17 Process Costing

Learning Objectives

1. Identify the situations in which process-costing systems are appropriate
2. Understand the basic concepts of process-costing and compute average unit costs
3. Describe the five steps in process costing and calculate equivalent units
4. Use the weighted-average method and first-in, first-out (FIFO) method of process costing
5. Apply process-costing methods to situations with transferred-in costs
6. Understand the need for hybrid-costing systems such as operation-costing

Companies that produce identical or similar units of a product or service (for example, an oil-refining company) often use process costing.

A key part of process costing is valuing inventory, which entails determining how many units of the product the firm has on hand at the end of an accounting reporting period, evaluating the units' stages of completion, and assigning costs to the units. There are different methods for doing this, each of which can result in different profits. At times, variations in international rules and customs make it difficult to compare inventory costs across competitors. In the case of ExxonMobil, differences in accounting rules between the United States and Europe also reduce the company's profits and tax liability.

ExxonMobil and Accounting Differences in the Oil Patch[1]

In 2010, ExxonMobil was number two on the *Fortune* 500 annual ranking of the largest U.S. companies. In 2009, the company had $284 billion dollars in revenue with more than $19 billion in profits. Believe it or not, however, by one measure ExxonMobil's profits are *understated*.

ExxonMobil, like most U.S. energy companies, uses last-in, first-out (LIFO) accounting. Under this treatment, ExxonMobil records its cost of inventory at the latest price paid for crude oil in the open market, even though it is often selling oil produced at a much lower cost. This increases the company's cost of goods sold, which in turn reduces profit. The benefit of using LIFO accounting for financial reporting is that ExxonMobil is then permitted to use LIFO for tax purposes as well, thereby lowering its payments to the tax authorities.

In contrast, International Financial Reporting Standards (IFRS) do not permit the use of LIFO accounting. European oil companies such as Royal Dutch Shell and British Petroleum use the first-in, first-out (FIFO) methodology instead when accounting for inventory. Under FIFO, oil companies use the cost of the oldest crude in their inventory to calculate the cost of barrels of oil sold. This reduces costs on the income statement, therefore increasing gross margins.

Assigning costs to inventory is a critical part of process costing, and a company's choice of method can result in substantially different

[1] *Source:* Exxon Mobil Corporation. 2010. 2009 Annual Report. Irving, TX: Exxon Mobil Corporation; Kaminska, Izabella. 2010. Shell, BP, and the increasing cost of inventory. *Financial Times*. "FT Alphaville" blog, April 29; Reilly, David. 2006. Big oil's accounting methods fuel criticism. *Wall Street Journal*, August 8.

profits. For instance, ExxonMobil's 2009 net income would have been $7.1 billion higher under FIFO. Moreover, at the end of fiscal 2009, the cumulative difference—or "LIFO Reserve"—between the value of inventory ExxonMobil was carrying on its balance sheet based on the initial cost versus the current replacement cost of that inventory was $17.1 billion. This number takes on special relevance in the context of current efforts to achieve convergence between U.S. GAAP and IFRS. Should that happen, and if U.S. firms are forced to adopt FIFO for financial and tax reporting, they would have to pay additional taxes on the cumulative savings to date from showing a higher cost of goods sold in LIFO. As an approximation, applying a marginal tax rate of 35% to ExxonMobil's LIFO Reserve of $17.1 billion suggests an incremental tax burden of almost $6 billion.

Companies such as ExxonMobil, Coca-Cola, and Novartis produce many identical or similar units of a product using mass-production techniques. The focus of these companies on individual production processes gives rise to process costing. This chapter describes how companies use process costing methods to determine the costs of products or services and to value inventory and cost of goods sold (using methods like FIFO).

Illustrating Process Costing

Learning Objective 1

Identify the situations in which process-costing systems are appropriate

. . . when masses of identical or similar units are produced

Before we examine process costing in more detail, let's briefly compare job costing and process costing. Job-costing and process-costing systems are best viewed as ends of a continuum:

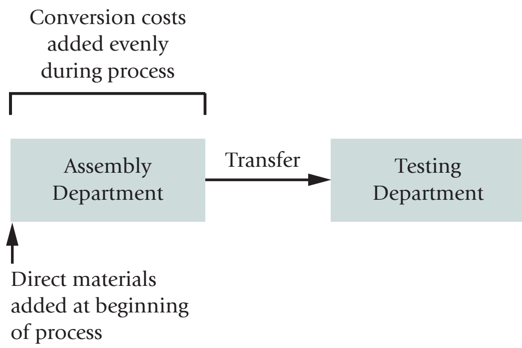
Job-costing system	Process-costing system
Distinct, identifiable units of a product or service (for example, custom-made machines and houses)	Masses of identical or similar units of a product or service (for example, food or chemical processing)

In a *process-costing system*, the unit cost of a product or service is obtained by assigning total costs to many identical or similar units of output. In other words, unit costs are calculated by dividing total costs incurred by the number of units of output from the production process. In a manufacturing process-costing setting, each unit receives the same or similar amounts of direct material costs, direct manufacturing labor costs, and indirect manufacturing costs (manufacturing overhead).

The main difference between process costing and job costing is the *extent of averaging* used to compute unit costs of products or services. In a job-costing system, individual jobs use different quantities of production resources, so it would be incorrect to cost each job at the same average production cost. In contrast, when identical or similar units of products or services are mass-produced, not processed as individual jobs, process costing is used to calculate an average production cost for all units produced. Some processes such as clothes manufacturing have aspects of both process costing (cost per unit of each operation, such as cutting or sewing, is identical) and job costing (different materials are used in different batches of clothing, say, wool versus cotton). The final section in this chapter describes "hybrid" costing systems that combine elements of both job and process costing.

Consider the following illustration of process costing: Suppose that Pacific Electronics manufactures a variety of cell phone models. These models are assembled in the assembly department. Upon completion, units are transferred to the testing department. We focus on the assembly department process for one model, SG-40. All units of SG-40 are identical and must meet a set of demanding performance specifications. The process-costing system for SG-40 in the assembly department has a single direct-cost category—direct materials—and a single indirect-cost category—conversion costs. Conversion costs are all manufacturing costs other than direct material costs, including manufacturing labor, energy, plant depreciation, and so on. Direct materials are added at the beginning of the assembly process. Conversion costs are added evenly during assembly.

The following graphic represents these facts:



Process-costing systems separate costs into cost categories according to *when costs are introduced into the process*. Often, as in our Pacific Electronics example, only two cost classifications—direct materials and conversion costs—are necessary to assign costs to products. Why only two? Because *all* direct materials are added to the process at one time and all conversion costs generally are added to the process evenly through time. If, however, two different direct materials were added to the process at different times, two different direct-materials categories would be needed to assign these costs to products. Similarly, if manufacturing labor costs were added to the process at a different time from when the other conversion costs were added, an additional cost category—direct manufacturing labor costs—would be needed to separately assign these costs to products.

We will use the production of the SG-40 component in the assembly department to illustrate process costing in three cases, starting with the simplest case and introducing additional complexities in subsequent cases:

- **Case 1—**Process costing with zero beginning and zero ending work-in-process inventory of SG-40. (That is, all units are started and fully completed within the accounting period.) *This case presents the most basic concepts of process costing and illustrates the feature of averaging of costs.*
- **Case 2—**Process costing with zero beginning work-in-process inventory and some ending work-in-process inventory of SG-40. (That is, some units of SG-40 started during the accounting period are incomplete at the end of the period.) *This case introduces the five steps of process costing and the concept of equivalent units.*
- **Case 3—**Process costing with both some beginning and some ending work-in-process inventory of SG-40. *This case adds more complexity and illustrates the effect of weighted-average and first-in, first-out (FIFO) cost flow assumptions on cost of units completed and cost of work-in-process inventory.*

Decision Point

Under what conditions is a process-costing system used?

Case 1: Process Costing with No Beginning or Ending Work-in-Process Inventory

On January 1, 2012, there was no beginning inventory of SG-40 units in the assembly department. During the month of January, Pacific Electronics started, completely assembled, and transferred out to the testing department 400 units.

Data for the assembly department for January 2012 are as follows:

Physical Units for January 2012	
Work in process, beginning inventory (January 1)	0 units
Started during January	400 units
Completed and transferred out during January	400 units
Work in process, ending inventory (January 31)	0 units

Physical units refer to the number of output units, whether complete or incomplete. In January 2012, all 400 physical units started were completed.

Total Costs for January 2012	
Direct material costs added during January	$32,000
Conversion costs added during January	24,000
Total assembly department costs added during January	$56,000

Pacific Electronics records direct material costs and conversion costs in the assembly department as these costs are incurred. By averaging, assembly cost of SG-40 is $56,000 ÷ 400 units = $140 per unit, itemized as follows:

Direct material cost per unit ($32,000 ÷ 400 units)	$ 80
Conversion cost per unit ($24,000 ÷ 400 units)	60
Assembly department cost per unit	$140

Learning Objective 2

Understand the basic concepts of process-costing and compute average unit costs

. . . divide total costs by total units in a given accounting period

Case 1 shows that in a process-costing system, average unit costs are calculated by dividing total costs in a given accounting period by total units produced in that period. Because each unit is identical, we assume all units receive the same amount of direct material costs and conversion costs. Case 1 applies whenever a company produces a homogeneous product or service but has no incomplete units when each accounting period ends, which is a common situation in service-sector organizations. For example, a bank can adopt this process-costing approach to compute the unit cost of processing 100,000 customer deposits, each similar to the other, made in a month.

Decision Point

How are average unit costs computed when no inventories are present?

Case 2: Process Costing with Zero Beginning and Some Ending Work-in-Process Inventory

In February 2012, Pacific Electronics places another 400 units of SG-40 into production. Because all units placed into production in January were completely assembled, there is no beginning inventory of partially completed units in the assembly department on February 1. Some customers order late, so not all units started in February are completed by the end of the month. Only 175 units are completed and transferred to the testing department.

Data for the assembly department for February 2012 are as follows:

	A	B	C	D	E
1		Physical Units (SG-40s) (1)	Direct Materials (2)	Conversion Costs (3)	Total Costs (4) = (2) + (3)
2	Work in process, beginning inventory (February 1)	0			
3	Started during February	400			
4	Completed and transferred out during February	175			
5	Work in process, ending inventory (February 29)	225			
6	Degree of completion of ending work in process		100%	60%	
7	Total costs added during February		$32,000	$18,600	$50,600

The 225 partially assembled units as of February 29, 2012, are fully processed with respect to direct materials, because all direct materials in the assembly department are added at the beginning of the assembly process. Conversion costs, however, are added evenly during assembly. Based on the work completed relative to the total work required

Learning Objective 3

Describe the five steps in process costing

. . . to assign total costs to units completed and to units in work in process

and calculate equivalent units

. . . output units adjusted for incomplete units

to complete the SG-40 units still in process at the end of February, an assembly department supervisor estimates that the partially assembled units are, on average, 60% complete with respect to conversion costs.

The accuracy of the completion estimate of conversion costs depends on the care, skill, and experience of the estimator and the nature of the conversion process. Estimating the degree of completion is usually easier for direct material costs than for conversion costs, because the quantity of direct materials needed for a completed unit and the quantity of direct materials in a partially completed unit can be measured more accurately. In contrast, the conversion sequence usually consists of a number of operations, each for a specified period of time, at various steps in the production process.[2] The degree of completion for conversion costs depends on the proportion of the total conversion costs needed to complete one unit (or a batch of production) that has already been incurred on the units still in process. It is a challenge for management accountants to make this estimate accurately.

Because of these uncertainties, department supervisors and line managers—individuals most familiar with the process—often make conversion cost estimates. Still, in some industries, such as semiconductor manufacturing, no exact estimate is possible; in other settings, such as the textile industry, vast quantities in process make the task of estimation too costly. In these cases, it is necessary to assume that all work in process in a department is complete to some preset degree with respect to conversion costs (for example, one-third, one-half, or two-thirds complete).

The point to understand here is that a partially assembled unit is not the same as a fully assembled unit. Faced with some fully assembled units and some partially assembled units, we require a common metric that will enable us to compare the work done in each category and, more important, obtain a total measure of work done. The concept we will use in this regard is that of *equivalent units*. We will explain this notion in greater detail next as part of the set of five steps required to calculate (1) the cost of fully assembled units in February 2012 and (2) the cost of partially assembled units still in process at the end of that month, for Pacific Electronics. The five steps of process costing are as follows:

Step 1: Summarize the flow of physical units of output.

Step 2: Compute output in terms of equivalent units.

Step 3: Summarize total costs to account for.

Step 4: Compute cost per equivalent unit.

Step 5: Assign total costs to units completed and to units in ending work in process.

Physical Units and Equivalent Units (Steps 1 and 2)

Step 1 tracks physical units of output. Recall that physical units are the number of output units, whether complete or incomplete. Where did physical units come from? Where did they go? The physical-units column of Exhibit 17-1 tracks where the physical units came from (400 units started) and where they went (175 units completed and transferred out, and 225 units in ending inventory). Remember, when there is no opening inventory, units started must equal the sum of units transferred out and ending inventory.

Because not all 400 physical units are fully completed, output in **Step 2** is computed in *equivalent units*, not in *physical units*. To see what we mean by equivalent units, let's say that during a month, 50 physical units were started but not completed by the end of the month. These 50 units in ending inventory are estimated to be 70% complete with respect to conversion costs. Let's examine those units from the perspective of the conversion costs already incurred to get the units to be 70% complete. Suppose we put all the conversion costs represented in the 70% into making fully completed units. How many units could have been 100% complete by the end of the month? The answer is 35 units. Why? Because 70% of conversion costs incurred on 50 incomplete units could have been incurred to make 35 (0.70×50) complete units by the end of the month. That is, if all the conversion-cost input in the 50 units in inventory had been used to make completed output units, the company would have produced 35 completed units (also called *equivalent units*) of output.

