CHAPTER OBJECTIVES

After careful study of this chapter, you will be able to:

1. Identify the factors involved in depreciation.

2. Explain the alternative methods of cost allocation, including time-based and activity-based methods.

3. Record depreciation.

4. Explain the conceptual issues regarding depreciation methods.

5. Understand the disclosure of depreciation.

6. Understand additional depreciation methods, including group and composite methods.

7. Compute depreciation for partial periods.

8. Explain the impairment of property, plant, and equipment.

9. Understand depreciation for income tax purposes.

10. Explain changes and corrections of depreciation.

11. Understand and record depletion.
SYNOPSIS

Factors Involved in Depreciation

1. Depreciation is the process of allocating, in a systematic and rational manner, the total cost of an asset held for more than one year as an expense to each period benefited by the asset. The total expense or depreciation base (depreciable cost) involved is the difference between the purchase price and the estimated residual value. Depreciation is not an attempt to reflect the market value of an asset. Land, which generally has an unlimited life and a future selling price higher than its cost, is not depreciated.

2. The term depreciation describes the allocation of the cost of tangible assets, such as property, plant, and equipment. The term depletion describes the allocation of the cost of natural resource assets, such as oil, gas, minerals, and timber. The term amortization describes the allocation of the cost of intangible assets, such as patents and copyrights. "Amortization" is also sometimes used as a synonym for "depreciation" and "depletion."

3. A company considers four factors in computing a periodic depreciation charge: (a) asset cost, (b) service life, (c) residual value, and (d) method of cost allocation.

4. The cost of an asset includes all the acquisition costs required to obtain the benefits expected from the asset. These acquisition costs include the contract price, freight, assembly, installation, and testing costs.

5. Service life is a measure of the number of units of service expected from an asset before its disposal. A company may make this measurement in units of time or units of activity or output. Service life is limited by (a) physical causes, including wear and tear from use, deterioration from the passage of time, and damage and destruction, and (b) functional causes, through obsolescence and inadequacy.

6. The residual value (salvage value) of an asset is the net amount that can be expected to be obtained from the disposition of the asset at the end of its service life. Because the residual value is difficult to estimate, it is often ignored or recorded at a standard percentage of cost. Such treatments of the residual value are acceptable unless the effects are material. Sometimes a company expects an obligation related to the retirement of an asset at the end of its life. In this case, at the time of acquisition the company computes the present value of the obligation and records this amount both as an increase in the cost of the asset and as an obligation.

Methods of Cost Allocation

7. As a general principle, cost allocation methods must be "systematic and rational." To be systematic, a method must be determined by a formula and must not be arbitrary. To be rational, a method must relate each period's depreciation expense to the benefits generated in that period.

8. In practice, companies use either activity (or use) methods or time-based methods. Activity methods are appropriate when an asset's service life is affected primarily by the amount of usage, rather than by the passage of time. The measure of activity is usually hours worked or units of output. The depreciation rate is determined by dividing the asset's depreciable cost by an estimate of the asset's lifetime activity. Depreciation for the period is computed by multiplying this rate by the period's activity level. Companies seldom use activity methods for depreciation, however, because of the difficulties of estimation and the cost of measuring and recording the activity level of each asset for each period. In contrast, depletion (discussed later) is normally recorded using an activity method.
9. Time-based methods are appropriate when an asset's service life is affected primarily by the passage of time, rather than by the amount of usage. Time-based methods may be divided into two general categories: the straight-line method and the accelerated method. The straight-line method allocates a constant depreciation charge to each period of the asset's life. It is appropriate when the benefits from the asset are expected to remain approximately constant over the periods of use.

10. Accelerated (declining-charge) methods are appropriate when the benefits from the asset are expected to decline over each period of use. The selection of a particular declining depreciation method is basically arbitrary, because generally a specific declining depreciation method cannot be matched against the expected pattern of declining revenue. Accelerated methods include the sum-of-the-years'-digits method and declining-balance method.

11. Depreciation on merchandising assets and on assets used for selling, general, and administrative functions is expensed currently. However, depreciation charges are not always expensed immediately. A company initially capitalizes depreciation on its manufacturing assets as part of the cost of the inventory produced through an increase to its Goods in Process inventory account. When inventory is sold, the company reports this depreciation on the income statement as part of the cost of goods sold. The company carries depreciation on unsold units as part of the inventory asset value on its balance sheet.

Conceptual Evaluation of Depreciation Methods

12. The choice of a depreciation method can have a significant impact on a company's reported income and assets, although its total income over the life of the asset will be unaffected. In selecting a depreciation method, a company should attempt to match total costs (including expected repair and maintenance costs) associated with the asset with the benefits expected from that asset. A company should also consider the effect of changing prices and the risk associated with the cash flows from the asset. Depreciation is not a measurement of the value of an asset, and is not recorded to fund the replacement of an asset.

Disclosure of Depreciation

13. APB Opinion No. 12 requires a company to make the following disclosures related to its depreciation: (a) depreciation expense for the period, (b) balances of major classes of depreciable assets, by nature or function, at the balance sheet date, (c) accumulated depreciation, either by major classes of depreciable assets or in total, at the balance sheet date, and (d) a general description of the method or methods used in computing depreciation with respect to the major classes of depreciable assets.

Additional Depreciation Methods

14. A company using group depreciation capitalizes the cost of a group of homogeneous (similar) assets in a single asset account and depreciates the cost as a single asset. The company bases the group depreciation rate on the average life of the group assets and applies the rate each period to the balance in the group account. It accumulates depreciation in a single contra-asset account. The company records the retirement of an individual asset by a credit to the asset for the asset's original cost and a debit to accumulated depreciation for the difference between the cost and the proceeds received. It does not record a gain or loss on the assets until all assets in the group have been retired. Then the company recognizes a total net gain or loss on the group.
15. A company may use composite depreciation with heterogeneous (dissimilar) assets that have somewhat similar characteristics or purposes. It applies composite depreciation in the same way as group depreciation. Both group and composite depreciation simplify a company's recordkeeping, particularly for large numbers of low-cost items. However, the methods may mask faulty estimates and defer gains and losses beyond the period of occurrence.

