3. Rowan believes that 35% of type *A* vacuum tubes shatter when exposed to alternating high and low temperatures.

Rowan takes a random sample of 15 of these type *A* vacuum tubes and uses a two-tailed test, at the 5% level of significance, to test his belief.

(a) Give **two** assumptions, in context, that Rowan needs to make for a binomial distribution to be a suitable model for the number of these type *A* vacuum tubes that shatter when exposed to alternating high and low temperatures.

(2)

(b) Using a binomial distribution, find the critical region for the test.
You should state the probability of rejection in each tail, which should be as close as possible to 0.025

(3)

(c) Find the actual level of significance of the test based on your critical region from part (b)

(1)

Rowan records that in the latest batch of 15 type *A* vacuum tubes exposed to alternating high and low temperatures, 4 of them shattered.

(d) With reference to part (b), comment on Rowan's belief. Give a reason for your answer.

(1)

Rowan changes to type *B* vacuum tubes. He takes a random sample of 40 type *B* vacuum tubes and finds that 8 of them shatter when exposed to alternating high and low temperatures.

(e) Test, at the 5% level of significance, whether or not there is evidence that the proportion of type *B* vacuum tubes that shatter when exposed to alternating high and low temperatures is lower than 35%
You should state your hypotheses clearly.

(5)

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Question 3 continued

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Question 3 continued

(Total for Question 3 is 12 marks)