Name: _____

GCSE Statistics

Quality Assurance

Total marks available: 33

Total marks achieved: _____

Instructions
• Use black ink or ball-point pen.
• Fill in the boxes at the top of this page with your name,
Centre number and candidate number.
• Answer all questions.
• Answer the questions in the spaces provided
– There may be more space than you need.
• Scientific calculators may be used.
• You must show all your working out with your answer clearly identified
At the end of your solution.

Information
• 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.

Q1. Laura owns a company that makes and sells packets of crisps.

Laura wants to find out how sales of different flavours of crisps have changed over the past five years.

Here is part of a spreadsheet showing information about the percentage of total sales for each flavour sold by the company for each year from 2013 to 2017

	Percentage of total sales for each year				
Flavour	**2013**	**2014**	**2015**	**2016**	**2017**
Salt and vinegar	14	15.5	15	15.8	16
Prawn cocktail	6.9	7.7	8.1	8	8.2
Beef	6	6.8	6.5	6	6.1
Chicken	9.4	10.2	10	10.5	10.6
Cheese and onion	176	17.5	17.1	17	17.3
Ready salted	16	15.1	15.3	14.9	14.2
Pickled onion	5	4.3	4.1	3.9	3.7
Cheese	13.1	12.2	12.9	12.5	13
Smoky bacon	12	10.7	11	11.4	10.9

Laura wants to do some quality control work to check the weights of large packets of crisps.

A sample of 10 large packets of crisps is taken at regular intervals and the mean weight of the packets in each sample is calculated.

The sample means should be normally distributed with a mean of 510 g and a standard deviation of 20 g.

Laura is going to draw a quality control chart for the sample means.

The next two sample means are 495 g and 558 g.

(a) Explain how Laura should draw this quality control chart for the sample means and write down what actions, if any, should be taken based on these two sample means.

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(5)

(b) Chose the correct words from the table below to complete correctly the following sentences.

approximately equal to	greater than	less than

(i) The population mean weight of large packets of crisps
Should be..... 510 g.

(1)

(ii) The population standard deviation of large packets of crisps
Should be..... 20 g.

(1)

(Total for question = 7 marks)

Q2.

A company makes bars of chocolate on a production line in a factory.

If a chocolate bar is found to weigh less than 60 g, the company will not be allowed to sell it.

The company uses quality assurance control charts to monitor the weight of the chocolate bars.

Samples of chocolate bars are taken at regular intervals.

The mean weights of the samples are normally distributed.

(a) Explain why it would not be appropriate for the production line to be set so that 60 g is the target weight.

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(1)

In fact the production line is set so that the sample means should be normally distributed with a mean of 62 g and a standard deviation of 0.4 g.

(b) What can be deduced from this information about the mean and standard deviation of all of the chocolate bars made on the production line?

