FRIDAY, 16 MAY

9:30 AM – 11:35 AM

X8447601

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day   Month   Year   Scottish candidate number

Total marks — 65

Attempt ALL questions.

You may use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

You should refer to the pre-release material for Higher Applications of Mathematics which you can access electronically.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Questions 5, 8 and 12 must be completed on software and then be printed.

Use **blue** or **black** ink.

Before leaving the examination room you must place this booklet and your printouts inside the clear envelope provided. You must give this envelope to the Invigilator; if you do not, you may lose all the marks for this paper.

◇ SQA

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A/HTP

Information and instructions for candidates

The electronic files listed below are provided for you to use during this examination:

- **'Q5 Radio.csv'** — a spreadsheet file containing a data set
- **'Q5 Radio Answers.docx'** — a word processing file. Your output from the statistical software in questions 5 (a) (i) and (a) (iii) must be copied and pasted into this file for printing.
- **'Q8 Finance.xlsx'** — a spreadsheet containing 2 worksheets
- **'Q12 Eye Colour.xlsx'** — a spreadsheet file containing 1 worksheet

You must display your name, SCN and centre name on all pages on each printout. Spaces have been provided in each electronic file for you to complete this information.

When printing spreadsheet files, ensure that:

- landscape orientation is used
- grid lines are shown
- row and column headings are shown
- the option 'Fit All Columns on One Page' is selected.

When printing word processing files ensure that portrait orientation is used.

Use this table to make sure you have all the printouts required.

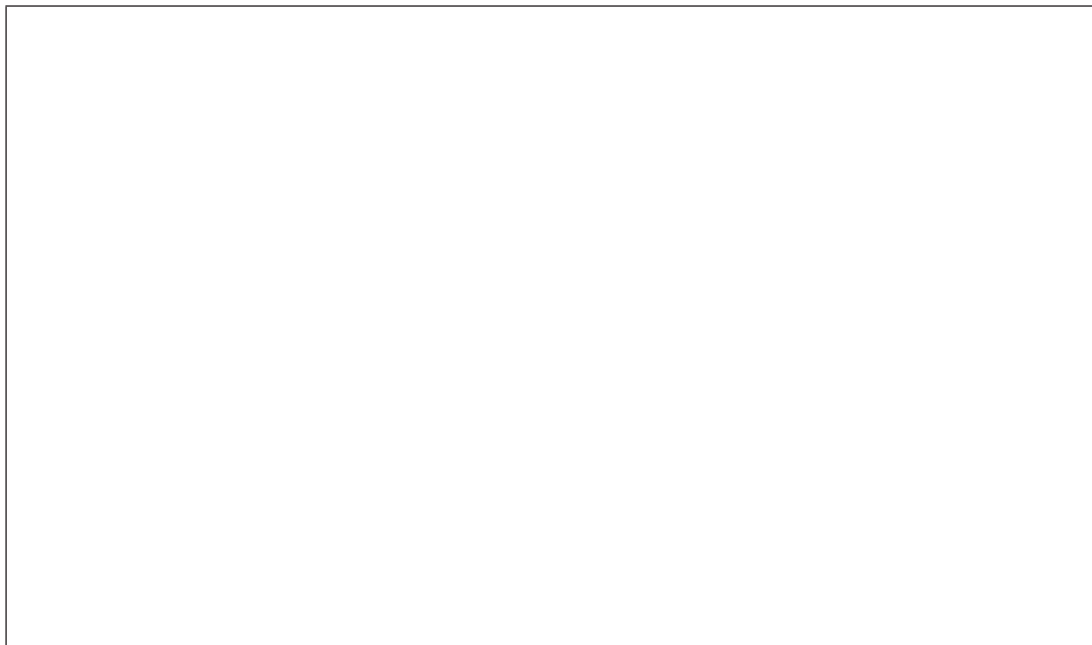| Question	Printout	Completed (✓)
5 (all parts)	'Q5 Radio Answers.docx' This should include your statistical software output and answers.	
8 (a)	'Car Finance' worksheet • value view • formula view	
8 (c)	'Savings' worksheet • value view • formula view	
12 (all parts)	'Eye Colour' worksheet • value view • formula view	

Total marks — 65

Attempt ALL questions

1. Estimate the total number of portions of fruit and vegetables that a typical person eats during their childhood.

   State any assumptions you make. 3

[Turn over

2. A group of gym members were asked what machines they regularly use from a choice of treadmill, rowing machine and cross trainer.

