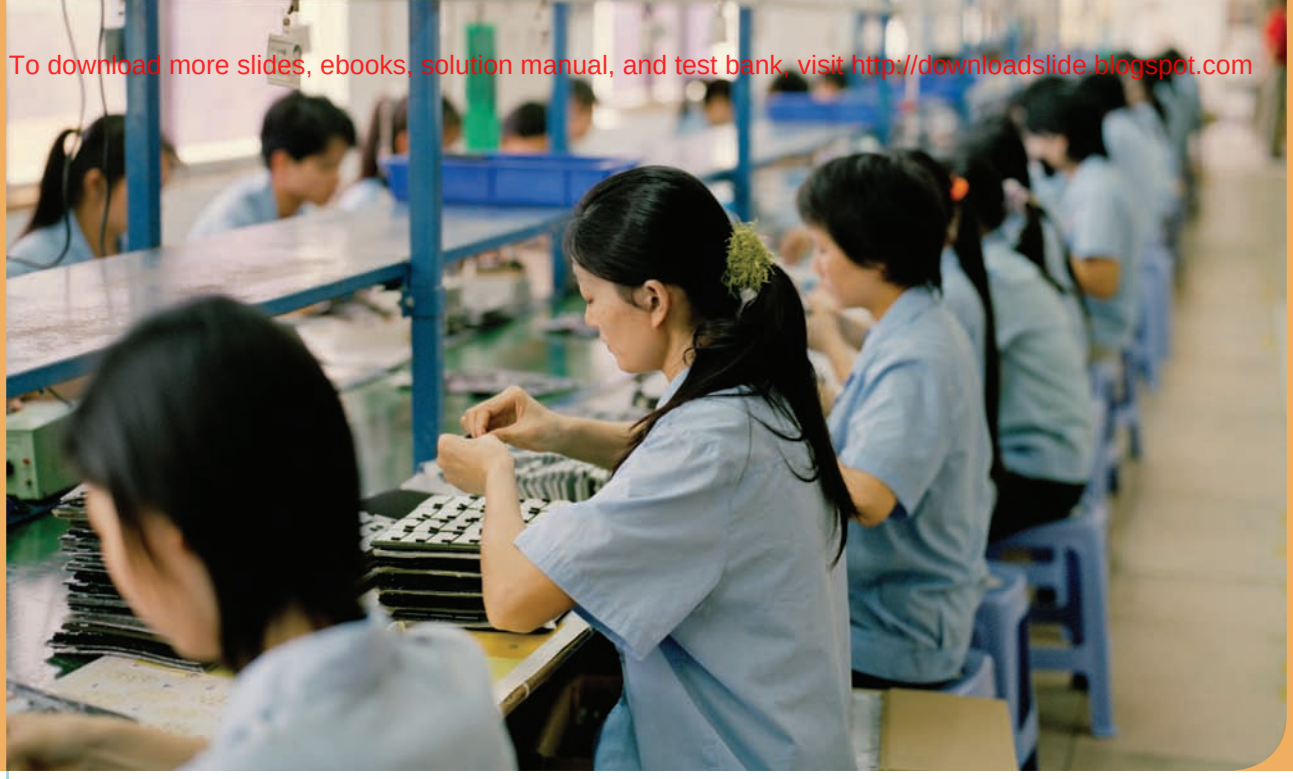
Chapter 15

Process Costing

CHEN ELECTRONICS IS ONE AMONG HUNDREDS OF ELECTRONICS firms in the Guangdong Province, People's Republic of China. Shibin Chen, the founder and CEO of Chen Electronics, has an extensive network of contacts in the United States. His firm specializes in assembling Digital Photo Display (DPD) devices. Usually, Shibin receives orders for several hundred thousand units at a time. Although shipments take place weekly, each order takes several months to complete. Shibin asks for your help in determining the cost of the units completed each month, as well as the cost of the units in process.



Getty Images

Chen Electronics, which assembles Digital Photo Display (DPD) devices, receives orders for several hundred thousand units at a time. Although shipments take place weekly, each order takes several months to complete. Shibin Chen wants to determine the cost of the units completed each month, as well as the cost of the units in process.

LEARNING OBJECTIVES

After studying this chapter, you will be able to:

1. Explain the mechanics of process costing.
2. Apply process costing to settings with many cost pools and beginning inventory.
3. Perform process costing using standard costs.

Chen Electronics' problem is typical of firms that produce similar units in large quantities. Like Chen Electronics, firms in the processed food, beverage, chemical, paper, pharmaceuticals, and plastics industries also mass produce relatively identical products. Examples of such companies include Tyson Foods, Heinz, Pfizer, and oil refinery units of energy giants like Exxon Mobil and BP. Firms that mass produce similar products use **process costing** to determine both the values of the inventories reported on their balance sheets and the cost of goods sold reported on their income statements.

CHAPTER CONNECTIONS

In Chapter 3, we distinguished between direct and indirect costs, noting that we could trace direct costs but needed to allocate indirect costs. Process-costing systems blur this distinction. In process-costing systems, we allocate materials and labor costs, usually termed direct costs, between the WIP and finished goods inventory accounts.

Mechanics of Process Costing

LEARNING OBJECTIVE 1

Explain the mechanics of process costing.

In Chapter 14, we outlined features of job- and process-costing systems. We learned that job costing is suitable for firms that produce customized products in small amounts. In contrast, process-costing systems are suitable for environments that involve mass production of like products. The difference in the environments results in the following key difference between job- and process-costing systems.

In settings with large batches, different units of the same batch might be at different stages of completion. However, because we still track costs for the entire batch, we need to distribute the cost of making the batch to those units that are still in process (work-in-process or WIP inventory) and to the units that have been completed during the period (cost of goods manufactured). Such *allocations* are central to process costing. We do not need them in a job-costing environment. There, a job either is in process or is completed. Thus, all the cost stays in the WIP account until the job is complete. When the job is done, we transfer the units to the FG inventory and the entire cost to the finished goods account.

How should we allocate the costs of a batch between completed and in-process units? The number of physical units in the WIP and the COGM accounts is an obvious candidate for the allocation of the costs of a batch. Let us see how. Suppose Chen began May with zero units in work-in-process inventory. During the month, Chen started production of 180,000 DPDs and completed 155,000 DPDs by May 31. Thus, 25,000 DPDs were still in process at month's end. Chen also incurred total manufacturing costs of $6,880,000 during May. Of this amount, $4,320,000 was for materials, with labor and overhead accounting for the remaining $2,560,000. Then, distributing costs proportionately, we allocate (25,000/180,000) × $6,880,000 or $955,555.56 to the WIP account and (155,000/180,000) × $6,880,000 = $5,924,444.44 to cost of goods manufactured.

Notice that such an allocation calculates, in effect, the average cost per unit of the product. We can calculate the cost as $6,880,000/180,000 units = $38.22 per unit (rounded). Because Chen produces large volumes, it is not possible to trace costs to individual units of the product. Instead, we recognize that all units are identical and employ allocations to determine the average cost per unit.

An allocation that computes costs based on the number of physical units is not quite accurate though. Why? The answer is that such an allocation attaches the same value to a unit whether the unit is in process or is complete. However, the in-process units still need more work to complete, which will involve more costs.

Process-costing systems use the concept of **equivalent units** to correct this deficiency. In particular, these systems convert *in-process* units to *equivalent* completed units. For example, suppose Chen estimates that the 25,000 units still in process are only 20% complete. Multiplying 25,000 units by 20%, Chen has the equivalent of 5,000 completed units in WIP inventory, or simply, 5,000 equivalent units.