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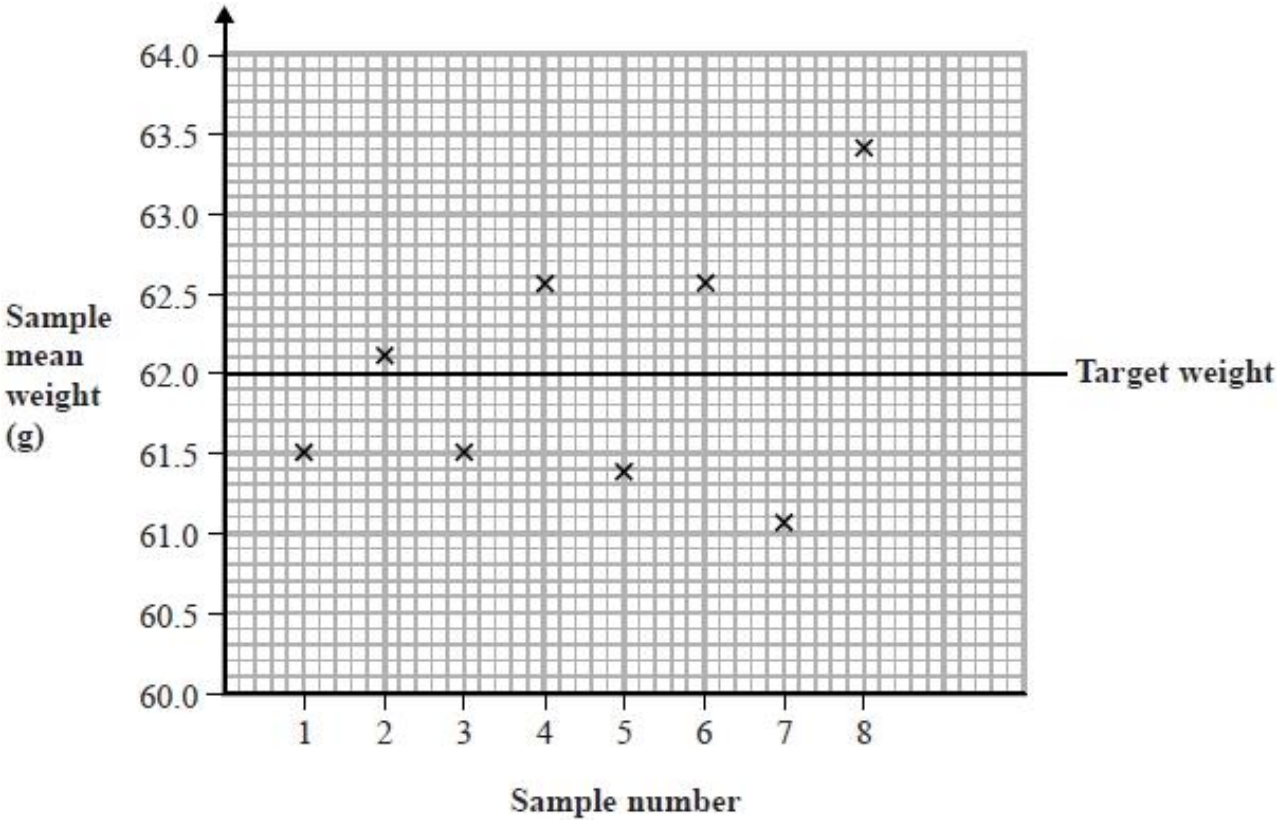
(2)

Alice takes the samples in order to monitor the sample means of the weights.

Here is her incomplete control chart showing 8 sample means.



(c) By completing the control chart, determine what actions, if any, Alice should have taken based on the information given.

You must justify your answer.

(6)

(Total for question = 9 marks)

Q3.

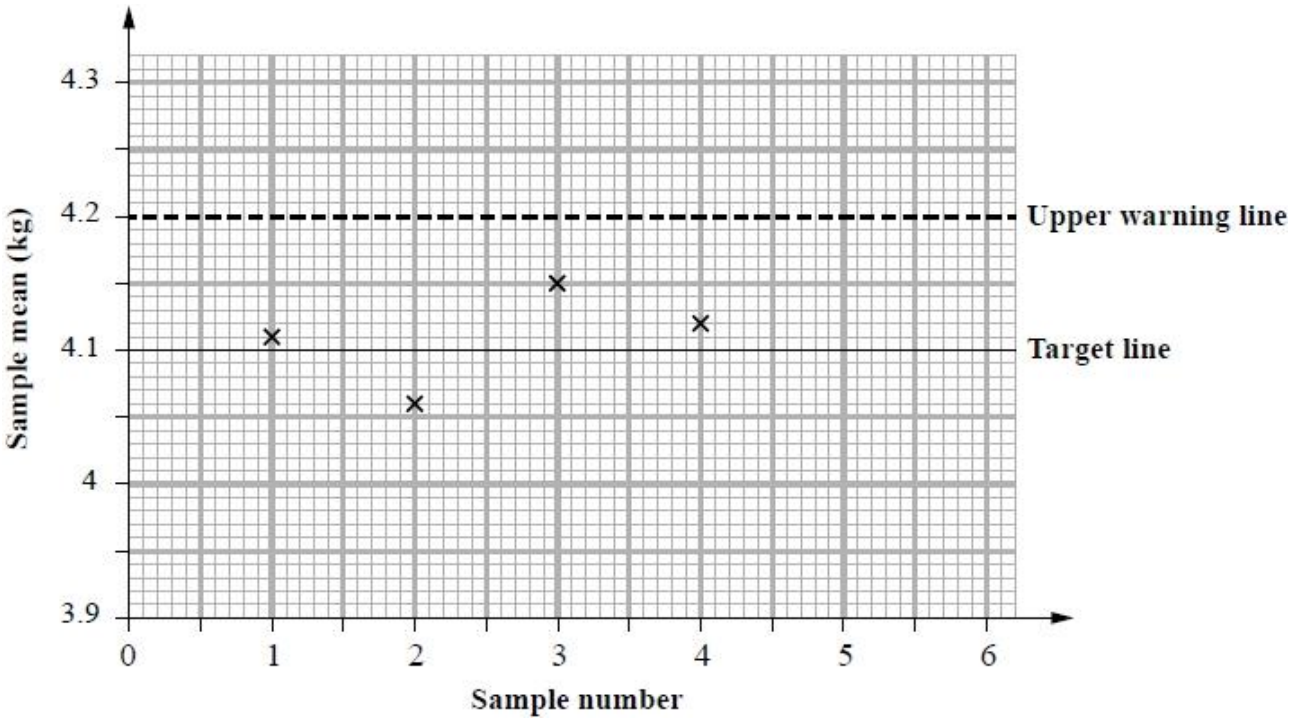
Glowbright Garden Products produce bags of charcoal for use on barbecues.