[2] For example, consider the conventional tanning process for converting hide to leather. Obtaining 250–300 kg of leather requires putting one metric ton of raw hide through as many as 15 steps: from soaking, liming, and pickling to tanning, dyeing, and fatliquoring, the step in which oils are introduced into the skin before the leather is dried.

Exhibit 17-1

Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units for Assembly Department of Pacific Electronics for February 2012

	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning	0		
5	Started during current period	400		
6	To account for	400		
7	Completed and transferred out during current period	175	175	175
8	Work in process, ending[a]	225		
9	(225 × 100%; 225 × 60%)		225	135
10	Accounted for	400		
11	Equivalent units of work done in current period		400	310
12				
13	[a]Degree of completion in this department; direct materials, 100%; conversion costs, 60%.			

Equivalent units is a derived amount of output units that (1) takes the quantity of each input (factor of production) in units completed and in incomplete units of work in process and (2) converts the quantity of input into the amount of completed output units that could be produced with that quantity of input. Note that equivalent units are calculated separately for each input (such as direct materials and conversion costs). Moreover, every completed unit, by definition, is composed of one equivalent unit of each input required to make it. This chapter focuses on equivalent-unit calculations in manufacturing settings. Equivalent-unit concepts are also found in nonmanufacturing settings. For example, universities convert their part-time student enrollments into "full-time student equivalents."

When calculating equivalent units in Step 2, focus on quantities. Disregard dollar amounts until after equivalent units are computed. In the Pacific Electronics example, all 400 physical units—the 175 fully assembled units and the 225 partially assembled units—are 100% complete with respect to direct materials because all direct materials are added in the assembly department at the start of the process. Therefore, Exhibit 17-1 shows output as 400 *equivalent units* for direct materials: 175 equivalent units for the 175 physical units assembled and transferred out, and 225 equivalent units for the 225 physical units in ending work-in-process inventory.

The 175 fully assembled units are also completely processed with respect to conversion costs. The partially assembled units in ending work in process are 60% complete (on average). Therefore, conversion costs in the 225 partially assembled units are *equivalent* to conversion costs in 135 (60% of 225) fully assembled units. Hence, Exhibit 17-1 shows output as 310 *equivalent units* with respect to conversion costs: 175 equivalent units for the 175 physical units assembled and transferred out and 135 equivalent units for the 225 physical units in ending work-in-process inventory.

Calculation of Product Costs (Steps 3, 4, and 5)

Exhibit 17-2 shows Steps 3, 4, and 5. Together, they are called the *production cost worksheet*.

Step 3 summarizes total costs to account for. Because the beginning balance of work-in-process inventory is zero on February 1, total costs to account for (that is, the total charges or debits to the Work in Process—Assembly account) consist only of costs added during February: direct materials of $32,000 and conversion costs of $18,600, for a total of $50,600.

Step 4 in Exhibit 17-2 calculates cost per equivalent unit separately for direct materials and for conversion costs by dividing direct material costs and conversion costs added during February by the related quantity of equivalent units of work done in February (as calculated in Exhibit 17-1).

To see the importance of using equivalent units in unit-cost calculations, compare conversion costs for January and February 2012. Total conversion costs of $18,600 for the 400 units worked on during February are lower than the conversion costs of

Exhibit 17-2 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process for Assembly Department of Pacific Electronics for February 2012

	A	B	C	D		E
1			Total Production Costs	Direct Materials		Conversion Costs
2	(Step 3)	Costs added during February	$50,600	$32,000		$18,600
3		Total costs to account for	$50,600	$32,000		$18,600
4						
5	(Step 4)	Costs added in current period	$50,600	$32,000		$18,600
6		Divide by equivalent units of work done in current period (Exhibit 17-1)		÷ 400		÷ 310
7		Cost per equivalent unit		$ 80		$ 60
8						
9	(Step 5)	Assignment of costs:				
10		Completed and transferred out (175 units)	$24,500	(175[a] × $80)	+	(175[a] × $60)
11		Work in process, ending (225 units):	26,100	(225[b] × $80)	+	(135[b] × $60)
12		Total costs accounted for	$50,600	$32,000	+	$18,600
13						
14	[a] Equivalent units completed and transferred out from Exhibit 17-1, step 2.					
15	[b] Equivalent units in ending work in process from Exhibit 17-1, step 2.					

$24,000 for the 400 units worked on in January. However, in this example, the conversion costs to fully assemble a unit are $60 in both January and February. Total conversion costs are lower in February because fewer equivalent units of conversion-costs work were completed in February (310) than in January (400). Using physical units instead of equivalent units in the per-unit calculation would have led to the erroneous conclusion that conversion costs per unit declined from $60 in January to $46.50 ($18,600 ÷ 400 units) in February. This incorrect costing might have prompted Pacific Electronics to presume that greater efficiencies in processing had been achieved and to lower the price of SG-40, for example, when in fact costs had not declined.

Step 5 in Exhibit 17-2 assigns these costs to units completed and transferred out and to units still in process at the end of February 2012. The idea is to attach dollar amounts to the equivalent output units for direct materials and conversion costs of (a) units completed and (b) ending work in process, as calculated in Exhibit 17-1, Step 2. *Equivalent output units for each input are multiplied by cost per equivalent unit, as calculated in Step 4 of Exhibit 17-2.* For example, costs assigned to the 225 physical units in ending work-in-process inventory are as follows:

Direct material costs of 225 equivalent units (Exhibit 17-1, Step 2) × $80 cost per equivalent unit of direct materials calculated in Step 4	$18,000
Conversion costs of 135 equivalent units (Exhibit 17-1, Step 2) × $60 cost per equivalent unit of conversion costs calculated in Step 4	8,100
Total cost of ending work-in-process inventory	$26,100

Note that total costs to account for in Step 3 ($50,600) equal total costs accounted for in Step 5.

Journal Entries

Journal entries in process-costing systems are similar to the entries made in job-costing systems with respect to direct materials and conversion costs. The main difference is that, in process costing, there is one Work in Process account for each process. In our example, there are accounts for Work in Process—Assembly and Work in Process—Testing. Pacific Electronics purchases direct materials as needed. These materials are delivered directly to the assembly department. Using amounts from Exhibit 17-2, summary journal entries for February are as follows:

1. Work in Process—Assembly	32,000	
Accounts Payable Control		32,000
To record direct materials purchased and used in production during February.		
2. Work in Process—Assembly	18,600	
Various accounts such as Wages Payable Control and Accumulated Depreciation		18,600
To record conversion costs for February; examples include energy, manufacturing supplies, all manufacturing labor, and plant depreciation.		
3. Work in Process—Testing	24,500	
Work in Process—Assembly		24,500
To record cost of goods completed and transferred from assembly to testing during February.		

Exhibit 17-3 shows a general framework for the flow of costs through T-accounts. Notice how entry 3 for $24,500 follows the physical transfer of goods from the assembly to the testing department. The T-account Work in Process—Assembly shows February 2012's ending balance of $26,100, which is the beginning balance of Work in Process—Assembly in March 2012. It is important to ensure that all costs have been accounted for and that the ending inventory of the current month is the beginning inventory of the following month.

Decision Point

What are the five steps in a process-costing system and how are equivalent units calculated?

Case 3: Process Costing with Some Beginning and Some Ending Work-in-Process Inventory

At the beginning of March 2012, Pacific Electronics had 225 partially assembled SG-40 units in the assembly department. It started production of another 275 units in March. Data for the assembly department for March are as follows:

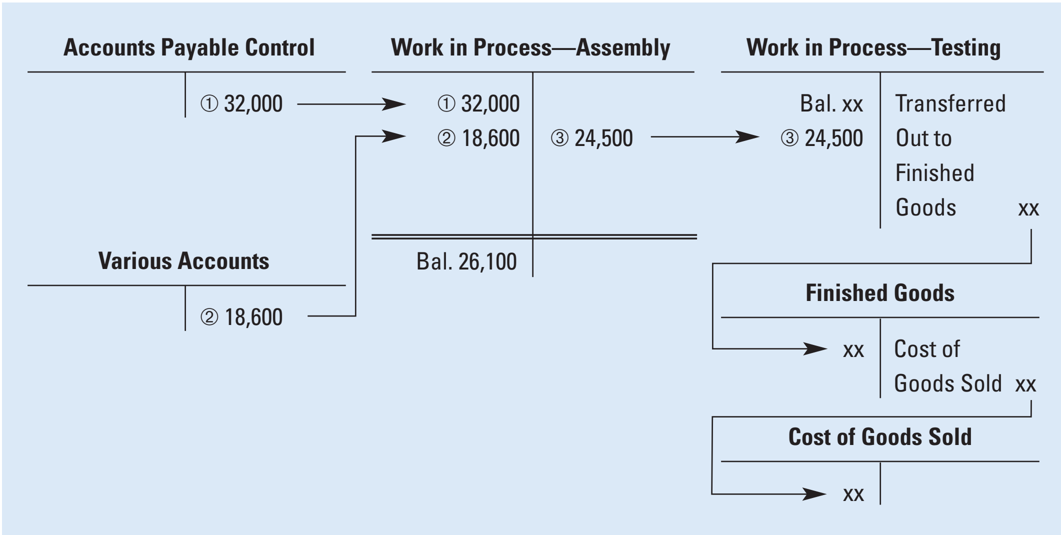
Home Insert Page Layout Formulas Data Review View

	A	B	C	D	E
1		Physical Units (SG-40s) (1)	Direct Materials (2)	Conversion Costs (3)	Total Costs (4) = (2) + (3)
2	Work in process, beginning inventory (March 1)	225	$18,000[a]	$8,100[a]	$26,100
3	Degree of completion of beginning work in process		100%	60%	
4	Started during March	275			
5	Completed and transferred out during March	400			
6	Work in process, ending inventory (March 31)	100			
7	Degree of completion of ending work in process		100%	50%	
8	Total costs added during March		$19,800	$16,380	$36,180
9					
10					
11	[a]Work in process, beginning inventory (equals work in process, ending inventory for February)				
12	Direct materials: 225 physical units × 100% completed × $80 per unit = $18,000				
13	Conversion costs: 225 physical units × 60% completed × $60 per unit = $8,100				

Pacific Electronics now has incomplete units in both beginning work-in-process inventory and ending work-in-process inventory for March 2012. We can still use the five steps described earlier to calculate (1) cost of units completed and transferred out and (2) cost of ending work in process. To assign costs to each of these categories, however, we first need to choose an inventory-valuation method. We next describe the five-step approach for two important methods—the *weighted-average method* and the *first-in, first-out method*. These different valuation methods produce different amounts for cost of units completed and for ending work in process when the unit cost of inputs changes from one period to the next.

Exhibit 17-3

Flow of Costs in a Process-Costing System for Assembly Department of Pacific Electronics for February 2012



Weighted-Average Method

Learning Objective 4

Use the weighted-average method of process costing

. . . assigns costs based on total costs and equivalent units completed to date

and the first-in, first-out (FIFO) method of process costing

. . . to assign costs based on costs and equivalent units of work done in the current period

The **weighted-average process-costing method** calculates cost per equivalent unit of all *work done to date* (regardless of the accounting period in which it was done) and assigns this cost to equivalent units completed and transferred out of the process and to equivalent units in ending work-in-process inventory. The weighted-average cost is the total of all costs entering the Work in Process account (whether the costs are from beginning work in process or from work started during the current period) divided by total equivalent units of work done to date. We now describe the weighted-average method using the five-step procedure introduced on page 610.

Step 1: Summarize the Flow of Physical Units of Output. The physical-units column of Exhibit 17-4 shows where the units came from—225 units from beginning inventory and 275 units started during the current period—and where they went—400 units completed and transferred out and 100 units in ending inventory.

Step 2: Compute Output in Terms of Equivalent Units. The weighted-average cost of inventory is calculated by merging together the costs of beginning inventory and the manufacturing costs of a period and dividing by the total number of units in beginning inventory and units produced during the accounting period. We apply the same concept here

Exhibit 17-4

Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units Using Weighted-Average Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

Home Insert Page Layout Formulas Data Review View

	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 613)	225		
5	Started during current period (given, p. 613)	275		
6	To account for	500		
7	Completed and transferred out during current period	400	400	400
8	Work in process, ending[a] (given, p. 613)	100		
9	(100 × 100%; 100 × 50%)		100	50
10	Accounted for	500		
11	Equivalent units of work done to date		500	450
12				
13	[a]Degree of completion in this department; direct materials, 100%; conversion costs, 50%.			

except that calculating the units—in this case equivalent units—is done differently. We use the relationship shown in the following equation:

$$\begin{matrix}\text{Equivalent units} & & \text{Equivalent units} & & \text{Equivalent units} & & \text{Equivalent units} \\ \text{in beginning work} & + & \text{of work done in} & = & \text{completed and transferred} & + & \text{in ending work} \\ \text{in process} & & \text{current period} & & \text{out in current period} & & \text{in process}\end{matrix}$$

Although we are interested in calculating the left-hand side of the preceding equation, it is easier to calculate this sum using the equation's right-hand side: (1) equivalent units completed and transferred out in the current period plus (2) equivalent units in ending work in process. *Note that the stage of completion of the current-period beginning work in process is not used in this computation.*

The equivalent-units columns in Exhibit 17-4 show equivalent units of work done to date: 500 equivalent units of direct materials and 450 equivalent units of conversion costs. All completed and transferred-out units are 100% complete as to both direct materials and conversion costs. Partially completed units in ending work in process are 100% complete as to direct materials because direct materials are introduced at the beginning of the process, and 50% complete as to conversion costs, based on estimates made by the assembly department manager.