Consumer electronics items such as the iPhone are produced in large quantities. (Sean Gallup/Getty Images)

Meanwhile, the 155,000 units in COGM are complete in all respects, and thus contribute 155,000 (= 155,000 × 100%) equivalent units. Adding these 155,000 equivalent units with the 5,000 equivalent units from WIP inventory, we see that Chen has worked on 160,000 equivalent units during May. Here, we are implicitly assuming that cost is proportional to the work done.

Using the estimate of total equivalent units as our denominator volume, we now execute our two-step allocation process:

- Compute the allocation rate using total equivalent units as the denominator volume:

$$\frac{\$6{,}880{,}000}{(5{,}000 + 155{,}000)\text{ equivalent units}} = \$43.00 \text{ per equivalent unit}$$

- Allocate to WIP and COGM at the rate of $43 per equivalent unit:

5,000 equivalent units × $43/equivalent unit = $215,000 to WIP, and
155,000 equivalent units × $43/equivalent unit = $6,665,000 to COGM

Exhibit 15.1 summarizes these computations for Chen in a **process-costing report** using the following five-step procedure. The first three steps correspond to collecting the data for performing the allocation, and the last two steps are the allocation procedure itself.

1. *Track the physical flow.* Determine how many physical units are at each stage of the process. Specifically, determine how many units are still in process at the end of the period and how many units were finished during the period. Determine the percentage completion for the units still in process. (Completed units are 100% done.)
2. *Compute equivalent units.* For the units still in process, multiply the physical units by the percentage completion to obtain equivalent units. Add this amount to the units completed to obtain total equivalent units for the period.

Exhibit 15.1 *Chen Electronics: Process Costing Report*

	Total	Detail
Step 1: Track Physical Flow		
Beginning inventory on May 1	0	
Started during May	180,000	
Total physical units to account for	180,000	
		Step 2: Compute Equivalent Units
Units completed during May	155,000	155,000 = 155,000 × 100%
Units in process on May 31	25,000	5,000 = 25,000 × 20%
Total physical units accounted for	180,000	160,000 equivalent units
Step 3: Collect Costs to Allocate		
Costs incurred during May	$6,880,000	$4,320,000 + $2,560,000
Total costs to account for	$6,880,000	
Step 4: Calculate the Rate per Equivalent Unit		
Cost per equivalent unit	$43/eq. unit	$6,880,000/160,000 eq. units
Step 5: Allocate Costs		
Units completed during May (**COGM**)	$6,665,000	$43 × 155,000 eq. units
Units in process on May 31 (**EWIP**)	215,000	$43 × 5,000 eq. units
Total costs accounted for	$6,880,000	

3. *Collect costs to allocate.* Determine the total costs in the cost pool. For Chen, this equals the total manufacturing costs of $6,880,000 incurred during May.
4. *Calculate the rate per equivalent unit.* Divide the costs in the pool by the total equivalent units.
5. *Allocate costs.* Multiply the rate by the number of equivalent units in WIP and COGM to determine the proportion of total costs allocated to each of these accounts.

In Exhibit 15.1, we assume that Chen collects all manufacturing costs related to materials, labor, and overhead into a single pool. However, most process-costing systems use multiple cost pools, which we consider next.

Process Costing with Many Cost Pools and Beginning Inventory

LEARNING OBJECTIVE 2

Apply process costing to settings with many cost pools and beginning inventory.

Chen could refine its process-costing system to incorporate several additional considerations. We discuss two important refinements: using many cost pools rather than a single cost pool, and allowing for beginning inventory.

PROCESS COSTING WITH MANY COST POOLS

Processes often require inputs at different stages. For example, many plastic manufacturing applications need a form of resin or polymer at the start of the process. At later stages, they mix in additives such as antimicrobials and bio-stabilizers to enhance the properties of the plastic. In such instances, a batch may be "complete" in all respects with regard to some inputs, and only partially complete with regard to other inputs. Accordingly, it becomes necessary to track these inputs separately in a process-costing system. Otherwise, the calculation of equivalent units will be incorrect.

When Chen starts production of a DPD, it issues all of the required materials, such as the case, screen, and circuit boards, in one basket. This basket then moves through several stations for DPD assembly. Consider units that are only 20% complete. Chen would have issued all of the materials required for these units even though the firm has completed only 20% of the assembly task for these units.

Our revised understanding of Chen's production process highlights a problem with the allocation in Exhibit 15.1. There, we allocated costs as if each in-process unit had consumed 20% of the materials, 20% of the labor, and 20% of the overhead resources. This allocation is appropriate for the **conversion costs** (labor plus overhead costs) as Chen has completed only 20% of the assembly work. However, it is incorrect for the cost of materials because Chen has already issued *all* of the needed materials. We should charge the in-process units with 100% of the material costs.

To address this problem, we compute *separate* rates for materials costs and conversion costs. As Exhibit 15.2 shows, our revised computation of equivalent units of materials accounts for the fact that in-process units are 100% complete with respect to the cost of materials. However, we still use the 20% completion rate for labor and overhead to compute the equivalent units for these costs.

Notice that, compared to Exhibit 15.1, the value of WIP inventory increases by $465,000, while the value of COGM decreases by a like amount, representing a significant change from our earlier estimates. This change occurs because our revised computation fully accounts for the materials costs in the units that are still in process.

Exhibit 15.2 *Chen Electronics: Process-Costing Report with Two Cost Pools*

	Total	Detail for each Cost Pool	
		Materials	*Conversion*
Step 1: Track Physical Flow			
Beginning inventory on May 1	0		
Started during May	180,000		
Total	180,000		
		Step 2: Compute Equivalent Units[1]	
Units completed during May	155,000	155,000	155,000
Units in process on May 31	25,000	25,000	5,000
Total	180,000	180,000	160,000
Step 3: Collect Costs to Allocate			
Costs incurred during May	$6,880,000	$4,320,000	$2,560,000
Total costs to account for	$6,880,000	$4,320,000	$2,560,000
Step 4: Calculate the Rate per Equivalent Unit			
Cost per equivalent unit[2]		$24/eq. unit of materials	$16/eq. unit of conversion
Step 5: Allocate Costs			
Units completed during May[3] (**COGM**)	$6,200,000	$3,720,000	$2,480,000
Units in process on May 31[4] (**EWIP**)	680,000	600,000	80,000
Total costs accounted for	$6,880,000	$4,320,000	$2,560,000

[1] Materials: 155,000 × 100% + 25,000 × 100%; Conversion: 155,000 × 100% + 25,000 × 20%.
[2] Materials: $4,320,000/180,000 eq. units = $24/eq. unit of materials;
Conversion: $2,560,000/160,000 eq. units = $16/eq. unit of conversion.
[3] Materials: 155,000 eq. units × $24/eq. unit; Conversion: 155,000 eq. units × $16/eq. unit.
[4] Materials: 25,000 eq. units × $24/eq. unit; Conversion: 5,000 eq. units × $16/eq. unit.

We can further refine Chen's process-costing system to accommodate more than two cost pools. In this case, we would calculate a separate equivalent unit basis for each cost pool. As we discuss below, process-costing systems often have several cost pools for the different types of materials and labor used during the production process.

Materials Issued at Different Points

Firms often use separate cost pools for different materials, as their consumption patterns could differ. Suppose Chen's materials cost of $4,320,000 includes $4,041,000 for the cost of the materials that make up the DPD and $279,000 for the carton, bubble wrap, and pamphlet. Although Chen issues the materials needed to make the DPD at the start of the process, it uses packing materials only at the end of the process—after it has fully assembled the DPD but before the unit is transferred to the finished goods inventory.

The above change in the physical production process changes the consumption of materials by the in-process units. The in-process units have consumed all of the materials going into the DPD but none of the packing materials. Thus, Chen needs to use three cost pools—for DPD materials, for conversion, and for packing materials—to capture the consumption of the three types of resources appropriately. *Check It! Exercise #1* allows you to verify that Chen would have zero equivalent units of packing materials for the in-process units, as these units are 0% complete with respect to this resource.

