35.21 A company invests $100K to make a product which will generate $25K of annual revenue over the next 12 years. Expenses will be $5,000 per year. The manufactured product is depreciated over the 12 years using straight-line depreciation. There is no salvage value as all the product is expected to be sold. The income tax rate is 35%. What is the after-tax rate of return?

A. -0.5%

B. 5.9%

C. 11.7%

D. 18.3%

Draw a cash flow diagram or make a list of cash flows.

In Year 0, there is an initial payment of $100K (negative).

In Years 1-12, there is a net profit before tax of $\$25K - \$5K = \$20K$. To calculate the tax, it is necessary to consider the depreciation. Depreciation is not an actual cash flow; rather, it is applied as a deduction from the profits, thereby lowering the taxable income for that year. Depreciation is like a fictitious expense which provides tax benefits of offsetting income without actually spending in that year. Straight line deperciation is calculated using the formula below, where C is the initial cost, S_n is the salvage value (if applicable), and n is the number of years.

$$D_j = \frac{C - S_n}{n} = \frac{\$100,000 - \$0}{12} = \$8333$$

Determine the tax basis (i.e. taxable income).

$$Tax\,basis = \$20,000 - \$8333 = \$11,667$$

Apply the tax rate to calculate the tax.

$$Tax = (0.35)\,(\$11,667) = \$4083$$

Since tax is an acutal expense, subtract the tax from the net profit before tax to obtain the net profit after tax. This figure summarizes the annualized cash flows for years 1 through 12.

$$Net\,profit\,after\,tax = \$20,000 - \$4083 = \$15,917$$

Write an expression for the present value. The after-tax rate of return is the interest rate that makes the present value equal zero. Solve for cash flow factor $(P/A, i, 12)$.

$$PV = -\$100,000 + \$15,917\,(P/A, i, 12) = 0$$

$$(P/A, i, 12) = 6.2827$$

Review the Economic Factor Tables and note that the cash flow factor P/A with a duration of 12 years decreases as the interest rate increases, because future cash flows are discounted more as the interest rate increases. At an interest rate $i = 10$, $(P/A, 10, 12) = 6.8137$. At an interest rate

$i = 12$, $(P/A, 12, 12) = 6.1944$. The interest rate must be within the range if $10 - 12\%$, which is sufficient information to select a final answer based on the choices. If time permits, make a table and interpolate to drill down on the answer.

$i[\%]$	$(P/A, i, 12)$
10	6.8137
i	6.2827
12	6.1944

$$\frac{i - 10}{12 - 10} = \frac{6.2827 - 6.8137}{6.1944 - 6.8137}$$

$$i - 10 = 1.71$$

$$i = 11.7\%$$

Answer C