The results were as follows:

- 4 members use all three machines
- 38 members use both the treadmill and the rowing machine
- 32 members use both the cross trainer and the treadmill
- 15 members use both the rowing machine and the cross trainer
- 90 members use the treadmill
- 85 members use the rowing machine
- 53 members use the cross trainer
- 13 members use none of these machines.

(a) Complete the Venn diagram to show this information.   **3**

(An additional diagram, if required, can be found on *page 21*.)

treadmill

rowing machine   cross trainer
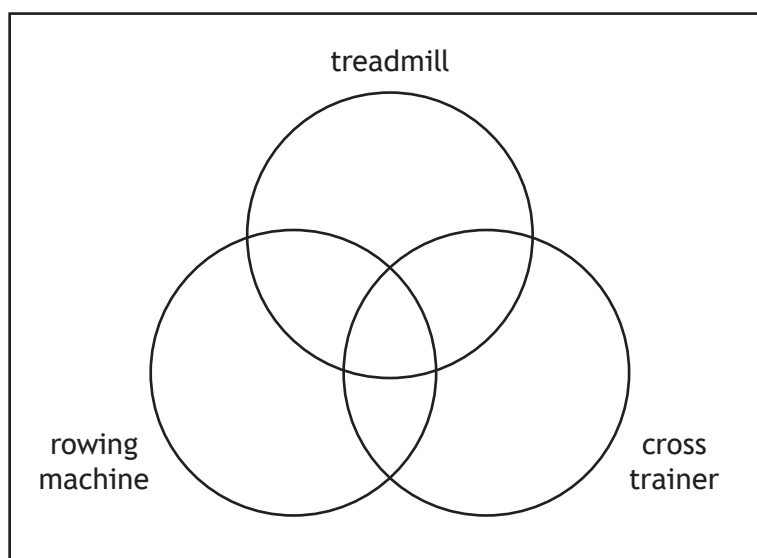
(b) A gym member is selected at random.

Determine the probability that they regularly use the rowing machine and the cross trainer, but not the treadmill.   **2**

3. You must refer to the information on 'Deductions from salaries' given in the pre-release material when answering this question.

Alaina earns a gross annual salary of £24,960. She pays 8.2% of her gross annual salary into her pension and pays £82.56 National Insurance per month.

Calculate her **net monthly salary** after all deductions.

4

4. A company makes hand-made teddy bears.

The tasks required to make each teddy bear are listed below.

	Task
A	Cut fur
B	Stuff and sew fur
C	Cut material
D	Sew clothes
E	Embroider t-shirt
F	Cut accessories
G	Sew accessories
H	Dress and accessorise
I	Package and ship bear

The Gantt chart shows the tasks, with float times, when three employees are available to make each teddy bear.

Each task is completed by a **single** employee.