Step 3: Summarize Total Costs to Account For. Exhibit 17-5 presents Step 3. Total costs to account for in March 2012 are described in the example data on page 615: beginning work in process, \$26,100 (direct materials, \$18,000, plus conversion costs, \$8,100), plus costs added during March, \$36,180 (direct materials, \$19,800, plus conversion costs, \$16,380). The total of these costs is \$62,280.

Step 4: Compute Cost per Equivalent Unit. Exhibit 17-5, Step 4, shows the computation of weighted-average cost per equivalent unit for direct materials and conversion costs. Weighted-average cost per equivalent unit is obtained by dividing the sum of costs for beginning work in process plus costs for work done in the current period by total

Exhibit 17-5 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process Using Weighted-Average Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

Home | Insert | Page Layout | Formulas | Data | Review | View

	A	B	C	D	E
1			Total Production Costs	Direct Materials	Conversion Costs
2	(Step 3)	Work in process, beginning (given, p. 613)	\$26,100	\$18,000	\$ 8,100
3		Costs added in current period (given, p. 613)	36,180	19,800	16,380
4		Total costs to account for	\$62,280	\$37,800	\$24,480
5					
6	(Step 4)	Costs incurred to date		\$37,800	\$24,480
7		Divide by equivalent units of work done to date (Exhibit 17-4)		÷ 500	÷ 450
8		Cost per equivalent unit of work done to date		\$ 75.60	\$ 54.40
9					
10	(Step 5)	Assignment of costs:			
11		Completed and transferred out (400 units)	\$52,000	(400[a] × \$75.60)	+ (400[a] × \$54.40)
12		Work in process, ending (100 units):	10,280	(100[b] × \$75.60)	+ (50[b] × \$54.40)
13		Total costs accounted for	\$62,280	\$37,800	+ \$24,480
14					
15	[a]Equivalent units completed and transferred out from Exhibit 17-4, Step 2.				
16	[b]Equivalent units in ending work in process from Exhibit 17-4, Step 2.				

equivalent units of work done to date. When calculating weighted-average conversion cost per equivalent unit in Exhibit 17-5, for example, we divide total conversion costs, $24,480 (beginning work in process, $8,100, plus work done in current period, $16,380), by total equivalent units of work done to date, 450 (equivalent units of conversion costs in beginning work in process and in work done in current period), to obtain weighted-average cost per equivalent unit of $54.40.

Step 5: Assign Total Costs to Units Completed and to Units in Ending Work in Process. Step 5 in Exhibit 17-5 takes the equivalent units completed and transferred out and equivalent units in ending work in process calculated in Exhibit 17-4, Step 2, and assigns dollar amounts to them using the weighted-average cost per equivalent unit for direct materials and conversion costs calculated in Step 4. For example, total costs of the 100 physical units in ending work in process are as follows:

Direct materials:	
100 equivalent units × weighted-average cost per equivalent unit of $75.60	$ 7,560
Conversion costs:	
50 equivalent units × weighted-average cost per equivalent unit of $54.40	2,720
Total costs of ending work in process	$10,280

The following table summarizes total costs to account for ($62,280) and how they are accounted for in Exhibit 17-5. The arrows indicate that the costs of units completed and transferred out and units in ending work in process are calculated using weighted-average total costs obtained after merging costs of beginning work in process and costs added in the current period.

Costs to Account For		Costs Accounted for Calculated on a Weighted-Average Basis	
Beginning work in process	$26,100	Completed and transferred out	$52,000
Costs added in current period	36,180	Ending work in process	10,280
Total costs to account for	$62,280	Total costs accounted for	$62,280

Before proceeding, review Exhibits 17-4 and 17-5 to check your understanding of the weighted-average method. Note: Exhibit 17-4 deals with only physical and equivalent units, not costs. Exhibit 17-5 shows the cost amounts.

Using amounts from Exhibit 17-5, the summary journal entries under the weighted-average method for March 2012 at Pacific Electronics are as follows:

1. Work in Process—Assembly	19,800	
Accounts Payable Control		19,800
To record direct materials purchased and used in production during March.		
2. Work in Process—Assembly	16,380	
Various accounts such as Wages Payable Control and Accumulated Depreciation		16,380
To record conversion costs for March; examples include energy, manufacturing supplies, all manufacturing labor, and plant depreciation.		
3. Work in Process—Testing	52,000	
Work in Process—Assembly		52,000
To record cost of goods completed and transferred from assembly to testing during March.		

The T-account Work in Process—Assembly, under the weighted-average method, is as follows:

Work in Process—Assembly

Beginning inventory, March 1	26,100	(3) Completed and transferred out to Work in Process—Testing	52,000
(1) Direct materials	19,800		
(2) Conversion costs	16,380		
Ending inventory, March 31	10,280		

First-In, First-Out Method

The **first-in, first-out (FIFO) process-costing method** (1) assigns the cost of the previous accounting period's equivalent units in beginning work-in-process inventory to the first units completed and transferred out of the process, and (2) assigns the cost of equivalent units worked on during the *current* period first to complete beginning inventory, next to start and complete new units, and finally to units in ending work-in-process inventory. The FIFO method assumes that the earliest equivalent units in work in process are completed first.

A distinctive feature of the FIFO process-costing method is that work done on beginning inventory before the current period is kept separate from work done in the current period. Costs incurred and units produced in the current period are used to calculate cost per equivalent unit of work done in the current period. In contrast, equivalent-unit and cost-per-equivalent-unit calculations under the weighted-average method *merge* units and costs in beginning inventory with units and costs of work done in the current period.

We now describe the FIFO method using the five-step procedure introduced on page 610.

Step 1: Summarize the Flow of Physical Units of Output. Exhibit 17-6, Step 1, traces the flow of physical units of production. The following observations help explain the calculation of physical units under the FIFO method for Pacific Electronics.

- The first physical units assumed to be completed and transferred out during the period are 225 units from beginning work-in-process inventory.
- The March data on page 613 indicate that 400 physical units were completed during March. The FIFO method assumes that of these 400 units, 175 units (400 units − 225 units from beginning work-in-process inventory) must have been started and completed during March.
- Ending work-in-process inventory consists of 100 physical units—the 275 physical units started minus the 175 units that were started and completed.
- The physical units "to account for" equal the physical units "accounted for" (500 units).

Step 2: Compute Output in Terms of Equivalent Units. Exhibit 17-6 also presents the computations for Step 2 under the FIFO method. *The equivalent-unit calculations for each cost category focus on equivalent units of work done in the current period (March) only.*

Under the FIFO method, equivalent units of work done in March on the beginning work-in-process inventory equal 225 physical units times *the percentage of work remaining to be done in March to complete these units*: 0% for direct materials, because beginning work in process is 100% complete with respect to direct materials, and 40% for conversion costs, because beginning work in process is 60% complete with respect to conversion costs. The results are 0 (0% × 225) equivalent units of work for direct materials and 90 (40% × 225) equivalent units of work for conversion costs.

The equivalent units of work done on the 175 physical units started and completed equals 175 units times 100% for both direct materials and conversion costs, because all work on these units is done in the current period.

The equivalent units of work done on the 100 units of ending work in process equal 100 physical units times 100% for direct materials (because all direct materials for these units are added in the current period) and 50% for conversion costs (because 50% of the conversion-costs work on these units is done in the current period).

Step 3: Summarize Total Costs to Account For. Exhibit 17-7 presents Step 3 and summarizes total costs to account for in March 2012 (beginning work in process and costs added in the current period) of $62,280, as described in the example data (p. 613).

Step 4: Compute Cost per Equivalent Unit. Exhibit 17-7 shows the Step 4 computation of cost per equivalent unit for *work done in the current period only* for direct materials and conversion costs. For example, conversion cost per equivalent unit of $52 is obtained by dividing current-period conversion costs of $16,380 by current-period conversion-costs equivalent units of 315.

Step 5: Assign Total Costs to Units Completed and to Units in Ending Work in Process. Exhibit 17-7 shows the assignment of costs under the FIFO method. Costs of work done in the current period are assigned (1) first to the additional work done to complete the beginning

Exhibit 17-6

Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units Using FIFO Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

Home Insert Page Layout Formulas Data Review View

	A	B	C	D
1		**(Step 1)**	**(Step 2)**	
2			**Equivalent Units**	
3	**Flow of Production**	**Physical Units**	**Direct Materials**	**Conversion Costs**
4	Work in process, beginning (given, p. 613)	225	(work done before current period)	
5	Started during current period (given, p. 613)	275		
6	To account for	500		
7	Completed and transferred out during current period:			
8	From beginning work in process[a]	225		
9	[225 × (100% – 100%); 225 × (100% – 60%)]		0	90
10	Started and completed	175[b]		
11	(175 × 100%; 175 × 100%)		175	175
12	Work in process, ending[c] (given, p. 613)	100		
13	(100 × 100%; 100 × 50%)		100	50
14	Accounted for	500		
15	Equivalent units of work done in current period		275	315
16				
17	[a]Degree of completion in this department; direct materials, 100%; conversion costs, 60%.			
18	[b]400 physical units completed and transferred out minus 225 physical units completed and			
19	transferred out from beginning work-in-process inventory.			
20	[c]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.			

work in process, then (2) to work done on units started and completed during the current period, and finally (3) to ending work in process. *Step 5 takes each quantity of equivalent units calculated in Exhibit 17-6, Step 2, and assigns dollar amounts to them (using the cost-per-equivalent-unit calculations in Step 4)*. The goal is to use the cost of work done in the current period to determine total costs of all units completed from beginning inventory and from work started and completed in the current period, and costs of ending work in process.

Of the 400 completed units, 225 units are from beginning inventory and 175 units are started and completed during March. The FIFO method starts by assigning the costs of beginning work-in-process inventory of $26,100 to the first units completed and transferred out. As we saw in Step 2, an additional 90 equivalent units of conversion costs are needed to complete these units in the current period. Current-period conversion cost per equivalent unit is $52, so $4,680 (90 equivalent units × $52 per equivalent unit) of additional costs are incurred to complete beginning inventory. Total production costs for units in beginning inventory are $26,100 + $4,680 = $30,780. The 175 units started and completed in the current period consist of 175 equivalent units of direct materials and 175 equivalent units of conversion costs. These units are costed at the cost per equivalent unit in the current period (direct materials, $72, and conversion costs, $52) for a total production cost of $21,700 [175 × ($72 + $52)].

Under FIFO, ending work-in-process inventory comes from units that were started but not fully completed during the current period. Total costs of the 100 partially assembled physical units in ending work in process are as follows:

Direct materials:	
100 equivalent units × $72 cost per equivalent unit in March	$7,200
Conversion costs:	
50 equivalent units × $52 cost per equivalent unit in March	2,600
Total cost of work in process on March 31	$9,800

The following table summarizes total costs to account for and costs accounted for of $62,280 in Exhibit 17-7. Notice how under the FIFO method, the layers of beginning work in process and costs added in the current period are kept separate. The arrows

Exhibit 17-7 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process Using FIFO Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

Home Insert Page Layout Formulas Data Review View

	A	B	C	D	E
1			**Total Production Costs**	**Direct Material**	**Conversion Costs**
2	**(Step 3)**	Work in process, beginning (given, p. 613)	$26,100	$18,000	$ 8,100
3		Costs added in current period (given, p. 613)	36,180	19,800	16,380
4		Total costs to account for	$62,280	$37,800	$24,480
5					
6	**(Step 4)**	Costs added in current period		$19,800	$16,380
7		Divide by equivalent units of work done in current period (Exhibit 17-6)		÷ 275	÷ 315
8		Cost per equivalent unit of work done in current period		$ 72	$ 52
9					
10	**(Step 5)**	Assignment of costs:			
11		Completed and transferred out (400 units):			
12		Work in process, beginning (225 units)	$26,100	$18,000 +	$8,100
13		Costs added to beginning work in process in current period	4,680	(0[a] × $72) +	(90[a] × $52)
14		Total from beginning inventory	30,780		
15		Started and completed (175 units)	21,700	(175[b] × $72) +	(175[b] × $52)
16		Total costs of units completed and transferred out	52,480		
17		Work in process, ending (100 units):	9,800	(100[c] × $72) +	(50[c] × $52)
18		Total costs accounted for	$62,280	$37,800 +	$24,480
19					
20	[a]Equivalent units used to complete beginning work in process from Exhibit 17-6, Step 2.				
21	[b]Equivalent units started and completed from Exhibit 17-6, Step 2.				
22	[c]Equivalent units in ending work in process from Exhibit 17-6, Step 2.				

indicate where the costs in each layer go—that is, to units completed and transferred out or to ending work in process. Be sure to include costs of beginning work in process ($26,100) when calculating costs of units completed from beginning inventory.

Costs to Account for			**Costs Accounted for Calculated on a FIFO Basis**	
		→	Completed and transferred out	
Beginning work in process	$26,100	→	Beginning work in process	$26,100
Costs added in current period	36,180	→	Used to complete beginning work in process	4,680
		→	Started and completed	21,700
			Completed and transferred out	52,480
			Ending work in process	9,800
Total costs to account for	$62,280		Total costs accounted for	$62,280

Before proceeding, review Exhibits 17-6 and 17-7 to check your understanding of the FIFO method. Note: Exhibit 17-6 deals with only physical and equivalent units, not costs. Exhibit 17-7 shows the cost amounts.

The journal entries under the FIFO method are identical to the journal entries under the weighted-average method except for one difference. The entry to record the cost of goods completed and transferred out would be $52,480 under the FIFO method instead of $52,000 under the weighted-average method.

