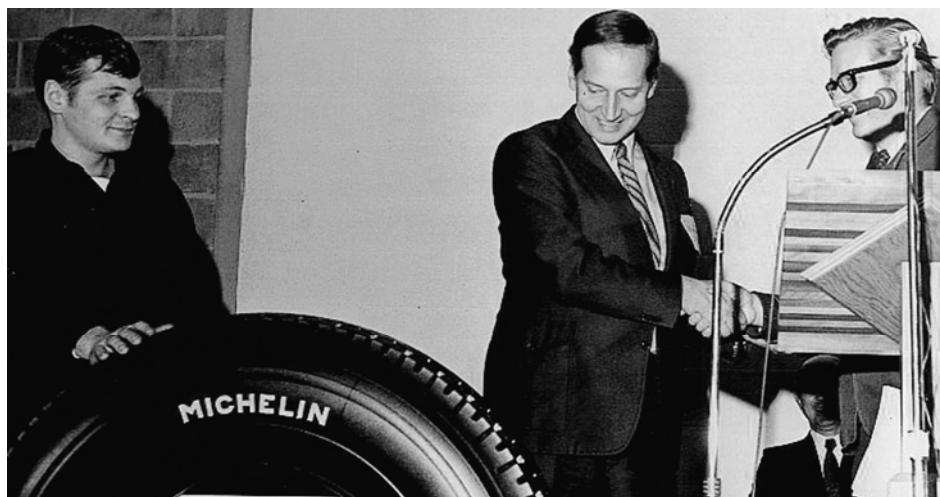


11

Lecture 17

Income, Depreciation, and Cash Flow

Taxes and Incentives



Taxes and Incentives, cont'd

- Taxes are used for lots of purposes. These include raising revenue to pay for public services, and discouraging activities perceived as bad ('sin' tax).
- Tobacco taxes are an example of a 'sin' tax. When governments decided that smoking was bad for the people and was costing governments a lot of money for healthcare, they used advertising campaigns to help people make informed choices and raised taxes to make smoking very expensive.

Taxes and Incentives, cont'd

- Government sometimes does the opposite, by providing incentives like grants, tax breaks, or subsidized salaries for workers to encourage certain activities or behaviour.

Taxes and Incentives, cont'd

- Grants or lower fees for development in a certain region are an example of an incentive.
- In the 1970s, Nova Scotia invited the Michelin Tire Company to establish a plant in Bridgewater and offered grants and favourable tax and labour legislation to encourage the company.
- By 2011 there were three Michelin plants in Nova Scotia employing about 3,500 people.

Taxes and Incentives, cont'd

- Another way of inducing desired behaviour is with targeted tax incentives. Subsidies for the purchase of electric cars are an example.
- Another example: In the 1990s, the Alberta government offered oil companies a low 1% royalty rate, which was to stay in effect until production had produced enough profit to pay off the construction costs. Then the royalty rate would rise to 20% of net profits. The oil companies responded by building plants and upgraders necessary to develop the resource.
- Firms understand the time value of money, and the government, by changing the **depreciation rules**, can change the rate at which firms recover their capital investments and can thereby encourage certain kinds of investment.

Learning Objectives

- Understand how business casing decisions and taxes are connected
- Describe depreciation, deterioration, and obsolescence
- Distinguish between various types of depreciable property and differentiate between depreciation expenses and other business expenses
- Use *historical* depreciation methods to calculate the *annual depreciation charge* and *book value* over the asset's life
- Explain the differences between historical depreciation methods and the capital cost allowance system (CCA)

Learning Objectives, cont'd

- Use CCA to calculate allowable *annual depreciation charge* and *book value* over the asset's life for various asset classes
- Account for *capital gains and losses*, *loss on disposal of fixed assets*, and *recaptured CCA* due to the disposal of a depreciated business asset
- Use the *unit-of-production* and *depletion* depreciation methods as needed in engineering economic analysis problems

Key Summary: Update

- Variables and parameters (puzzle pieces):
 - Different kinds of interest rates
 - Discount rates
 - Costs and cost savings or revenues, now and in the future
 - Different expected lives of the possible project/purchases
 - Salvage value
 - **Depreciation, taxes, and tax savings**
 - How these escalate
- Analysis methods (ways to put the pieces together):
 - Present worth analysis (Net Present Value)
 - Equivalent uniform annual cost analysis
 - Rate of return analysis
 - Benefit-cost ratio analysis
 - Payback period
 - Cost-effectiveness analysis

Assets and Depreciation

- One key measure of a business's success is its annual profit or loss.
- Revenue is money coming in and costs are money going out to obtain the resources to generate revenue.
 - $\text{Net Income (Profit)} = \text{Revenue} - \text{Costs to obtain revenue}$
- As noted in our lecture on accounting, most businesses obtain physical assets to help generate revenue. These physical assets typically lose value, or depreciate, over time.