Teddy bear manufacturing process
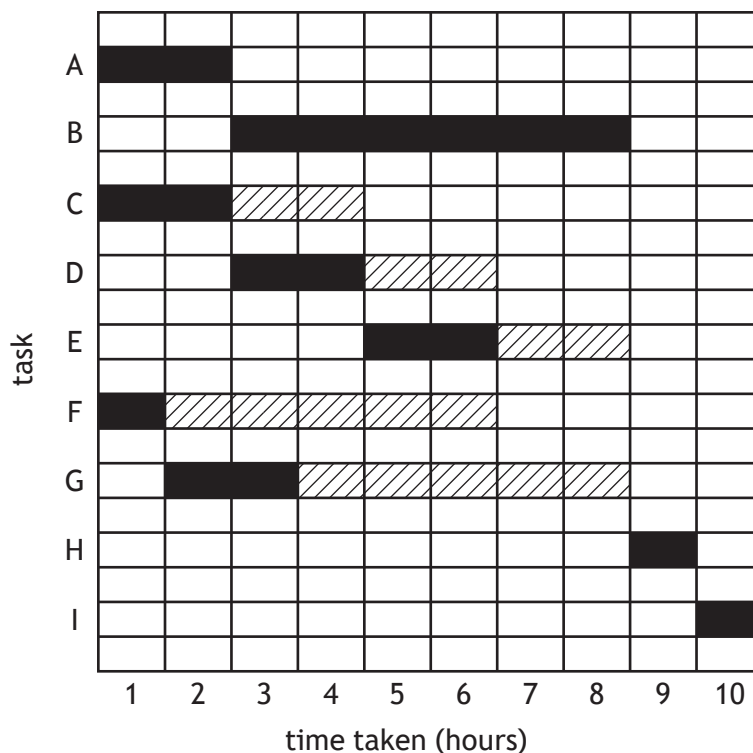
Float times in the Gantt chart are represented by ⬜.
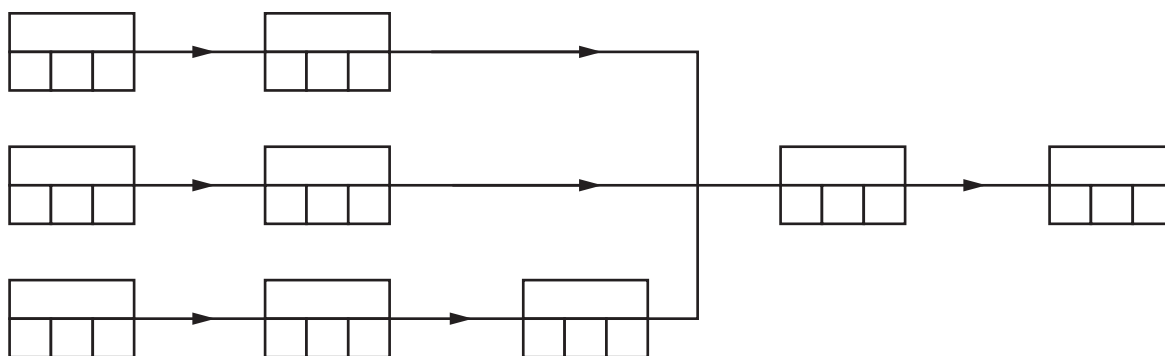
4. (continued)

(a) State the critical path. **1**

(b) Complete the PERT chart showing the earliest start time and the latest completion time for each task. **4**

(An additional diagram, if required, can be found on *page 21*.)

(c) Determine the minimum time taken to make each teddy bear when only two employees are available. **1**

[Turn over

5. You must refer to the spreadsheet file 'Q5 Radio.csv' for the data, and the word processing file 'Q5 Radio Answers.docx' when answering this question.

You must complete parts (a)(i) and (a)(iii) using appropriate statistical software.

You must include all output from statistical software, and your answers in the word processing file 'Q5 Radio Answers.docx'.

A radio station asks their listeners to report how many hours they are listening for one week in July.

(a)   (i)   Construct a histogram to summarise the data.   **1**

(ii)   Describe the distribution of the data shown in the histogram.   **1**

(iii)   Hence, generate and state the appropriate measure of location to summarise the data.   **2**

The data is then used to determine listening hours last summer.

(b)   State one reason why the data might misrepresent the listening hours last summer.   **1**

Print the word processing file 'Q5 Radio Answers.docx'.

6. You must refer to the information on 'Lifetime ISA' given in the pre-release material when answering this question.

Morgan opens a Lifetime ISA with an online bank. The account has an annual effective rate of interest of 3.25%.

Morgan makes a deposit of £2500 into the account on 1 January 2024. The government bonus is paid into her account on the first day of the following month.

She makes no further deposits in 2024.

Calculate the accumulated value of Morgan's Lifetime ISA on 31 December 2024. **4**

7. An events management company has been awarded a contract to construct the stages for a music festival.

   If the construction of the stages is delayed the contract says that a penalty of £25,000 will be charged.

   For the purposes of the cost-benefit analysis, the company has assumed only two events will cause a delay:

   • a stage structure failing

   • staff failing to attend the site.

   The probability of **no delay** is 0.76.

   (a) Calculate the expected cost of a delay.　　　　　2

7. (continued)

The company is considering using the following control measures:

- Control Measure 1 — Pay another company to have staff on standby to attend the site in the case of their staff being unable to attend, at a cost of £1000.

- Control Measure 2 — Have a spare stage on standby in case of a failure, at a cost of £1500.

The probability of staff failing to attend the site is 0.2.

