



A Look Back

Chapter 2 introduced managerial accounting and described cost concepts and the reporting of manufacturing activities. Chapter 2 explained job order costing—an important cost accounting system for customized products and services.



A Look at This Chapter

This chapter focuses on how to measure and account for costs in process operations. We explain process production, describe how to assign costs to processes, and compute cost per equivalent unit for a process.



A Look Ahead

Chapter 4 introduces the activity-based costing (ABC) system, which provides managers with strategic cost information that is not readily available from other costing methods.

3 Chapter

Process Costing and Analysis

Learning Objectives

CAP

Conceptual

- C1** Explain process operations and the way they differ from job order operations. (p. 86)
- C2** Define equivalent units and explain their use in process cost accounting. (p. 93)
- C3** Explain the four steps in accounting for production activity in a period. (p. 94)
- C4** Define a process cost summary and describe its purposes. (p. 98)
- C5** Appendix 3A—Explain and illustrate the four steps in accounting for production activity using FIFO. (p. 105)

Analytical

- A1** Compare process cost accounting and job order cost accounting. (p. 87)
- A2** Explain and illustrate a hybrid costing system. (p. 101)

Procedural

- P1** Record the flow of direct materials costs in process cost accounting. (p. 90)
- P2** Record the flow of direct labor costs in process cost accounting. (p. 91)
- P3** Record the flow of factory overhead costs in process cost accounting. (p. 91)
- P4** Compute equivalent units produced in a period. (p. 93)
- P5** Prepare a process cost summary. (p. 98)
- P6** Record the transfer of completed goods to Finished Goods Inventory and Cost of Goods Sold. (p. 99)



LP3



Decision Feature

The Big Apple



HOOD RIVER, OR—After a few years of working in the family business of growing apples and making cider, David Ryan launched his own company, **Hood River Juice Company** [HR]CO.com], to focus on the processing stage of apple juice and cider. Like many entrepreneurs, David sought guidance from experienced mentors, in his case the Small Business Development Center located in the local community college. These mentors explained managerial accounting and the financial aspects of successful manufacturing.

Today, before an apple enters David's production process, it is inspected by his drivers when the apples are loaded from the field. A foreman then inspects the apples again when unloading them at his factory. David's factory employees then wash and hand select the best apples from those that survive the previous two inspections.

Apple quality is paramount. Explains David, "If we are willing to eat it, we're willing to squeeze it." From cutting apples into small pieces and squeezing those pieces into juice, through filtering the juice and packaging the finished product, David's production process is monitored and accounting reports are produced.

Entrepreneurs such as David are aided by process cost summaries that help them monitor and control the costs of material, labor, and

"If we are willing to eat it, we're willing to squeeze it"
—David Ryan

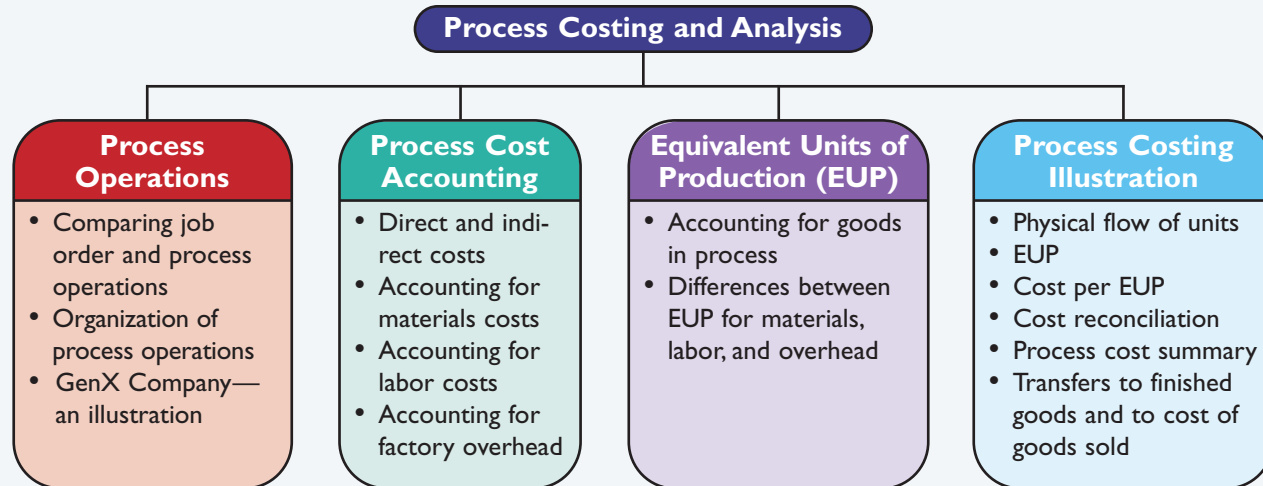
overhead applied to production processes. For example, David tries to maintain regular full-time employees to better manage costs. Thus, he purchases and processes apples year-round as opposed to only seasonal production. David estimates this year-round process reduces his overhead costs by 40%. "Needless to say, every company has their own overhead they have to deal with," explains David. "If your total throughput is down by 35%, you must look elsewhere to get the margin to be sustainable. The only way to do that is to cut your overhead." Managerial accounting information aids in his decisions.