16. Retirement and replacement methods recognize depreciation expense only when an asset is retired or replaced. A company using the retirement method expenses the cost of the old asset (less residual value) when the asset is retired. A company using the replacement method expenses the cost of the new asset (less residual value of the old asset) when it is acquired. Neither method matches expenses with revenues in each period of the asset’s life. However, retirement and replacement methods are sometimes used by railroads and public utilities.

Depreciation for Partial Periods

17. Companies commonly use three alternatives to compute depreciation on assets purchased or sold during the year:

(a) Depreciation may be computed to the nearest whole month, considering assets purchased on or before the 15th of the month as owned for the whole month, and assets purchased after the 15th as not owned during the month.

(b) Depreciation may be computed to the nearest whole year, considering assets purchased during the first six months as owned for the whole year, and assets purchased during the last six months as not owned during the year.

(c) One-half year’s depreciation may be charged on all assets purchased or sold during the year.

Impairment of Property, Plant and Equipment

18. GAAP requires that a company review its property, plant, and equipment for impairment when events or changes in circumstances indicate that the book value of these assets may not be recoverable. To test for impairment, a company compares the total expected cash flows (undiscounted) of an asset with the asset's book value. If future net cash flows are lower than book value, the company recognizes an impairment loss. For this comparison the company groups assets at the lowest level at which identifiable cash flows are largely independent of the cash flows of other groups of assets.

19. The impairment loss is the difference between the asset’s book value and its lower fair value. The fair value is the amount at which the asset could be sold in a current transaction between market participants. If quoted market prices are not available, then the fair value may be measured by the present value method. The discount rate used is the rate of return that the company requires for similar investments with similar risks. The company includes the impairment loss in income from continuing operations on the income statement and reports the new lower book value on the company’s ending balance sheet.

20. Disclosures regarding a write-down include a description of the impaired asset and the circumstances of the impairment, the amount of the loss, the method of determining fair value, the income statement caption that includes the loss, and the operating segment affected, if applicable.

21. Financial reporting is enhanced by the requirements of FASB Statement No. 144: a company recognizes an impairment loss when it occurs, and the company reports its productive assets at their fair values. However, dissenters criticize the use of fair value as a departure from transaction based historical cost and point out that a current write-down will ensure future profits.
22. International standards for the impairment of assets are similar to U.S. standards. However, international standards use an asset’s selling price to measure the impairment loss, and also allow impairment losses to be reversed.

**Depreciation and Income Taxes**

23. The purpose of income-tax depreciation methods is to stimulate capital investment through rapid capital-cost recovery. In contrast, accounting depreciation is used in the determination of accounting income, whose purpose is to fairly represent the results of the company’s activities for a period. The use of different depreciation methods for income tax reporting and financial reporting is acceptable and common.

24. For assets purchased before 1981, the methods described earlier are required for income tax reporting. For assets purchased in the years 1981 through 1986, the Accelerated Cost Recovery System (ACRS) is used. MACRS (Modified ACRS) rules apply to assets purchased in 1987 and later. MACRS depreciation differs from depreciation for financial reporting in three major ways: (a) the MACRS-mandated tax life is usually shorter than the economic life of the asset, (b) MACRS accelerates cost recovery (except for buildings), and (c) MACRS ignores residual value. Each difference lowers income taxes payable in the early years of the asset's life. However, over the asset's total life, the sum of total depreciation and the gain or loss on disposal will be equal under income tax and financial reporting.

25. MACRS specifies lives (recovery periods) to be used for classes of assets. The following methods are specified:

<table>
<thead>
<tr>
<th>Method</th>
<th>MACRS Life (in Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double-declining balance</td>
<td>3, 5, 7, 10</td>
</tr>
<tr>
<td>150% declining balance</td>
<td>15, 20</td>
</tr>
<tr>
<td>Straight-line</td>
<td>27½, 39</td>
</tr>
</tbody>
</table>

One-half year's depreciation is recorded in the year of acquisition and in the last year of the MACRS life. Residual value is not considered under MACRS. The IRS has published tables to simplify the MACRS calculations; these tables are illustrated in Exhibit 11-3 of the main text.

26. Companies may use the straight-line method over the mandated life as an alternative to MACRS for income tax reporting.

**Changes and Corrections of Depreciation**

27. FASB Statement No. 154, which is discussed fully in Chapter 23, specifies how a company makes changes and corrections in depreciation for the following situations:

(a) A change in an estimate of the residual value or service life of a currently owned asset is accounted for prospectively, allocating the undepreciated cost over the new remaining life, considering the new residual value.

(b) A change in the depreciation method for a currently owned asset is also accounted for prospectively.

(c) A correction of an error in depreciation is accounted for as a prior period adjustment to correct the company's previous financial statements, and an adjustment of the accumulated depreciation and retained earnings.
Depletion

28. Depletion, the allocation of the depletable cost of the consumption of a natural resource (wasting asset) to the periods when benefits are received, is normally recorded on the basis of an activity method. The total number of units expected to be extracted is the activity measure. When additional capital expenditures are made or estimates are revised, the company calculates a new depletion rate.

29. Tangible assets, such as buildings, whose useful life is dependent on the life of the natural resource, are depreciated over the shorter of the life of the resource (using the same activity method) or the life of the asset itself.

30. For income tax purposes, a company may use percentage depletion (statutory depletion) instead of the cost depletion described earlier. Under percentage depletion, a stated percentage of gross income may be deducted as depletion expense. Percentage depletion over the life of the asset may exceed the cost of the asset less the expected residual value. Percentage depletion is not acceptable for financial reporting.

SELF-EVALUATION EXERCISES

True-False Questions

Determine whether each of the following statements is true or false.

1. The straight-line method of depreciation is appropriate when benefits to be received from an asset are expected to remain constant over the asset’s service life.

   Answer: True

   If an asset’s benefits are to be received evenly over the life of the asset, then straight-line depreciation would appropriately match the expense of the cost of the asset to the periods in which the benefits are received.

2. The sum-of-the-years’-digits method of depreciation ignores residual value.

   Answer: False

   Sum-of-the-years’-digits uses the depreciable base of an asset to determine the appropriate amount of depreciation expense in any period. The depreciable base of an asset is the asset’s cost less any residual value; therefore, the sum-of-the-years’-digits method of depreciation does not ignore residual value.

