HL Paper 2

The company *Fresh Water* produces one-litre bottles of mineral water. The company wants to determine the amount of magnesium, in milligrams, in these bottles.

A random sample of ten bottles is analysed and the results are as follows:

6.7, 7.2, 6.7, 6.8, 6.9, 7.0, 6.8, 6.6, 7.1, 7.3.

Find unbiased estimates of the mean and variance of the amount of magnesium in the one-litre bottles.

Markscheme

$\bar{m} = \frac{6.7+7.2+\ldots+7.3}{10} = 6.91$ ***(M1)A1***

$s_{n-1}^2 = \frac{1}{9}\left((6.7-6.91)^2 + \ldots + (7.3-6.91)^2\right)$ ***(M1)***

$= \frac{0.489}{9} = 0.0543\ (3\text{ sf})$ ***A1***

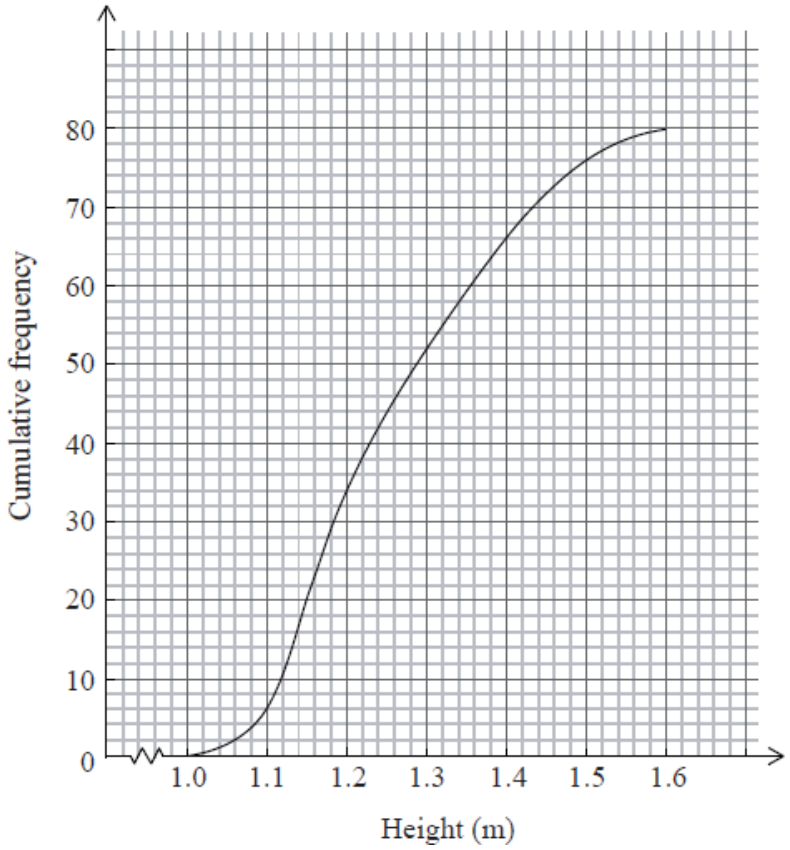
Note: Award ***M1A0*** for 0.233.

[4 marks]

Examiners report

Most candidates used a GDC to answer this question and many scored full marks in this question. However there were a significant number of candidates who showed little understanding of the meaning of unbiased estimate. In some cases, candidates wasted time by attempting to calculate the required values by hand.

The heights of all the new boys starting at a school were measured and the following cumulative frequency graph was produced.



a. Complete the grouped frequency table for these data. [2]

Interval	Frequency
]1.0, 1.1]	
]1.1, 1.2]	
]1.2, 1.3]	
]1.3, 1.4]	
]1.4, 1.5]	
]1.5, 1.6]	

b. Estimate the mean and standard deviation of the heights of these 80 boys. [2]

c. Explain briefly whether or not the normal distribution provides a suitable model for this population. [2]

Markscheme

a.

Interval	Frequency
]1.0, 1.1]	6
]1.1, 1.2]	28
]1.2, 1.3]	18
]1.3, 1.4]	14
]1.4, 1.5]	10
]1.5, 1.6]	4

A2

[2 marks]

b. $\mu = 1.26,\ \sigma = 0.133$ ***A1A1***

[2 marks]

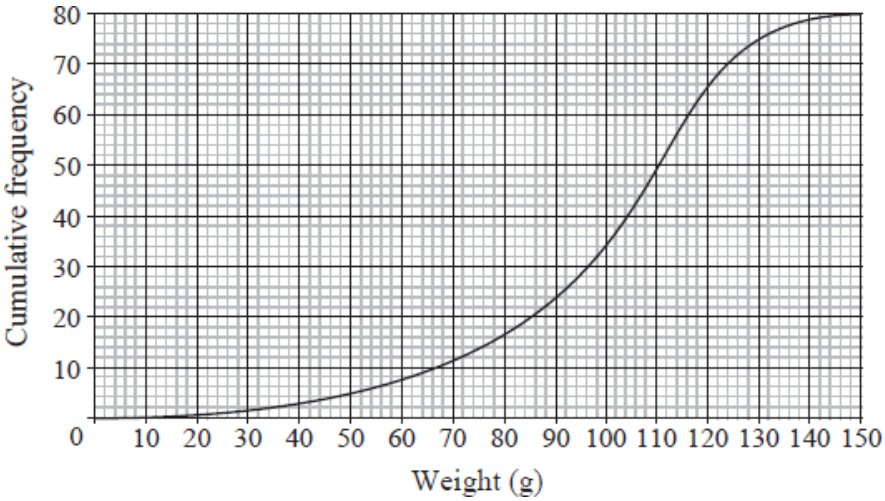
c. no because the normal distribution is symmetric and these data are not ***R2***

[2 marks]

Examiners report

a. [N/A]
b. [N/A]
c. [N/A]

The cumulative frequency graph below represents the weight in grams of 80 apples picked from a particular tree.



a. Estimate the [2]

(i) median weight of the apples;

(ii) 30^{th} percentile of the weight of the apples.

b. Estimate the number of apples which weigh more than 110 grams. [2]

Markscheme

a. (i) median = 104 grams ***A1***

Note: Accept 105.

(ii) 30^{th} percentile = 90 grams ***A1***

[2 marks]

b. $80 - 49$ ***(M1)***

$= 31$ ***A1***

Note: Accept answers 30 to 32.

[2 marks]

Examiners report

a. On a very straightforward question there were many correct answers. However, there was evidence that some candidates had not previously encountered cumulative frequency graphs and hence scored low marks on the question.

b. On a very straightforward question there were many correct answers. However, there was evidence that some candidates had not previously encountered cumulative frequency graphs and hence scored low marks on the question.