David's focus on cost management minimizes the risk of bad decisions, and his passion for quality control enables him to improve process operations. His overriding goal is customer satisfaction. That focus has led him to produce bulk apple juice for use in protein shakes and smoothies, and it has allowed his customers to select from over 50 varieties of apples for a custom-blended juice. Juice drinkers seem happy: From an initial investment of \$36,000 in 2000, David's annual sales now exceed \$14 million. Those are juicy numbers.

[Sources: Hood River Juice Company Website, January 2009; Yakima-Herald.com, March 2008; Hood River News, February 2006; Entrepreneur, April 2008]

The type of product or service a company offers determines its cost accounting system. Job order costing is used to account for custom products and services that meet the demands of a particular customer. Not all products are manufactured in this way; many carry standard designs so that one unit is no different than any other unit. Such a system often produces large numbers of units on a continuous basis,

all of which pass through similar processes. This chapter describes how to use a process cost accounting system to account for these types of products. It also explains how costs are accumulated for each process and then assigned to units passing through those processes. This information helps us understand and estimate the cost of each process as well as find ways to reduce costs and improve processes.



Process Operations

C1 Explain process operations and the way they differ from job order operations.

Process operations, also called *process manufacturing* or *process production*, is the mass production of products in a continuous flow of steps. This means that products pass through a series of sequential processes. Petroleum refining is a common example of process operations. Crude oil passes through a series of steps before it is processed into different grades of petroleum. **Exxon Mobil**'s oil activities reflect a process operation. An important characteristic of process operations is the high level of standardization necessary if the system is to produce large volumes of products. Process operations also extend to services. Examples include mail sorting in large post offices and order processing in large mail-order firms such as **L.L. Bean**. The common feature in these service organizations is that operations are performed in a sequential manner using a series of standardized processes. Other companies using process operations include **Kellogg** (cereals), **Pfizer** (drugs), **Procter & Gamble** (household products), **Xerox** (copiers), **Coca-Cola** (soft drinks), **Heinz** (ketchup), **Penn** (tennis balls), and **Hershey** (chocolate). For a virtual tour of tennis ball manufacturing, see penracquet.com/factory.html.



Each of these examples of products and services involves operations having a series of *processes*, or steps. Each process involves a different set of activities. A production operation that processes chemicals, for instance, might include the four steps shown in Exhibit 3.1. Understanding such processes for companies with process operations is crucial for measuring their costs. Increasingly, process operations use machines and automation to control product quality and reduce manufacturing costs.

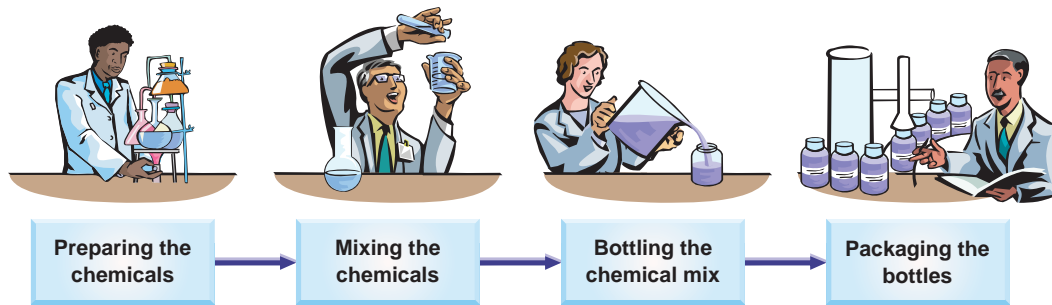


EXHIBIT 3.1

Process Operations: Chemicals

Comparing Job Order and Process Operations

Job order and process operations can be considered as two ends of a continuum. Important features of both systems are shown in Exhibit 3.2. We often describe job order and process operations with manufacturing examples, but both also apply to service companies. In a job order costing system, the measurement focus is on the individual job or batch. In a process costing system, the measurement focus is on the process itself and the standardized units produced.

A1 Compare process cost accounting and job order cost accounting.

