Express the null hypothesis and the alternative hypothesis in symbolic form. Use the correct symbol (μ, p, σ) for the indicated parameter.

1) A skeptical paranormal researcher claims that the proportion of Americans that have seen a UFO,   1) _____
   p, is less than 2 in every one thousand.

   A) H_0: p > 0.002   B) H_0: p = 0.002   C) H_0: p < 0.002   D) H_0: p = 0.002
      H_1: p $\le$ 0.002 H_1: p < 0.002 H_1: p $\ge$ 0.002 H_1: p > 0.002

2) A researcher claims that 62% of voters favor gun control.   2) _____

   A) H_0: p $\ne$ 0.62   B) H_0: p = 0.62   C) H_0: p $\ge$ 0.62   D) H_0: p < 0.62
      H_1: p = 0.62 H_1: p $\ne$ 0.62 H_1: p < 0.62 H_1: p $\ge$ 0.62

Formulate the indicated conclusion in nontechnical terms. Be sure to address the original claim.

3) A psychologist claims that more than 24 percent of the population suffers from professional   3) _____
   problems due to extreme shyness. Assuming that a hypothesis test of the claim has been conducted
   and that the conclusion is failure to reject the null hypothesis, state the conclusion in nontechnical
   terms.

   A) There is sufficient evidence to support the claim that the true proportion is greater than 24
      percent.
   B) There is not sufficient evidence to support the claim that the true proportion is greater than 24
      percent.
   C) There is not sufficient evidence to support the claim that the true proportion is less than 24
      percent.
   D) There is sufficient evidence to support the claim that the true proportion is less than 24
      percent.

4) The manufacturer of a refrigerator system for beer kegs produces refrigerators that are supposed to   4) _____
   maintain a true mean temperature, μ, of 42°F, ideal for a certain type of German pilsner. The owner
   of the brewery does not agree with the refrigerator manufacturer, and claims he can prove that the
   true mean temperature is incorrect. Assuming that a hypothesis test of the claim has been
   conducted and that the conclusion is to reject the null hypothesis, state the conclusion in
   nontechnical terms.

   A) There is not sufficient evidence to support the claim that the mean temperature is equal to
      42°F.
   B) There is sufficient evidence to support the claim that the mean temperature is different from
      42°F.
   C) There is not sufficient evidence to support the claim that the mean temperature is different
      from 42°F.
   D) There is sufficient evidence to support the claim that the mean temperature is equal to 42°F.

Assume that a hypothesis test of the given claim will be conducted. Identify the type I or type II error for the test.

5) A medical researcher claims that 12% of children suffer from a certain disorder. Identify the type I error for the test.

    5) _____

   A) Reject the claim that the percentage of children who suffer from the disorder is different from 12% when that percentage really is different from 12%.

   B) Fail to reject the claim that the percentage of children who suffer from the disorder is equal to 12% when that percentage is actually different from 12%.

   C) Fail to reject the claim that the percentage of children who suffer from the disorder is equal to 12% when that percentage is actually 12%.

   D) Reject the claim that the percentage of children who suffer from the disorder is equal to 12% when that percentage is actually 12%.

6) The principal of a school claims that the percentage of students at his school that come from single-parent homes is 16%. Identify the type II error for the test.

    6) _____

   A) Reject the claim that the percentage of students that come from single-parent homes is equal to 16% when that percentage is actually less than 16%.

   B) Fail to reject the claim that the percentage of students that come from single-parent homes is equal to 16% when that percentage is actually different from 16%.

   C) Reject the claim that the percentage of students that come from single-parent homes is equal to 16% when that percentage is actually 16%.

   D) Fail to reject the claim that the percentage of students that come from single-parent homes is equal to 16% when that percentage is actually 16%.

Identify the null hypothesis, alternative hypothesis, test statistic, P-value, conclusion about the null hypothesis, and final conclusion that addresses the original claim.

7) According to a recent poll 53% of Americans would vote for the incumbent president. If a random sample of 100 people results in 45% who would vote for the incumbent, test the claim that the actual percentage is 53%. Use a 0.10 significance level.

    7) _____

8) In a clinical study of an allergy drug, 108 of the 202 subjects reported experiencing significant relief from their symptoms. At the 0.01 significance level, test the claim that more than half of all those using the drug experience relief.

    8) _____

9) Various temperature measurements are recorded at different times for a particular city. The mean of 20°C is obtained for 60 temperatures on 60 different days. Assuming that $\sigma = 1.5°C$, test the claim that the population mean is 22°C. Use a 0.05 significance level.

    9) _____

Assume that a simple random sample has been selected from a normally distributed population and test the given claim. Use either the traditional method or P-value method as indicated. Identify the null and alternative hypotheses, test statistic, critical value(s) or P-value (or range of P-values) as appropriate, and state the final conclusion that addresses the original claim.