3. The choice of depreciation method will have no effect on total income over the life of an asset.

   Answer: True

   The choice of depreciation method may have an effect on income in any one period but it will not have an effect on income over the life of an asset. No matter which depreciation method is used, the total amount of depreciation to be taken over an asset’s life is fixed and depends on the asset’s cost minus residual value. Therefore, all methods will depreciate the same amount for each asset and have no effect on income over the life of an asset.
4. Composite depreciation is appropriate only for homogeneous or similar assets.  
   **Answer: False**  
   Composite depreciation is used for heterogeneous (dissimilar) assets. Group depreciation is used for homogeneous (similar) assets.

5. For financial reporting, depletion is normally charged on the basis of an activity method.  
   **Answer: True**  
   Depletion is normally charged on an activity base (such as barrels of oil, or board feet of lumber) for financial reporting basis. For tax purposes, natural resources are usually reported as a percentage of gross income. This percentage method is not allowed for financial reporting purposes.

6. Over an asset's total life, the sum of total depreciation and gain or loss on disposal will be equal under tax and financial reporting.  
   **Answer: False**  
   Using MACRS for tax reporting, the concept of residual value is not used and companies may and do depreciate assets completely to a zero value. When this is done, any proceeds at a sale are considered a gain for tax purposes.

7. MACRS specifies use of the double-declining balance method for assets with a life (recovery period) of 15 years.  
   **Answer: False**  
   MACRS specifies the use of a 150%-declining balance for 15- and 20-year assets. Double-declining balance is used for 3-, 5-, 7-, and 10-year assets under MACRS.

8. A change in an estimate of residual value or service life of a currently owned asset should be accounted for by a retrospective change in depreciation expenses charged.  
   **Answer: False**  
   Changes in estimates of residual value or service life of a currently owned asset should be accounted for prospectively, not retrospectively.

9. The term "depletion" describes the amortization of intangible assets.  
   **Answer: False**  
   Depletion is the allocation of costs for natural resources. Amortization is the term used for the systematic and rational expensing of the costs associated with intangible assets.

10. The purposes of depreciation for financial reporting and income tax reporting are the same.  
    **Answer: False**  
    The purpose of depreciation methods for income tax accounting is to stimulate capital investment through the rapid recovery of capital costs. The purpose of depreciation for financial accounting purposes is to fairly present the activities of the company over a particular period.

11. According to generally accepted accounting principles, one-half year's depreciation must be taken on assets purchased or sold during the year.  
    **Answer: False**  
    Generally accepted accounting principles do not dictate what method is to be used for assets used or purchased during the year and provide three alternatives: 1) nearest whole month; 2) nearest whole year; and 3) one-half year on all assets purchased or sold during the year.
12. An asset’s service life may be limited by functional causes long before the asset has physically deteriorated.  
Answer: True  
Service life is determined by both physical causes (wear and tear, etc.) and functional causes (obsolescence or inadequacy). An asset may still be physically functional but be obsolete and therefore be at the end of its service life.

13. The unit depletion rate of a natural resource equals the cost of the asset, net of residual value, divided by the estimated number of units of the resource.  
Answer: True  
The unit depletion rate of a natural resource is the amount of cost that will be consumed (cost less residual value) divided by the number of output units expected.

14. Land, which is assumed to have an unlimited life, is not depreciated.  
Answer: True  
Land is not considered to have a limited economic life and therefore cannot be depreciated because the time period is undefined. Also, the residual value of land is usually more than the original cost of the land.

15. Depreciation, depletion, and amortization are recorded to reflect the market value of owned assets.  
Answer: False  
Depreciation, depletion, and amortization have nothing to do with market value of the assets. Instead, they are a process of rationally and systematically allocating the costs of these assets over the period in which they contribute to the company. Again, depreciation has nothing to do with market value of assets.

16. When evaluating the impairment of an asset, a company compares the total discounted cash flows expected from the asset with the asset’s book value.  
Answer: False  
The impairment test for an asset is to compare the asset’s book value and the future net expected cash flows. These cash flows are not discounted.

17. Once a method of depreciation is chosen, that method must be used for the life of the asset.  
Answer: False  
Changes between depreciation methods are allowed but they should not be arbitrary. Instead, any change should be based on systematic and rational decisions and based on allocating the cost of the asset to the expected pattern of benefits to be received from the asset.

18. Activity-based depreciation is the most commonly used method.  
Answer: False  
For many assets, the activity-based method would seem most appropriate but in reality it is seldom used. The reason it is seldom used is the difficulty of recording and tracking the information required to determine depreciation costs.
Multiple Choice Questions

Select the one best answer for each of the following questions.

1. The Osage Company uses the sum-of-the-years'-digits method of depreciation and computes depreciation to the nearest whole year. What amount should Osage record for second-year depreciation of a chain saw (purchased in April) costing $500, with an expected life of 5 years and an expected residual value of $50
   (a) $120
   (b) $150
   (c) $100
   (d) $132

   Answer: (a) $120

   Osage computes depreciation to the nearest year, which means that items purchased before June 30 get a full year of depreciation in the year of purchases. Items purchased after July 1 do not get any depreciation in the year of purchase. Because the chain saw was purchased in April, it will receive a full year for the first year. The amount of the depreciable base is $450 ($500 cost − $50 residual value). In the sum-of-the-years'-digits method the denominator for 5 years' service life is 15 (5 + 4 + 3 + 2 + 1 = 15). Because this is the second year, the numerator will be 4. Therefore, the second year depreciation is $120 ($450 × 4/15 = $120).

   Choice (b) is incorrect because $150 would be the first year of depreciation ($450 × 5/15 = $150). Because the saw was purchased in April, the year of purchase would receive the first year of depreciation. Choice (c) is incorrect because this would be the straight-line total if residual value were ignored. Choice (d) is also incorrect.