Job Order Operations	Process Operations
<ul style="list-style-type: none"> • Custom orders • Heterogeneous products and services • Low production volume • High product flexibility • Low to medium standardization 	<ul style="list-style-type: none"> • Repetitive procedures • Homogeneous products and services • High production volume • Low product flexibility • High standardization

EXHIBIT 3.2

Comparing Job Order and Process Operations

Organization of Process Operations

In a process operation, each process is identified as a separate *production department*, *workstation*, or *work center*. With the exception of the first process or department, each receives the output from the prior department as a partially processed product. Depending on the nature of the process, a company applies direct labor, overhead, and, perhaps, additional direct materials to move the product toward completion. Only the final process or department in the series produces finished goods ready for sale to customers.

Tracking costs for several related departments can seem complex. Yet because process costing procedures are applied to the activity of each department or process separately, we need to consider only one process at a time. This simplifies the procedures.

When the output of one department becomes an input to another department, as is the case in sequential processing, we simply transfer the costs associated with those units from the first department into the next. We repeat these steps from department to department until the final process is complete. At that point the accumulated costs are transferred with the product from Goods in Process Inventory to Finished Goods Inventory. The next section illustrates a company with a single process, but the methods illustrated apply to a multiprocess scenario as each department's costs are handled separately for each department.

Decision Insight

Accounting for Health Many service companies use process departments to perform specific tasks for consumers. Hospitals, for instance, have radiology and physical therapy facilities with special equipment and trained employees. When patients need services, they are processed through departments to receive prescribed care. Service companies need process cost accounting information as much as manufacturers to estimate costs of services, to plan future operations, to control costs, and to determine customer charges.

GenX Company— An Illustration

The GenX Company illustrates process operations. It produces Profen[®], an over-the-counter pain reliever for athletes. GenX sells Profen to wholesale distributors, who in turn sell it to

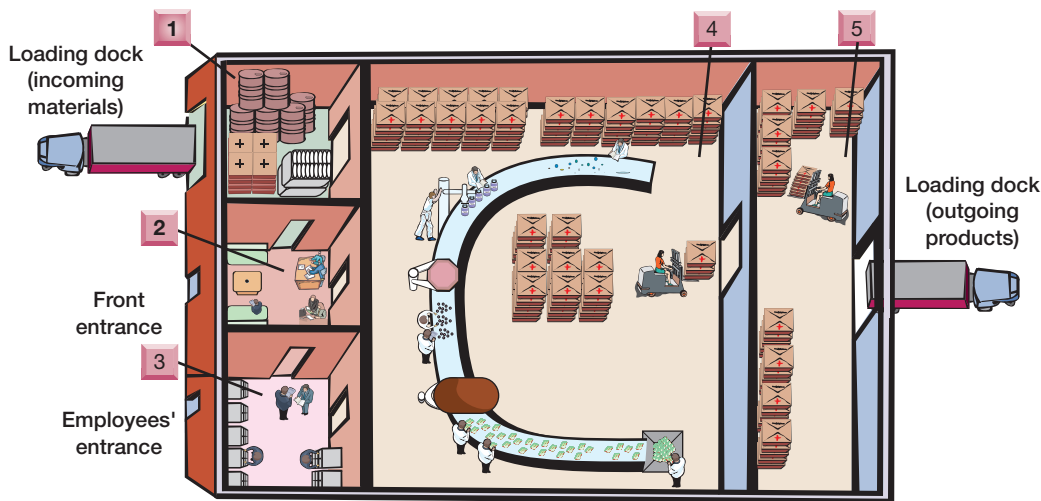
retailers. Profen is produced by mixing its active ingredient, Profelene, with flavorings and preservatives, molding it into Profen tablets, and packaging the tablets. Exhibit 3.3 shows a summary floor plan of the GenX factory, which has five areas.

- 1 *Storeroom*—materials are received and then distributed when requisitioned.
- 2 *Production support offices*—used by administrative and maintenance employees who support manufacturing operations.
- 3 *Locker rooms*—workers change from street clothes into sanitized uniforms before working in the factory.
- 4 *Production floor*—area where the powder is processed into tablets.
- 5 *Warehouse*—finished products are stored before being shipped to wholesalers.

Point: Electronic monitoring of operations is common in factories.

