Lesson 11.1.3

11-14. a. an observational study

b. To the oranges at the Fresh Foods that day. Any other extrapolation is risky.

c. There is no reason to pair any particular orange from the traditional group to any particular orange in the organic group. The samples are independent.

d. Answers will vary. Though the traditional center is clearly higher than the organic center, the large amount of variability makes it hard to be certain. Either direction is arguable here.

e. H_0: $\mu_T = \mu_O$, H_A: $\mu_T > \mu_O$ or H_0: $\mu_T - \mu_O = 0$, H_A: $\mu_T - \mu_O > 0$

f. Yes. Random sampling is established in the setup. The populations of both the organic and traditional oranges are declared "large" so you can assume the independent trials condition is met. And both samples have $n = 30$, so the large samples condition is met.

g. Yes. The traditional and organic oranges have no effect on one another.

11-15. a. $\sigma_{\overline{T}} = \frac{\sigma_T}{\sqrt{n_T}}$, $\sigma_{\overline{O}} = \frac{\sigma_O}{\sqrt{n_O}}$

b. Using the rule that $\sigma_{A-B} = \sqrt{\sigma_A{}^2 + \sigma_B{}^2}$, you can find $\sigma_{\bar{T}-\bar{O}} = \sqrt{\frac{\sigma_T{}^2}{n_T} + \frac{\sigma_O{}^2}{n_O}}$.

c. SE ≈ 0.8223

11-16. a. 0

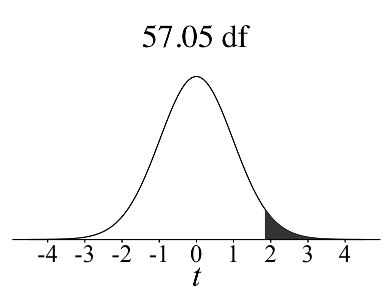
b. $33.1333 - 31.6167 = 1.5166$

c. $t = \frac{2.5166}{0.8223} = 1.844$

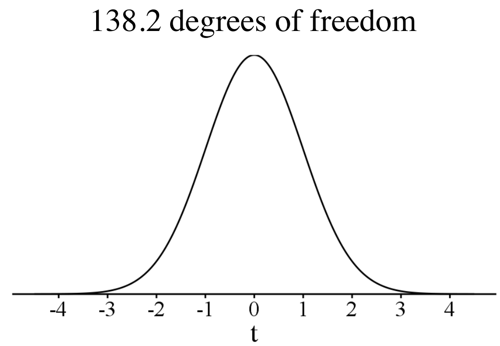
11-17. a. 29

b. Since the degrees of freedom are much higher, your t-distribution will be closer to normal and the power of your tests will increase. However, it is much harder to calculate and it will not be a huge difference since df = 29 is already pretty normal!

11-18. This is a one-tailed t-test. The p-value, $P(t > 1.844)$, is 0.035. Since $p < \alpha$ of 0.05, Latavia has sufficient evidence to reject the null hypothesis and conclude that the population of organic oranges produces less juice, on average, than the traditional orange. See diagram at right.



11-19. Identify: This is a two-sample t-test for the difference of means. Let $\alpha = 0.05$. Hypotheses: H_0: $\mu_{\pi P} - \mu_{NU} = 0$, H_A: $\mu_{\pi P} - \mu_{NU} \neq 0$ where $\mu_{\pi P}$ is the population mean battery life of πPhone 7s and μ_{NU} is the population mean battery life of Noid Universe 6s Phones. Sample evidence for H_A: $\bar{x}_D = 1.25$.



Check conditions: Random selection, to avoid bias—given in problem. Independent trials, for and accurate σ—assumed that there are more than $n10 = 1000$ of each phone model available in the populations. Large samples, so the sampling distribution is ≈ normal—the sample sizes are larger than 30 so the Central Limit Theorem applies. The samples are independent, not paired.

Calculate: $\bar{x}_d = 1.25$ hours, $s_d = \sqrt{\frac{1.25^2}{100} + \frac{2.75^2}{100}} = 0.3021$ hours, df = 138.23,

$t = \frac{1.25-0}{0.3021} = 4.1377$, p-value ≈ 0.

Conclude: Reject H_0. You have convincing evidence that there is a significant difference in the mean battery life between the πPhone 7s and the Noid Universal 6s models. See diagram above.

11-20. a. See table below.

	Post Grad	College Grad	Some College	High School or Less	
Democrat Candidate	161 (137)	248 (235)	296 (322)	444 (454)	1149
Republican Candidate	88 (111)	175 (191)	289 (262)	382 (369)	934
Other	19 (19)	37 (33)	44 (45)	62 (64)	162
	268	460	629	888	2245

b. See table above.

c. Conditions: The samples are assumed to be random. The population of U.S. adults is much larger than 22450. All expected frequencies are greater than 5.
Calculate: the $\chi^2 = 17.33$, since with 6 degrees of freedom. p-value = 0.0082. You should reject H_0.

d. Education level is independent of candidate choice. Looking at the expected counts, it seems the biggest difference in the candidates occurs at the post-grad level, but in general the higher the level of education, the more likely one is to vote for the Democrat candidate.

11-21. Let A be the event that the patient is from out of town, B be the event that the patient is over 60. Then according to the rule of addition, you have
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ or $0.60 + 0.50 - 0.30 = 0.8 = 80\%$ chance.