Check It! Exercise #1

Using three cost pools, one for DPD materials, one for conversion costs, and one for packing materials, verify that the value of Chen's WIP inventory as of May 31 equals $641,250 and that Chen's COGM for May equals $6,238,750.

	Total	*Detail for Each Cost Pool*		
		DPD Materials	***Conversion***	***Packing***
Step 1: Track Physical Flow				
Beginning inventory on May 1	0			
Started during May	180,000			
Total units to account for	180,000			
		Step 2: Compute Equivalent Units		
Units completed during May	155,000	155,000	155,000	_____
Units in process on May 31	25,000	25,000	5,000	_____
Total units accounted for	180,000	180,000	160,000	155,000
Step 3: Collect Costs to Allocate				
Costs incurred during May	$6,880,000	$4,041,000	$2,560,000	$279,000
Total costs to account for	$6,880,000	$4,041,000	$2,560,000	$279,000
Step 4: Calculate the Rate per Equivalent Unit				
Cost per equivalent unit		_____	$16/eq. unit of conversion	_____
Step 5: Allocate Costs				
Units completed during May (COGM)	$6,238,750	_____	$2,480,000	$279,000
Units in process on May 31 (EWIP)	$641,250	_____	80,000	0
Total costs accounted for	$6,880,000	$4,041,000	$2,560,000	$279,000

Solution at end of chapter.

CONSIDERING BEGINNING INVENTORY

The presence of beginning inventory can complicate a process-costing system because the units in inventory produced in a prior period might have different costs than units produced during the current period. Most process-costing systems avoid this complication by using **weighted average process costs**. *These systems do not distinguish between the costs from the prior period and costs incurred during the current period.* Keep in mind that beginning inventory for this period is the ending inventory from the prior period. The value of this inventory would be determined by costs incurred in the prior period(s). We also incur costs this period for the work done currently. Under the weighted average method, we ignore *when* costs are actually incurred. We simply add the costs from beginning inventory and the costs incurred during the period to determine the total cost in the pool. We then follow the remaining process costing steps as before.

As you determined in *Check It! Exercise #1*, Chen will begin the month of June with an inventory of 25,000 physical units that have a value of $641,250. (Notice that we considered the month of May in Exhibits 15.1 and 15.2. Of course, the ending inventory for May becomes the beginning inventory for June). Suppose that Chen starts 175,000 additional units in June. It also incurs DPD materials costs of $4,038,750, conversion

Exhibit 15.3 *Chen Electronics: Process Costing Report for June (Beginning Inventory)*

	Total	Detail for each cost pool		
		DPD Materials	*Conversion*	*Packing*
Step 1: Track Physical Flow				
Beginning inventory on June 1	25,000			
Started during June	175,000			
Total physical units to account for	200,000			
		Step 2: Compute Equivalent Units[1]		
Units completed during June	185,000	185,000	185,000	185,000
Units in process on June 30	15,000	15,000	9,000	0
Total physical units accounted for	200,000	200,000	194,000	185,000
Step 3: Collect Costs to Allocate				
Costs from beginning inventory	$641,250	$561,250	$80,000	$0
Costs incurred during June	7,192,500	4,038,750	2,830,000	323,750
Total costs to account for	$7,833,750	$4,600,000	$2,910,000	$323,750
Step 4: Calculate the Rate per Equivalent Unit				
Cost per equivalent unit[2]		$23/eq. unit of DPD materials	$15/eq. unit of conversion	$1.75/eq. unit of packing
Step 5: Allocate Costs				
Units completed during June[3] (**COGM**)	$7,353,750	$4,255,000	$2,775,000	$323,750
Units in process on June 30[4] (EWIP)	480,000	345,000	135,000	0
Total costs accounted for	$7,833,750	$4,600,000	$2,910,000	$323,750

[1] DPD Materials: 185,000 × 100% + 15,000 × 100%; Conversion: 185,000 × 100% + 15,000 × 60%; Packing: 185,000 × 100% + 15,000 × 0%.
[2] Materials: $4,600,000/200,000 eq. units = $23/eq. unit; Conversion: $2,910,000/194,000 eq. units = $15/eq. unit; packing: $323,750/185,000 = $1.75 per equivalent unit
[3] Materials: 185,000 eq. units × $23/eq. unit; Conversion: 185,000 eq. units × $15/eq. unit; Packing: 185,000 eq. units × $1.75/eq. unit.
[4] Materials: 15,000 eq. units × $23/eq. unit; Conversion: 9,000 eq. units × $15/eq. unit.

costs of $2,830,000, and packing costs of $323,750 during the month. On June 30, Chen has 15,000 DPDs still in process. These units are 60% complete with respect to conversion costs. Given Chen's production process, these units are 100% complete with respect to all materials that go into the DPD and 0% complete with respect to packing costs. Exhibit 15.3 illustrates Chen's process-costing report for June.

Focusing on DPD materials, Chen has to account for a total cost of $4,600,000. The firm needs to allocate this amount over 200,000 equivalent units. We then calculate a rate of $23 per equivalent unit of DPD materials, leading to an allocation of $4,255,000 to COGM and the remaining $345,000 to ending WIP. Note that we add the cost of materials in beginning inventory ($561,250) to the cost of materials incurred during June ($4,088,750) before arriving at a weighted average rate of $23 per equivalent unit of materials. We perform similar calculations for the other cost pools and then use these weighted average rates to value COGM and ending WIP.

Note that during May and June, Chen produced the same DPD in large quantities. Its production technologies and other processes were substantially the same. Yet, dividing total costs by total completed units, Chen values each unit completed in May at $40.25 ($6,238,750/155,000 units) but each unit completed in June at $39.75 ($7,353,750/185,000 units). This difference arises because Chen uses the *actual costs* each month to calculate the costs per equivalent unit. Such fluctuations are unavoidable because of minor variations in actual costs from month to month. In the next section, we discuss how firms can reduce the effect of these fluctuations in their accounting records.

Standard Process Costing

LEARNING OBJECTIVE 3

Perform process costing using standard costs.

Recall from Chapter 14 that job-costing systems smooth fluctuations in product costs by using a predetermined rate to apply overhead to products. In a job-cost environment, firms compute a predetermined rate for overhead costs alone, as these are the only costs that the firm allocates. In process costing, however, a firm must also allocate the cost of materials and conversion. Therefore, it might use predetermined rates for these cost categories as well.

Predetermined rates for materials and labor come from a company's engineering standards that determine quantities and from expectations regarding materials prices and wage rates. Because the predetermined rates in process costing come from company standards, we refer to these rates as standard rates and to the system as a **standard costing** system.

Firms use standard process costing for two primary reasons. First, record keeping is easier because the method attaches the same value to each completed unit, without regard to the period in which the unit was made. Second, the standard cost of work done provides a natural benchmark for actual costs. Such a benchmark helps firms determine variances from expectations.

However, it takes considerable resources and effort to compute standard costs. It makes sense to employ standard costing only in those production environments where a firm makes similar or identical units in large quantities. Standard costing has less appeal in a job shop environment because each job is unique and would require a fresh set of standards.

CHAPTER CONNECTIONS

In Chapter 7, we used predetermined rates for materials and labor to come up with materials and labor budgets.

To apply a standard process-costing system, we use the standards for materials, labor, and overhead to value COGM and ending WIP. For example, Exhibit 15.4 shows the computations for Chen Electronics for May, assuming standard rates of $22.25, $15.75, and $1.85 per equivalent unit of DPD materials, conversion, and packing, respectively.