EXHIBIT 3.3

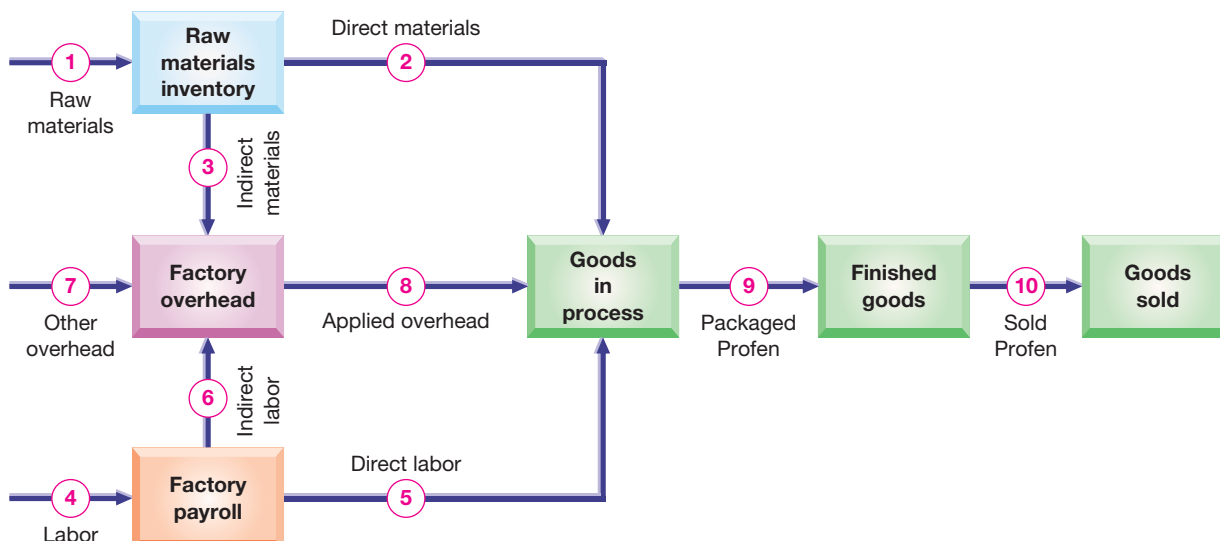
Floor Plan of GenX's Factory



The first step in process manufacturing is to decide when to produce a product. Management determines the types and quantities of materials and labor needed and then schedules the work. Unlike a job order process, where production often begins only after receipt of a custom order, managers of companies with process operations often forecast the demand expected for their products. Based on these plans, production begins. The flowchart in Exhibit 3.4 shows the production steps for GenX. The following sections explain how GenX uses a process cost accounting system to compute these costs. Many of the explanations refer to this exhibit and its numbered cost flows ① through ⑩. (*Hint:* The amounts for the numbered cost flows in Exhibit 3.4 are summarized in Exhibit 3.21. Those amounts are explained in the following pages, but it can help to refer to Exhibit 3.21 as we proceed through the explanations.)

EXHIBIT 3.4

Process Operations and Costs: GenX



Process Cost Accounting

Process and job order operations are similar in that both combine materials, labor, and overhead in the process of producing products. They differ in how they are organized and managed. The measurement focus in a job order costing system is on the individual job or batch, whereas in a process costing system, it is on the individual process. Regardless of the measurement focus, we are ultimately interested in determining the cost per unit of product (or service) resulting from either system.

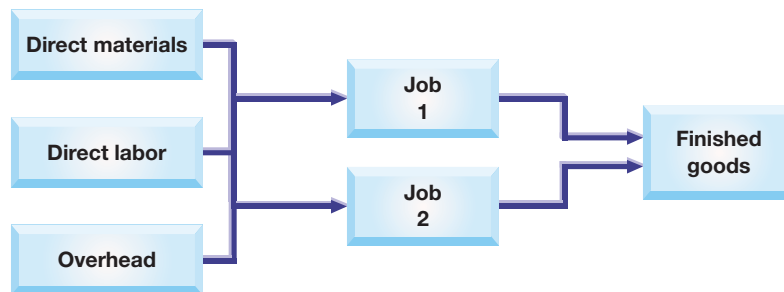
Specifically, the **job order cost accounting system** assigns direct materials, direct labor, and overhead to jobs. The total job cost is then divided by the number of units to compute a cost per unit for that job. The **process cost accounting system** assigns direct materials, direct labor, and overhead to specific processes (or departments). The total costs associated with each process are then divided by the number of units passing through that process to determine the cost per equivalent unit (defined later in the chapter) for that process. Differences in the way these two systems apply materials, labor, and overhead costs are highlighted in Exhibit 3.5.



Video3.1

Point: The cost object in a job order system is the specific job; the cost object in a process costing system is the process.

Job order systems



Process systems

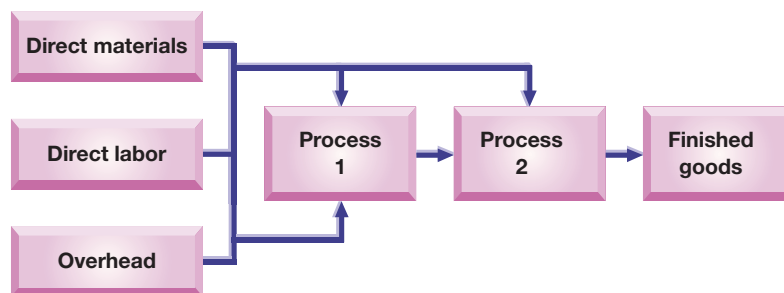


EXHIBIT 3.5

Comparing Job Order and Process Cost Accounting Systems

Direct and Indirect Costs

Like job order operations, process cost accounting systems use the concepts of direct and indirect costs. Materials and labor that can be traced to specific processes are assigned to those processes as direct costs. Materials and labor that cannot be traced to a specific process are indirect costs and are assigned to overhead. Some costs classified as overhead in a job order system may be classified as direct costs in process cost accounting. For example, depreciation of a machine used entirely by one process is a direct cost of that process.