The probability of a stage structure failing is 0.05.

(b) Calculate the expected cost if control measure 2 is taken. **1**

The expected cost if control measure 1 is taken is £2250.

The company will only use one control measure.

(c) Explain which control measure the company should use to minimise expected costs. **1**

8. You must refer to the spreadsheet file 'Q8 Finance.xlsx' when answering this question.

You must complete parts (a) and (c) using the spreadsheet file.

Part (b) must be completed in the answer space provided.

Martin is buying a car for £7500. The garage offered Martin the finance package below:

- 20% deposit
- 35 level monthly repayments of £216.77
- final monthly repayment £216.13.

(a) Open the 'Car Finance' worksheet.

Complete the loan schedule to determine the annual effective rate of interest that is being charged for the finance package. **5**

Car insurance is a legal requirement for cars driven on UK roads.

(b) Explain the purpose of car insurance. **1**

8. **(continued)**

Martin has been saving for the deposit and car insurance. He opened a savings account with an initial deposit of £500 on 1 August 2023.

He made regular monthly payments of £250 into the account on the first day of each month from 1 September 2023. The effective rates of interest for the savings account are as follows.

Dates	Effective rate of interest
1 August 2023 to 30 November 2023	0.24% per month
From 1 December 2023	3.1% per year

(c) Open the 'Savings' worksheet.

Calculate the balance in Martin's savings account immediately before he makes his payment on 1 August 2024.

4

> **Print the 'Car Finance' worksheet in value view and in formula view.**
>
> **Print the 'Savings' worksheet in value view and in formula view.**

[Turn over

9. You must refer to the information on 'Feeding chicks' given in the pre-release material when answering this question.

To monitor the effect of the type of feed on their mass, a group of chicks were randomly allocated into two groups at birth.

One group was given feed type A and the second group was given feed type B from birth.

The comparative boxplot summarises the mass of chicks, in grams, when weighed at three weeks old.

Boxplot of mass of chicks
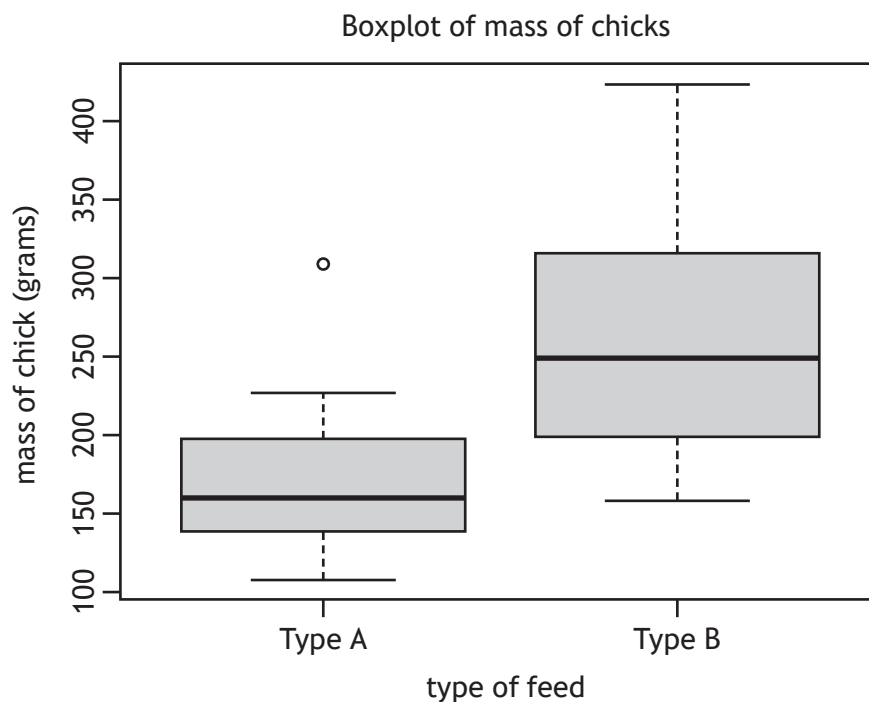
(a) Explain which type of feed results in chicks with the least variability in mass.   **1**

MARKS

A hypothesis test was performed to compare the two groups.

(b) (i) State the hypothesis test performed. **1**

(ii) Hence state the null and alternative hypotheses. **1**

The p-value was 0.003147.

