

1. A study was done to determine whether the amount of sleep a student gets affects their GPA. A random sample of high school seniors was taken in the United States. The results are in the following table.

	GPA < 2.0	2.0 ≤ GPA < 3.0	3.0 ≤ GPA ≤ 4.0
Hours of Sleep < 7	10	12	6
7 ≤ Hours of Sleep < 8	7	14	18
8 ≤ Hours of Sleep	9	12	25

A χ^2 test was performed at the 1% significance level. The critical value for this test is 13.77.

- (a) State the null hypothesis. (1 mark)
- (b) Write down the degrees of freedom. (1 mark)
- (c) Write down:
- The χ^2 statistic. (1 mark)
 - The associated p-value. (1 mark)
- (d) State, giving a reason, whether the null hypothesis should be accepted. (2 marks)

Mark scheme:

- (a) H_0 : The GPA of a high school senior is independent of the number of hours of sleep they receive. (A1)
- (b) Degrees of Freedom: $(3 - 1)(3 - 1) = 4$ (A1)
- (c)
- $\chi^2 = 8.63912$ (A1)
 - p-value = 0.070781 (A1)
- (d) Method 1: $\chi^2 < \text{critical value}$
 $8.64 < 13.277$ (R1)
 Fail to reject the null hypothesis (A1)

Method 2: p-value > significance level
0.070781 > 0.01 (R1)
Enough evidence to support null hypothesis (A1)