Point: If a cost can be traced to the cost object, it is direct; if it cannot, it is indirect.

Decision Insight

JIT Boon to Process Operations Companies that adopt JIT manufacturing often organize their production system as a series of sequential processes. One survey found 60% of companies that converted to JIT used process operations; this compares to only 20% before converting to JIT.

P1 Record the flow of direct materials costs in process cost accounting.

Accounting for Materials Costs

In Exhibit 3.4, arrow line ① reflects the arrival of materials at GenX’s factory. These materials include Profelene, flavorings, preservatives, and packaging. They also include supplies for the production support office. GenX uses a perpetual inventory system and makes all purchases on credit. The summary entry for receipts of raw materials in April follows (dates in journal entries numbered ① through ⑩ are omitted because they are summary entries, often reflecting two or more transactions or events).

Assets = Liabilities + Equity
+11,095 +11,095

①	Raw Materials Inventory	11,095	
	Accounts Payable		11,095
	<i>Acquired materials on credit for factory use.</i>		



Arrow line ② in Exhibit 3.4 reflects the flow of direct materials to production, where they are used to produce Profen. Most direct materials are physically combined into the finished product; the remaining direct materials include those used and clearly linked with a specific process. The manager of a process usually obtains materials by submitting a *materials requisition* to the materials storeroom manager. In some situations, materials move continuously from raw materials inventory through the manufacturing process. **Pepsi Bottling**, for instance, uses a process in which inventory moves continuously through the system. In these cases, a **materials consumption report** summarizes the materials used by a department during a reporting period and replaces materials requisitions. The entry to record the use of direct materials by GenX’s production department in April follows.

Assets = Liabilities + Equity
+9,900
-9,900

②	Goods in Process Inventory	9,900	
	Raw Materials Inventory		9,900
	<i>To assign costs of direct materials used in production.</i>		

This entry transfers costs from one asset account to another asset account. (When two or more production departments exist, a company uses two or more Goods in Process Inventory accounts to separately accumulate costs incurred by each.)

In Exhibit 3.4, the arrow line ③ reflects the flow of indirect materials from the storeroom to factory overhead. These materials are not clearly linked with any specific production process or department but are used to support overall production activity. The following entry records the cost of indirect materials used by GenX in April.

Assets = Liabilities + Equity
-1,195 -1,195

③	Factory Overhead	1,195	
	Raw Materials Inventory		1,195
	<i>To record indirect materials used in April.</i>		

After the entries for both direct and indirect materials are posted, the Raw Materials Inventory account appears as shown in Exhibit 3.6. The April 30 balance sheet reports the \$4,000 Raw Materials Inventory account as a current asset.

EXHIBIT 3.6

Raw Materials Inventory

Raw Materials Inventory			Acct. No. 132		
Date		Explanation	Debit	Credit	Balance
Mar.	31	Balance			4,000
Apr.	30	Materials purchases	11,095		15,095
	30	Direct materials usage		9,900	5,195
	30	Indirect materials usage		1,195	4,000

Accounting for Labor Costs

Exhibit 3.4 shows GenX factory payroll costs as reflected in arrow line ④. Total labor costs of \$8,920 are paid in cash and are recorded in the Factory Payroll account.

④	Factory Payroll	8,920	
	Cash		8,920
	<i>To record factory wages for April.</i>		

P2 Record the flow of direct labor costs in process cost accounting.

$$\begin{array}{l} \text{Assets} = \text{Liabilities} + \text{Equity} \\ -8,920 \qquad \qquad \qquad -8,920 \end{array}$$

Time reports from the production department and the production support office triggered this entry. (For simplicity, we do not separately identify withholdings and additional payroll taxes for employees.) In a process operation, the direct labor of a production department includes all labor used exclusively by that department. This is the case even if the labor is not applied to the product itself. If a production department in a process operation, for instance, has a full-time manager and a full-time maintenance worker, their salaries are direct labor costs of that process and are not factory overhead.

Arrow line ⑤ in Exhibit 3.4 shows GenX’s use of direct labor in the production department. The following entry transfers April’s direct labor costs from the Factory Payroll account to the Goods in Process Inventory account.