Keep in mind that FIFO is applied within each department to compile the cost of units *transferred out*. As a practical matter, however, units *transferred in* during a given period usually are carried at a single average unit cost. For example, the assembly department uses FIFO in the preceding example to distinguish between monthly batches of production. The resulting average cost of units transferred out of the assembly department is $52,480 ÷ 400 units = $131.20 per SG-40 unit. The succeeding department, testing, however, costs these units (which consist of costs incurred in both February and March) at one average unit cost ($131.20 in this illustration). If this averaging were not done, the attempt to track costs on a pure FIFO basis throughout a series of processes would be cumbersome. As a result, the FIFO method should really be called a *modified* or *department* FIFO method.

Comparison of Weighted-Average and FIFO Methods

Consider the summary of the costs assigned to units completed and to units still in process under the weighted-average and FIFO process-costing methods in our example for March 2012:

	Weighted Average (from Exhibit 17-5)	FIFO (from Exhibit 17-7)	Difference
Cost of units completed and transferred out	$52,000	$52,480	+ $480
Work in process, ending	10,280	9,800	− $480
Total costs accounted for	$62,280	$62,280	

The weighted-average ending inventory is higher than the FIFO ending inventory by $480, or 4.9% ($480 ÷ $9,800 = 0.049, or 4.9%). This would be a significant difference when aggregated over the many thousands of products that Pacific Electronics makes. When completed units are sold, the weighted-average method in our example leads to a lower cost of goods sold and, therefore, higher operating income and higher income taxes than the FIFO method. To see why the weighted-average method yields a lower cost of units completed, recall the data on page 613. Direct material cost per equivalent unit in beginning work-in-process inventory is $80, and conversion cost per equivalent unit in beginning work-in-process inventory is $60. These costs are greater, respectively, than the $72 direct materials cost and the $52 conversion cost per equivalent unit of work done during the current period. The current-period costs could be lower due to a decline in the prices of direct materials and conversion-cost inputs, or as a result of Pacific Electronics becoming more efficient in its processes by using smaller quantities of inputs per unit of output, or both.

For the assembly department, FIFO assumes that (1) all the higher-cost units from the previous period in beginning work in process are the first to be completed and transferred out of the process and (2) ending work in process consists of only the lower-cost current-period units. The weighted-average method, however, smooths out cost per equivalent unit by assuming that (1) more of the lower-cost units are completed and transferred out and (2) some of the higher-cost units are placed in ending work in process. The decline in the current-period cost per equivalent unit results in a lower cost of units completed and transferred out and a higher ending work-in-process inventory under the weighted-average method compared with FIFO.

Cost of units completed and, hence, operating income can differ materially between the weighted-average and FIFO methods when (1) direct material or conversion cost per equivalent unit varies significantly from period to period and (2) physical-inventory levels of work in process are large in relation to the total number of units transferred out of the process. As companies move toward long-term procurement contracts that reduce differences in unit costs from period to period and reduce inventory levels, the difference in cost of units completed under the weighted-average and FIFO methods will decrease.[3]

[3] For example, suppose beginning work-in-process inventory for March were 125 physical units (instead of 225), and suppose costs per equivalent unit of work done in the current period (March) were direct materials, $75, and conversion costs, $55. Assume that all other data for March are the same as in our example. In this case, the cost of units completed and transferred out would be $52,833 under the weighted-average method and $53,000 under the FIFO method. The work-in-process ending inventory would be $10,417 under the weighted-average method and $10,250 under the FIFO method (calculations not shown). These differences are much smaller than in the chapter example. The weighted-average ending inventory is higher than the FIFO ending inventory by only $167 ($10,417 – $10,250), or 1.6% ($167 ÷ $10,250 = 0.016, or 1.6%), compared with 4.9% higher in the chapter example.

Managers use information from process-costing systems to aid them in pricing and product-mix decisions and to provide them with feedback about their performance. FIFO provides managers with information about changes in costs per unit from one period to the next. Managers can use this information to adjust selling prices based on current conditions (for example, based on the $72 direct material cost and $52 conversion cost in March). They can also more easily evaluate performance in the current period compared with a budget or relative to performance in the previous period (for example, recognizing the decline in both unit direct material and conversion costs relative to the prior period). By focusing on work done and costs of work done during the current period, the FIFO method provides useful information for these planning and control purposes.

The weighted-average method merges unit costs from different accounting periods, obscuring period-to-period comparisons. For example, the weighted-average method would lead managers at Pacific Electronics to make decisions based on the $75.60 direct materials and $54.40 conversion costs, rather than the costs of $72 and $52 prevailing in the current period. Advantages of the weighted-average method, however, are its relative computational simplicity and its reporting of a more-representative average unit cost when input prices fluctuate markedly from month to month.

Activity-based costing plays a significant role in our study of job costing, but how is activity-based costing related to process costing? Each process—assembly, testing, and so on—can be considered a different (production) activity. However, no additional activities need to be identified within each process. That's because products are homogeneous and use resources of each process in a uniform way. The bottom line is that activity-based costing has less applicability in process-costing environments. *The appendix illustrates the use of the standard costing method for the assembly department.*

Decision Point

What are the weighted-average and first-in, first-out (FIFO) methods of process costing? Under what conditions will they yield different levels of operating income?

Transferred-In Costs in Process Costing

Learning Objective 5

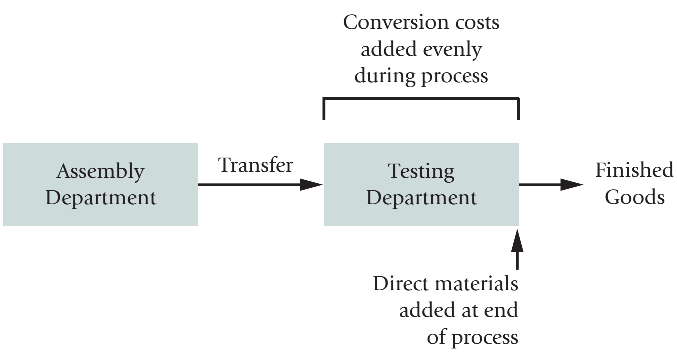
Apply process-costing methods to situations with transferred-in costs

. . . using weighted-average and FIFO methods

Many process-costing systems have two or more departments or processes in the production cycle. As units move from department to department, the related costs are also transferred by monthly journal entries. **Transferred-in costs** (also called **previous-department costs**) are costs incurred in previous departments that are carried forward as the product's cost when it moves to a subsequent process in the production cycle.

We now extend our Pacific Electronics example to the testing department. As the assembly process is completed, the assembly department of Pacific Electronics immediately transfers SG-40 units to the testing department. Conversion costs are added evenly during the testing department's process. At the ***end of the process*** in testing, units receive additional direct materials, including crating and other packing materials to prepare units for shipment. As units are completed in testing, they are immediately transferred to Finished Goods. Computation of testing department costs consists of transferred-in costs, as well as direct materials and conversion costs that are added in testing.

The following diagram represents these facts:



Data for the testing department for March 2012 are as follows:

	A	B	C	D	E
1		Physical Units (SG-40s)	Transferred-In Costs	Direct Materials	Conversion Costs
2	Work in process, beginning inventory (March 1)	240	$33,600	$ 0	$18,000
3	Degree of completion of beginning work in process		100%	0%	62.5%
4	Transferred in during March	400			
5	Completed and transferred out during March	440			
6	Work in process, ending inventory (March 31)	200			
7	Degree of completion of ending work in process		100%	0%	80%
8	Total costs added during March				
9	Direct materials and conversion costs			$13,200	$48,600
10	Transferred in (Weighted-average from Exhibit 17-5)[a]		$52,000		
11	Transferred in (FIFO from Exhibit 17-7)[a]		$52,480		
12					
13	[a]The transferred-in costs during March are different under the weighted-average method (Exhibit 17-5) and the FIFO method (Exhibit 17-7). In our example, beginning work-in-process inventory, $51,600 ($33,600 + $0 + $18,000) is the same under both the weighted-average and FIFO inventory methods because we assume costs per equivalent unit to be the same in both January and February. If costs per equivalent unit had been different in the two months, work-in-process inventory at the end of February (beginning of March) would be costed differently under the weighted-average and FIFO methods. The basic approach to process costing with transferred-in costs, however, would still be the same as what we describe in this section.				

Transferred-in costs are treated as if they are a separate type of direct material added at the beginning of the process. That is, transferred-in costs are always 100% complete as of the beginning of the process in the new department. When successive departments are involved, transferred units from one department become all or a part of the direct materials of the next department; however, they are called transferred-in costs, not direct material costs.

Transferred-In Costs and the Weighted-Average Method

To examine the weighted-average process-costing method with transferred-in costs, we use the five-step procedure described earlier (p. 610) to assign costs of the testing department to units completed and transferred out and to units in ending work in process.

Exhibit 17-8 shows Steps 1 and 2. The computations are similar to the calculations of equivalent units under the weighted-average method for the assembly department in Exhibit 17-4. The one difference here is that we have transferred-in costs as an additional input. All units, whether completed and transferred out during the period or in ending work in process, are always fully complete with respect to transferred-in costs. The reason is that the transferred-in costs refer to costs incurred in the assembly department, and any units received in the testing department must have first been completed in the assembly department. However, direct material costs have a zero degree of completion in both beginning and ending work-in-process inventories because, in testing, direct materials are introduced at the *end* of the process.

Exhibit 17-9 describes Steps 3, 4, and 5 for the weighted-average method. Beginning work in process and work done in the current period are combined for purposes of computing cost per equivalent unit for transferred-in costs, direct material costs, and conversion costs.

The journal entry for the transfer from testing to Finished Goods (see Exhibit 17-9) is as follows:

Finished Goods Control	120,890	
Work in Process—Testing		120,890
To record cost of goods completed and transferred from testing to Finished Goods.		

Entries in the Work in Process—Testing account (see Exhibit 17-9) are as follows:

Work in Process—Testing

Beginning inventory, March 1	51,600	Transferred out	120,890
Transferred-in costs	52,000		
Direct materials	13,200		
Conversion costs	48,600		
Ending inventory, March 31	44,510		

Exhibit 17-8 Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units Using Weighted-Average Method of Process Costing for Testing Department of Pacific Electronics for March 2012

Home Insert Page Layout Formulas Data Review View

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 622)	240			
5	Transferred in during current period (given, p. 622)	400			
6	To account for	640			
7	Completed and transferred out during current period	440	440	440	440
8	Work in process, ending[a] (given, p. 622)	200			
9	(200 × 100%; 200 × 0%; 200 × 80%)		200	0	160
10	Accounted for	640			
11	Equivalent units of work done to date		640	440	600
12					
13	[a]Degree of completion in this department; transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.				

Exhibit 17-9 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process Using Weighted-Average Method of Process Costing for Testing Department of Pacific Electronics for March 2012

Home Insert Page Layout Formulas Data Review View

	A	B	C	D	E	F
1			Total Production Costs	Transferred-In Costs	Direct Materials	Conversion Costs
2	(Step 3)	Work in process, beginning (given, p. 622)	$ 51,600	$33,600	$ 0	$18,000
3		Costs added in current period (given, p. 622)	113,800	52,000	13,200	48,600
4		Total costs to account for	$165,400	$85,600	$13,200	$66,600
5						
6	(Step 4)	Costs incurred to date		$85,600	$13,200	$66,600
7		Divide by equivalent units of work done to date (Exhibit 17-8)		÷ 640	÷ 440	÷ 600
8		Cost per equivalent unit of work done to date		$133.75	$ 30.00	$111.00
9						
10	(Step 5)	Assignment of costs:				
11		Completed and transferred out (440 units)	$120,890	(440[a] × $133.75) +	(440[a] × $30) +	(440[a] × $111)
12		Work in process, ending (200 units):	44,510	(200[b] × $133.75) +	(0[b] × $30) +	(160[b] × $111)
13		Total costs accounted for	$165,400	$85,600 +	$13,200 +	$66,600
14						
15	[a]Equivalent units completed and transferred out from Exhibit 17-8, Step 2.					
16	[b]Equivalent units in ending work in process from Exhibit 17-8, Step 2.					

Transferred-In Costs and the FIFO Method

To examine the FIFO process-costing method with transferred-in costs, we again use the five-step procedure. Exhibit 17-10 shows Steps 1 and 2. Other than considering transferred-in costs, computations of equivalent units are the same as under the FIFO method for the assembly department shown in Exhibit 17-6.

Exhibit 17-11 describes Steps 3, 4, and 5. In Step 3, total costs to account for of $165,880 under the FIFO method differs from the corresponding amount under the weighted-average method of $165,400. The reason is the difference in cost of completed units transferred in from the assembly department under the two methods—$52,480 under FIFO and $52,000 under weighted average. Cost per equivalent unit for the current period in Step 4 is calculated on the basis of costs transferred in and work done in the current period only. Step 5 then accounts for the total costs of $165,880 by assigning them to the units transferred out and those in ending work in process. Again, other than considering transferred-in costs, the calculations mirror those under the FIFO method for the assembly department shown in Exhibit 17-7.

Remember that in a series of interdepartmental transfers, each department is regarded as separate and distinct for accounting purposes. The journal entry for the transfer from testing to Finished Goods (see Exhibit 17-11) is as follows:

Finished Goods Control	122,360	
Work in Process—Testing		122,360
To record cost of goods completed and transferred from testing to Finished Goods.		