Looking at the last three lines of Exhibit 15.4, note that Chen allocated $6,811,750, while it actually incurred costs of $6,880,000 during the month. That is, Chen has underallocated total costs by $68,250. For each cost pool, Chen will accumulate such under- or overapplied amounts for the year. At the end of the year, Chen will dispose of the cumulative under- or overapplied amounts using one of the techniques that we discussed in Chapter 14.

Exhibit 15.4 *Chen Electronics: Standard Process Costing*

	Total	Detail for each Cost Pool		
		DPD Materials	*Conversion*	*Packing*
Step 1: Track Physical Flow				
Beginning inventory on May 1	0			
Started during May	180,000			
Total	180,000			
		Step 2: Compute Equivalent Units		
Units completed during May	155,000	155,000	155,000	155,000
Units in process on May 31	25,000	25,000	5,000	0
Total physical units accounted for	180,000	180,000	160,000	155,000
Step 3: Collect Costs to Allocate		*Using predetermined rates—go to Step 4*		
Step 4: Calculate the Rate per Equivalent Unit				
Predetermined standard rate per equivalent unit		$22.25/eq. unit of DPD materials	$15.75/eq. unit of conversion	$1.85/eq. unit of packaging
Step 5: Allocate Costs				
Units completed during May[1] (**COGM**)	$6,176,750	$3,448,750	$2,441,250	$286,750
Units in process on May 31[2] (EWIP)	635,000	556,250	78,750	0
Total costs allocated	6,811,750	$4,005,000	$2,520,000	$286,750
Total costs allocated (from above)	$6,811,750	$4,005,000	$2,520,000	$286,750
Actual costs incurred in May[3]	6,880,000	4,041,000	2,560,000	279,000
Favorable (unfavorable) variance	($68,250)	($36,000)	($40,000)	$7,750

[1] Materials: 155,000 eq. units × $22.25/eq. unit; Conversion: 155,000 eq. units × $15.75/eq. unit of conversion; Packaging: 155,000 units × $1.85/eq. unit of packaging.
[2] Materials: 25,000 eq. units × $22.25/eq. unit; Conversion: 5,000 eq. units × $15.75/eq. unit of conversion; Packaging: 0 equivalent units.
[3] From *Check It! Exercise #1*.

CHAPTER CONNECTIONS

In Chapter 8, we discussed variance analysis, calculating cost variances as the difference between budgeted and actual results. Thus, favorable and unfavorable variances correspond to over- and underapplied amounts in the cost pool.

Check It! Exercise #2 extends Chen's standard process-costing system to June. Note that we use the standard costs for the work done in June as the benchmark for June's actual costs.

Check It! Exercise #2

Verify that Chen allocates total costs of $7,212,750 for work done in June and that Chen overallocated costs during June by $20,250.

	Total	*Detail for Each Cost Pool*		
		Materials	***Conversion***	***Packaging***
Step 1: Track Physical Flow				
Beginning Inventory on June 1	25,000			
Started during June	175,000			
Total	200,000			
		Step 2: Compute Equivalent Units		
Units completed during June	185,000	185,000	185,000	_____
Units in process on June 30	15,000	15,000	9,000	_____
Total units accounted for	200,000	200,000	194,000	185,000
Step 3: Collect Costs to Allocate		*Using predetermined rates— go to Step 4*		
Step 4: Calculate the Rate per Equivalent Unit				
Predetermined rate per equivalent unit		$22.25/eq. unit of material	$15.75/eq. unit of conversion	$1.85/eq. unit of packaging
Step 5: Allocate Costs				
Units completed during June (COGM)	$7,372,250	_____	$2,913,750	_____
Units in process on June 30 (EWIP)	475,500	333,750	_____	0
Total costs allocated	$7,847,750	$4,450,000	$3,055,500	$342,250
Total costs allocated	$7,847,750	$4,450,000	$3,055,500	$342,250
− Costs from beginning inventory	635,000	_____	78,750	_____
= Allocated for work done in June	$7,212,750	$3,893,750	$2,976,750	_____
− Costs incurred in June	7,192,500	4,038,750	_____	323,750
= Favorable (unfavorable) variance	$20,250	_____	$146,750	$18,500

Solution at end of chapter.

Connecting to Practice

Breakfast Cereals and Process Costing

The manufacturing process for breakfast cereals such as General Mills' *Wheaties,* marketed with the slogan, "the breakfast of champions," provides a classic setting for process costing. The production process combines raw materials such as wheat, sugar, salt, and preservatives in a continuously running mill. Almost all of the labor is indirect in this highly automated, high-volume production process. To stay competitive, General Mills likely tracks closely the costs of input materials, such as wheat and its conversion costs, as well as machine utilization. The firm also closely monitors packaging costs, a significant percentage of total costs.

Commentary: General Mills may run a particular *Wheaties* box design for several weeks at a time (the firm frequently changes the packaging to highlight new champions). However, because it uses a standard costing system, the only change involves a change in the cost of the box. Standard costs and conversion rates also provide a natural benchmark for measuring operating efficiencies on a daily basis.

The manufacturing process for breakfast cereals such as General Mills' Wheaties, *marketed with the slogan, "the breakfast of champions," provides a classic setting for process costing.* (AP Photo/General Mills/©AP/Wide World Photos)

Summary

In this chapter, we studied process costing, a cost accumulation and reporting system found in firms that mass produce similar products over extended periods. We used the concept of equivalent units to deal with units belonging to the same batch being at different stages of completion. We then valued these equivalent units using average costs. Finally, we considered several common extensions of process-costing systems, including the use of many cost pools, the existence of beginning inventories, and the use of standard costs.

Rapid Review

Learning Objective 1

Explain the mechanics of process costing.

- Process-costing systems are suitable for environments that involve mass production of products. With continuous production or in settings with large batches, only part of a batch typically is completed during an accounting period. This means that we need to allocate costs between ending WIP and COGM.
- Process-costing systems use equivalent units to convert in-process units to equivalent completed units. We use equivalent units as the basis to allocate costs between ending WIP and COGM. We use percent completion to convert physical units into equivalent completed units.
- Process-costing reports use five steps: (1) track the physical flow, (2) compute equivalent units, (3) collect costs to allocate, (4) calculate the rate per equivalent unit, and (5) allocate costs.

Learning Objective 2

Apply process costing to settings with many cost pools and beginning inventory.

- If we track materials and conversion costs in separate cost pools, then we should perform a separate computation of equivalent units for each pool. The computation for each pool reflects the percent of work completed for the resources whose costs are in the pool.
- If the firm begins a period with beginning inventory, it needs to make an inventory cost flow assumption. Most firms use the weighted average method for process costing. This method does not distinguish between the costs from beginning inventory and the costs incurred during the period.

LEARNING OBJECTIVE 3

Perform process costing using standard costs.

- Firms can streamline their process-costing systems by using standard rates to value the cost of materials, labor, and overhead in COGM and ending WIP inventory.
- The process of using standard rates gives rise to a variance (i.e., an under- or overapplied amount) in each cost pool. At year end, the firm needs to dispose of this balance using one of the options we discussed in Chapter 14.

Answers to Check It! Exercises

Exercise #1: Equivalent packing units for units completed during May = 155,000 because these units are finished; equivalent packing units for units in process on May 31 = 0 because these units are yet to reach the packing stage; Cost per equivalent unit: $4,041,000/180,000 eq. units of material = $22.45 per equivalent unit of materials, and $279,000/155,000 eq. units of packing = $1.80 per eq. unit of packing. Materials cost of units completed during May, 155,000 eq. units × $22.45 per eq. unit of material = $3,479,750; Materials cost of units in process on May 31, 25,000 eq. units × $22.45 per eq. unit of material = $561,250.