2. Which of the following depreciation-related disclosures is not required under APB Opinion No. 12?
   (a) depreciation expense for the period
   (b) accumulated depreciation, either by major classes of assets or in total
   (c) a general description of the depreciation method or methods used
   (d) disclosure in the notes to the financial statements of straight-line depreciation if a declining-balance method was used

   Answer: (d) disclosure in the notes to the financial statements of straight-line depreciation if a declining-balance method was used

   There is no requirement to list the straight-line amount of depreciation if an alternative form of depreciation calculation is used. Choices (a), (b), and (c) are all incorrect because these items are required by APB Opinion No. 12 to be disclosed.

3. Which of the following is not a characteristic of MACRS?
   (a) MACRS uses shorter asset lives.
   (b) MACRS increases income in the early years of the asset’s life.
   (c) MACRS accelerates cost recovery.
   (d) MACRS ignores residual value.

   Answer: (b) MACRS increases income in the early years of the asset's life.

   Under MACRS, cost recovery is accelerated through depreciation expense. Because this expense is accelerated, there is more expense in the early years and therefore less income. Therefore, MACRS does not increase income in the early years of an asset’s life.

   Choice (a) is incorrect because MACRS does have shorter asset lives. Choice (c) is incorrect because MACRS does accelerate cost recovery. Choice (d) is incorrect because MACRS ignores residual value.
4. The Pommel Company uses the double-declining balance method of depreciation and charges one-half year's depreciation on assets purchased. What amount should Pommel record for first-year depreciation of an asset with a list price of $500, delivery charges of $80, an estimated life of 5 years, and an expected residual value of $100?

(a) $58
(b) $96
(c) $116
(d) $232

Answer: (c) $116

The first step is to determine the asset’s cost. In this example, the cost would be $580, which includes the actual price of the asset plus the delivery charge. In the double-declining balance method, the percentage that would be charged for straight-line is doubled. Because the asset has a service life of five years, the straight-line method would result in a depreciation percentage of 20%; therefore, in double-declining balance we will use 40% ($2 \times 20\% = 40\%). Double-declining balance ignores the residual value when determining the depreciation charge. Therefore, the initial calculation for this asset is $580 \times 40\% = 232$. However, because Pommel charges one-half year's depreciation, the amount calculated for the first year will be divided by 2 to determine the answer. Therefore, the correct answer is $232/2 = $116.$

Choice (a) is incorrect because this would represent one-half of the straight-line method. Choice (b) is incorrect because this answer used the sum-of-the-years'-digits method and not the double-declining balance method. Choice (d) is incorrect because this is the amount of a full year's worth of depreciation. Pommel only charges one-half year in the year purchased.

5. The factors involved in computing periodic depreciation charges do not include:

(a) asset cost.
(b) service life.
(c) current value.
(d) residual value.

Answer: (c) current value.

The factors involved in computing depreciation charges are asset cost, service life, and residual value. Current value is not used for depreciation because depreciation is designed to allocate cost, not determine value.

Choices (a), (b), and (d) are incorrect because they are all factors involved in the calculation of periodic depreciation charges.

6. The depreciable cost of an asset does not include:

(a) maintenance costs.
(b) acquisition cost.
(c) installation costs.
(d) costs of preparation for use.

Answer: (a) maintenance costs.

Maintenance costs are not part of the depreciable cost of an asset. Remember from Chapter 10 that maintenance costs are expensed as incurred, not capitalized.

The depreciable cost of an asset includes the cost of the asset and all other charges required to get the asset to perform its intended function. Choices (b), (c), and (d) are incorrect because these costs are required to get the asset ready to perform its intended function.
7. Which of the following methods will produce the largest amount of first-year depreciation of an asset with a five-year service life and no residual value?
   (a) straight-line
   (b) sum-of-the-years'-digits
   (c) double-declining balance
   (d) Not enough information given to answer the question.

   **Answer:** (c) double-declining balance

   To answer this question you need to calculate what percentage of cost each method would use for first-year depreciation. In straight-line the percentage would be 1/5th or 20% of the asset's depreciable base. Double-declining balance doubles straight-line so it would produce 40% of the asset's costs. Sum-of-the-years'-digits would produce 33% (5 ÷ 15). Therefore, double-declining balance produces the largest first-year depreciation. This can be determined without having full knowledge of the asset's cost.

8. The straight-line method of depreciation is an example of:
   (a) an activity method.
   (b) a declining-charge method.
   (c) a time-based method.
   (d) an accelerated method.

   **Answer:** (c) a time-based method.

   The straight-line method is based on the number of years of an asset's service life; therefore, it is a time-based method.

   Choice (a) is incorrect because the amount of activity of the assets has no bearing on the depreciation charge under the straight-line method. Choices (b) and (d) are incorrect because straight-line produces a constant charge and does not decline or accelerate over time. A declining-charge method and an accelerated method (which are the same thing) are examples of a time-based activity, but that is not what the question asked.

9. Company A and Company B each purchased a $50,000 asset with an expected life of 10 years on January 1, 2011. Company A uses the straight-line method, and Company B uses the double-declining balance method. Each company had the same sales and expenses other than the depreciation on this asset in 2011. Which of the following statements is true?
   (a) Company A's method is appropriate for an asset whose benefits are expected to decline over the periods of use.
   (b) Company B's 2011 net income is lower than Company A's.
   (c) Company A and Company B have the same net income.
   (d) Company B uses an activity method of depreciation.

   **Answer:** (b) Company B's 2011 net income is lower than Company A's.

   Because Company A and B have the same sales and other expenses, the only difference in their net income would be from the depreciation expense on this asset. Because Company B is using an accelerated method (double-declining balance), their expenses would be higher in 2011, which results in lower net income.

   Choice (a) is incorrect because Company A is using the straight-line method, which gives a constant depreciation expense over the life of an asset. A more appropriate choice for an asset whose benefits are expected to decline over time would be one of the accelerated methods. Choice (c) is incorrect because while their sales and other expenses are the same, the depreciation expense for B is larger than A so they could not have the same net income. Choice (d) is incorrect because double-declining balance is a time-based depreciation method, not an activity method.
10. Which of the following methods is in use when a number of homogeneous or similar assets are capitalized in a single asset account and depreciated as a single asset?
   (a) composite method
   (b) activity method
   (c) group method
   (d) none of the above

   Answer: (c) group method
   The group method is used for homogenous assets. The assets are capitalized in a single asset account and depreciated as a single asset. Choice (a) is incorrect because the composite method is for heterogeneous assets, not homogeneous. Choice (b) is incorrect because the activity method does not group assets together. Instead, it bases depreciation charges on the output or usage of individual assets. Choice (d) is incorrect because choice (c) is the correct answer.