(iii) Interpret the p-value, and the result of the hypothesis test, in context. **2**

The type of feed used for one group of chicks is sold in 4.5 kilogram bags.

The nutritional content is shown.

Nutritional content of feed	
Protein	720 g
Fat	150 g
Fibre	320 g
Other	3310 g

(c) Explain whether this nutritional information is more likely to be for feed type A or type B. **1**
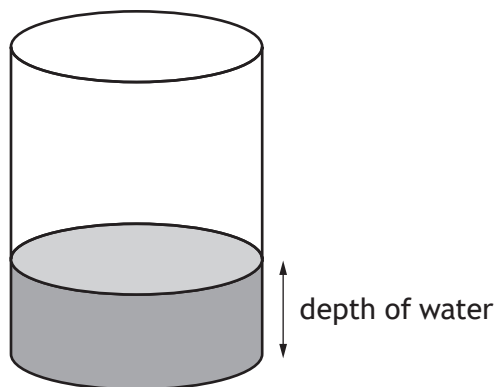
**10.** A cylindrical container is being filled with water.

depth of water

- Initially, the depth of water is 4 centimetres.
- The depth of the water in the container increases at a constant rate of 3 centimetres per minute.
- It takes 8 minutes to finish filling the container.

(a) Draw a graph to model how the depth of water in the container changes over time until it is filled. Use the axes provided. **3**

(An additional diagram, if required, can be found on *page 22*.)

Filling a cylindrical container

(graph with x-axis "time (minutes)" from 0 to 10, y-axis "depth of water (centimetres)" from 0 to 30)
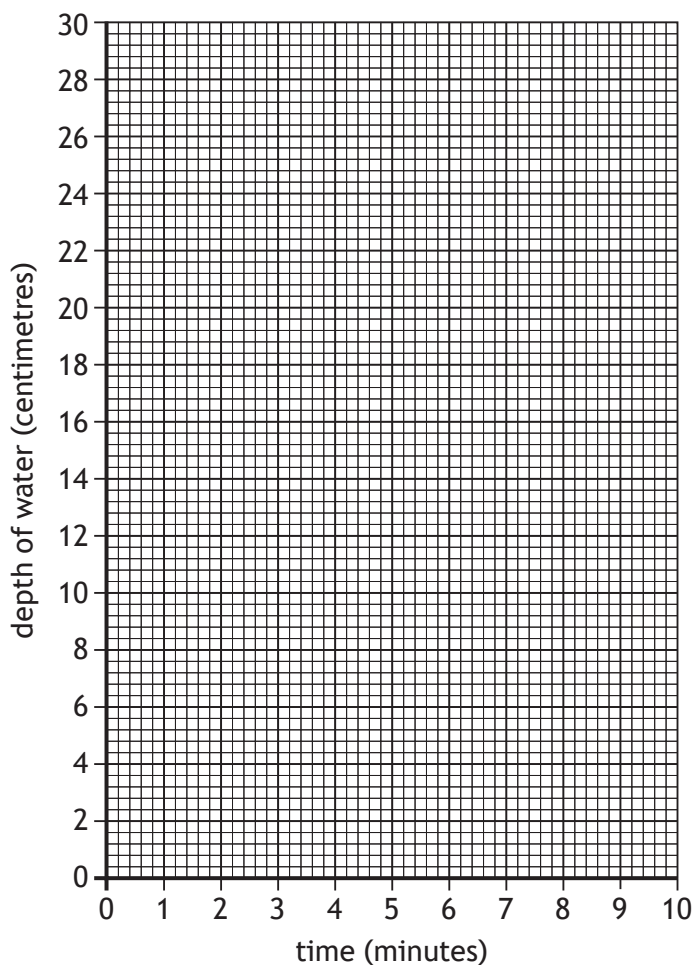
10. (continued)