⑤	Goods in Process Inventory	5,700	
	Factory Payroll		5,700
	<i>To assign costs of direct labor used in production.</i>		

$$\begin{array}{l} \text{Assets} = \text{Liabilities} + \text{Equity} \\ +5,700 \qquad \qquad \qquad +5,700 \end{array}$$

Arrow line ⑥ in Exhibit 3.4 reflects GenX’s indirect labor costs. These employees provide clerical, maintenance, and other services that help produce Profen efficiently. For example, they order materials, deliver them to the factory floor, repair equipment, operate and program computers used in production, keep payroll and other production records, clean up, and move the finished goods to the warehouse. The following entry charges these indirect labor costs to factory overhead.

Point: A department’s indirect labor cost might include an allocated portion of the salary of a manager who supervises two or more departments. Allocation of costs between departments is discussed in a later chapter.

⑥	Factory Overhead	3,220	
	Factory Payroll		3,220
	<i>To record indirect labor as overhead.</i>		

$$\begin{array}{l} \text{Assets} = \text{Liabilities} + \text{Equity} \\ \qquad \qquad \qquad -3,220 \\ \qquad \qquad \qquad +3,220 \end{array}$$

After these entries for both direct and indirect labor are posted, the Factory Payroll account appears as shown in Exhibit 3.7. The temporary Factory Payroll account is now closed to another temporary account, Factory Overhead, and is ready to receive entries for May. Next we show how to apply overhead to production and close the temporary Factory Overhead account.

Factory Payroll			Acct. No. 530		
Date		Explanation	Debit	Credit	Balance
Mar.	31	Balance			0
Apr.	30	Total payroll for April	8,920		8,920
	30	Direct labor costs		5,700	3,220
	30	Indirect labor costs		3,220	0

EXHIBIT 3.7

Factory Payroll

Accounting for Factory Overhead

Overhead costs other than indirect materials and indirect labor are reflected by arrow line ⑦ in Exhibit 3.4. These overhead items include the costs of insuring production assets, renting the factory building, using factory utilities, and depreciating equipment not directly related to a specific process. The following entry records overhead costs for April.

P3 Record the flow of factory overhead costs in process cost accounting.

Assets = Liabilities + Equity
 -180 +645 -2,425
 -750
 -850

⑦	Factory Overhead	2,425	
	Prepaid Insurance		180
	Utilities Payable		645
	Cash		750
	Accumulated Depreciation—Factory Equipment		850
<i>To record overhead items incurred in April.</i>			

After this entry is posted, the Factory Overhead account balance is \$6,840, comprising indirect materials of \$1,195, indirect labor of \$3,220, and \$2,425 of other overhead.

Arrow line ⑧ in Exhibit 3.4 reflects the application of factory overhead to production. Factory overhead is applied to processes by relating overhead cost to another variable such as direct labor hours or machine hours used. With increasing automation, companies with process operations are more likely to use machine hours to allocate overhead. In some situations, a single allocation basis such as direct labor hours (or a single rate for the entire plant) fails to provide useful allocations. As a result, management can use different rates for different production departments. Based on an analysis of its operations, GenX applies its April overhead at a rate of 120% of direct labor cost, as shown in Exhibit 3.8.

Point: The time it takes to process (cycle) products through a process is sometimes used to allocate costs.

EXHIBIT 3.8

Applying Factory Overhead

	Direct Labor Cost	Predetermined Rate	Overhead Applied
Production Department	\$5,700	120%	\$6,840

GenX records its applied overhead with the following entry.

Assets = Liabilities + Equity
 +6,840 +6,840

⑧	Goods in Process Inventory	6,840	
	Factory Overhead		6,840
<i>Allocated overhead costs to production at 120% of direct labor cost.</i>			

After posting this entry, the Factory Overhead account appears as shown in Exhibit 3.9. For GenX, the amount of overhead applied equals the actual overhead incurred during April. In most cases, using a predetermined overhead rate leaves an overapplied or underapplied balance in the Factory Overhead account. At the end of the period, this overapplied or underapplied balance should be closed to the Cost of Goods Sold account, as described in the job order costing chapter.

EXHIBIT 3.9

Factory Overhead

Factory Overhead			Acct. No. 540		
Date		Explanation	Debit	Credit	Balance
Mar.	31	Balance			0
Apr.	30	Indirect materials usage	1,195		1,195
	30	Indirect labor costs	3,220		4,415
	30	Other overhead costs	2,425		6,840
	30	Applied to production departments		6,840	0

Example: If applied overhead results in a \$6,940 credit to the factory overhead account, does it yield an over- or underapplied overhead amount?
 Answer: \$100 overapplied overhead

Decision Ethics

Budget Officer You are working to identify the direct and indirect costs of a new processing department that has several machines. This department's manager instructs you to classify a majority of the costs as indirect to take advantage of the direct labor-based overhead allocation method so it will be charged a lower amount of overhead (because of its small direct labor cost). This would penalize other departments with higher allocations. It also will cause the performance ratings of managers in these other departments to suffer. What action do you take? [Answer—p. 110]

Quick Check

Answers—p. 111

1. A process operation (a) is another name for a job order operation, (b) does not use the concepts of direct materials or direct labor, or (c) typically produces large quantities of homogeneous products or services.
2. Under what conditions is a process cost accounting system more suitable for measuring production costs than a job order cost accounting system?
3. When direct materials are assigned and used in production, the entry to record their use includes (a) a credit to Goods in Process Inventory, (b) a debit to Goods in Process Inventory, or (c) a debit to Raw Materials Inventory.
4. What are the three cost categories incurred by both job order and process operations?
5. How many Goods in Process Inventory accounts are needed in a process cost system?

