

# Bozeman Science: Pre-Lab Chi-Square Video Sheet

[www.bozemanscience.com/chi-squared-test](http://www.bozemanscience.com/chi-squared-test)

$$X^2 = \sum \frac{(O - E)^2}{E}$$

1. Label what each element represents in the Chi-square formula:

2. Why do you use the Chi-Square Test?

**A way to compare when you collect data, is the variation in your data just due to chance or is due to one of the variables that you are actually testing.**

3. Define the Null Hypothesis.

**There is NO (Zero/Nil/Nulla) SIGNIFICANT difference between the observed and the expected values.**

4. What is the whole point or cool thing about Chi-Square?

**We can actually measure our data, or look at our data to see if there is a statistical difference.**

5. What is the whole point of a Chi-Square test?

**The whole point of Chi-Square is to ACCEPT or REJECT our Null Hypothesis.**

6. What is the definition of and how do you calculate the “Degrees of Freedom”?

**Degrees of freedom refers to the maximum number of logically independent values, which are values that have the freedom to "vary", in the data. It is calculated by n-1.**

**(Critical Value)**

7. What is the **probability** (**p**) we will always use in this class (*AP Biology at NSU*)? **0.05**

8. What does a **probability** (**p**) of **.05** actually mean?

**A critical value of 0.05 means that you can be 95% sure that you are either accepting or rejecting the Null Hypothesis.**

9. What happens if you get a Chi-Square **HIGHER** than your critical value?

You **REJECT** the Null Hypothesis.

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10. What happens if you get a Chi-Square **LOWER** than your critical value?

You **ACCEPT** the Null Hypothesis.

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11. Complete the Chi-square question Paul Andersen uses as an example involving coin flipping.

(a) State your **null hypothesis** ( $H_0$ ) for this problem:

**$H_0$  = There is NO SIGNIFICANT difference between the observed and expected values.**

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- (b) Fill in the data table to the right with the sample data Mr. Andersen gives you and then solve.

	Heads	Tails
Expected	25	25
Observed	28	22

Please **SHOW ALL WORK** in the space below.

(Equation – Substitute – AnsWER = ESA)

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$\chi^2 = \sum \frac{(28-25)^2}{25} + \frac{(22-25)^2}{25}$$

$$\chi^2 = \sum \frac{9}{25} + \frac{9}{25} = \frac{18}{25} = \mathbf{0.72}$$

12. (a) What is the **probability** ( $p$ ) we will use in this problem and **ALL** problems at NSU? 0.05
- (b) What is your **critical value** for this problem? 3.814
- (c) What is your **degrees of freedom** for this problem? 2 - 1 = 1
- (d) What is the Chi-square value you calculated? 0.72
- (e) Is your Chi-square **HIGHER** or **LOWER** than the critical value from the table? Lower
- (f) Do you **ACCEPT** or **REJECT** your null hypothesis? Accept

What **EXACTLY** does this mean: \_\_\_\_\_

**There is NO SIGNIFICANT difference between what was observed and expected and there is nothing wrong with the coins.**

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13. Complete the 2<sup>nd</sup> Chi-square question Paul Andersen uses as an example involving dice.

(a) State your **null hypothesis** ( $H_0$ ) for this problem:

**$H_0$  = There is NO SIGNIFICANT difference between the observed and the expected values.**

(b) Fill in the data table below with the sample data Mr. Andersen give you and then solve.

	1	2	3	4	5	6
<i>Expected</i>	6	6	6	6	6	6
<i>Observed</i>	2	4	8	9	3	10

Please **SHOW ALL WORK** in the space below.

(Equation – Substitute – Answer = ESA)

$$\chi^2 = 9.6$$

14. (a) What is the **probability** ( $p$ ) we will use in this problem and ALL problems at NSU? **0.05**
- (b) What is your **critical value** for this problem? **11.07**
- (c) What is your **degrees of freedom** for this problem? **5**
- (d) What is the **Chi-square value** you calculated? **9.6**
- (e) Is your Chi-square **HIGHER** or **LOWER** than the critical value from the table? **Lower**
- (f) Do you **ACCEPT** or **REJECT** your null hypothesis? **Accept**

What **EXACTLY** does this mean: \_\_\_\_\_

**There is NO SIGNIFICANT difference between what was observed and expected and there is nothing wrong with the dice.**

15. Complete the 3<sup>rd</sup> Chi-square question Paul Andersen uses as an example involving pill bugs.

(a) State your **null hypothesis** ( $H_0$ ) for this problem:

**$H_0$  = There is NO SIGNIFICANT difference between the observed and the expected values.**

(b) Fill in the data table to the right with the sample data Mr. Andersen give you and then solve.

	Wet	Dry
Expected	5.0	5.0
Observed	8.9	1.1

Please **SHOW ALL WORK** in the space below.  
(Equation – Substitute – Answer = ESA)

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$\chi^2 = \sum \frac{(8.9 - 5.0)^2}{5.0} + \frac{(1.1 - 5.0)^2}{5.0}$$

$$\chi^2 = \sum \frac{(3.9)^2}{5.0} + \frac{(-3.9)^2}{5.0}$$

$$\chi^2 = \sum \frac{15.21}{5.0} + \frac{15.21}{5.0}$$

$$\chi^2 = 3.042 + 3.042 = 6.084$$

16. (a) What is the **probability** ( $p$ ) we will use in this problem and ALL problems at NSU? 0.05

(b) What is your **critical value** for this problem? 3.841

(c) What is your **degrees of freedom** for this problem? 1

(d) What is the **Chi-square** value you calculated? 6.084

(e) Is your Chi-square **HIGHER** or **LOWER** than the critical value from the table? Higher

(f) Do you **ACCEPT** or **REJECT** your null hypothesis? Reject

What **EXACTLY** does this mean: \_\_\_\_\_

**There IS A SIGNIFICANT difference between what was observed and expected.**

**The pill bugs preferred the wet environment over the the dry environment.**