Exhibit 17-10 Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units Using FIFO Method of Process Costing for Testing Department of Pacific Electronics for March 2012

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 622)	240	(work done before current period)		
5	Transferred in during current period (given, p. 622)	400			
6	To account for	640			
7	Completed and transferred out during current period:				
8	From beginning work in process[a]	240			
9	[240 × (100% – 100%); 240 × (100% – 0%); 240 × (100% – 62.5%)]		0	240	90
10	Started and completed	200[b]			
11	(200 × 100%; 200 × 100%; 200 × 100%)		200	200	200
12	Work in process, ending[c] (given, p. 000)	200			
13	(200 × 100%; 200 × 0%; 200 × 80%)		200	0	160
14	Accounted for	640			
15	Equivalent units of work done in current period		400	440	450
16					
17	[a]Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 62.5%.				
18	[b]440 physical units completed and transferred out minus 240 physical units completed and transferred out from beginning				
19	work-in-process inventory.				
20	[c]Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.				

Exhibit 17-11 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process Using FIFO Method of Process Costing for Testing Department of Pacific Electronics for March 2012

	A	B	C	D	E	F
1			Total Production Costs	Transferred-In Cost	Direct Material	Conversion Costs
2	**(Step 3)**	Work in process, beginning (given, p. 622)	$ 51,600	$33,600	$ 0	$18,000
3		Costs added in current period (given, p. 622)	114,280	52,480	13,200	48,600
4		Total costs to account for	$165,880	$86,080	$13,200	$66,600
5						
6	**(Step 4)**	Costs added in current period		$52,480	$13,200	$48,600
7		Divide by equivalent units of work done in current period (Exhibit 17-10)		÷ 400	÷ 440	÷ 450
8		Cost per equivalent unit of work done in current period		$131.20	$ 30	$ 108
9						
10	**(Step 5)**	Assignment of costs:				
11		Completed and transferred out (440 units)				
12		Work in process, beginning (240 units)	$ 51,600	$33,600 +	$0 +	$18,000
13		Costs added to beginning work in process in current period	16,920	(0[a] × $131.20) +	(240[a] × $30) +	(90[a] × $108)
14		Total from beginning inventory	68,520			
15		Started and completed (200 units)	53,840	(200[b] × $131.20) +	(200[b] × $30) +	(200[b] × $108)
16		Total costs of units completed and transferred out	122,360			
17		Work in process, ending (200 units):	43,520	(200[c] × $131.20) +	(0[c] × $30) +	(160[c] × $108)
18		Total costs accounted for	$165,880	$86,080 +	$13,200 +	$66,600
19						
20	[a]Equivalent units used to complete beginning work in process from Exhibit 17-10, Step 2.					
21	[b]Equivalent units started and completed from Exhibit 17-10, Step 2.					
22	[c]Equivalent units in ending work in process from Exhibit 17-10, Step 2.					

Entries in the Work in Process—Testing account (see Exhibit 17-11) are as follows:

Work in Process—Testing

Beginning inventory, March 1	51,600	Transferred out	122,360
Transferred-in costs	52,480		
Direct materials	13,200		
Conversion costs	48,600		
Ending inventory, March 31	43,520		

Points to Remember About Transferred-In Costs

Some points to remember when accounting for transferred-in costs are as follows:

1. Be sure to include transferred-in costs from previous departments in your calculations.
2. In calculating costs to be transferred on a FIFO basis, do not overlook costs assigned in the previous period to units that were in process at the beginning of the current period but are now included in the units transferred. For example, do not overlook the $51,600 in Exhibit 17-11.
3. Unit costs may fluctuate between periods. Therefore, transferred units may contain batches accumulated at different unit costs. For example, the 400 units transferred in

Decision Point

How are the weighted-average and FIFO process-costing methods applied to transferred-in costs?

at $52,480 in Exhibit 17-11 using the FIFO method consist of units that have different unit costs of direct materials and conversion costs when these units were worked on in the assembly department (see Exhibit 17-7). Remember, however, that when these units are transferred to the testing department, they are costed at *one average unit cost* of $131.20 ($52,480 ÷ 400 units), as in Exhibit 17-11.

4. Units may be measured in different denominations in different departments. Consider each department separately. For example, unit costs could be based on kilograms in the first department and liters in the second department. Accordingly, as units are received in the second department, their measurements must be converted to liters.

Hybrid Costing Systems

Learning Objective 6

Understand the need for hybrid-costing systems such as operation-costing

. . . when product-costing does not fall into job-costing or process-costing categories

Product-costing systems do not always fall neatly into either job-costing or process-costing categories. Consider Ford Motor Company. Automobiles may be manufactured in a continuous flow (suited to process costing), but individual units may be customized with a special combination of engine size, transmission, music system, and so on (which requires job costing). A **hybrid-costing system** blends characteristics from both job-costing and process-costing systems. Product-costing systems often must be designed to fit the particular characteristics of different production systems. Many production systems are a hybrid: They have some features of custom-order manufacturing and other features of mass-production manufacturing. Manufacturers of a relatively wide variety of closely related standardized products (for example, televisions, dishwashers, and washing machines) tend to use hybrid-costing systems. The Concepts in Action feature (p. 627) describes a hybrid-costing system at Adidas. The next section explains *operation costing*, a common type of hybrid-costing system.

Overview of Operation-Costing Systems

An **operation** is a standardized method or technique that is performed repetitively, often on different materials, resulting in different finished goods. Multiple operations are usually conducted within a department. For instance, a suit maker may have a cutting operation and a hemming operation within a single department. The term *operation*, however, is often used loosely. It may be a synonym for a department or process. For example, some companies may call their finishing department a finishing process or a finishing operation.

An **operation-costing system** is a hybrid-costing system applied to batches of similar, but not identical, products. Each batch of products is often a variation of a single design, and it proceeds through a sequence of operations. Within each operation, all product units are treated exactly alike, using identical amounts of the operation's resources. A key point in the operation system is that each batch does not necessarily move through the same operations as other batches. Batches are also called production runs.

In a company that makes suits, management may select a single basic design for every suit to be made, but depending on specifications, each batch of suits varies somewhat from other batches. Batches may vary with respect to the material used or the type of stitching. Semiconductors, textiles, and shoes are also manufactured in batches and may have similar variations from batch to batch.

An operation-costing system uses work orders that specify the needed direct materials and step-by-step operations. Product costs are compiled for each work order. Direct materials that are unique to different work orders are specifically identified with the appropriate work order, as in job costing. However, each unit is assumed to use an identical amount of conversion costs for a given operation, as in process costing. A single average conversion cost per unit is calculated for each operation, by dividing total conversion costs for that operation by the number of units that pass through it. This average cost is then assigned to each unit passing through the operation. Units that do not pass through an operation are not allocated any costs of that

Concepts in Action

Hybrid Costing for Customized Shoes at Adidas

Adidas has been designing and manufacturing athletic footwear for nearly 90 years. Although shoemakers have long individually crafted shoes for professional athletes like Reggie Bush of the New Orleans Saints, Adidas took this concept a step further when it initiated the *mi adidas* program. *Mi adidas* gives customers the opportunity to create shoes to their exact personal specifications for function, fit, and aesthetics. *Mi adidas* is available in retail stores around the world, and in special *mi adidas* "Performance Stores" in cities such as New York, Chicago, and San Francisco.

The process works as follows: The customer goes to a *mi adidas* station, where a salesperson develops an in-depth customer profile, a 3-D computer scanner develops a scan of the customer's feet, and the customer selects from among 90 to 100 different styles and colors for his or her modularly designed shoe. During the three-step, 30-minute high-tech process, *mi adidas* experts take customers through the "mi fit," "mi performance," and "mi design" phases, resulting in a customized shoe to fit their needs. The resulting data are transferred to an Adidas plant, where small, multiskilled teams produce the customized shoe. The measuring and fitting process is free, but purchasing your own specially made shoes costs between $40 and $65 on top of the normal retail price, depending on the style.

Historically, costs associated with individually customized products have fallen into the domain of job costing. Adidas, however, uses a hybrid-costing system—job costing for the material and customizable components that customers choose and process costing to account for the conversion costs of production. The cost of making each pair of shoes is calculated by accumulating all production costs and dividing by the number of shoes made. In other words, even though each pair of shoes is different, the conversion cost of each pair is assumed to be the same.

The combination of customization with certain features of mass production is called mass customization. It is the consequence of being able to digitize information that individual customers indicate is important to them. Various products that companies are now able to customize within a mass-production setting (for example, personal computers, blue jeans, bicycles) still require job costing of materials and considerable human intervention. However, as manufacturing systems become flexible, companies are also using process costing to account for the standardized conversion costs.

Sources: Adidas. 2010. New Orleans Saints running back Reggie Bush designs custom Adidas shoes to aid in Haiti relief efforts. AG press release. Portland, OR: February 5; Kamenev, Marina. 2006. Adidas' high tech footwear. *BusinessWeek.com*, November 3; Seifert, Ralf. 2003. The "mi adidas" mass customization initiative. IMD No. 159. Lausanne, Switzerland: International Institute for Management Development.

operation. Our examples assume only two cost categories—direct materials and conversion costs—but operation costing can have more than two cost categories. Costs in each category are identified with specific work orders using job-costing or process-costing methods as appropriate.

Managers find operation costing useful in cost management because operation costing focuses on control of physical processes, or operations, of a given production system. For example, in clothing manufacturing, managers are concerned with fabric waste, how many fabric layers that can be cut at one time, and so on. Operation costing measures, in financial terms, how well managers have controlled physical processes.

Illustration of an Operation-Costing System

The Baltimore Clothing Company, a clothing manufacturer, produces two lines of blazers for department stores: those made of wool and those made of polyester. Wool blazers use better-quality materials and undergo more operations than polyester blazers do.

Operations information on work order 423 for 50 wool blazers and work order 424 for 100 polyester blazers is as follows:

	Work Order 423	Work Order 424
Direct materials	Wool	Polyester
	Satin full lining	Rayon partial lining
	Bone buttons	Plastic buttons
Operations		
1. Cutting cloth	Use	Use
2. Checking edges	Use	Do not use
3. Sewing body	Use	Use
4. Checking seams	Use	Do not use
5. Machine sewing of collars and lapels	Do not use	Use
6. Hand sewing of collars and lapels	Use	Do not use

Cost data for these work orders, started and completed in March 2012, are as follows:

	Work Order 423	Work Order 424
Number of blazers	50	100
Direct material costs	$ 6,000	$3,000
Conversion costs allocated:		
Operation 1	580	1,160
Operation 2	400	—
Operation 3	1,900	3,800
Operation 4	500	—
Operation 5	—	875
Operation 6	700	—
Total manufacturing costs	$10,080	$8,835

As in process costing, all product units in any work order are assumed to consume identical amounts of conversion costs of a particular operation. Baltimore's operation-costing system uses a budgeted rate to calculate the conversion costs of each operation. The budgeted rate for Operation 1 (amounts assumed) is as follows:

$$\text{Operation 1 budgeted conversion-cost rate for 2012} = \frac{\text{Operation 1 budgeted conversion costs for 2012}}{\text{Operation 1 budgeted product units for 2012}}$$

$$= \frac{\$232{,}000}{20{,}000 \text{ units}}$$

$$= \$11.60 \text{ per unit}$$

Budgeted conversion costs of Operation 1 include labor, power, repairs, supplies, depreciation, and other overhead of this operation. If some units have not been completed (so all units in Operation 1 have not received the same amounts of conversion costs), the conversion-cost rate is computed by dividing budgeted conversion costs by *equivalent units* of conversion costs, as in process costing.

As goods are manufactured, conversion costs are allocated to the work orders processed in Operation 1 by multiplying the $11.60 conversion cost per unit by the number of units processed. Conversion costs of Operation 1 for 50 wool blazers (work order 423) are $11.60 per blazer × 50 blazers = $580, and for 100 polyester blazers (work order 424) are $11.60 per blazer × 100 blazers = $1,160. When equivalent units are used to calculate the conversion-cost rate, costs are allocated to work orders by multiplying conversion cost per equivalent unit by number of equivalent units in the work order. Direct material costs of $6,000 for the 50 wool blazers (work order 423) and $3,000 for the 100 polyester blazers (work order 424) are specifically identified with each order, as in job costing. Remember the basic point in operation costing: Operation unit costs are assumed to be the same regardless of the work order, but direct material costs vary across orders when the materials for each work order vary.

Journal Entries

Actual conversion costs for Operation 1 in March 2012—assumed to be $24,400, including actual costs incurred for work order 423 and work order 424—are entered into a Conversion Costs Control account:

1. Conversion Costs Control	24,400	
Various accounts (such as Wages Payable Control and Accumulated Depreciation)		24,400

Summary journal entries for assigning costs to polyester blazers (work order 424) follow. Entries for wool blazers would be similar. Of the $3,000 of direct materials for work order 424, $2,975 are used in Operation 1, and the remaining $25 of materials are used in another operation. The journal entry to record direct materials used for the 100 polyester blazers in March 2012 is as follows:

2. Work in Process, Operation 1	2,975	
Materials Inventory Control		2,975

The journal entry to record the allocation of conversion costs to products uses the budgeted rate of $11.60 per blazer times the 100 polyester blazers processed, or $1,160:

3. Work in Process, Operation 1	1,160	
Conversion Costs Allocated		1,160

The journal entry to record the transfer of the 100 polyester blazers (at a cost of $2,975 + $1,160) from Operation 1 to Operation 3 (polyester blazers do not go through Operation 2) is as follows:

4. Work in Process, Operation 3	4,135	
Work in Process, Operation 1		4,135

After posting these entries, the Work in Process, Operation 1, account appears as follows:

Work in Process, Operation 1

(2) Direct materials	2,975	(4) Transferred to Operation 3	4,135
(3) Conversion costs allocated	1,160		
Ending inventory, March 31	0		

Costs of the blazers are transferred through the operations in which blazers are worked on and then to finished goods in the usual manner. Costs are added throughout the fiscal year in the Conversion Costs Control account and the Conversion Costs Allocated account. Any overallocation or underallocation of conversion costs is disposed of in the same way as overallocated or underallocated manufacturing overhead in a job-costing system (see pp. 117–122).