Exercise #2: Equivalent packing for units completed during June = 185,000 because these units are finished; equivalent packing units for units in process on June 30 = 0 as these units are yet to reach the packing step; Materials cost of units completed in June = 185,000 units × $22.25 per eq. unit of materials = $4,116,250; packing cost of units completed in June is 185,000 units × $1.85 per eq. unit of packing = $342,250; conversion cost of work in process on June 30 is 9,000 units × $15.75 per eq. unit of conversion = $141,750.

Materials cost in beginning inventory = 25,000 eq. units × $22.25 per eq. unit of material = $556,250 (*Note:* the same standard costing rate would have been in force for May); Packing costs in beginning inventory = $0, as these units were still in process. Packing costs allocated for work done in June = $342,250. Labor cost incurred during June = $2,830,000; Materials variance in June = $145,000 U.

Self-Study Problems

Kumar and Sons manufacture leather goods such as handbags and belts. In the process used for making belts, treated and dyed leather strips are first cut to their desired lengths. In the next step, the edges are folded over so that the belts can be stitched and trimmed. The belt buckle is added at the very end of the process, after the belts have been waxed and polished. Conversion costs are incurred uniformly throughout the process.

Kumar began the month of September with 500 36-inch two-tone belts in process valued at $1,100 (= $800 in materials + $300 in conversion costs). During September, Kumar started an additional 15,500 36-inch two-tone belts, completing 14,000 units during the month. Kumar also incurred $63,640 in manufacturing costs during September—$28,800 for materials (leather), $24,340 for conversion costs, and $10,500 for the buckles. Kumar estimates that the ending WIP inventory is 70% complete with respect to conversion costs.

Prepare a process costing report for Kumar and Sons for September.

Exhibit 15.5 provides the required report. Kumar values the 14,000 belts manufactured during September at $58,800, or $4.20 per belt. The ending work-in-process inventory of 2,000 belts is valued at $5,940, comprising $3,700 for the cost of the leather strips and $2,240 for conversion costs.

Exhibit 15.5 *Kumar and Sons: Process-Costing Report for September*

	Total	Detail for Each Cost Pool		
		Leather Strips	*Conversion*	*Buckles*
Step 1: Track Physical Flow				
Beginning inventory on September 1	500			
Started during September	15,500			
Total physical units to account for	16,000			

Exhibit 15.5 *Kumar and Sons: Process-Costing Report for September (continued)*

	Total	Detail for Each Cost Pool		
		Leather Strips	*Conversion*	*Buckles*
		Step 2: Compute Equivalent Units[2]		
Units completed during September	14,000	14,000	14,000	14,000
Units in process on September 30[1]	2,000	2,000	1,400	0
Total physical units accounted for	16,000	16,000	15,400	14,000
Step 3: Collect Costs to Allocate				
Costs from beginning inventory	$1,100	$800	$300	$0
Costs incurred during September	63,640	28,800	24,340	10,500
Total costs to account for	$64,740	$29,600	$24,640	$10,500
Step 4: Calculate the Rate per Equivalent Unit				
Cost per equivalent unit[3]		$1.85/eq. unit of strips	$1.60/eq. unit of conversion	$0.75/eq. unit of buckles
Step 5: Value Inventories				
Units completed during September[4] (COGM)	$58,800	$25,900	$22,400	$10,500
Units in process on September 30[5] (EWIP)	5,940	3,700	2,240	0
Total costs accounted for	$64,740	$29,600	$24,640	$10,500

[1] Ending inventory = Total units − completed units = 16,000 belts − 14,000 belts.
[2] Leather Strips: 14,000 × 100% + 2,000 × 100%; Conversion 14,000 × 100% + 2,000 × 70%; Buckles 14,000 × 100% + 2,000 × 0%.
[3] Leather Strips: $29,600/16,000 eq. units = $1.85/eq. unit; Conversion: $24,640/15,400 eq. units = $1.60/eq. unit; Buckles: $10,500/14,000 = $0.75 per equivalent unit.
[4] Leather Strips: 14,000 eq. units × $1.85/eq. unit; Conversion: 14,000 eq. units × $1.60/eq. unit; Buckles 14,000 eq. units × $0.75/eq. unit.
[5] Leather strips: 2,000 eq. units × $1.85/eq. unit; Conversion: 1,400 eq. units × $1.60/eq. unit.

Glossary

Conversion costs The cost of resources, usually labor and overhead, required to convert input materials into finished goods.

Equivalent units The amount of output stated in terms of completed units. For example, 100 units in WIP that are 50% complete represent 50 equivalent units.

Process costing A costing method used by firms that mass produce similar products.

Process-costing report A format that shows the physical flow of materials, computations of equivalent units, and the allocation of total costs to WIP and COGM.

Standard costing A product-costing system that uses predetermined rates to value the materials, labor, and overhead costs.

Weighted average process costing A process-costing system that does not distinguish between the costs from beginning inventory and the costs incurred during the period.

Review Questions

15.1 LO1. What production environments are most suitable for process costing?

15.2 LO1. What is the key difference between process costing and job costing?

15.3 LO1. What is an equivalent unit?

15.4 LO1. Why is the concept of an equivalent unit important in process costing?

15.5 LO1. Why is the concept of equivalent units not relevant for job costing?

15.6 LO1. What are the five steps in a process-costing report?

15.7 LO2. Why do many process-costing systems use multiple cost pools?

15.8 LO2. Suppose a factory accumulates costs in five separate cost pools. Would the equivalent units be different for each of these cost pools?

15.9 LO2. Consider the cost of materials. Why is the percentage completion for units that are finished during the period always 100%?

15.10 LO2. Consider the cost of materials added at the end of the process. Why is the percentage completion for units that are still in process always zero?

15.11 LO2. Why do most process-costing systems need to rely on an inventory cost flow assumption?

15.12 LO2. How does the weighted average process-costing system treat the costs of items in beginning inventory?

15.13 LO3. What is the key distinction between standard process costing and process costing using actual rates?

15.14 LO3. What are the two primary reasons firms use standard process costing?

15.15 LO3. How could you use standard process costing to obtain information that helps improve the efficiency of the process?

Discussion Questions

15.16 LO1. Why is process costing suitable for a soft drink company but not well suited for a firm that makes luxury yachts?

15.17 LO1. What is the role for process costing in a Just-in-Time (JIT) production environment, where work-in-process inventories are negligible? For example, at any given point in time a JIT plant might only have 2 hours worth of production in process.

15.18 LO1. Why do we need process costing in industries that produce large batches of goods but not in firms that make their products in small batches?

15.19 LO1 (Advanced). Can you describe a revenue recognition setting in financial accounting that employs the concept of equivalent work? (*Hint:* Think of revenue recognition for large projects lasting several years.)

15.20 LO1. Process-costing systems involve steps where we *allocate* costs such as materials and labor that are directly traceable to a batch. Why do we need steps that allocate direct costs?

15.21 LO1. When calculating equivalent units, we assume that cost is proportional to work done. Why does this assumption make sense?

15.22 LO1. Who in the factory would be best equipped to provide estimates of the percent completion for work in process?

15.23 LO1 (Advanced). Suppose your production manager tells you that one-half the WIP is 20% complete in terms of conversion, and that the remainder is 70% complete. How would you modify the process-costing report to include this information?

15.24 LO2. The chapter illustrates how the process-costing template could be modified to include many kinds of materials, added at different points in the production process. How could you modify process costing to include multiple overhead rates? Comment on the usefulness of such a modification for decision making.

15.25 LO2. How could we implement process costing in a plant that has a sequential production process? For example, assume a plant has two separate departments—parts are fabricated in department 1 and assembled in department 2.

15.26 LO2. Consider a multidepartment (or multistation) production environment in which not all products go though all processes. Why would we use process costing on a station-by-station basis in this setting? Does this setting reflect a blend of both job- and process-costing systems?

15.27 LO2. When you have beginning work-in-process inventory, why is the weighted average method preferred in practice over the First-In-First-Out (FIFO) and Last-In-First-Out (LIFO) methods?