For quality control, a sample of 5 bags of charcoal is taken at regular intervals and the mean weight of the bags in the sample calculated.

The sample means should be normally distributed with a mean of 4.1 kg and a standard deviation of 0.05 kg.

A quality control chart for the sample means is drawn.

Four sample means have been plotted.



(a) Complete the control chart by drawing the upper action line, the lower action line **and** the lower warning line.

Label your lines.

(2)

The sample mean of sample 5 is 4.22 kg.

(b) Determine any actions that need to be taken.

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(2)

David says that the standard deviation of the weights of bags of charcoal produced by Glowbright Garden Products should be 0.05 kg.

(c) Is David correct?

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(1)

(Total for question = 5 marks)

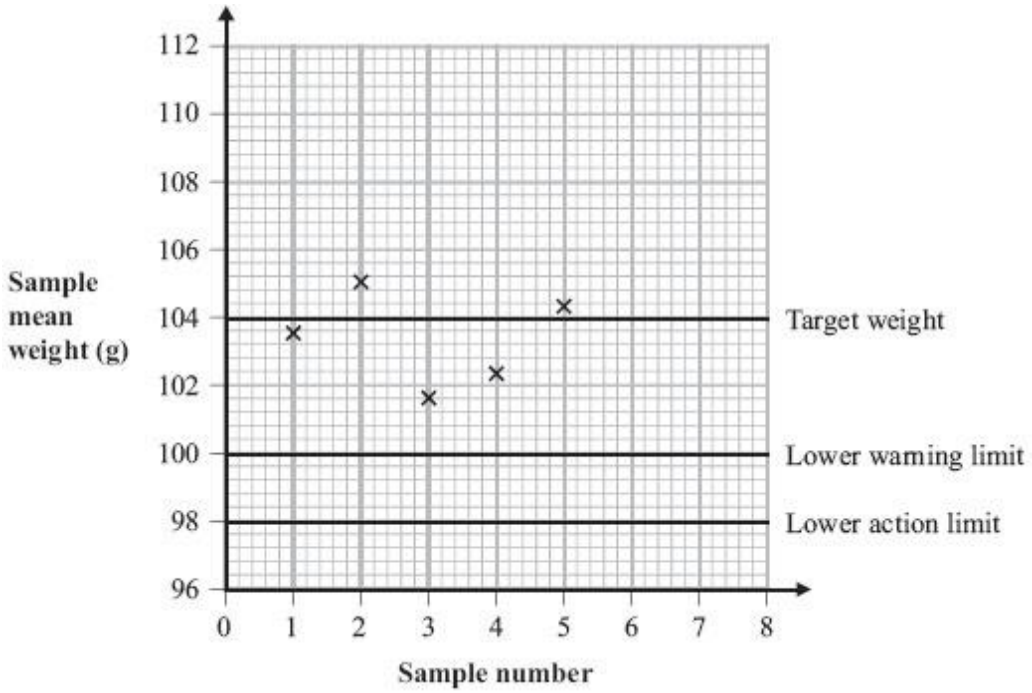
Q4.