Decision Point

What is an operation-costing system and when is it a better approach to product-costing?

Problem for Self-Study

Allied Chemicals operates a thermo-assembly process as the second of three processes at its plastics plant. Direct materials in thermo-assembly are added at the end of the process. Conversion costs are added evenly during the process. The following data pertain to the thermo-assembly department for June 2012:

	A	B	C	D	E
1		Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
2	Work in process, beginning inventory	50,000			
3	Degree of completion of beginning work in process		100%	0%	80%
4	Transferred in during current period	200,000			
5	Completed and transferred out during current period	210,000			
6	Work in process, ending inventory	?			
7	Degree of completion of ending work in process		100%	0%	40%

Required Compute equivalent units under (1) the weighted-average method and (2) the FIFO method.

Solution

1. The weighted-average method uses equivalent units of work done to date to compute cost per equivalent unit. The calculations of equivalent units follow:

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given)	50,000			
5	Transferred in during current period (given)	200,000			
6	To account for	250,000			
7	Completed and transferred out during current period	210,000	210,000	210,000	210,000
8	Work in process, ending[a]	40,000[b]			
9	(40,000 × 100%; 40,000 × 0%; 40,000 × 40%)		40,000	0	16,000
10	Accounted for	250,000			
11	Equivalent units of work done to date		250,000	210,000	226,000
12					
13	[a]Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 40%.				
14	[b]250,000 physical units to account for minus 210,000 physical units completed and transferred out.				

2. The FIFO method uses equivalent units of work done in the current period only to compute cost per equivalent unit. The calculations of equivalent units follow:

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given)	50,000			
5	Transferred in during current period (given)	200,000			
6	To account for	250,000			
7	Completed and transferred out during current period:				
8	From beginning work in process[a]	50,000			
9	[50,000 × (100% – 100%); 50,000 × (100% – 0%); 50,000 × (100% – 80%)]		0	50,000	10,000
10	Started and completed	160,000[b]			
11	(160,000 × 100%; 160,000 × 100%; 160,000 × 100%)		160,000	160,000	160,000
12	Work in process, ending[c]	40,000[d]			
13	(40,000 × 100%; 40,000 × 0%; 40,000 × 40%)		40,000	0	16,000
14	Accounted for	250,000			
15	Equivalent units of work done in current period		200,000	210,000	186,000
16					
17	[a]Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.				
18	[b]210,000 physical units completed and transferred out minus 50,000 physical units completed and transferred out from beginning work-in-process inventory.				
19	[c]Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 40%.				
20	[d]250,000 physical units to account for minus 210,000 physical units completed and transferred out.				

Decision Points

The following question-and-answer format summarizes the chapter's learning objectives. Each decision presents a key question related to a learning objective. The guidelines are the answer to that question.

Decision	Guidelines
1. Under what conditions is a process-costing system used?	A process-costing system is used to determine cost of a product or service when masses of identical or similar units are produced. Industries using process-costing systems include food, textiles, and oil refining.
2. How are average unit costs computed when no inventories are present?	Average unit costs are computed by dividing total costs in a given accounting period by total units produced in that period.
3. What are the five steps in a process-costing system and how are equivalent units calculated?	The five steps in a process-costing system are (1) summarize the flow of physical units of output, (2) compute output in terms of equivalent units, (3) summarize total costs to account for, (4) compute cost per equivalent unit, and (5) assign total costs to units completed and to units in ending work in process. Equivalent units is a derived amount of output units that (a) takes the quantity of each input (factor of production) in units completed or in incomplete units in work in process and (b) converts the quantity of input into the amount of completed output units that could be made with that quantity of input.

4. What are the weighted-average and first-in, first-out methods of process costing? Under what conditions will they yield different levels of operating income?	The weighted-average method computes unit costs by dividing total costs in the Work in Process account by total equivalent units completed to date, and assigns this average cost to units completed and to units in ending work-in-process inventory. The first-in, first-out (FIFO) method computes unit costs based on costs incurred during the current period and equivalent units of work done in the current period. Operating income can differ materially between the two methods when (1) direct material or conversion cost per equivalent unit varies significantly from period to period and (2) physical-inventory levels of work in process are large in relation to the total number of units transferred out of the process.
5. How are the weighted-average and FIFO process-costing methods applied to transferred-in costs?	The weighted-average method computes transferred-in costs per unit by dividing total transferred-in costs to date by total equivalent transferred-in units completed to date, and assigns this average cost to units completed and to units in ending work-in-process inventory. The FIFO method computes transferred-in costs per unit based on costs transferred in during the current period and equivalent units of transferred-in costs of work done in the current period. The FIFO method assigns transferred-in costs in beginning work in process to units completed and costs transferred in during the current period first to complete beginning inventory, next to start and complete new units, and finally to units in ending work-in-process inventory.
6. What is an operation-costing system and when is it a better approach to product-costing?	Operation-costing is a hybrid-costing system that blends characteristics from both job-costing and process-costing systems. It is a better approach to product-costing when production systems share some features of custom-order manufacturing and other features of mass-production manufacturing.

Appendix

Standard-Costing Method of Process Costing

Chapter 7 described accounting in a standard-costing system. Recall that this involves making entries using standard costs and then isolating variances from these standards in order to support management control. This appendix describes how the principles of standard costing can be employed in process-costing systems.

Benefits of Standard Costing

Companies that use process-costing systems produce masses of identical or similar units of output. In such companies, it is fairly easy to set standards for quantities of inputs needed to produce output. Standard cost per input unit can then be multiplied by input quantity standards to develop standard cost per output unit.

The weighted-average and FIFO methods become very complicated when used in process industries that produce a wide variety of similar products. For example, a steel-rolling mill uses various steel alloys and produces sheets of various sizes and finishes. The different types of direct materials used and the operations performed are few, but used in various combinations, they yield a wide variety of products. Similarly, complex conditions are frequently found, for example, in plants that manufacture rubber products, textiles, ceramics, paints, and packaged food products. In each of these cases, if the broad averaging procedure of *actual* process costing were used, the result would be inaccurate costs for each product. Therefore, the standard-costing method of process costing is widely used in these industries.

Under the standard-costing method, teams of design and process engineers, operations personnel, and management accountants work together to determine *separate* standard costs per equivalent unit on the basis of different technical processing specifications for each product. Identifying standard costs for each product overcomes the disadvantage of costing all products at a single average amount, as under actual costing.

Computations Under Standard Costing

We return to the assembly department of Pacific Electronics, but this time we use standard costs. Assume the same standard costs apply in February and March of 2012. Data for the assembly department are as follows:

	A	B	C	D	E
1		Physical Units (SG-40s) (1)	Direct Materials (2)	Conversion Costs (3)	Total Costs (4) = (2) + (3)
2	Standard cost per unit		$ 74	$ 54	
3	Work in process, beginning inventory (March 1)	225			
4	Degree of completion of beginning work in process		100%	60%	
5	Beginning work in process inventory at standard costs		$16,650[a]	$ 7,290[a]	$23,940
6	Started during March	275			
7	Completed and transferred out during March	400			
8	Work in process, ending inventory (March 31)	100			
9	Degree of completion of ending work in process		100%	50%	
10	Actual total costs added during March		$19,800	$16,380	$36,180
11					
12	[a]Work in process, beginning inventory at standard costs				
13	Direct materials: 225 physical units × 100% completed × $74 per unit = $16,650				
14	Conversion costs: 225 physical units × 60% completed × $54 per unit = $7,290				

We illustrate the standard-costing method of process costing using the five-step procedure introduced earlier (p. 610).

Exhibit 17-12 presents Steps 1 and 2. These steps are identical to the steps described for the FIFO method in Exhibit 17-6 because, as in FIFO, the standard-costing method also assumes that the earliest equivalent units in beginning work in process are completed first. Work done in the current period for direct materials is 275 equivalent units. Work done in the current period for conversion costs is 315 equivalent units.

Exhibit 17-13 describes Steps 3, 4, and 5. In Step 3, total costs to account for (that is, the total debits to Work in Process—Assembly) differ from total debits to Work in Process—Assembly under the actual-cost-based weighted-average

Exhibit 17-12

Steps 1 and 2: Summarize Output in Physical Units and Compute Output in Equivalent Units Using Standard-Costing Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 633)	225		
5	Started during current period (given, p. 633)	275		
6	To account for	500		
7	Completed and transferred out during current period:			
8	From beginning work in process[a]	225		
9	[225 × (100% – 100%); 225 × (100% – 60%)]		0	90
10	Started and completed	175[b]		
11	(175 × 100%; 175 × 100%)		175	175
12	Work in process, ending[c] (given, p. 633)	100		
13	(100 × 100%; 100 × 50%)		100	50
14	Accounted for	500		
15	Equivalent units of work done in current period		275	315
16				
17	[a]Degree of completion in this department: direct materials, 100%; conversion costs, 60%.			
18	[b]400 physical units completed and transferred out minus 225 physical units completed and transferred out from beginning work-in-process inventory.			
19	[c]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.			

Exhibit 17-13 Steps 3, 4, and 5: Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed and to Units in Ending Work in Process Using Standard-Costing Method of Process Costing for Assembly Department of Pacific Electronics for March 2012

	A	B	C	D	E	F	G
1			Total Production Costs	Direct Materials		Conversion Costs	
2	(Step 3)	Work in process, beginning (given, p. 633)					
3		Direct materials, 225 × $74; Conversion costs, 135 × $54	$23,940	$16,650		$ 7,290	
4		Costs added in current period at standard costs					
5		Direct materials, 275 × $74; Conversion costs, 315 × $54	37,360	20,350		17,010	
6		Total costs to account for	$61,300	$37,000		$24,300	
7							
8	(Step 4)	Standard cost per equivalent unit (given, p. 633)		$ 74		$ 54	
9							
10	(Step 5)	Assignment of costs at standard costs:					
11		Completed and transferred out (400 units):					
12		Work in process, beginning (225 units)	$23,940	$16,650	+	$ 7,290	
13		Costs added to beginning work in process in current period	4,860	(0[a] × $74)	+	(90[a] × $54)	
14		Total from beginning inventory	28,800				
15		Started and completed (175 units)	22,400	(175[b] × $74)	+	(175[b] × $54)	
16		Total costs of units completed and transferred out	51,200				
17		Work in process, ending (100 units):	10,100	(100[c] × $74)	+	(50[c] × $54)	
18		Total costs accounted for	$61,300	$37,000	+	$24,300	
19							
20	Summary of variances for current performance:						
21	Costs added in current period at standard costs (see step 3)			$20,350		$17,010	
22	Actual costs incurred (given, p. 633)			$19,800		$16,380	
23	Variance			$ 550	F	$ 630	F
24							
25	[a]Equivalent units used to complete beginning work in process from Exhibit 17-12, Step 2.						
26	[b]Equivalent units started and completed from Exhibit 17-12, Step 2.						
27	[c]Equivalent units in ending work in process from Exhibit 17-12, Step 2.						

and FIFO methods. That's because, as in all standard-costing systems, the debits to the Work in Process account are at standard costs, rather than actual costs. These standard costs total $61,300 in Exhibit 17-13. In Step 4, costs per equivalent unit are standard costs: direct materials, $74, and conversion costs, $54. *Therefore, costs per equivalent unit do not have to be computed as they were for the weighted-average and FIFO methods.*

Exhibit 17-13, Step 5, assigns total costs to units completed and transferred out and to units in ending work-in-process inventory, as in the FIFO method. Step 5 assigns amounts of standard costs to equivalent units calculated in Exhibit 17-12. These costs are assigned (1) first to complete beginning work-in-process inventory, (2) next to start and complete new units, and (3) finally to start new units that are in ending work-in-process inventory. Note how the $61,300 total costs accounted for in Step 5 of Exhibit 17-13 equal total costs to account for.

Accounting for Variances

Process-costing systems using standard costs record actual direct material costs in Direct Materials Control and actual conversion costs in Conversion Costs Control (similar to Variable and Fixed Overhead Control in Chapter 8). In the journal entries that follow, the first two record these *actual costs*. In entries 3 and 4a, the Work-in-Process—Assembly account accumulates direct material costs and conversion costs at *standard costs*. Entries 3 and 4b isolate total variances. The final entry transfers out completed goods at standard costs.

1. Assembly Department Direct Materials Control (at actual costs)	19,800	
Accounts Payable Control		19,800
To record direct materials purchased and used in production during March. This cost control account is debited with actual costs.		

2. Assembly Department Conversion Costs Control (at actual costs)	16,380	
Various accounts such as Wages Payable Control and Accumulated Depreciation		16,380
To record assembly department conversion costs for March. This cost control account is debited with actual costs.		
Entries 3, 4, and 5 use standard cost amounts from Exhibit 17-13.		
3. Work in Process—Assembly (at standard costs)	20,350	
Direct Materials Variances		550
Assembly Department Direct Materials Control		19,800
To record standard costs of direct materials assigned to units worked on and total direct materials variances.		
4a. Work in Process—Assembly (at standard costs)	17,010	
Assembly Department Conversion Costs Allocated		17,010
To record conversion costs allocated at standard rates to the units worked on during March.		
4b. Assembly Department Conversion Costs Allocated	17,010	
Conversion Costs Variances		630
Assembly Department Conversion Costs Control		16,380
To record total conversion costs variances.		
5. Work in Process—Testing (at standard costs)	51,200	
Work in Process—Assembly (at standard costs)		51,200
To record standard costs of units completed and transferred out from assembly to testing.		