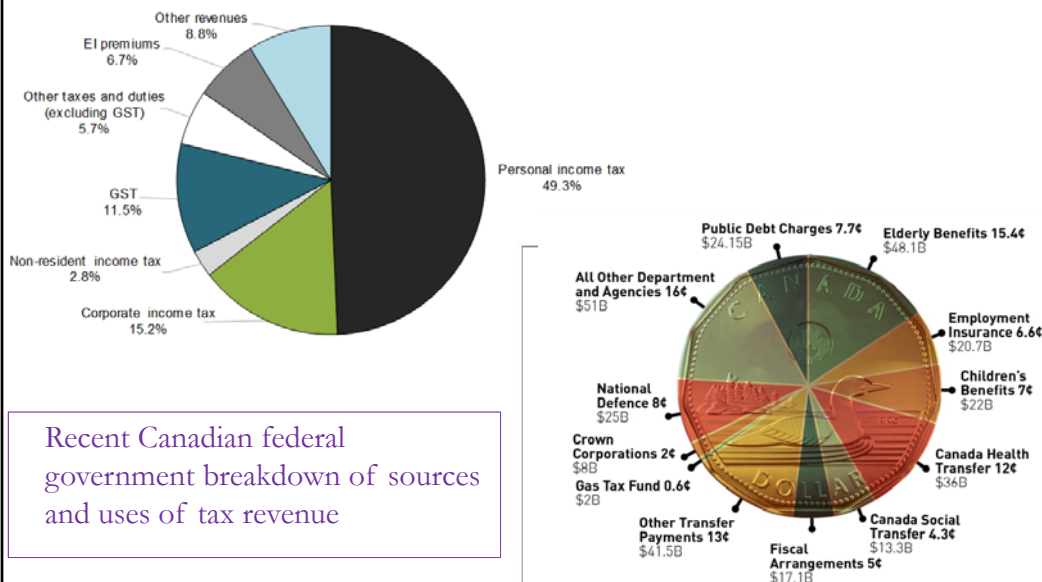
Costs Affecting Taxes

XYZ Company Income Statement For the year ending 25 April 2014		
Revenue		\$
	Sales of product	
	Charges for services	
	Total Revenue	\$
Costs		
	Cost of Goods Sold	
	Labour wages	
	Materials	
	Utilities	
	Machines (a portion of the cost)	
	Factory buildings (a portion of the cost)	
	Selling Costs	
	Advertising	
	Sale commissions	
	Administration Costs	
	Administrative salaries	
	Office rental	
	Financing Costs	
	Interest paid on debt	
	Total Costs	\$
	Net Income before Taxes	

FIGURE 11-1 The income statement.

Taxation Context

Governments tax individuals and businesses to support processes.



Taxation, cont'd

- Taxes should be included in economic analyses if they could impact a decision.
- We need to understand how taxes are imposed, so we can include them in analyses.

Potential break
point



Depreciation and Expenses

- Capital assets vs supplies
 - Capital assets are considered different from supplies (inventory goods), because they last longer, and usually wear out over time
- Expenses
- Capital assets
 - depreciated over an extended period of time

Basic Aspects of Depreciation

- How can we measure how they lose value, or depreciate?
 1. Decline in market value
 2. Decline in value to an owner
 3. Systematic allocation of the cost of an asset over its depreciable life [accountant's definition]

Deterioration and Obsolescence

- How can we measure how they lose value, or depreciate?
 - Deterioration: A machine may decrease in value because it is deteriorating or wearing out
 - Obsolescence: Depreciation can also be caused by obsolescence: when it is no longer useful or needed

Depreciation and Expenses cont'd

- Depreciation is a **non-cash cost** (no actual exchange of dollars) that causes **real cash impacts** (because it affects profits and taxes).
- Depreciation is a way to claim business expenses over time.
- To be depreciable, assets must:
 - Be used for business purposes to produce income;
 - Have a useful life that can be determined and that is longer than one year;
 - Be an asset that decays, gets used up, wears out, becomes obsolete, or loses value to the owner from natural causes.