10) A test of sobriety involves measuring the subject's motor skills. Twenty randomly selected sober subjects take the test and produce a mean score of 41.0 with a standard deviation of 3.7. At the 0.01 level of significance, test the claim that the true mean score for all sober subjects is equal to 35.0. Use the traditional method of testing hypotheses.

    10) _____

11) A public bus company official claims that the mean waiting time for bus number 14 during peak hours is less than 10 minutes. Karen took bus number 14 during peak hours on 18 different occasions. Her mean waiting time was 7.3 minutes with a standard deviation of 1.5 minutes. At the 0.01 significance level, test the claim that the mean waiting time is less than 10 minutes. Use the P-value method of testing hypotheses.

    11) _____

12) In tests of a computer component, it is found that the mean time between failures is 520 hours. A modification is made which is supposed to increase the time between failures. Tests on a random sample of 10 modified components resulted in the following times (in hours) between failures.

    518   548   561   523   536
    499   538   557   528   563

At the 0.05 significance level, test the claim that for the modified components, the mean time between failures is greater than 520 hours. Use the P-value method of testing hypotheses.

12) _____

Test the indicated claim about the means of two populations. Assume that the two samples are independent simple random samples selected from normally distributed populations. Do not assume that the population standard deviations are equal. Use the traditional method or P-value method as indicated.

13) A researcher was interested in comparing the resting pulse rates of people who exercise regularly and of those who do not exercise regularly. Independent simple random samples of 16 people who do not exercise regularly and 12 people who exercise regularly were selected, and the resting pulse rates (in beats per minute) were recorded. The summary statistics are as follows.

Do not exercise regularly	Exercise regularly
$\bar{x}_1 = 73.2$ beats/min	$\bar{x}_2 = 68.9$ beats/min
$s_1 = 10.9$ beats/min	$s_2 = 8.2$ beats/min
$n_1 = 16$	$n_2 = 12$

Use a 0.025 significance level to test the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly. Use the traditional method of hypothesis testing.

13) _____

14) A researcher was interested in comparing the response times of two different cab companies. Companies A and B were each called at 50 randomly selected times. The calls to company A were made independently of the calls to company B. The response times for each call were recorded. The summary statistics were as follows:

	Company A	Company B
Mean response time	7.6 mins	6.9 mins
Standard deviation	1.4 mins	1.7 mins

Use a 0.02 significance level to test the claim that the mean response time for company A is the same as the mean response time for company B. Use the P-value method of hypothesis testing.

14) _____

1) B
2) B
3) B
4) B
5) D
6) B
7) H_0: p = 0.53. H_1: p ≠ 0.53. Test statistic: z = -1.60. P-value: p = 0.0548.

   Critical value: z = ±1.645. Fail to reject null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the actual percentage is 53%.
8) H_0: p = 0.5. H_1: p > 0.5. Test statistic: z = 0.99. P-value: p = 0.1611.

   Critical value: z = 2.33. Fail to reject null hypothesis. There is not sufficient evidence to support the claim that more than half of all those using the drug experience relief.
9) H_0: μ = 22; H_1: μ ≠ 22. Test statistic: z = -10.33. P-value: 0.0002. Because the P-value is less than the significance level of α = 0.05, we reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the population mean temperature is 22°C.
10) H_0: μ = 35.0. H_1: μ ≠ 35.0. Test statistic: t = 7.252. Critical values: t = -2.861, 2.861. Reject H_0. There is sufficient evidence to warrant rejection of the claim that the mean is equal to 35.0.
11) H_0: μ = 10 min. H_1: μ < 10 min. Test statistic: t = -7.637. P-value < 0.005. Reject H_0. There is sufficient evidence to support the claim that the mean is less than 10 minutes.
12) H_0: μ = 520 hrs. H_1: μ > 520 hrs. Test statistic: t = 2.612.

    0.01 < P-value < 0.025. Reject H_0. There is sufficient evidence to support the claim that the mean is greater than 520 hours.
13) H_0: $\mu_1 = \mu_2$

    H_1: $\mu_1 > \mu_2$

    Test statistic: t = 1.191
    Critical value: t = 2.060
    Do not reject H_0. At the 2.5% significance level, there is not sufficient evidence to support the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly.
14) H_0: $\mu_1 = \mu_2$

    H_1: $\mu_1 \neq \mu_2$

    Test statistic: t = 2.248
    0.02 < P-value < 0.05
    Do not reject H_0. At the 2% significance level, there is not sufficient evidence to warrant rejection of the claim that the mean response time for company A is the same as the mean response time for company B.