15.28 LO2. In process costing, the volume of production for a period is likely to be much greater than the volume in inventory at any given point in time. This feature means that the value of inventory is a small fraction of the value of output. How does this feature help firms justify the use of the weighted average method for process costing?

15.29 LO3. How does standard process costing relate to variance analysis? Is variance analysis likely to be more or less informative in a process-costing setting relative to a job-costing setting?

15.30 LO3 (Advanced). How could you modify standard process costing so that individual batches generally follow the same process, but some batches have some unique steps (e.g., extra finishing)?

Exercises

15.31 Mechanics of process costing, steps 1 and 2 (LO1). Orange Computers began June with zero units of its portable music player in work-in-process inventory. During June, Orange started 250,000 units into production, completing 175,000 units by month's end. Production personnel estimate that the 75,000 units still in process on June 30 are 100% complete with respect to materials and 40% complete with respect to conversion costs.

Required: Complete steps 1 and 2 of Orange's process-costing report for June.

15.32 Mechanics of process costing, steps 1–4 (LO1). Refer to Problem 15.31. You learn that Orange spent $18,750,000 on materials costs and $7,790,000 on conversion costs during June.

Required: Complete steps 3 and 4 of Orange's process-costing report for June.

15.33 Mechanics of process costing, steps 1–4 (LO1). Refer to Problem 15.32.

Required: Complete steps 1–5 of Orange's process-costing report for June. What is Orange's cost of goods manufactured (COGM) for June and the cost of its work-in-process inventory (EWIP) on June 30?

15.34 Process-costing report, no beginning inventory, single-cost pool (LO1). The Cruise Salad Company began March with zero cases of its Thousand Island dressing in work-in-process inventory. During March, Cruise started 125,000 cases into production. On March 31, Cruise had 25,000 cases still in process, which production personnel estimated to be 30% complete.

Cruise accumulates all of its manufacturing costs in a single pool. During March, Cruise spent a total of $3,225,000 on manufacturing costs for its Thousand Island dressing.

Required:

a. Compute the number of cases finished during March.

b. Compute the number of equivalent units for cases finished during March and for cases still in process at the end of March.

c. Compute the total costs to account for.

d. Determine the cost per equivalent case.

e. Determine the cost of the cases finished during March and the cost of the cases still in process at the end of March. (The total of these two amounts should equal your answer for part (c) above.)

15.35 Process-costing report, no beginning inventory, two cost pools (LO1, LO2). Mahaska Chemicals makes a patented fertilizer in its Naperville, Illinois plant. The production process begins by mixing all of the required materials. In a series of steps, the mixed slurry is converted to a finished fertilizer that is bagged and sold. Mahaska incurs conversion costs uniformly throughout the process.

Mahaska shut its plant down for major maintenance during November and began December with zero pounds of fertilizer in beginning inventory. Mahaska started 645,000 pounds of material into production in early December and had 95,000 pounds still in process on December 31. Mahaska estimates the ending work-in-process (EWIP) inventory to be 20% complete with respect to conversion costs. (Because all materials are added at the start of the process, ending WIP is 100% complete with respect to materials.) Finally, Mahaska spent $1,935,000 on materials and $1,024,200 on conversion costs during December.

Required:

a. Compute the quantity of fertilizer completed during December.

b. Compute the number of equivalent units for pounds finished during December and for pounds still in process at the end of December. Be sure to perform the exercise separately for materials and for conversion costs.

c. Compute the total costs to account for.

d. Determine the cost per equivalent pound for materials and for conversion costs.

e. Determine the cost of the fertilizer finished during December and the cost of the WIP inventory on December 31.

15.36 Working backwards (LO1): Kang Industries provides the following partially complete process-cost report.

Item	*Equivalent Units of Material*	*Equivalent Units of Conversion*	*Value*
Ending WIP inventory	10,000	7,000	?
Cost of goods completed & transferred out	90,000	90,000	$270,000

The cost of goods completed and transferred out contains $162,000 toward the cost of materials and $108,000 toward conversion cost.

Required: Determine the value of Kang's ending WIP inventory.

15.37 Working backwards (LO1): Baiman and Company informs you that it completed 110,000 units during November, valued at $550,000. Its cost per equivalent unit of conversion is $2.00. Finally, you learn that Baiman has 20,000 units in ending WIP, 50% complete with respect to conversion. Baiman adds all materials at the start of the process.

Required: Determine the value of Baiman's ending WIP inventory.

15.38 Standard process costing (LO3). Igloo Electronics makes cell phones under contract to a *Chaebol*, which is the Korean term for a conglomerate. Igloo began work on a new contract in January. During January, Igloo started 150,000 units into production, completing and shipping 145,000 phones by the end of the month. Igloo estimates the remaining 5,000 units to be 30% complete with respect to conversion costs.

Igloo is primarily an assembler because the *Chaebol* supplies the casing, screens, circuit boards, and other needed materials. Thus, Igloo accumulates all costs into a single-cost pool—conversion costs. Igloo actually spent $2,270,750 on conversion costs during January.

Igloo uses standard process costing to value its inventories. Specifically, it values each equivalent unit of work (for conversion) at $15.

Required: Compute Igloo's conversion cost variance for January.

15.39 Process-costing report, no beginning inventory, two cost pools (LO1, LO2). Rhino Car Wax makes its best-selling car wax in Mobile, Alabama. The production process begins by mixing all of the required materials. In a series of steps, the mix is then converted to a finished car wax paste. Rhino incurs conversion costs uniformly throughout the process.

Rhino began March with zero cases of car wax in beginning inventory. On March 1, Rhino started enough material for 74,500 cases of finished wax. By the end of March, Rhino had completed work on 63,250 cases, and assessed ending WIP inventory to be 60% complete with respect to conversion costs. Finally, Rhino spent $782,250 on materials and $1,697,500 on conversion costs during March.

Required:

Prepare a process-cost report to compute the cost of the cases of car wax finished during March and the cost of the cases still in process as of March 31.

15.40 Standard process costing, no beginning inventory (LO3). Refer to the information for Rhino Car Wax in the previous exercise. Rather than using actual costs, assume that Rhino uses standard process costing to value its inventories. Rhino values each equivalent unit of materials at $10 and each equivalent unit of conversion costs at $25.

Required:

a. Prepare Rhino's standard process-costing report for March. What is the cost of the cases of car wax finished during March and the cost of the cases still in process on March 31?

b. Compute Rhino's materials variance and conversion cost variance for March.

15.41 Process-costing report, no beginning inventory, three cost pools (LO1, LO2). Demski Technologies specializes in making surgical instruments. The firm closely collaborates with a German company that provides all of the needed technical expertise. The production process begins with a block of specially formulated, surgical-quality stainless steel. The instrument is formed after a number of operations to shape and trim the metal. The final step in the operation is to test each instrument for manufacturing and other defects.

Demski began July with zero instruments in process. During July, Demski began work on 4,000 instruments, completing 3,500 by month's end. Demski estimates that the units still in process as of July 31 are 30% complete with respect to conversion costs. Finally, Demski spent $600,000 on materials costs, $1,095,000 on conversion costs, and $612,500 on testing costs during July.

Required: Prepare Demski's process-costing report for July.

15.42 Process-costing report, no beginning inventory, materials added at different points (LO1, LO2). The Jogirushi Company makes a line of premium rice cookers, specially designed for the Japanese market. In February, Jogirushi launched a new model that is exclusively made in its Osaka factory.

The production process for the new model begins by forming sheet metal, the primary material, into the appropriate shape. The heating element and other electrical items are added when the unit is 40% complete. As the last step in the production process, the unit is packed in an attractive box. Jogirushi incurs conversion costs uniformly throughout the process.