Depreciation and Expenses, cont'd

EXAMPLE 11-1

Consider the costs that are incurred by a local pizza business. Identify each cost as either *expensed* or *depreciated* and explain why.

- Cost of pizza dough and toppings
- Cost of new delivery van
- Cost of wages for janitor
- Cost of furnishings in dining room
- Cost of a new baking oven
- Utility costs for soft drink refrigerator

SOLUTION

Cost Item	Type of Cost	Why
Pizza dough and toppings	expensed	Life < 1 year, loses value immediately
New delivery van	depreciated	Meets 3 requirements for depreciation
Wages for janitor	expensed	Life < 1 year, loses value immediately
Furnishings in dining room	depreciated	Meets 3 requirements for depreciation
New baking oven	depreciated	Meets 3 requirements for depreciation
Utilities for soft drink refrigerator	expensed	Life < 1 year, loses value immediately

Types of Property

- Tangible Property

Can be seen, touched, and felt

- Real Property

Land, buildings, and all things growing on, built upon, constructed on, or attached to the land

- Personal Property

Equipment, furnishings, vehicles, and any other tangible properties that is not real property

Types of Property, cont'd

- Intangible Property

Value to the owner but cannot be seen or touched:
patents, copyrights, trademarks, trade names, and franchises

- Exceptions to depreciation

Land is never depreciated: it never wears out.
Leased property: it can wear out, but it's not your firm's problem
Factory inventory: although inventory may sit around for years, in theory supplies or goods are short-term, being used up within a year, so they aren't depreciated

Asset Depreciation Concept

- Cost Basis
"first cost" = total cost of acquiring and putting an asset into use
- Total cost
Total cost is assumed to be equal to the total value of the asset
- Value over time
The value declines over time, so the cost of buying it is also spread out over time - over the life of the assets
- depreciation expenses
The spread out costs

Calculating Depreciation

- Book Value
 - $\text{Book value} = \text{Cost basis} - \text{Depreciation charges made to date}$

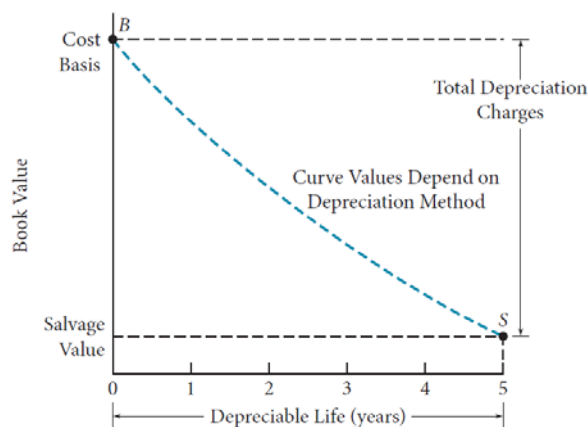


FIGURE 11-2 General depreciation.

- Each year, the amount that the book value drops by can be recorded as a depreciation expense. The remaining value is the "book value"
- Continues until the asset is of no value.
- Largely separate from the physical condition of the asset.

Calculating Depreciation

- We'll be learning several different depreciation methods.
- Caution:
The book implies that you can use any of these methods to come up with depreciation numbers, and can use them to calculate your firm's taxes: that's often not the case.

For that reason, you'll see a lot of problems that I have modified from the textbook version, clarifying as "IF you could use this method to calculate your taxes..."

Depreciation Methods

- General Depreciation Methods:
 - There are lots of different possible depreciation curves:
 - Straight-line, sum-of-years'-digits, declining-balance, and unit-of-production methods
 - Each method requires estimates of an asset's useful life and salvage value
- Tax Reporting Depreciation Methods:
 - Canada: The Capital Cost Allowance (CCA)
 - USA: The Modified Accelerated Cost Recovery System (MACRS)

Straight-Line Depreciation

Annual depreciation charge

$$= d_t = \frac{(B - S)}{N}$$

B = cost basis, S = salvage value,
 N = depreciable life

$B = \$900$

$S = \$70$

$N = 5$ years

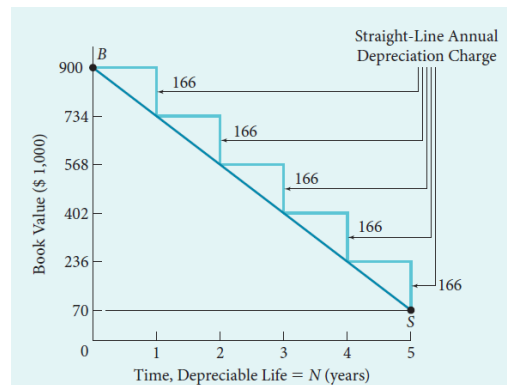


FIGURE 11-3 Straight-line depreciation.

