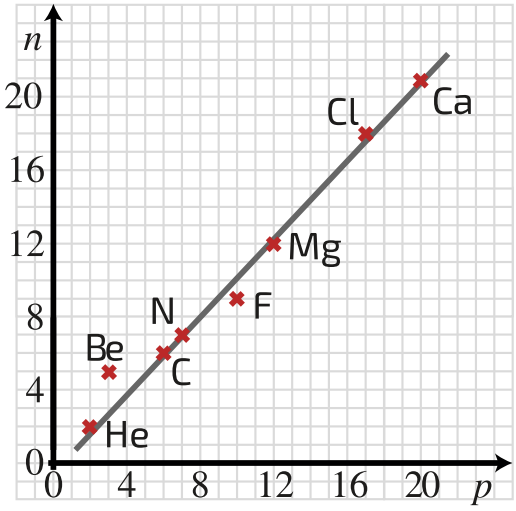

Figure 3: Option C.

- Option A
- Option B
- Option C

Part B Type of correlation: light nuclei

What sort of correlation do you see?

- Positive linear correlation
- Negative linear correlation
- Correlation that is not linear
- No correlation

Part C Conclusions from graph: light nuclei

What can you conclude from the graph about the value of the ratio $n : p$ for the nuclei given?

- The number of neutrons is generally smaller than the number of protons. $n < p$.
- The number of neutrons is roughly the same as the number of protons. For these light nuclei $n : p \approx 1 : 1$
- The number of neutrons is generally larger than the number of protons. $n > p$.
- There is no relation between the number of protons (p) and the number of neutrons (n).

Part D Graph of n against p: heavy nuclei

Plot a graph with p on the x-axis and n on the y-axis for the following selected heavier nuclei, and then choose which of the options below is the best.

Element	Pd	Cs	Pr	Tb	W	Pt	Au	Pb
p	46	55	59	65	74	78	79	82
$p+n$	106	133	141	159	184	195	197	207

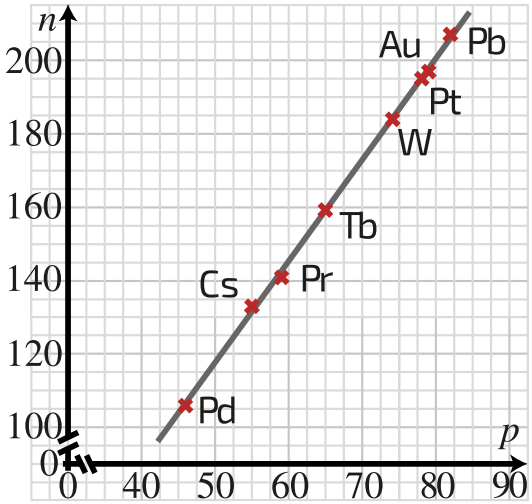

Figure 4: Option A.

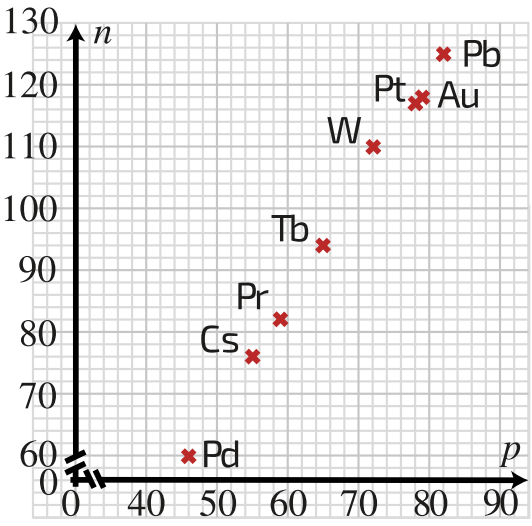

Figure 5: Option B.

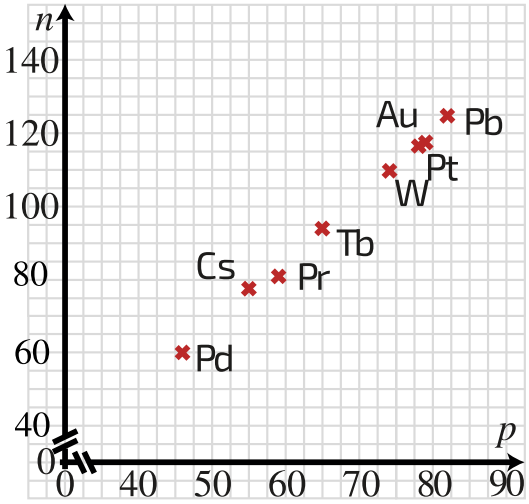

Figure 6: Option C.

- Option A
- Option B
- Option C

Part E Type of correlation: heavy nuclei

What sort of correlation do you see?

- No correlation
- Correlation that is not linear
- Positive linear correlation
- Negative linear correlation

Part F Line of best fit: heavy nuclei

Find the gradient.