Equivalent Units of Production

We explained how materials, labor, and overhead costs for a period are accumulated in the Goods in Process Inventory account, but we have not explained the arrow lines labeled ⑨ and ⑩ in Exhibit 3.4. These lines reflect the transfer of products from the production department to finished goods inventory, and from finished goods inventory to cost of goods sold. To determine the costs recorded for these flows, we must first determine the cost per unit of product and then apply this result to the number of units transferred.

C2 Define equivalent units and explain their use in process cost accounting.

Accounting for Goods in Process

If a process has *no beginning and no ending goods in process inventory*, the unit cost of goods transferred out of a process is computed as follows.



Video3.1

$$\frac{\text{Total cost assigned to the process (direct materials, direct labor, and overhead)}}{\text{Total number of units started and finished in the period}}$$

If a process has a beginning or ending inventory of partially processed units (or both), then the total cost assigned to the process must be allocated to all completed and incomplete units worked on during the period. Therefore, the denominator must measure the entire production activity of the process for the period, called **equivalent units of production** (or **EUP**), a phrase that refers to the number of units that could have been started *and* completed given the cost incurred during a period. This measure is then used to compute the cost per equivalent unit and to assign costs to finished goods and goods in process inventory.

To illustrate, assume that GenX adds (or introduces) 100 units into its process during a period. Suppose at the end of that period, the production supervisor determines that those 100 units are 60% of the way through the process. Therefore, equivalent units of production for that period total 60 EUP (100 units \times 60%). This means that with the resources used to put 100 units 60% of the way through the process, GenX could have started and completed 60 whole units.

Point: For GenX, "units" might refer to individual Profen tablets. For a juice maker, units might refer to gallons.

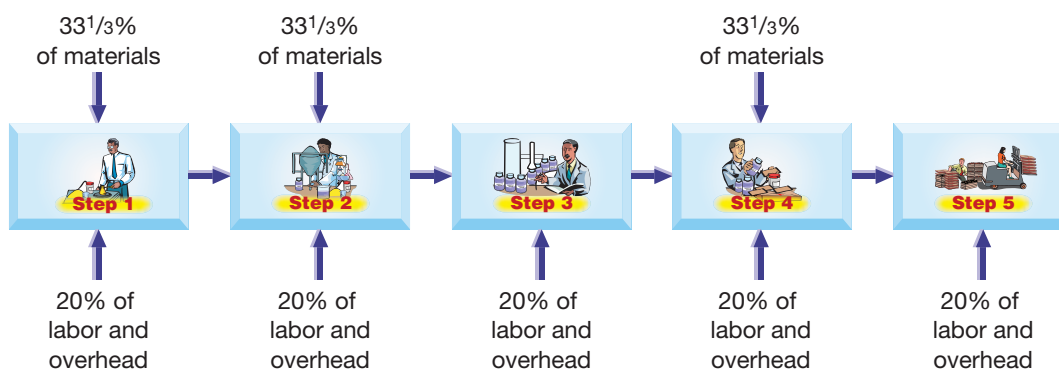
Differences in Equivalent Units for Materials, Labor, and Overhead

In many processes, the equivalent units of production for direct materials are not the same with respect to direct labor and overhead. To illustrate, consider a five-step process operation shown in Exhibit 3.10.

P4 Compute equivalent units produced in a period.

EXHIBIT 3.10

An Illustrative Five-Step Process Operation



This exhibit shows that one-third of the direct material cost is added at each of three steps: 1, 2, and 4. One-fifth of the direct labor cost is added at each of the five steps. One-fifth of the overhead also is added at each step because overhead is applied as a percent of direct labor for this company.

When units finish step 1, they are one-third complete with respect to direct materials but only one-fifth complete with respect to direct labor and overhead. When they finish step 2, they are two-thirds complete with respect to direct materials but only two-fifths complete with respect to direct labor and overhead. When they finish step 3, they remain two-thirds complete with respect to materials but are now three-fifths complete with respect to labor and overhead. When they finish step 4, they are 100% complete with respect to materials (all direct materials have been added) but only four-fifths complete with respect to labor and overhead.