11. Which of the following statements regarding impaired assets is true?
   (a) An impairment loss is included in income from continuing operations on the income statement.
   (b) A company reviews a productive asset for impairment when events or circumstances indicate that the asset's book value is overstated.
   (c) After an impairment loss is recognized, the productive asset is reported at its fair value.
   (d) All of the above.

   Answer: (d) All of the above.
   All of the choices for this question are correct. A company tests for impairment by comparing an asset's book value with the future net cash flows expected to result from the use of the asset. If these total cash flows are less than the book value then the book value is overstated (Choice (b)) and an impairment loss must be reported. An impairment loss is included as part of income from continuing operations (Choice (a)). The reduced book value (i.e., fair value) becomes the amount that is reported in the balance sheet (Choice (c)).

Use the following information for questions 12 through 14:

Heideman Painting, Inc. purchased new painting equipment at a cost of $35,000 on January 1, 2011. The equipment is expected to have a five-year service life and a residual value of $2,500.

Note: Round all of your answers to the nearest dollar.
12. If the equipment is depreciated using the sum-of-the-years'-digits method, what would be the depreciation expense for 2012 and the book value on December 31, 2012?
   (a) Depreciation Expense = $8,667; Book value = $15,500
   (b) Depreciation Expense = $8,667; Book value = $24,167
   (c) Depreciation Expense = $6,500; Book value = $22,000
   (d) Depreciation Expense = $10,833; Book value = $24,167

   **Answer:** (a) Depreciation Expense = $8,667; Book value = $15,500

   The sum-of-the-years'-digits method denominator for a five-year service life asset would be 15 (5 + 4 + 3 + 2 + 1 = 15). Because this is the second year and there are four years remaining, the numerator would be 4; therefore to determine the amount of depreciation expense you would multiply 4/15 by the depreciable base of the painting equipment, which is $32,500 (cost ($35,000) – residual value ($2,500)). This would give you depreciation expense for the second year of $8,667. Book value would be cost ($35,000) − year 1 depreciation expense of $10,833 (5/15 × $32,500) − year 2 depreciation expense of $8,667. Thus, the book value at the end of year 2 is $15,500 ($35,000 − $10,833 − $8,667).

   Choice (b) is incorrect. The depreciation expense is correct, but the book value only includes year 1 depreciation. Choice (c) is incorrect because this is the amount for straight-line depreciation. Choice (d) is incorrect because this is for year 1 depreciation expense and book value.

13. If the equipment is depreciated using the double-declining balance method, what would be the depreciation expense for 2012 and the book value on December 31, 2012?
   (a) Depreciation Expense = $8,400; Book value = $21,000
   (b) Depreciation Expense = $14,000; Book value = $21,000
   (c) Depreciation Expense = $8,667; Book value = $15,500
   (d) Depreciation Expense = $8,400; Book value = $12,600

   **Answer:** (d) Depreciation Expense = $8,400; Book value = $12,600

   For double-declining balance, you take the depreciation percentage for the straight-line method (1/5 or 20%) and double that to 40% to find the rate that is applied to the current book value. For year 1 the beginning book value is the asset's cost ($35,000); therefore depreciation expense is $14,000 (40% × $35,000). For year 2 depreciation expense, you need to subtract the amount of year 1 depreciation to determine the beginning book value ($35,000 - $14,000 = $21,000) and multiply this by the depreciation percentage. Therefore, the year 2 depreciation expense is $8,400 ($21,000 × 40%). The book value at the end of year 2 would be the book value at the start of year 2 ($21,000) less the year 2 depreciation ($8,400); therefore book value at the end of year 2 is $12,600.

   Choice (a) is incorrect. This is the correct depreciation expense for year 2 using the double-declining balance method, but the book value is year 1's amount. Choice (b) is incorrect because this is the depreciation expense and book value for year 1 using the double-declining balance method. Choice (c) is incorrect because this is the amount for the sum-of-the-years'-digits method amount.
14. If the equipment is depreciated using the straight-line method, what would be the depreciation expense for 2012 and the book value on December 31, 2012?

(a) Depreciation Expense = $8,667; Book value = $15,500
(b) Depreciation Expense = $6,500; Book value = $22,000
(c) Depreciation Expense = $6,500; Book value = $28,500
(d) Depreciation Expense = $7,000; Book value = $21,000

Answer: (b) Depreciation Expense = $6,500; Book value = $22,000

To find the annual depreciation expense for the straight-line method you take the depreciable base of $32,500 (cost ($35,000) – residual value ($2,500)) and divide by the expected service life of 5 years. This gives an annual depreciation expense of $6,500 ($32,500 ÷ 5). This amount is the same for each year. The book value at the end of year 2 would be the cost ($35,000) – two years' annual depreciation (2 × $6,500); therefore the book value is $22,000.

Choice (a) is incorrect because this is the value for the sum-of-the-years'-digits method. Choice (c) is incorrect because this is the year 1 totals for the straight-line method. Choice (d) is incorrect because this method used cost to calculate the depreciation expense, not cost – residual value.

Problem-Solving Strategies

<table>
<thead>
<tr>
<th>Strategy:</th>
<th>Many students think that depreciation is a way of determining fairness of the value of an asset. This is definitely not true. Depreciation is nothing more than a method of cost allocation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy:</td>
<td>Remember:</td>
</tr>
<tr>
<td>Book Value ≠ Fair Value</td>
<td>Depreciation = Cost Allocation</td>
</tr>
</tbody>
</table>

There are several methods for determining depreciation and we will discuss the most frequently used. To facilitate the discussion of depreciation calculations we will use the same information for each method we discuss. This will allow us to see the similarities and differences. For these problems, we will use the following information:

Heideman Painting Inc. purchases a large piece of painting equipment for use in their business. The equipment was purchased on January 1, 2011, at a total cost of $175,000. The equipment is expected to last for four years and have a residual value of $25,000 at the end of the four years. In addition, it is anticipated that it will last a total of 20,000 hours.