(b) (i) State the type of relationship modelled in your graph. **1**

(ii) State the dependent variable in your graph. **1**
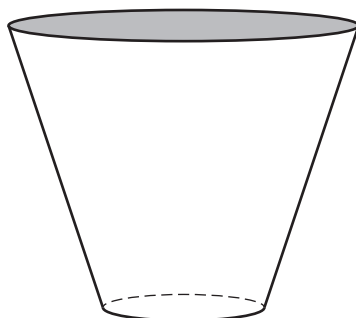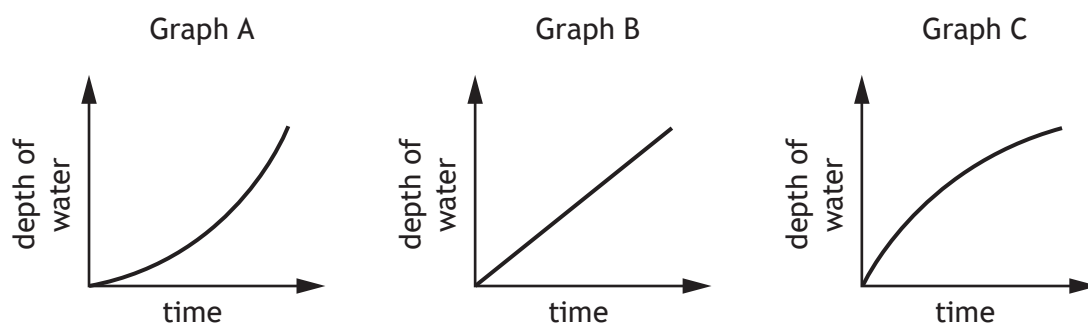
[Turn over

10. (continued)

Another container is shown below.

This container is also filled with water at a constant rate of 5 cubic centimetres per second.

Three graphs are shown below showing how the depth of water in the container changes over time.

Graph A   Graph B   Graph C

(c) Explain which graph could model the depth of water in the container. **2**

11. Freddie has a credit card with an annual effective rate of interest of 29.9%. Interest is applied at the end of each month.

Payments must be made on the first day of each month. The minimum payment must be either 5% of the balance outstanding at that time or £5, whichever is higher.

After Freddie makes his payment on 1 March, the balance of his credit card was £823.19.

Freddie does not use his credit card during March.

(a) Calculate the balance of his credit card on 1 April after Freddie has made the minimum payment.

3

(b) Give one reason why Freddie should consider paying the full balance of his credit card each month.

1

12. You must refer to the spreadsheet file 'Q12 Eye Colour.xlsx' when answering this question.

You must complete parts (a), (b) and (c) using the spreadsheet file.

A random sample of 50 children were invited to take part in a general health study. They were asked to answer the following questions:

- State your sex.

  Please select from: male, female, prefer not to say

- State your eye colour.

  Please select from: blue, brown, green

- Are you colour blind?

  Please select from: yes, no

The responses from the survey were partially entered into a 'Participant Responses' table.

Participants 3, 7, 13, and 18 responded 'yes' to being colour blind.

All other participants were not colour blind.

Participant 42 has withdrawn their consent for their responses to be included in the data.

Open the 'Eye Colour' worksheet.

(a) Complete the 'Participant Responses' table using the information above. **2**

(b) Complete the 'Eye Colour Summary' table. **2**

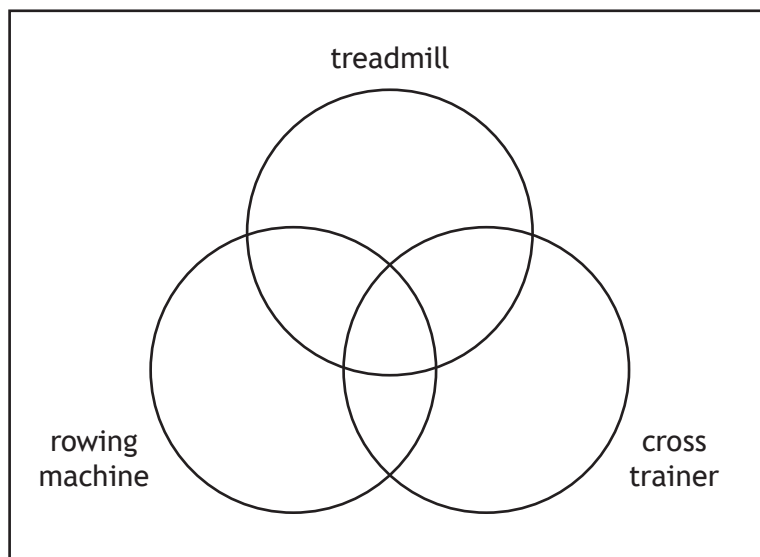(c) Create an appropriate chart to display the frequencies in the 'Eye Colour Summary' data. **3**

Print the 'Eye Colour' worksheet in value view and formula view.