During February, Jogirushi began production on 23,500 units, completing 21,200 units by month's end. Jogirushi estimates these in-process units to be 50% complete with respect to conversion costs.

During February, Jogirushi spent ¥10,575,000 on sheet metal, ¥58,750,000 on the heating element and other electrical items, ¥33,525,000 on conversion costs, and ¥12,720,000 on packing costs. (Note: ¥ is the symbol for the Yen, the Japanese unit of currency).

Required:

a. Compute the equivalent units for sheet metal, the heating element and other electrical items, conversion costs, and packing materials for Jogirushi for February.

b. Using your answer to part (a), prepare Jogirushi's process-costing report for February.

15.43 Process-costing report, working backwards (LO1, LO2). Yum Yum makes jams and other preserves from seasonal fruits and berries. The production process begins with the berries and sugar. After processing, Yum Yum packs the finished jams into glass containers prior to shipping them.

Yum Yum began June with zero cases of jam in work-in-process inventory. During June, Yum Yum started into production enough berries for 20,000 cases of jam. However, only 18,000 cases were completed during the month, with the remaining in-process cases being 80% complete at month's end. Yum Yum incurs conversion costs uniformly throughout the process.

Yum Yum estimates that the cost of the berries and sugar for the *finished cases* (i.e., COGM) equals $2,160,000. The cost of packing cases amounts to $450,000. Yum Yum further estimates that *ending WIP inventory* contains $36,000 in conversion costs.

Required:

Compute the total amount that Yum Yum spent on berries and sugar, conversion costs, and packing costs during June.

PROBLEMS

15.44 Process-costing report, beginning inventory, single-cost pool (LO1, LO2). The Cruise Salad Company began April with 25,000 cases of its Thousand Island dressing in work-in-process inventory. This inventory was valued at $225,000. During April, Cruise started 125,000 cases into production. On April 30, Cruise had 15,000 cases still in process, which production personnel estimate to be 50% complete.

Cruise accumulates all of its manufacturing costs in a single pool. During April, Cruise spent a total of $3,978,750 on manufacturing costs for its Thousand Island dressing.

Required:

a. Compute the number of cases finished during April.

b. Compute the number of equivalent units for cases finished during April and for cases still in process at the end of April.

c. Compute the total costs to account for.

d. Determine the cost per equivalent case.

e. Determine the cost of the cases finished during April and the cost of cases still in process at the end of April.

15.45 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Orange Computers began July with 75,000 units of its portable music player in work-in-process inventory. These units were 100% complete with respect to materials and 40% complete with respect to conversion costs. Orange valued this inventory at $6,765,000, comprising $5,625,000 in materials costs and $1,140,000 in conversion costs.

During July, Orange started another 150,000 units to production and completed a total of 200,000 units by month's end. Production personnel estimate that the 25,000 units still in process on July 31 are 100% complete with respect to materials and 50% complete with respect to conversion costs. Finally, Orange spent $11,475,000 on materials costs and $7,147,500 on conversion costs during July.

Required: Complete Orange's process-costing report for July. What is Orange's cost of goods manufactured (COGM) for July and the cost of its work-in-process inventory (WIP) on July 31?

15.46 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Damon and Company uses the weighted-average method of process costing. On January 1, the units in work-in-process (WIP) inventory were 100% complete with respect to materials and 60% complete with respect to conversion. Materials costs in beginning WIP were $330,000, and conversion costs were $432,000. Damon provides the following additional information:

- The 100,000 units in ending work-in-process (EWIP) inventory on December 31 were 100% complete with respect to materials and 80% complete with respect to conversion.
- 990,000 units started in production. Costs added during the year were $2,970,000 for materials and $1,728,000 for conversion.
- During the year, 1,000,000 units were completed and transferred to finished goods. There was no finished goods inventory on January 1. 800,000 units were sold.

Required:

a. How many units were there in beginning work-in-process (WIP) inventory on January 1?

b. Calculate the total equivalent units with respect to conversion.

c. Compute the cost per equivalent unit for materials.

d. What is the cost of the December 31, 20 × 1 work-in-process inventory?

15.47 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Chang's Office Furniture manufactures office furniture by using an assembly-line process. All direct materials are introduced at the start of the process, and conversion cost is incurred evenly throughout manufacturing. An examination of the company's work-in-process account for August revealed the following selected information:

August 1 balances:	900 units, 30% complete
Value of beginning inventory	$133,800*
Production started in August	2,700 units
Direct materials used during August	$270,000
August conversion cost	$154,200
Production completed	2,100 units

* Supplementary records disclosed direct material cost of $90,000 and conversion cost of $43,800.

Conversations with manufacturing personnel revealed that the ending work in process was 80% complete.

Required:

a. Determine the number of units in the August 31 work-in-process inventory.

b. Calculate the total equivalent units with respect to conversion.

c. Calculate the cost per equivalent unit with respect to conversion in August.

d. Determine the cost of the August 31 work-in-process inventory.

15.48 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Ace Chemical Company manufactures and sells a cleaning solution. All direct materials are added at the beginning of the manufacturing process. A review of the inventory cost records disclosed the following information about the month of August:

	Units	*Materials*	*Labor*	*Overhead*
WIP August 1 (72% complete with respect to conversion)	?	$1,260,000	$170,000	$510,000
Units started into production during August	2,200,000			
Costs incurred during August		$3,900,000	$5,500,000	$16,500,000

During the month of August, 1,800,000 units were completed and transferred to finished goods inventory. There were 600,000 units, 60% complete with respect to conversion, in the work-in-process account on August 31.

Required:

a. How many units were in the work-in-process account on August 1?

b. Calculate the total equivalent units with respect to conversion for the month of August.

c. Determine the cost of goods manufactured for the month of August.

15.49 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Guess Company manufactures a variety of natural fabrics for the clothing industry.

The following cost data are available for the month of January.

Items	*Materials*	*Conversion*
Cost of WIP on 1/1/ XX	$ 95,000	$112,000
Costs incurred during January	$ 85,000	$200,000

There were 80,000 units in process on January 1 (100% complete as to direct material and 60% complete as to conversion). The firms started 100,000 units into production in January. During January, 120,000 units were completed and transferred to finished goods. There was no finished goods inventory on January 1. We also know that 110,000 units were sold during January.

The units in ending work-in-process (EWIP) inventory on January 31 were 100% complete with respect to materials and 60% complete with respect to conversion.

Required:

a. How many units were there in ending work-in-process (WIP) inventory on January 31?

b. Calculate the total equivalent units with respect to conversion.

c. Compute the cost per equivalent unit for materials.

d. What is the cost of goods *sold* during January?

e. Suppose Guess also had beginning finished goods of 5,000 units with a unit cost of $2.90. Furthermore, Guess uses FIFO to value finished goods inventories. What is the cost of goods *sold* during January?

15.50 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Tom & Jerry Corporation processes and packages ice cream. The following data are available. Conversion activity occurs uniformly throughout the production process.

Work in process, June 1—15,000 units:	
Direct material: 100% complete, cost of	$16,250
conversion: 90% complete, cost of	$85,000
Units completed during June and transferred out to finished-goods inventory	190,300
Work in process, June 30—45,200 units:	
Direct material: 100% complete	
Conversion: 75% complete	
Costs incurred during June:	
Direct material	$165,085
Conversion costs:	
Direct labor	$76,300
Applied manufacturing overhead	$235,534
Total conversion costs	$311,834

Required:

a. How many units were started during June?

b. Calculate the cost per equivalent unit with respect to conversion for the month of June.

c. Determine the cost of the June 30 work-in-process inventory. Clearly identify and label your final answer.

15.51 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Mahaska Chemicals makes a patented fertilizer in its Naperville, Illinois plant. The production process begins by mixing all of the required materials. In a series of steps, the mixed slurry is converted to a finished fertilizer that is bagged and sold. Mahaska incurs conversion costs uniformly throughout the process.