The three items required to calculate depreciation under any method is the asset’s cost ($175,000), the asset’s expected service life (4 years or 20,000 hours omit this part it’s not used), and if the asset will have any residual value at disposal ($25,000).
**Time-based Methods:**

**Straight-line**

Perhaps the easiest depreciation method to compute and to understand is the straight-line method. In this method, the costs of the asset are allocated equally over the service life. To calculate the annual depreciation expense for the straight-line method we use the following equation:

\[
\text{Depreciation Expense} = \frac{\text{Cost} - \text{Residual Value}}{\text{Service Life}}
\]

Applying our example to this equation, we find the following:

\[
\begin{align*}
37,500 & = \frac{175,000 - 25,000}{4 \text{ years}} \\
\end{align*}
\]

So our annual depreciation expense over the entire four-year service life is $37,500 per year. Over the entire life of the asset, we would have:

<table>
<thead>
<tr>
<th>Year of year</th>
<th>BV at beginning of year</th>
<th>Depreciation expense</th>
<th>BV at end of year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$175,000</td>
<td>$37,500</td>
<td>$137,500</td>
</tr>
<tr>
<td>2012</td>
<td>$137,500.00</td>
<td>37,500</td>
<td>100,000</td>
</tr>
<tr>
<td>2012</td>
<td>$100,000.00</td>
<td>37,500</td>
<td>62,500</td>
</tr>
<tr>
<td>2013</td>
<td>$62,500.00</td>
<td>37,500</td>
<td>25,000</td>
</tr>
</tbody>
</table>

**Sum-of-the-Years'-Digits**

The sum-of-the-years'-digits method is also a time-based method but it is accelerated, which is sometimes called a declining charge. This method might be used when the productive capacity of an asset decreases over time or as more units are used. A company using the sum-of-the-years'-digits method computes the depreciation charge by multiplying the asset's depreciation base (cost less residual value) by a declining fraction. The denominator of that fraction is the sum of the digits of the asset's estimated life. In our example, it would be 10 (1 + 2 + 3 + 4 = 10). The numerator is determined by taking those digits in reverse order (4, 3, 2, and 1). Another way to look at the amount in the numerator is to think of the number of years of service life remaining. In our example, to calculate the first year of depreciation we would realize that we have four years of life left; therefore 4 would be the numerator. Based on this the equation for year 1 of depreciation expense would be:

\[
\text{Depreciation Expense} = \left( \frac{\text{Cost} - \text{Residual Value}}{10} \right) \times 4
\]

\[
\begin{align*}
60,000 & = \left( \frac{175,000 - 25,000}{10} \right) \times 4 \\
\end{align*}
\]
Over the entire life of the asset, we would have:

<table>
<thead>
<tr>
<th>Year</th>
<th>Depreciation Base</th>
<th>Fraction</th>
<th>Depreciation expense</th>
<th>BV at end of year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$150,000</td>
<td>4/10</td>
<td>$60,000</td>
<td>$115,000</td>
</tr>
<tr>
<td>2012</td>
<td>$150,000</td>
<td>3/10</td>
<td>45,000</td>
<td>70,000</td>
</tr>
<tr>
<td>2013</td>
<td>$150,000</td>
<td>2/10</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td>2014</td>
<td>$150,000</td>
<td>1/10</td>
<td>15,000</td>
<td>25,000</td>
</tr>
</tbody>
</table>

**Declining-Balance**

Another form of accelerated depreciation is the declining-balance method. Like the straight-line and sum-of-the-years'-digits, it is also a time-based method. The declining-balance determines depreciation expense each year by applying a constant rate to the book value at the beginning of each period.

**Strategy:** Note that in the declining-balance method the book value is used and not the depreciable base. Therefore, we do not need to know the residual value of the asset to calculate the depreciation expense. Because the book value changes each year, this method will produce a declining depreciation expense despite using a constant rate.

**Strategy:** You must be careful using this method to not depreciate more than the depreciable base of the asset.

The actual rate determined is based on the straight-line rate. The most common method is the double declining method. This method takes the name "double" because the constant rate used is double the rate of the straight-line method. The highest rate allowed for both income tax and financial reporting is twice the straight-line rate.

Over the entire life of the asset, we would have:

<table>
<thead>
<tr>
<th>Year</th>
<th>BV at beginning of year</th>
<th>Rate</th>
<th>Depreciation expense</th>
<th>BV at end of year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$175,000</td>
<td>40%</td>
<td>$70,000</td>
<td>$105,000</td>
</tr>
<tr>
<td>2012</td>
<td>105,000</td>
<td>40%</td>
<td>42,000</td>
<td>63,000</td>
</tr>
<tr>
<td>2013</td>
<td>63,000</td>
<td>40%</td>
<td>25,200</td>
<td>37,800</td>
</tr>
<tr>
<td>2014</td>
<td>37,800</td>
<td>40%</td>
<td>12,800*</td>
<td>25,000</td>
</tr>
<tr>
<td>Total</td>
<td>N/A</td>
<td>N/A</td>
<td>$150,000</td>
<td>N/A</td>
</tr>
</tbody>
</table>

\* Notice that the last entry was for only $12,800 of depreciation expense. A full 40% of the beginning book value of $37,800 would have resulted in a depreciation expense of $15,120. The double-declining balance method does not consider the residual value of the asset. Using the $15,120 amount would mean that the book value at the end of the year would be less than the $25,000 residual value. This is not allowed, so for the last entry we limited depreciation expense to $12,800 so that ending book value would equal the residual value of $25,000. Also note that we added a total to the depreciation expense column that lets us know that we have depreciated the $150,000 of the depreciable base (Cost ($175,000) − residual value ($25,000)).

It should be noted that many companies avoid the problem of potentially depreciating too much of an asset that we described earlier by switching from the double-declining balance method during the life of the asset.
Activity Methods

An asset whose service life is primarily affected by usage and not the passage of time should use an activity method of depreciation. However, "should" does not mean required and most companies do not use an activity method because of the added cost to maintain records and update individual depreciation accounts.

