4-21) A standard reference material is certified to contain 94.6 ppm of an organic contaminant in soil. Your analysis gives values of 98.6, 98.4, 97.2, 94.6, and 96.2 ppm. Do your results differ from the expected result at the 95% confidence level? If you made one more measurement and found 94.5, would your conclusion change?

Soln.

x = 98.6, 98.4, 97.2, 94.6 and 96.2

$n = 5$

$$\bar{x} = \frac{98.6 + 98.4 + 97.2 + 94.6 + 96.2}{5}$$

$$\therefore \bar{x} = 97.0$$

Standard deviation $$s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n-1}}$$

$$s = 1.65$$

$$t_{calculated} = \frac{|\text{known value} - \bar{x}|}{s}\sqrt{n}$$

$$= \frac{|94.6 - 97.0|}{1.6_6}\sqrt{5}$$

$$= \frac{2.4}{1.6_6}\sqrt{5}$$

$$= 3.2_3$$

For 4 degrees of freedom and 95% confidence

$t_{table} = 2.776$

Here $t_{calculated}\ (3.23) > t_{table}\ (2.776)$

∴ The difference is significant.

d.f =

$n-1 = 5-1$

$= 4$

t value from the table @ 95% C

$= 2.776$.

4-23 Should the value 216 be rejected from the set of results 192, 216, 202, 195, and 204?

Soln: 192, 195, 202, 204, 216

$$\bar{x} = \frac{192 + 195 + 202 + 204 + 216}{5}$$

$$\bar{x} = 201.8$$

$$s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n-1}}$$

$$s = 9.34$$

Grubbs test:

$$G_{calculated} = \frac{|\text{questionable value} - \bar{x}|}{s}$$

$$G_{calculated} = \frac{|216 - 201.8|}{9.84}$$

$$= 1.52$$

$G_{table} = 1.672$ for five measurements.

Because $G_{calculated} < G_{table}$

$1.52 < 1.672$

$\therefore$ we should retain 21b.