Mahaska began January with 95,000 pounds of fertilizer in process, valued at $319,200. This value equals $285,000 for materials plus $34,200 for conversion costs. Mahaska started an additional 600,000 pounds into production in early January and had a total of 55,000 pounds still in process on January 31. The ending WIP inventory was estimated to be 25% complete with respect to conversion costs. Finally, Mahaska spent $1,869,500 on materials and $1,077,175 on conversion costs during January.

Required:

a. Compute the quantity of fertilizer completed during January.

b. Compute the number of equivalent units for pounds finished during January and for pounds still in process at the end of January. Be sure to perform the exercise separately for materials and for conversion costs.

c. Compute the total costs that must be accounted for.

d. Determine the cost per equivalent pound for materials and for conversion costs.

e. Determine the cost of the fertilizer finished during January and the cost of the WIP inventory on January 31.

15.52 Process-costing report, beginning inventory, two cost pools (LO1, LO2). Rhino Car Wax makes its best-selling car wax in Mobile, Alabama. The production process begins by mixing all of the required materials. In a series of steps, the mix is then converted to a finished car wax paste. Rhino incurs conversion costs uniformly throughout the process.

Rhino began April with 11,250 cases of car wax in beginning work-in-process inventory. These cases were valued at $281,812.50, with $118,125 being the cost of materials and the remainder being conversion costs. Rhino estimated its April beginning WIP inventory to be 100% complete with respect to materials and 60% complete with respect to conversion costs.

On April 1, Rhino started enough material for 80,000 cases of the finished wax. By the end of April, Rhino had completed work on a total of 85,000 cases and assessed ending WIP inventory to be 70% complete with respect to conversion costs. Finally, Rhino spent $830,875 on materials and $2,008,125 on conversion costs during April.

Required:

Prepare Rhino's process-costing report for April. What is Rhino's COGM for April and the cost of its ending WIP inventory on April 30?

15.53 Standard process costing, beginning inventory (LO1, LO2, LO3). Refer to the information for Rhino Car Wax in the previous problem. Rather than using actual costs, assume that Rhino uses standard process costing to value its inventories. Rhino values each equivalent unit of materials at $10 and each equivalent unit of conversion costs at $25.

Required:

a. Prepare Rhino's process-costing report for April. What is the cost of cases of car wax finished during April and the cost of the cases still in process on April 30?

b. Compute Rhino's materials variance and conversion cost variance for April. (*Note:* Be sure to compute the standard cost of the *work done in April* as the basis for comparing actual costs incurred in April).

15.54 Process-costing report, beginning inventory, three cost pools (LO1, LO2). Demski Technologies specializes in making surgical instruments. The firm closely collaborates with a German company that provides all of the needed technical expertise. The production process begins with a block of specially formulated, surgical-quality stainless steel. The instrument is formed after a number of operations to shape and trim the metal. The final step in the operation is to test each instrument for manufacturing and other defects.

Demski began August with 500 instruments in work-in-process inventory. The 500 instruments were valued at $120,000, comprising $75,000 in materials plus $45,000 in conversion costs. During August, Demski started another 4,500 instruments into production, completing a total of 4,600 instruments by month's end. Demski estimates that the units still in process on August 31 are 40% complete with respect to conversion costs. Finally, Demski spent $685,000 on materials costs, $1,335,400 on conversion costs, and $828,000 on testing costs during August.

Required: Prepare Demski's process-costing report for August.

15.55 Process-costing report, beginning inventory, materials added at different points (LO1, LO2). The Jogirushi Company makes a line of premium rice cookers, specially designed for the Japanese market. In February, Jogirushi launched a new model that is exclusively made in its Osaka factory.

The production process for the new model begins by forming sheet metal, the primary material, into the appropriate shape. The heating element and other electrical items are added when the unit is 40% complete. As the last step in the production process, the unit is packed in an attractive box. Jogirushi incurs conversion costs uniformly throughout the process.

Jogirushi began May with an inventory of 2,300 units, which were 50% complete with respect to conversion costs. These units were valued at ¥8,360,000 (= ¥1,035,000 for sheet metal, ¥5,600,000 for the heating element and other electrical items, and ¥1,725,000 for conversion costs). During May, Jogirushi began production on an additional 25,000 units. At the end of May, Jogirushi had 2,200 units still in process, estimated to be 30% complete with respect to conversion.

During May, Jogirushi spent ¥11,523,000 on sheet metal, ¥55,895,000 on the heating element and other electrical items, ¥39,491,000 on conversion costs, and ¥15,311,000 on packing costs. (*Note:* ¥ is the symbol for the Yen, the Japanese unit of currency.)

Required:

a. Compute the equivalent units for sheet metal, the heating element and other electrical items, conversion costs, and packing materials for Jogirushi for May.

b. Using your answer to part (a), prepare Jogirushi's process-costing report for May.

15.56 Standard process costing, beginning inventory (LO3). Igloo Electronics makes cell phones under contract to a *Chaebol*. Continuing work on an existing contact, Igloo began February with 5,000 units in process that were 30% complete. During February, Igloo started an additional 145,000 units into production, completing and shipping a total of 148,000 phones by the end of the month. Igloo estimates the remaining 2,000 units to be 20% complete with respect to conversion costs.

Igloo is primarily an assembler, for the contractor supplies the casing, screens, circuit boards, and other needed materials. Thus, Igloo accumulates all costs into a single-cost pool—conversion costs. Igloo actually spent $2,245,000 on conversion costs during February.

Igloo uses standard process costing to value its inventories. Specifically, it values each equivalent unit of work (for conversion) at $15.

Required:

Compute Igloo's conversion cost variance for February. (*Note:* Be sure to compare the actual cost for February with the standard cost of the work done in February.)

MINI-CASES

15.57 Multiple materials, ending work in process at differing stages of completion, standard process costing (LO1, LO2, LO3). The Shalimar Paint Company makes a variety of latex- and oil-based paints for interior and exterior use. The process for making paint is virtually the same regardless of the color. Because it takes considerable time and effort to switch colors, however, the firm uses a sophisticated model to schedule colors, usually going from lighter to darker shades. Further, Shalimar produces a large quantity of each color, counting each color as a batch. Consequently, Shalimar uses a process-costing system to value its inventories.

The production process begins by mixing all of the needed materials. After a series of steps, the paint is filled in gallon-sized cans when the conversion process is 95% complete. Shalimar incurs conversion costs uniformly throughout the process.

On April 1, Shalimar had 45,000 gallons of lilac paint in work-in-process inventory. Shalimar valued this inventory at $280,350, comprising $198,000 for materials and $82,350 for conversion costs. Moreover, Shalimar estimates that its beginning WIP inventory on April 1 is 60% complete with respect to conversion costs.

During April, Shalimar started an additional 145,000 gallons of lilac paint into production. On April 30, Shalimar had only 5,000 gallons of lilac paint still in process. Of this amount, 4,000 gallons were 50% complete with respect to conversion costs, while the remaining 1,000 gallons were 98% complete with respect to conversion costs.

Shalimar spent $657,000 on materials, $481,590 on conversion costs, and $139,500 on cans during April.

Required:

a. Prepare Shalimar's process-costing report for April. What is Shalimar's cost of goods manufactured for lilac paint for April? What is the cost of Shalimar's April 30 work-in-process inventory of lilac paint?

b. Assume Shalimar uses standard process costing to value its inventories, valuing each equivalent unit for materials, conversion costs, and cans at standard costs of $4.40, $2.95, and $0.78, respectively. Compute Shalimar's materials variance, conversion cost variance, and can variance for April. (*Note:* Be sure to compare the actual costs with the standard cost for the work done in April.)