The activity method uses the following equation to calculate depreciation rate:

\[
\text{Depreciation Expense} = \frac{\text{Cost} - \text{Residual Value}}{\text{Total Lifetime Activity Level}}
\]

**Strategy:** Notice that the equation for depreciation expense for the activity method is the same equation that we use for straight-line depreciation except that we measure the service life of an asset in something other than the passage of time.

The total lifetime activity level can be expressed in hours or whatever activity or output can be measured. Some common examples would be miles driven for a truck, or hours flown for an aircraft engine, or number of parts produced for a manufacturing piece of equipment. In our example, we estimated service life as 20,000 hours of operation. Therefore, our depreciation expense is $7.50 per hour based on this calculation:

\[
$7.50 \text{ per hour} = \frac{\$175,000 - \$25,000}{20,000 \text{ hours}}
\]

Once this charge is determined, we just add up the amount of hours the equipment was used in the period and multiply that by $7.50 to determine the depreciation expense for the asset. For example, if we used the equipment for 1,537 hours in the first year, the depreciation charge would be:

\[
1,537 \times $7.50 = $11,527.50
\]

Recording Depreciation

A company includes the depreciation on manufacturing assets as a cost of the inventory produced and records depreciation as an increase (debit) to the Work in Process Inventory account.

If the asset is not part of the manufacturing process, the debit would be to an expense account.

The credit for recording depreciation is to a contra-asset account called Accumulated Depreciation. A company will report this as a deduction from property, plant, and equipment to arrive at a book value for the property, plant, and equipment.

Group and Composite Depreciation

Group and composite depreciation are methods to apply depreciation to more than one asset. Group depreciation is applied to homogeneous assets that are expected to have similar service lives and residual values. Composite depreciation is applied to heterogeneous assets having similar characteristics but varying service lives and residual values.
Partial Period Depreciation

When assets are purchased and sold at dates other than the beginning of the year or the end of the year, we must account for partial depreciation. We could calculate depreciation to the nearest day, but when you have a company with thousands of purchases in a year, the complications caused by trying to keep track of each asset and its date of purchase would be costly and complex. Because of this, there are three alternate methods to deal with partial period depreciation: (1) nearest whole month; (2) nearest whole year; and (3) midyear convention.

Nearest Whole Month

Using this method, assets purchased in the first half of the month (15th) are considered to be owned for the whole month and assets purchased in the second half of the month are not considered to be owned until the following month. When the asset is sold the asset is considered sold at the beginning of the month if it is sold before the middle of the month or considered sold at the end of the month if sold after the middle of the month.

For straight-line depreciation, you would then use the number of months as a fraction of the 12 months' total to determine partial year's depreciation. Assume in our example that Heideman Painting purchased the equipment on August 17. The annual depreciation expense does not change and is still $37,500 per year (($175,000 − $25,000)/4). However, because the asset was not purchased on January 1 we need to determine how long we owned it in the year of purchase. Using the nearest whole month, we would conclude that August 17 is closer to September 1 than it is to August 1 so we would not count any of August for depreciation. This would leave us with September, October, November, and December for a total of four months. Therefore, our depreciation expense for this first year would be:

\[
$20,000 = \frac{4}{12} \times 37,500
\]

With the sum-of-the-years'-digits and declining-balance methods, it is a little more difficult. This is because each year has a different amount of depreciation expense. For example, in year 1 under the declining-balance method, the depreciation expense is $70,000. In year 2, it is $42,000. The first year would be calculated the same as under the straight-line method:

\[
$23,333 = \frac{4}{12} \times 70,000
\]

The second year creates a problem because we still have 8/12 of the $70,000 of year 1 before we get to year 2’s $42,000. What we would do is add the remaining 8 months of year 1 and the first 4 months of year 2. The total depreciation would look like this:

<table>
<thead>
<tr>
<th>Annual Depreciation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Expense</td>
</tr>
<tr>
<td>1</td>
<td>$70,000</td>
</tr>
<tr>
<td>2</td>
<td>42,000</td>
</tr>
<tr>
<td>3</td>
<td>25,200</td>
</tr>
<tr>
<td>4</td>
<td>12,800*</td>
</tr>
<tr>
<td>Total</td>
<td>$150,000</td>
</tr>
</tbody>
</table>
### Annual Depreciation

<table>
<thead>
<tr>
<th>Year</th>
<th>Months</th>
<th>Computation</th>
<th>Annual Depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>4</td>
<td>$70,000</td>
<td>$23,333</td>
</tr>
<tr>
<td>2012</td>
<td>12</td>
<td>$70,000 + $42,000</td>
<td>60,667</td>
</tr>
<tr>
<td>2013</td>
<td>12</td>
<td>$42,000 + $25,200</td>
<td>36,400</td>
</tr>
<tr>
<td>2014</td>
<td>8</td>
<td>$25,200 + $12,800</td>
<td>21,067</td>
</tr>
<tr>
<td>2015</td>
<td>8</td>
<td>$12,800</td>
<td>8,533</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$150,000</td>
</tr>
</tbody>
</table>

Notice that the same amount was depreciated over the life of the equipment; just the amounts in the years have changed.

### Nearest Whole Year

This method is the same as the nearest whole month except six months is used instead of the middle of the month. In other words, a piece of equipment purchased in the first six months of the year would receive depreciation expense for the entire year and a piece of equipment purchased in the last six months of the year would not receive depreciation expense until the next year. Sales, as in the nearest whole month method, are just the opposite.

### Mid-Year Convention

Using this method (which in general is also used for income tax purposes), an asset is assumed to be purchased at the midpoint of the year (July 1 for calendar-year companies) and disposed of at the midpoint of the year, regardless of when the actual purchase and disposal occurred. This results in a half year of depreciation in the first and last year and full years’ depreciation in the other years.

Using the same double declining-balance example, it would look like this:

<table>
<thead>
<tr>
<th>Year</th>
<th>Computation</th>
<th>Annual Depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1/2 × $70,000</td>
<td>$35,000</td>
</tr>
<tr>
<td>2012</td>
<td>1/2 × $70,000 + 1/2 × $42,000</td>
<td>56,000</td>
</tr>
<tr>
<td>2013</td>
<td>1/2 × $42,000 + 1/2 × $25,200</td>
<td>33,600</td>
</tr>
<tr>
<td>2014</td>
<td>1/2 × $25,200 + 1/2 × $12,800</td>
<td>19,000</td>
</tr>
<tr>
<td>2015</td>
<td>1/2 × $12,800</td>
<td>6,400</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$150,000</td>
</tr>
</tbody>
</table>

### Impairment

FASB Statement No. 144 requires that companies review their property, plant, and equipment for impairment whenever circumstances indicate that the book value of the asset may not be recoverable. To do this a company will compare the asset's book value with the net cash flows expected from the use of the asset. If these undiscounted cash flows are less than the book value then the asset is impaired.