Variances arise under standard costing, as in entries 3 and 4b. That's because the standard costs assigned to products on the basis of work done in the current period do not equal actual costs incurred in the current period. Recall that variances that result in higher income than expected are termed favorable, while those that reduce income are unfavorable. From an accounting standpoint, favorable cost variances are credit entries, while unfavorable ones are debits. In the preceding example, both direct materials and conversion cost variances are favorable. This is also reflected in the "F" designations for both variances in Exhibit 17-13.

Variances can be analyzed in little or great detail for planning and control purposes, as described in Chapters 7 and 8. Sometimes direct materials price variances are isolated at the time direct materials are purchased and only efficiency variances are computed in entry 3. Exhibit 17-14 shows how the costs flow through the general-ledger accounts under standard costing.

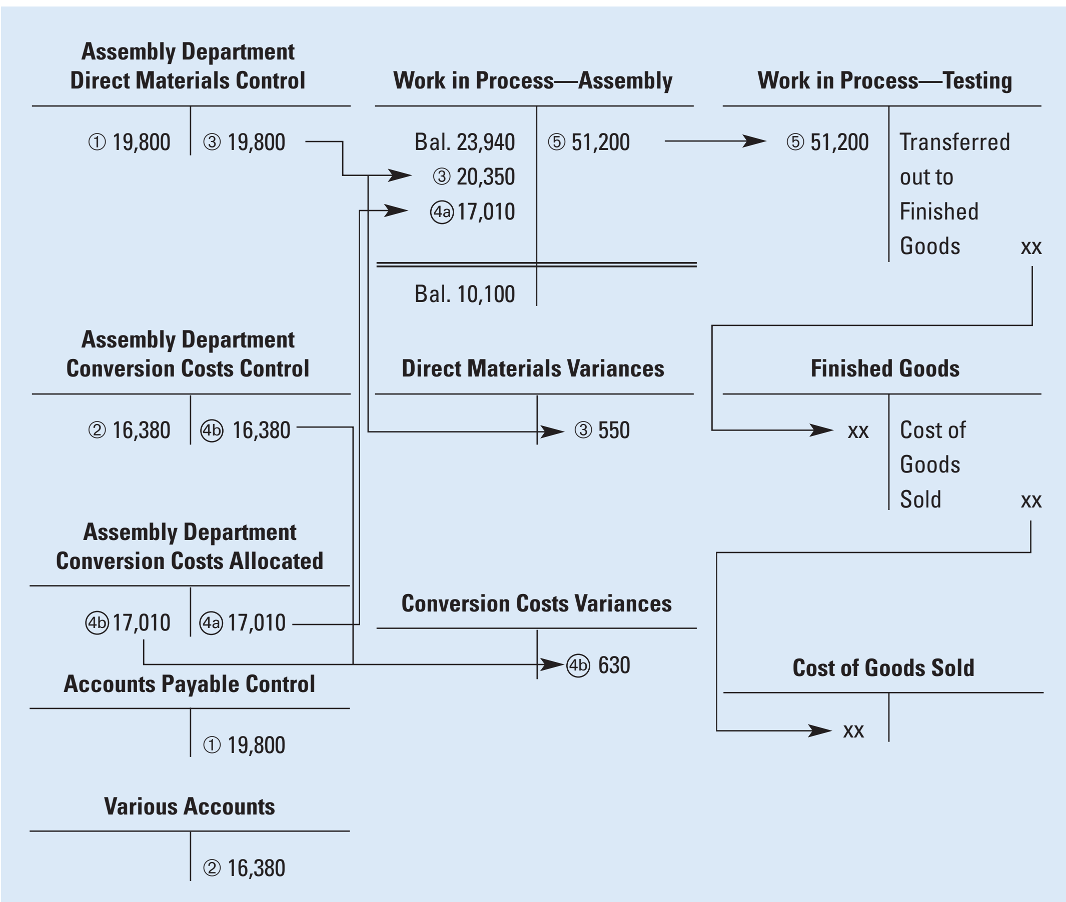


Exhibit 17-14

Flow of Standard Costs in a Process-Costing System for Assembly Department of Pacific Electronics for March 2012

Terms to Learn

This chapter and the Glossary at the end of the book contain definitions of the following important terms:

equivalent units (**p. 611**)
first-in, first-out (FIFO) process-costing method (**p. 617**)
hybrid-costing system (**p. 626**)
operation (**p. 626**)
operation-costing system (**p. 626**)
previous-department costs (**p. 621**)
transferred-in costs (**p. 621**)
weighted-average process-costing method (**p. 614**)

Assignment Material

MyAccountingLab

Questions

17-1 Give three examples of industries that use process-costing systems.

17-2 In process costing, why are costs often divided into two main classifications?

17-3 Explain equivalent units. Why are equivalent-unit calculations necessary in process costing?

17-4 What problems might arise in estimating the degree of completion of semiconductor chips in a semiconductor plant?

17-5 Name the five steps in process costing when equivalent units are computed.

17-6 Name the three inventory methods commonly associated with process costing.

17-7 Describe the distinctive characteristic of weighted-average computations in assigning costs to units completed and to units in ending work in process.

17-8 Describe the distinctive characteristic of FIFO computations in assigning costs to units completed and to units in ending work in process.

17-9 Why should the FIFO method be called a modified or department FIFO method?

17-10 Identify a major advantage of the FIFO method for purposes of planning and control.

17-11 Identify the main difference between journal entries in process costing and job costing.

17-12 "The standard-costing method is particularly applicable to process-costing situations." Do you agree? Why?

17-13 Why should the accountant distinguish between transferred-in costs and additional direct material costs for each subsequent department in a process-costing system?

17-14 "Transferred-in costs are those costs incurred in the preceding accounting period." Do you agree? Explain.

17-15 "There's no reason for me to get excited about the choice between the weighted-average and FIFO methods in my process-costing system. I have long-term contracts with my materials suppliers at fixed prices." Do you agree with this statement made by a plant controller? Explain.

MyAccountingLab

Exercises

17-16 Equivalent units, zero beginning inventory. Nihon, Inc., is a manufacturer of digital cameras. It has two departments: assembly and testing. In January 2012, the company incurred $750,000 on direct materials and $798,000 on conversion costs, for a total manufacturing cost of $1,548,000.

Required

1. Assume there was no beginning inventory of any kind on January 1, 2012. During January, 10,000 cameras were placed into production and all 10,000 were fully completed at the end of the month. What is the unit cost of an assembled camera in January?
2. Assume that during February 10,000 cameras are placed into production. Further assume the same total assembly costs for January are also incurred in February, but only 9,000 cameras are fully completed at the end of the month. All direct materials have been added to the remaining 1,000 cameras. However, on average, these remaining 1,000 cameras are only 50% complete as to conversion costs. (a) What are the equivalent units for direct materials and conversion costs and their respective costs per equivalent unit for February? (b) What is the unit cost of an assembled camera in February 2012?
3. Explain the difference in your answers to requirements 1 and 2.

17-17 Journal entries (continuation of 17-16). Refer to requirement 2 of Exercise 17-16.

Required Prepare summary journal entries for the use of direct materials and incurrence of conversion costs. Also prepare a journal entry to transfer out the cost of goods completed. Show the postings to the Work in Process account.

17-18 Zero beginning inventory, materials introduced in middle of process. Roary Chemicals has a mixing department and a refining department. Its process-costing system in the mixing department has two direct materials cost categories (chemical P and chemical Q) and one conversion costs pool. The following data pertain to the mixing department for July 2012:

Units	
Work in process, July 1	0
Units started	50,000
Completed and transferred to refining department	35,000
Costs	
Chemical P	$250,000
Chemical Q	70,000
Conversion costs	135,000

Chemical P is introduced at the start of operations in the mixing department, and chemical Q is added when the product is three-fourths completed in the mixing department. Conversion costs are added evenly during the process. The ending work in process in the mixing department is two-thirds complete.

Required

1. Compute the equivalent units in the mixing department for July 2012 for each cost category.
2. Compute (a) the cost of goods completed and transferred to the refining department during July and (b) the cost of work in process as of July 31, 2012.

17-19 Weighted-average method, equivalent units. Consider the following data for the assembly division of Fenton Watches, Inc.:

The assembly division uses the weighted-average method of process costing.

	Physical Units (Watches)	Direct Materials	Conversion Costs
Beginning work in process (May 1)[a]	80	$ 493,360	$ 91,040
Started in May 2012	500		
Completed during May 2012	460		
Ending work in process (May 31)[b]	120		
Total costs added during May 2012		$3,220,000	$1,392,000

[a]Degree of completion: direct materials, 90%; conversion costs, 40%.
[b]Degree of completion: direct materials, 60%; conversion costs, 30%.

Required Compute equivalent units for direct materials and conversion costs. Show physical units in the first column of your schedule.

17-20 Weighted-average method, assigning costs (continuation of 17-19).

Required For the data in Exercise 17-19, summarize total costs to account for, calculate cost per equivalent unit for direct materials and conversion costs, and assign total costs to units completed (and transferred out) and to units in ending work in process.

17-21 FIFO method, equivalent units. Refer to the information in Exercise 17-19. Suppose the assembly division at Fenton Watches, Inc., uses the FIFO method of process costing instead of the weighted-average method.

Required Compute equivalent units for direct materials and conversion costs. Show physical units in the first column of your schedule.

17-22 FIFO method, assigning costs (continuation of 17-21).

Required For the data in Exercise 17-19, use the FIFO method to summarize total costs to account for, calculate cost per equivalent unit for direct materials and conversion costs, and assign total costs to units completed (and transferred out) and to units in ending work in process.

17-23 Operation Costing. Whole Goodness Bakery needs to determine the cost of two work orders for the month of June. Work order 215 is for 1,200 packages of dinner rolls and work order 216 is for 1,400 loaves of multigrain bread. Dinner rolls are mixed and cut into individual rolls before being baked and then packaged. Multigrain loaves are mixed and shaped before being baked, sliced, and packaged. The following information applies to work order 215 and work order 216:

	Work Order 215	Work Order 216
Quantity (packages)	1,200	1,400
Operations		
1. Mix	Use	Use
2. Shape loaves	Do not use	Use
3. Cut rolls	Use	Do not use
4. Bake	Use	Use
5. Slice loaves	Do not use	Use
6. Package	Use	Use

Selected budget information for June follows:

	Dinner Rolls	Multigrain Loaves	Total
Packages	4,800	6,500	11,300
Direct material costs	$2,640	$5,850	$ 8,490

Budgeted conversion costs for each operation for June follow:

Mixing	$9,040
Shaping	1,625
Cutting	720
Baking	7,345
Slicing	650
Packaging	8,475

Required

1. Using budgeted number of packages as the denominator, calculate the budgeted conversion-cost rates for each operation.
2. Using the information in requirement 1, calculate the budgeted cost of goods manufactured for the two June work orders.
3. Calculate the cost per package of dinner rolls and multigrain loaves for work order 215 and 216.

17-24 Weighted-average method, assigning costs. Bio Doc Corporation is a biotech company based in Milpitas. It makes a cancer-treatment drug in a single processing department. Direct materials are added at the start of the process. Conversion costs are added evenly during the process. Bio Doc uses the weighted-average method of process costing. The following information for July 2011 is available.

		Equivalent Units	
	Physical Units	Direct Materials	Conversion Costs
Work in process, July 1	8,500[a]	8,500	1,700
Started during July	35,000		
Completed and transferred out during July	33,000	33,000	33,000
Work in process, July 31	10,500[b]	10,500	6,300

[a]Degree of completion: direct materials, 100%; conversion costs, 20%.
[b]Degree of completion: direct materials, 100%; conversion costs, 60%.

Total Costs for July 2008		
Work in process, beginning		
Direct materials	$63,100	
Conversion costs	45,510	$108,610
Direct materials added during July		284,900
Conversion costs added during July		485,040
Total costs to account for		$878,550

Required

1. Calculate cost per equivalent unit for direct materials and conversion costs.
2. Summarize total costs to account for, and assign total costs to units completed (and transferred out) and to units in ending work in process.

17-25 FIFO method, assigning costs.

Do Exercise 17-24 using the FIFO method. Note that you first need to calculate the equivalent units of work done in the current period (for direct materials and conversion costs) to complete beginning work in process, to start and complete new units, and to produce ending work in process.

Required

17-26 Standard-costing method, assigning costs. Refer to the information in Exercise 17-24. Suppose Bio Doc determines standard costs of $8.25 per equivalent unit for direct materials and $12.70 per equivalent unit for conversion costs for both beginning work in process and work done in the current period.

Required

1. Do Exercise 17-24 using the standard-costing method. Note that you first need to calculate the equivalent units of work done in the current period (for direct materials and conversion costs) to complete beginning work in process, to start and complete new units, and to produce ending work in process.
2. Compute the total direct materials and conversion costs variances for July 2011.

17-27 Transferred-in costs, weighted-average method. Asaya Clothing, Inc., is a manufacturer of winter clothes. It has a knitting department and a finishing department. This exercise focuses on the finishing department. Direct materials are added at the end of the process. Conversion costs are added evenly during the process. Asaya uses the weighted-average method of process costing. The following information for June 2012 is available.

Home Insert Page Layout Formulas Data Review View

	A	B	C	D	E
1		Physical Units (tons)	Transferred-In Costs	Direct Materials	Conversion Costs
2	Work in process, beginning inventory (June 1)	75	$ 75,000	$ 0	$30,000
3	Degree of completion, beginning work in process		100%	0%	60%
4	Transferred in during June	135			
5	Completed and transferred out during June	150			
6	Work in process, ending inventory (June 30)	60			
7	Degree of completion, ending work in process		100%	0%	75%
8	Total costs added during June		$142,500	$37,500	$78,000

Required

1. Calculate equivalent units of transferred-in costs, direct materials, and conversion costs.
2. Summarize total costs to account for, and calculate the cost per equivalent unit for transferred-in costs, direct materials, and conversion costs.
3. Assign total costs to units completed (and transferred out) and to units in ending work in process.