Straight-Line Depreciation: Problem

A high technology company just purchased a new rack of database servers for \$550,000. The installation cost was \$40,000. The life expectancy is 6 years with a salvage value of \$60,000. Using straight-line depreciation, determine the first cost, the annual depreciation amounts, and the book value after 4 years.

Straight-Line Depreciation: Problem, cont'd

Solution

$$\text{First Cost} = \$550,000 + \$40,000 = \$590,000$$

$$\begin{aligned}\text{Depreciation} &= (\$590,000 - \$60,000)/6 \\ &= \$88,333.33/\text{year}\end{aligned}$$

$$\begin{aligned}\text{Book Value at year 4} &= \$590,000 - (4)(\$88,333.33) \\ &= \$236,666.67\end{aligned}$$

Sum-of-Years'-Digits Depreciation

$$d_t = \frac{N - t + 1}{\text{SOYD}} (B - S)$$

d_t = depreciation charge in any year t

N = number of years in depreciable life

SOYD = sum of years' digits, calculated as $N(N+1)/2$

B = cost of the asset made ready for use

S = estimated salvage value after

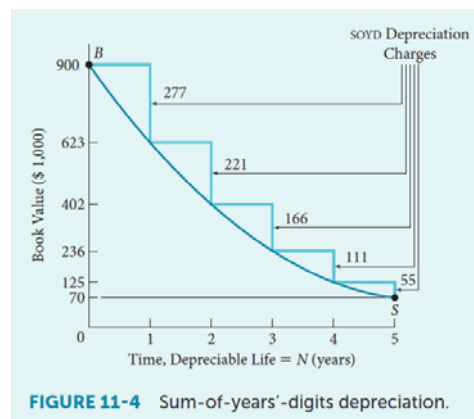


FIGURE 11-4 Sum-of-years'-digits depreciation.

Sum-of-Years'-Digits Depreciation Example

Problem:

An asset costs \$12,000 and has a salvage value of \$2000 after 5 years. If you use sum-of-years'-digits method of depreciation, find the book value at the end of Year 2.

Sum-of-Years'-Digits Depreciation Example

Solution:

$B = \$12,000$ $S = \$2000$ $N = 5$ Years

$$SOYD = (5)(5 + 1) / 2 = 15$$

$$d_t = \frac{N - t + 1}{SOYD} (B - S)$$

$$\text{Depreciation in Year 1} = (5/15)(12,000 - 2,000) = \$3,333$$

$$\text{Depreciation in Year 2} = (4/15)(12,000 - 2,000) = \$2,667$$

$$\text{Book value end of Year 2} = \$12,000 - \$3,333 - \$2,667 = \mathbf{\$6,000}$$

Declining-Balance Depreciation

Declining-balance depreciation applies a constant depreciation % rate (D).

$$d_n = DB(1 - D)^{n-1}$$

$$= DBV_{n-1}$$

Declining-Balance Depreciation Example

Declining-balance depreciation applies a constant depreciation % rate (D).

$$d_n = DB(1 - D)^{n-1}$$

$$= DBV_{n-1}$$

Example:

- Cost of asset B = \$900
- Declining balance rate = 40%
- Salvage value = \$70
- Depreciation for year 1 = 40% x \$900 = \$360
- Remaining book value = \$540
- Depreciation for year 2 = 40% x \$540 = \$216

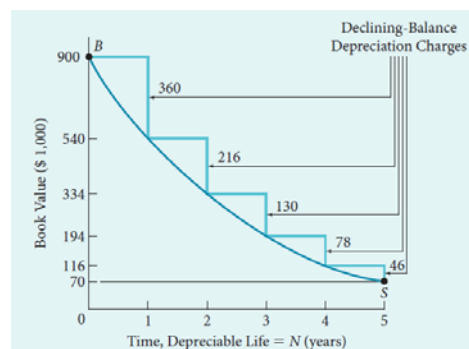


FIGURE 11-5 Declining-balance depreciation.