If an asset is impaired, the company will recognize an impairment loss and write down the value of the asset to the lower fair value. The amount of the loss will be the difference between the discounted future cash flows and the asset's book value. This lower fair value becomes the new “cost” for the calculation of future depreciation expenses.

**Strategy:** Notice that the test for impairment uses the undiscounted future cash flows but the calculation for determining the amount of loss to recognize uses discounted future cash flows.
To illustrate an impairment loss, let’s assume that in 2013 circumstances have indicated that the painting equipment that Heideman purchased in 2011 for $175,000 might be impaired. To date, Heideman has accumulated $75,000 of depreciation on the equipment using the straight-line method. Cash flows over the next two years are expected to be $45,000 per year (cash inflows of $85,000 per year minus cash outflows of $40,000 per year).

To test for impairment we determine that the asset’s book value is $100,000 ($175,000 – $75,000). The net future cash flows are $90,000 (cash inflows ($85,000 × 2) – cash outflows ($40,000 × 2)). Because the $90,000 cash flows are less than the $100,000 book value, an impairment has occurred.

But how much is the loss? To calculate the loss we need to use the book value and the discounted cash flows. If we assume that the company uses a discount rate of 8%, then the discounted future cash flows are:

$80,247 (rounded) = $45,000 cash flows per year × 1.783265 (From Table 4 for n = 2, and i = 8.0%)

The loss would be:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book value</td>
<td>$100,000</td>
</tr>
<tr>
<td>Discounted cash flows</td>
<td>($80,247)</td>
</tr>
<tr>
<td>Loss</td>
<td>(19,753)</td>
</tr>
</tbody>
</table>

FASB Statement No. 144 does not specify how the entry to record the loss should be made but states that the new lower fair value should be used as the new cost, so we treat the write-down as a sale and with an acquisition at the new "cost":

Loss from Impairment          19,753
Accumulated Depreciation – Equipment  75,000
Equipment (new cost)          80,247
Equipment (old cost)          175,000

**Depletion**

Depletion is the allocation of the depletable cost for the use of a natural resource to the periods in which benefits are received.

A company determines depletion by multiplying actual production for the period by the unit depletion rate:

\[
\text{Unit Depletion Rate} = \frac{\text{Cost – Residual Value}}{\text{Units}}
\]
Test Your Knowledge

11-1. Below is a list of depreciation-related terms. Following is a list of twelve descriptive phrases. Match each term with its descriptive phrase by placing the appropriate letter in the space provided.

a. depletion  g. rate of return
b. service life  h. group depreciation method
c. systematic  i. Modified Accelerated Cost Recovery System
d. activity methods  j. percentage depletion
e. time-based methods  k. impairment loss
f. accelerated methods  l. depreciation base

___ 1. Includes straight-line and accelerated methods
___ 2. A measure of the number of units of service expected from an asset before its disposal
___ 3. The difference between a productive asset’s future net cash flows and its higher book value
___ 4. Over the life of an asset may exceed the asset’s cost less expected residual value
___ 5. The difference between the purchase price and the estimated residual value of a depreciable asset
___ 6. Determined by formula, and not arbitrary
___ 7. Required for income tax reporting for assets purchased in 1987 and later
___ 8. Appropriate when benefits from an asset are expected to decline over the periods of use
___ 9. Net income divided by assets
___ 10. Capitalizes and depreciates homogeneous or similar assets as a single asset
___ 11. Appropriate when an asset’s service life is determined by usage
___ 12. Allocation of the acquisition cost of assets such as oil, gas, minerals, and timber
The Trimble Company purchased a machine costing $400,000 on January 1, 2011. Estimated service life is 10 years or 20,000 hours. Estimated production is 600,000 units. Estimated residual value is $50,000. In 2011, the company used the machine for 2,000 hours to produce 75,000 units. The company computes depreciation to the nearest whole year.

Calculate 2011 depreciation using each of the following methods:

1. straight-line

2. double-declining balance

3. sum-of-the-years'-digits

4. hours worked

5. units of output
11-3. Mineral Mountain Mining Company purchased land on January 1, 2011, for $13,000,000. The company expects to produce 600,000 tons of ore over a 5-year period. After completing mining operations, the company expects to sell the land for $1,000,000.

In 2011, the company constructed buildings at a cost of $1,000,000. The buildings have an estimated physical life of 20 years. They will be used by Mineral Mountain Mining only for mining operations. The expected residual value of the buildings is $250,000.

150,000 tons of ore were produced in 2011.

(a) Determine Mineral Mountain Mining's depletion for 2011.

(b) Determine Mineral Mountain Mining's depreciation on buildings for 2011 (use activity method).
Answers to Test Your Knowledge

1. 1. e 7. i
   2. b 8. f
   3. k 9. g
   4. j 10. h
   5. l 11. d
   6. c 12. a

2. 1. $35,000 \left[ (\frac{400,000 - 50,000}{10}) \right]
   2. $80,000 \left[ 400,000 \times 0.20 \right]
   3. $63,636 \left[ (\frac{400,000 - 50,000}{55}) \right]
   4. $35,000 \left[ (\frac{400,000 - 50,000}{20,000} = 17.50; 17.50 \times 2,000 = 35,000 \right]
   5. $43,750 \left[ (\frac{400,000 - 50,000}{600,000} = 0.5833; 0.5833 \times 75,000 = 43,750 \right]

3. (a) $3,000,000 \left\{ (\frac{13,000,000 - 1,000,000}{600,000}) \times 150,000 \right\}
   (b) $187,500 \left\{ (\frac{1,000,000 - 250,000}{600,000}) \times (150,000/600,000) \right\}

Chapter 11 Depreciation and Depletion