17-28 Transferred-in costs, FIFO method. Refer to the information in Exercise 17-27. Suppose that Asaya uses the FIFO method instead of the weighted-average method in all of its departments. The only changes to Exercise 17-27 under the FIFO method are that total transferred-in costs of beginning work in process on June 1 are $60,000 (instead of $75,000) and total transferred-in costs added during June are $130,800 (instead of $142,500).

Required

Do Exercise 17-27 using the FIFO method. Note that you first need to calculate equivalent units of work done in the current period (for transferred-in costs, direct materials, and conversion costs) to complete beginning work in process, to start and complete new units, and to produce ending work in process.

17-29 Operation Costing. UB Healthy Company manufactures three different types of vitamins: vitamin A, vitamin B, and a multivitamin. The company uses four operations to manufacture the vitamins: mixing, tableting, encapsulating, and bottling. Vitamins A and B are produced in tablet form (in the tableting department) and the multivitamin is produced in capsule form (in the encapsulating department). Each bottle contains 200 vitamins, regardless of the product.

Conversion costs are applied based on the number of bottles in the tableting and encapsulating departments. Conversion costs are applied based on labor hours in the mixing department. It takes 1.5 minutes to mix the ingredients for a 200-unit bottle for each product. Conversion costs are applied based on machine hours in the bottling department. It takes 1 minute of machine time to fill a 200-unit bottle, regardless of the product.

UB Healthy is planning to complete one batch of each type of vitamin in July. The budgeted number of bottles and expected direct material cost for each type of vitamin is as follows:

	Vitamin A	Vitamin B	Multivitamin
Number of 200 unit bottles	12,000	9,000	18,000
Direct material cost	$23,040	$21,600	$47,520

The budgeted conversion costs for each department for July are as follows:

Department	Budgeted Conversion Cost
Mixing	$ 8,190
Tableting	24,150
Encapsulating	25,200
Bottling	3,510

Required

1. Calculate the conversion cost rates for each department.
2. Calculate the budgeted cost of goods manufactured for vitamin A, vitamin B, and the multivitamin for the month of July.
3. Calculate the cost per 200-unit bottle for each type of vitamin for the month of July.

MyAccountingLab

Problems

17-30 Weighted-average method. Larsen Company manufactures car seats in its San Antonio plant. Each car seat passes through the assembly department and the testing department. This problem focuses on the assembly department. The process-costing system at Larsen Company has a single direct-cost category (direct materials) and a single indirect-cost category (conversion costs). Direct materials are added at the beginning of the process. Conversion costs are added evenly during the process. When the assembly department finishes work on each car seat, it is immediately transferred to testing.

Larsen Company uses the weighted-average method of process costing. Data for the assembly department for October 2012 are as follows:

	Physical Units (Car Seats)	Direct Materials	Conversion Costs
Work in process, October 1[a]	5,000	$1,250,000	$ 402,750
Started during October 2012	20,000		
Completed during October 2012	22,500		
Work in process, October 31[b]	2,500		
Total costs added during October 2012		$4,500,000	$2,337,500

[a]Degree of completion: direct materials, ?%; conversion costs, 60%.
[b]Degree of completion: direct materials, ?%; conversion costs, 70%.

Required

1. For each cost category, compute equivalent units in the assembly department. Show physical units in the first column of your schedule.
2. For each cost category, summarize total assembly department costs for October 2012 and calculate the cost per equivalent unit.
3. Assign total costs to units completed and transferred out and to units in ending work in process.

17-31 Journal entries (continuation of 17-30).

Required Prepare a set of summarized journal entries for all October 2012 transactions affecting Work in Process—Assembly. Set up a T-account for Work in Process—Assembly and post your entries to it.

17-32 FIFO method (continuation of 17-30).

Required Do Problem 17-30 using the FIFO method of process costing. Explain any difference between the cost per equivalent unit in the assembly department under the weighted-average method and the FIFO method.

17-33 Transferred-in costs, weighted-average method (related to 17-30 to 17-32). Larsen Company, as you know, is a manufacturer of car seats. Each car seat passes through the assembly department and testing department. This problem focuses on the testing department. Direct materials are added when the testing department process is 90% complete. Conversion costs are added evenly during the testing department's process. As work in assembly is completed, each unit is immediately transferred to testing. As each unit is completed in testing, it is immediately transferred to Finished Goods.

Larsen Company uses the weighted-average method of process costing. Data for the testing department for October 2012 are as follows:

	Physical Units (Car Seats)	Transferred-In Costs	Direct Materials	Conversion Costs
Work in process, October 1[a]	7,500	$2,932,500	$ 0	$ 835,460
Transferred in during October 2012	?			
Completed during October 2012	26,300			
Work in process, October 31[b]	3,700			
Total costs added during October 2012		$7,717,500	$9,704,700	$3,955,900

[a]Degree of completion: transferred-in costs, ?%; direct materials, ?%; conversion costs, 70%.
[b]Degree of completion: transferred-in costs, ?%; direct materials, ?%; conversion costs, 60%.

Required

1. What is the percentage of completion for (a) transferred-in costs and direct materials in beginning work-in-process inventory, and (b) transferred-in costs and direct materials in ending work-in-process inventory?
2. For each cost category, compute equivalent units in the testing department. Show physical units in the first column of your schedule.
3. For each cost category, summarize total testing department costs for October 2012, calculate the cost per equivalent unit, and assign total costs to units completed (and transferred out) and to units in ending work in process.
4. Prepare journal entries for October transfers from the assembly department to the testing department and from the testing department to Finished Goods.

17-34 Transferred-in costs, FIFO method (continuation of 17-33). Refer to the information in Problem 17-33. Suppose that Larsen Company uses the FIFO method instead of the weighted-average method in all of its departments. The only changes to Problem 17-33 under the FIFO method are that total transferred-in costs of beginning work in process on October 1 are $2,881,875 (instead of $2,932,500) and that total transferred-in costs added during October are $7,735,250 (instead of $7,717,500).

Using the FIFO process-costing method, complete Problem 17-33. **Required**

17-35 Weighted-average method. Ashworth Handcraft is a manufacturer of picture frames for large retailers. Every picture frame passes through two departments: the assembly department and the finishing department. This problem focuses on the assembly department. The process-costing system at Ashworth has a single direct-cost category (direct materials) and a single indirect-cost category (conversion costs). Direct materials are added when the assembly department process is 10% complete. Conversion costs are added evenly during the assembly department's process.

Ashworth uses the weighted-average method of process costing. Consider the following data for the assembly department in April 2012:

	Physical Unit (Frames)	Direct Materials	Conversion Costs
Work in process, April 1[a]	95	$ 1,665	$ 988
Started during April 2012	490		
Completed during April 2012	455		
Work in process, April 30[b]	130		
Total costs added during April 2012		$17,640	$11,856

[a]Degree of completion: direct materials, 100%; conversion costs, 40%.
[b]Degree of completion: direct materials, 100%; conversion costs, 30%.

Summarize total assembly department costs for April 2012, and assign total costs to units completed (and transferred out) and to units in ending work in process. **Required**

17-36 Journal entries (continuation of 17-35).

Prepare a set of summarized journal entries for all April transactions affecting Work in Process—Assembly. Set up a T-account for Work in Process—Assembly and post your entries to it. **Required**

17-37 FIFO method (continuation of 17-35).

Do Problem 17-35 using the FIFO method of process costing. If you did Problem 17-35, explain any difference between the cost of work completed and transferred out and the cost of ending work in process in the assembly department under the weighted-average method and the FIFO method. **Required**

17-38 Transferred-in costs, weighted-average method. Bookworm, Inc., has two departments: printing and binding. Each department has one direct-cost category (direct materials) and one indirect-cost category (conversion costs). This problem focuses on the binding department. Books that have undergone the printing process are immediately transferred to the binding department. Direct material is added when the binding process is 80% complete. Conversion costs are added evenly during binding operations. When those operations are done, the books are immediately transferred to Finished Goods. Bookworm, Inc., uses the weighted-average method of process costing. The following is a summary of the April 2012 operations of the binding department.

	A	B	C	D	E
1		Physical Units (books)	Transferred-In Costs	Direct Materials	Conversion Costs
2	Beginning work in process	1,050	$ 32,550	$ 0	$13,650
3	Degree of completion, beginning work in process		100%	0%	50%
4	Transferred in during April 2012	2,400			
5	Completed and transferred out during April	2,700			
6	Ending work in process (April 30)	750			
7	Degree of completion, ending work in process		100%	0%	70%
8	Total costs added during April		$129,600	$23,490	$70,200

Required

1. Summarize total binding department costs for April 2012, and assign these costs to units completed (and transferred out) and to units in ending work in process.
2. Prepare journal entries for April transfers from the printing department to the binding department and from the binding department to Finished Goods.

17-39 Transferred-in costs, FIFO method. Refer to the information in Problem 17-38. Suppose that Bookworm, Inc., uses the FIFO method instead of the weighted-average method in all of its departments. The only changes to Problem 17-38 under the FIFO method are that total transferred-in costs of beginning work in process on April 1 are $36,750 (instead of $32,550) and that total transferred-in costs added during April are $124,800 (instead of $129,600).

Required

1. Using the FIFO process-costing method, complete Problem 17-38.
2. If you did Problem 17-38, explain any difference between the cost of work completed and transferred out and the cost of ending work in process in the binding department under the weighted-average method and the FIFO method.

17-40 Transferred-in costs, weighted-average and FIFO methods. Frito-Lay, Inc., manufactures convenience foods, including potato chips and corn chips. Production of corn chips occurs in four departments: cleaning, mixing, cooking, and drying and packaging. Consider the drying and packaging department, where direct materials (packaging) are added at the end of the process. Conversion costs are added evenly during the process. The accounting records of a Frito-Lay plant provide the following information for corn chips in its drying and packaging department during a weekly period (week 37):

	Physical Units (Cases)	Transferred-In Costs	Direct Materials	Conversion Costs
Beginning work in process[a]	1,200	$26,750	$ 0	$ 4,020
Transferred in during week 37 from cooking department	4,200			
Completed during week 37	4,000			
Ending work in process, week 37[b]	1,400			
Total costs added during week 37		$91,510	$23,000	$27,940

[a]Degree of completion: transferred-in costs, 100%; direct materials, ?%; conversion costs, 25%.
[b]Degree of completion: transferred-in costs, 100%; direct materials, ?%; conversion costs, 50%.

Required

1. Using the weighted-average method, summarize the total drying and packaging department costs for week 37, and assign total costs to units completed (and transferred out) and to units in ending work in process.
2. Assume that the FIFO method is used for the drying and packaging department. Under FIFO, the transferred-in costs for work-in-process beginning inventory in week 37 are $28,920 (instead of $26,750 under the weighted-average method), and the transferred-in costs during week 37 from the cooking department are $93,660 (instead of $91,510 under the weighted-average method). All other data are unchanged. Summarize the total drying and packaging department costs for week 37, and assign total costs to units completed and transferred out and to units in ending work in process using the FIFO method.

17-41 **Standard-costing with beginning and ending work in process.** Penelope's Pearls Company (PPC) is a manufacturer of knock off jewelry. Penelope attends Fashion Week in New York City every September and February to gauge the latest fashion trends in jewelry. She then makes trendy jewelry at a fraction of the cost of those designers who participate in Fashion Week. This Fall's biggest item is triple-stranded pearl necklaces. Because of her large volume, Penelope uses process costing to account for her production. In October, she had started some of the triple strands. She continued to work on those in November. Costs and output figures are as follows:

Penelope's Pearls Company
Process Costing
For the Month Ended November 30, 2012

	Units	Direct Materials	Conversion Costs
Standard cost per unit		$3.00	$10.50
Work in process, beginning inventory (Nov. 1)	24,000	$72,000	$176,400
Degree of completion of beginning work in process		100%	70%
Started during November	124,400		
Completed and transferred out	123,000		
Work in process, ending inventory (Nov. 30)	25,400		
Degree of completion of ending work in process		100%	50%
Total costs added during November		$329,000	$1,217,000

Required

1. Compute equivalent units for direct materials and conversion costs. Show physical units in the first column of your schedule.
2. Compute the total standard costs of pearls transferred out in November and the total standard costs of the November 30 inventory of work in process.
3. Compute the total November variances for direct materials and conversion costs.

Collaborative Learning Problem

17-42 **Standard-costing method.** Ozumo's Gardening makes several different kinds of mulch. Its busy period is in the summer months. In August, the controller suddenly quit due to a stress-related disorder. He took with him the standard costing results for RoseBark, Ozumo's highest quality mulch. The controller had already completed the assignment of costs to finished goods and work in process, but Ozumo does not know standard costs or the completion levels of inventory. The following information is available:

Physical and Equivalent Units for RoseBark
For the Month Ended August 31, 2012

		Equivalent Units (yards)	
	Physical Units (Yards of Mulch)	Direct Materials	Conversion Costs
Completion of beginning work in process	965,000	—	434,250
Started and completed	845,000	845,000	845,000
Work on ending work in process	1,817,000	1,817,000	1,090,200
		2,662,000	2,369,450
Units to account for	3,627,000		

	Costs
Cost of units completed from beginning work in process	$ 7,671,750
Cost of new units started and completed	6,717,750
Cost of units completed in August	14,389,500
Cost of ending work in process	12,192,070
Total costs accounted for	$26,581,570

Required

1. Calculate the completion percentages of beginning work in process with respect to the two inputs.
2. Calculate the completion percentages of ending work in process with respect to the two inputs.
3. What are the standard costs per unit for the two inputs?
4. What is the total cost of work-in-process inventory as of August 1, 2012?