Declining Balance and Double Declining-Balance Depreciation

Declining balance rate: $D = \frac{1}{N}$

Double-Declining balance rate: $D = \frac{2}{N}$

Double-declining example:

Suppose original cost of asset = \$1,000, and asset expected to last 7 years ($N=7$)

Depreciation rate $D = 2/7 = 28.6\%$

Depreciation in year $t = d_t = D * \text{remaining book value}_{(t-1)}$

- Depreciation for year 1 = $28.6\% \times \$1,000 = \286
 - Remaining book value = \$714
- Depreciation for year 2 = $28.6\% \times \$714 = \204
 - Remaining book value \$510
- Depreciation for year 3 = $28.6\% \times \$510 = \146
 - Remaining book value \$364
- etc
- Note that the asset will NEVER fully depreciate using this method, but that isn't important
- Salvage value not used in calculation
- Other variants are possible (1.5x declining balance)

Unit-of-Production Depreciation

$$UOP \text{ depreciation} = \frac{\text{Production for Year}}{\text{Total lifetime production}} (B - S)$$

- Based on physical use of the asset, not time.
- The remaining value of the asset = the remaining physical amount of the asset
- Works well for supplies that you intend to use over many years.

Unit-of-Production Depreciation example

Example 11-5

$$UOP \text{ depreciation} = \frac{\text{Production for Year}}{\text{Total lifetime production}} (B - S)$$

- Capital cost \$900,000, Project life 5 years, Salvage value \$70,000
- 40,000 m³ of sand to be used:

Year	Sand required (m ³)
1	4,000
2	8,000
3	16,000
4	8,000
5	4,000

- Calculate UOP depreciation schedule.

Unit-of-Production Depreciation example

Example 11-5

$$\text{First - year UOP depreciation} = \frac{4,000}{40,000} (900,000 - 70,000) = \$83,000$$

Year	UOP Depreciation
1	\$ 83,000
2	\$ 166,000
3	\$ 332,000
4	\$ 166,000
5	\$ 83,000

Potential break point



Depreciation for Tax Purposes—Capital Cost Allowance

- Canada has legislation on how assets are depreciated.
- The terms used in Income Tax Act (tax code) are different:

Book Depreciation Term	Tax Depreciation Term
Asset	Property
Depreciation	Capital cost allowance
Cost base	Capital cost
Book value	Undepreciated capital cost
Salvage value	Proceeds from disposition

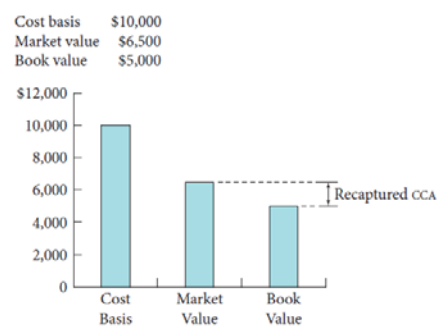
- There are different rates for different types of assets.
- The maximum capital cost allowance a company can take in one year is what would be sufficient to reduce taxable income to zero.
- Generally, only half of a given rate can be applied during the year that an asset is purchased (the first year of depreciation) – but there are exceptions.

Depreciation for Tax Purposes—Capital Cost Allowance

- First year depreciation $CCA_1 = P (d/2)$
- CCA depreciation in all other years:
- $CCA_n = P (1-d/2) (1-d)^{n-2} (d)$
- Note that this equation (Equation 11-7) is **WRONG** in the textbook. The above equation is **CORRECT**.
- <switch to CCA example worksheet>

Depreciation and Asset Disposal

- Taxes-owed changes based on different factors with respect to disposal:
 - Recaptured CCA (recaptured depreciation):
 - Occurs when an asset is sold for more than the book value
 - Is reported as ordinary income (for which a higher tax rate applies usually)

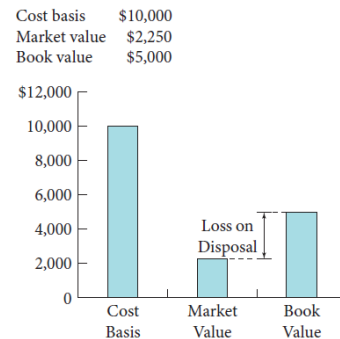


If Cost basis > Market value > Book value, there is Recaptured CCA.
 Recaptured CCA = Market value minus Book value = \$1,500

FIGURE 11-7 Recaptured CCA.