A production line is set up to produce chocolate bars with a target weight of 104 g.
for quality control, random samples are taken to check that the production line is working correctly.

The chocolate bars in each sample should have a mean weight of 104 g and a standard deviation of 2 g.

The sample mean weights have a normal distribution.

A quality control chart is used to plot the sample mean weights.



The lower warning limit and the lower action limit have been drawn on the chart.

(a) Complete the control chart by adding the upper warning limit and the upper action limit.
Label your lines.

(2)

(b) When the chocolate production line is working correctly, write down the percentage of samples expected to have a mean weight outside the warning limits.

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(1)

Five sample means have been plotted on the control chart.

The next sample has a mean weight of 97.8 g

(c) (I) Plot this sample mean on the control chart.

(ii) Describe the action that now needs to be taken.

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(2)

(d) Explain how warning limits on a control chart are used.

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(3)

(Total for Question is 8 marks)

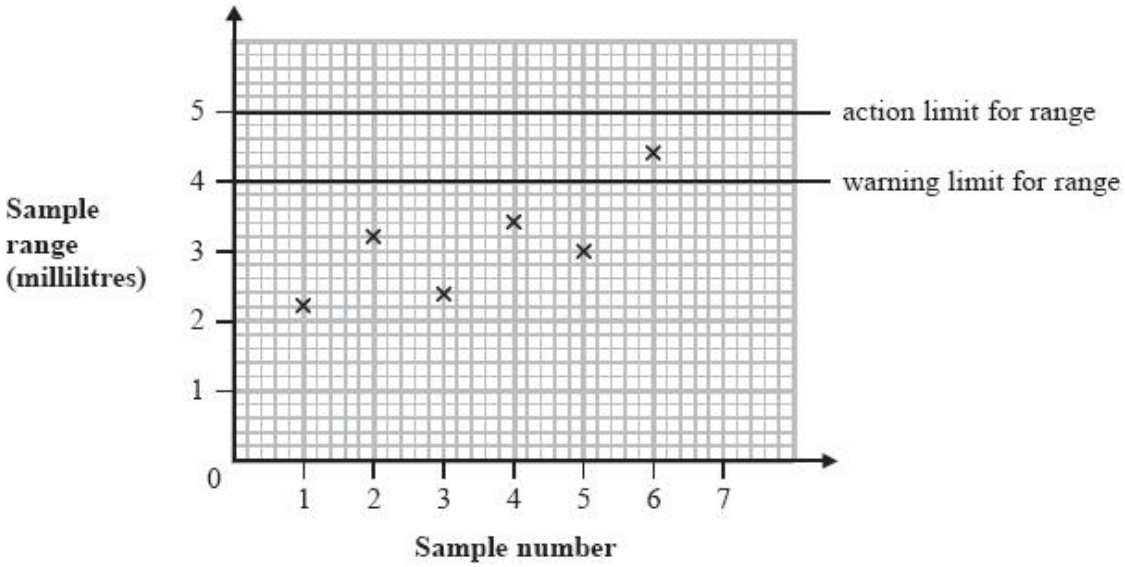
Q5.

A coffee machine is designed to produce 150 millilitres of coffee per serving.

For quality control, random samples of 3 servings are taken and the range of each sample is found.

A quality control chart is used to plot the sample ranges.

The first 6 sample ranges have been plotted.



(a) Describe what action should be taken after the 6th sample.

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(1)

The amounts of coffee, in millilitres, in the 7th sample are

147.4 152.6 152.1

(b) (i) find the value of the sample range for this sample.

..... Millilitres

(ii) Plot this sample range on the quality control chart.

(iii) Describe what action should be taken after the 7th sample.

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(3)

(Total for question = 4 marks)