Ensure the chart is visible and contained on one page in each printout.

[END OF QUESTION PAPER]

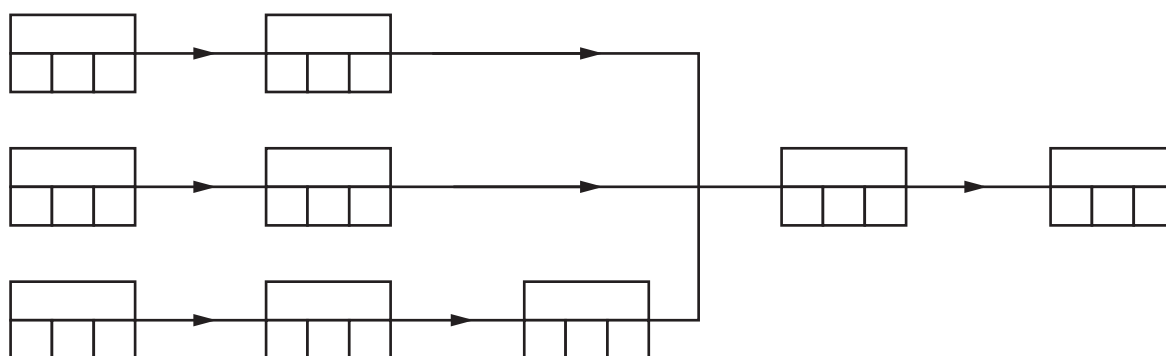## ADDITIONAL SPACE FOR ANSWERS

Additional diagram for use with question 2 (a)

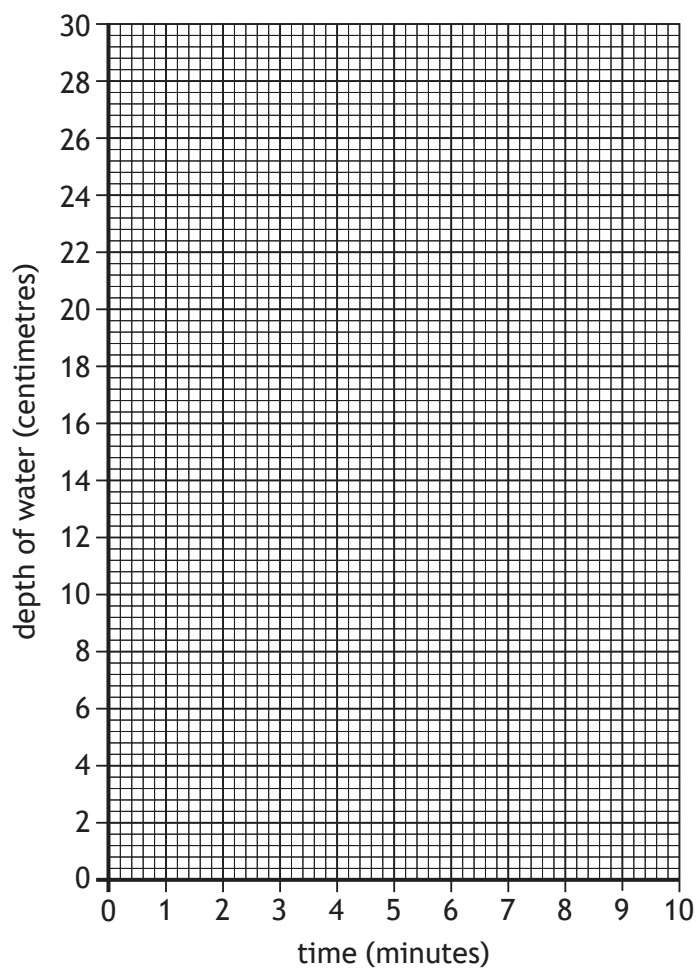treadmill

rowing machine

cross trainer

Additional diagram for use with question 4 (b)

ADDITIONAL SPACE FOR ANSWERS

Additional diagram for use with question 10 (a)

Filling a cylindrical container

ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL SPACE FOR ANSWERS