Depreciation and Asset Disposal, cont'd

- Loss on disposal
 - Occurs when the market value is less than the book value
 - Did not claim enough depreciation expense
 - Occurs when an asset is sold for less than the book value
 - Is reported as an ordinary loss

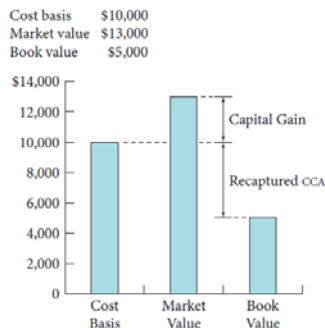


If Book value > Market value, there is a *loss on disposal*.
 Loss on disposal = Book value minus Market value = \$2,750

FIGURE 11-8 Loss on disposal.

Depreciation and Asset Disposal, cont'd

- Capital Gains
 - Occur when the asset is sold for more than its original cost
 - The excess over the original cost is a “capital gain.”
 - Occurs when an asset is sold for more than the cost basis (original value)
 - Is reported as a capital gain (for which a lower tax rate applies), IF the investment has been held long enough



If Market value > Cost basis, there is a *capital gain* plus *recaptured depreciation*.
 Capital gain = Market value minus Cost basis = \$3,000
 Recaptured depreciation = Cost basis minus Book value = \$5,000

FIGURE 11-9 Capital gain.

Reminder: Calculating Depreciation

- We've seen several different depreciation methods.

- Caution:

The book implies that you can use any of these methods to come up with depreciation numbers, and can use them to calculate your firm's taxes: that's often not the case.

Some countries allow multiple (less attractive) depreciation methods to be used for tax purposes.

For that reason, you'll see a lot of problems that I have modified from the textbook version, clarifying as "IF you could use this method to calculate your taxes..."

Most firms use these depreciation methods for financial statements (because they are closer to a true representation of the financial state of the business), **but use CCA method for tax preparation.**

Natural Resource Allowances

- Depletion

The consumption of exhaustible natural resources

Provinces own their resources and subsequently the rules are different across the country

- Two standard methods of calculating depletion:

- **Percentage Depletion**

A certain percentage of the property's gross income during the year

- **Cost Depletion**

- **Calculation uses:**

- property costs
- Estimated number of recoverable assets
- salvage value of property

Natural Resource Allowances, cont'd

EXAMPLE 11-7

A coal mine has a gross income of \$250,000 for the year. Mining expenses equal \$210,000. Compute the allowable percentage depletion deduction.

SOLUTION

From Table 11-2, coal has a 10% depletion allowance. The percentage depletion deduction is computed from gross mining income. Then the taxable income must be computed. The allowable percentage depletion deduction is limited to the computed percentage depletion or 50% of taxable income, whichever is smaller.

Table 11-2 Percentage Depletion Allowance for Selected Items

Type of Deposit	Percentage
Lead, zinc, nickel, sulphur, uranium	22
Oil and gas (small producers only)	15
Gold, silver, copper, iron ore	15
Coal and sodium chloride	10
Sand, gravel, stone, clam and oyster shells, brick, and tile clay	5
Most other minerals and metallic ores	14

Computed Percentage Depletion

Gross income from mine	\$250,000
Depletion percentage	× 10%
Computed percentage depletion	\$25,000

Taxable Income Limitation

Gross income from mine	\$250,000
Less: expenses other than depletion	− 210,000
Taxable income from mine	40,000
Deduction limitation	× 50%
Taxable income limitation	\$20,000

Since the taxable income limitation (\$20,000) is less than the computed percentage depletion (\$25,000), the allowable percentage depletion deduction is \$20,000.

Natural Resource Allowances, cont'd

EXAMPLE 11-7

Assume that an oil reservoir is estimated to contain 150,000 barrels (bbl.) and the investment cost to develop the reserve is \$1,250,000. Then the unit depletion rate would be calculated as
The depletion allowance for a year when 5,000 bbl. of oil were produced would be

$$\text{Number of units produced} \times \text{unit depletion rate} = 5,000 \times \$8.33 = \$41,667$$

As previously stated, in the case of mineral property and some oil and gas wells, the depletion deduction can be based on either cost or percentage depletion, depending upon the rules of the jurisdiction.

Natural Capital Assets

- What is natural capital?
- Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things.
- It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible.
- Examples:
 - land [food], forests [building material], watersheds [water], insects [pollination]
- Impact on economic systems:
 - Interest is growing in incorporating such assets into traditional accounting frameworks
 - In the past, such assets could be degraded or used up without accounting for the impacts on our economic systems
- Example story: Gibsons, BC
 - <https://gibsons.ca/sustainability/natural-assets/gibsons-natural-asset-management-journey/>