11. $(\bar{x}-\bar{y})\pm z_{\alpha/2}\sqrt{\frac{s_1^2}{m}+\frac{s_2^2}{n}} = (\bar{x}-\bar{y})\pm z_{\alpha/2}\sqrt{(SE_1)^2+(SE_2)^2}$. Using $\alpha = .05$ and $z_{\alpha/2} = 1.96$ yields $(5.5-3.8)\pm 1.96\sqrt{(0.3)^2+(0.2)^2} = (0.99, 2.41)$. We are 95% confident that the true average blood lead level for male workers is between 0.99 and 2.41 higher than the corresponding average for female workers.

13. $\sigma_1 = \sigma_2 = .05$, $d = .04$, $\alpha = .01$, $\beta = .05$, and the test is one-tailed $\Rightarrow$

$$n = \frac{(.0025+.0025)(2.33+1.645)^2}{.0016} = 49.38,$$ so use $n = 50$.

18.

a. Let μ_1 and μ_2 denote true mean CO_2 loss with a traditional pour and a slanted pour, respectively. The hypotheses of interest are H_0: $\mu_1 - \mu_2 = 0$ v. H_a: $\mu_1 - \mu_2 \neq 0$. We'll apply the two-sample t procedure, with $\nu = \frac{(.5^2/4+.3^2/4)^2}{(.5^2/4)^2/(4-1)+(.3^2/4)^2/(4-1)} = 4.91 \rightarrow 4$. The test statistic is $t = \frac{(4.0-3.7)-0}{\sqrt{\frac{.5^2}{4}+\frac{.3^2}{4}}} = 1.03$, with a two-sided P-value of roughly 2(.187) = .374 from Table A.8. [Software provides the more accurate P-value of .362.] Hence, we fail to reject H_0 at any reasonable significance level; we conclude that there is no statistically significant difference in mean "bubble" loss between traditional and slanted champagne pouring, when the temperature is 18°C.

b. Repeating the process of **a** at 12°C, we have $\nu \approx 5$, $t = 7.21$, P-value $\approx 2(0) = 0$. [Software gives P = .001]. Hence, we reject H_0 at any reasonable significance level; we conclude that there is a statistically significant difference in mean "bubble" loss between traditional and slanted champagne pouring, when the temperature is 12°C.

24.

a. 95% upper confidence bound: $\bar{x} + t_{.05,65-1}SE = 13.4 + 1.671(2.05) = 16.83$ seconds

b. Let μ_1 and μ_2 represent the true average time spent by blackbirds at the experimental and natural locations, respectively. We wish to test H_0: $\mu_1 - \mu_2 = 0$ v. H_a: $\mu_1 - \mu_2 > 0$. The relevant test statistic is $t = \frac{13.4-9.7}{\sqrt{2.05^2+1.76^2}} = 1.37$, with estimated df $= \frac{(2.05^2+1.76^2)^2}{\frac{2.05^4}{64}+\frac{1.76^4}{49}} \approx 112.9$. Rounding to $t = 1.4$ and df = 120, the tabulated P-value is very roughly .082. Hence, at the 5% significance level, we fail to reject the null hypothesis. The true average time spent by blackbirds at the experimental location is not statistically significantly higher than at the natural location.

c. 95% CI for silvereyes' average time – blackbirds' average time at the natural location: (38.4 – 9.7) ± $(2.00)\sqrt{1.76^2+5.06^2}$ = (17.96 sec, 39.44 sec). The t-value 2.00 is based on estimated df = 55.

28. We will test the hypotheses: H_0: $\mu_1 - \mu_2 = 10$ v. H_a: $\mu_1 - \mu_2 > 10$. The test statistic is $t = \frac{(\bar{x}-\bar{y})-10}{\sqrt{\left(\frac{2.75^2}{10}+\frac{4.44^2}{5}\right)}} = \frac{4.5}{2.17} = 2.08$ with df $= \nu = \frac{\left(\frac{2.75^2}{10}+\frac{4.44^2}{5}\right)^2}{\frac{\left(\frac{2.75^2}{10}\right)^2}{9}+\frac{\left(\frac{4.44^2}{5}\right)^2}{4}} = \frac{22.08}{3.95} = 5.59 \searrow 5$, and the P-value from Table A.8 is $\approx .045$, which is $< .10$ so we reject H_0 and conclude that the true average lean angle for older females is more than 10 degrees smaller than that of younger females.

36. From the data provided, $\bar{d} = 7.25$ and $s_D = 11.8628$. The parameter of interest: μ_D = true average difference of breaking load for fabric in unabraded or abraded condition. The hypotheses are H_0: $\mu_D = 0$ versus H_a: $\mu_D > 0$. The calculated test statistic is $t = \dfrac{7.25 - 0}{11.8628/\sqrt{8}} = 1.73$; at 7 df, the P-value is roughly .065. Since .065 > .01, we fail to reject H_0 at the $\alpha = .01$ level. The data do not indicate a significant mean difference in breaking load for the two fabric load conditions.

40. From the data, $n = 10$, $\bar{d} = 105.7$, $s_D = 103.845$.

a. Let μ_D = true mean difference in TBBMC, postweaning minus lactation. We wish to test the hypotheses H_0: $\mu_D \le 25$ v. H_a: $\mu_D > 25$. The test statistic is $t = \dfrac{105.7 - 25}{103.845/\sqrt{10}} = 2.46$; at 9 df, the corresponding P-value is around .018. Hence, at the 5% significance level, we reject H_0 and conclude that true average TBBMC during postweaning does exceed the average during lactation by more than 25 grams.

b. A 95% upper confidence bound for $\mu_D = \bar{d} + t_{.05,9}s_D/\sqrt{n} = 105.7 + 1.833(103.845)/\sqrt{10} = 165.89$ g.

c. No. If we pretend the two samples are independent, the new standard error is is roughly 235, far greater than $103.845/\sqrt{10}$. In turn, the resulting t statistic is just $t = 0.45$, with estimated df = 17 and P-value = .329 (all using a computer).