For example, if 300 units of product are started and processed through step 1 of Exhibit 3.10, they are said to be one-third complete *with respect to materials*. Expressed in terms of equivalent finished units, the processing of these 300 units is equal to finishing 100 EUP with respect to materials ($300 \text{ units} \times 33\frac{1}{3}\%$). However, only one-fifth of direct labor and overhead has been applied to the 300 units at the end of step 1. This means that the equivalent units of production *with respect to labor and overhead* total 60 EUP ($300 \text{ units} \times 20\%$).

Decision Insight

Process Services Customer interaction software is a hot item in customer service processes. Whether in insurance, delivery, or technology services, companies are finding that this software can turn their customer service process into an asset. How does it work? For starters, it cuts time spent on service calls because a customer describes a problem only once. It also yields a database of customer questions and complaints that gives insights into needed improvements. It recognizes incoming phone numbers and accesses previous dealings.

Process Costing Illustration

C3 Explain the four steps in accounting for production activity in a period.

This section applies process costing concepts and procedures to GenX. **This illustration uses the weighted-average method for inventory costs. The FIFO method is illustrated in Appendix 3A.** (Assume a weighted-average cost flow for all computations and assignments in this chapter unless explicitly stated differently. When using a just-in-time inventory system, different inventory methods yield similar results because inventories are immaterial.)

Exhibit 3.11 shows selected information from the production department for the month of April. Accounting for a department's activity for a period includes four steps involving analysis of (1) physical flow, (2) equivalent units, (3) cost per equivalent unit, and (4) cost assignment and reconciliation. The next sections describe each step.

Beginning goods in process inventory (March 31)	
Units of product	30,000
Percentage of completion—Direct materials	100%
Percentage of completion—Direct labor	65%
Direct materials costs	\$ 3,300
Direct labor costs	\$ 600
Factory overhead costs applied (120% of direct labor)	\$ 720
Activities during the current period (April)	
Units started this period	90,000
Units transferred out (completed)	100,000
Direct materials costs	\$ 9,900
Direct labor costs	\$ 5,700
Factory overhead costs applied (120% of direct labor)	\$ 6,840
Ending goods in process inventory (April 30)	
Units of product	20,000
Percentage of completion—Direct materials	100%
Percentage of completion—Direct labor	25%

EXHIBIT 3.11

Production Data



Video3.1

Step 1: Determine the Physical Flow of Units

A *physical flow reconciliation* is a report that reconciles (1) the physical units started in a period with (2) the physical units completed in that period. A physical flow reconciliation for GenX is shown in Exhibit 3.12 for April.

Units to Account For		Units Accounted For	
Beginning goods in process inventory	30,000 units	Units completed and transferred out	100,000 units
Units started this period	<u>90,000 units</u>	Ending goods in process inventory	<u>20,000 units</u>
Total units to account for	<u>120,000 units</u>	Total units accounted for	<u>120,000 units</u>
	↑	reconciled	↑

EXHIBIT 3.12

Physical Flow Reconciliation

The weighted-average method does not require us to separately track the units in beginning work in process from those units started this period. Instead, the units are treated as part of a large pool with an average cost per unit.

Step 2: Compute Equivalent Units of Production

The second step is to compute *equivalent units of production* for direct materials, direct labor, and factory overhead for April. Overhead is applied using direct labor as the allocation base for GenX. This also implies that equivalent units are the same for both labor and overhead.

GenX used its direct materials, direct labor, and overhead to make finished units of Profen and to begin processing some units that are not yet complete. We must convert the physical units measure to equivalent units based on how each input has been used. Equivalent units are computed by multiplying the number of physical units by the percentage of completion for each input—see Exhibit 3.13.

Equivalent Units of Production	Direct Materials	Direct Labor	Factory Overhead
Equivalent units completed and transferred out (100,000 × 100%)	100,000 EUP	100,000 EUP	100,000 EUP
Equivalent units for ending goods in process			
Direct materials (20,000 × 100%)	20,000		
Direct labor (20,000 × 25%)		5,000	
Factory overhead (20,000 × 25%)			5,000
Equivalent units of production	<u>120,000 EUP</u>	<u>105,000 EUP</u>	<u>105,000 EUP</u>

EXHIBIT 3.13

Equivalent Units of Production—Weighted Average



The first row of Exhibit 3.13 reflects units transferred out in April. The production department entirely completed its work on the 100,000 units transferred out. These units have 100% of the materials, labor, and overhead required, or 100,000 equivalent units of each input ($100,000 \times 100\%$).

The second row references the ending goods in process, and rows three, four, and five break it down by materials, labor, and overhead. For direct materials, the units in ending goods in process inventory (20,000 physical units) include all materials required, so there are 20,000 equivalent units ($20,000 \times 100\%$) of materials in the unfinished physical units. Regarding labor, the units in ending goods in process inventory include 25% of the labor required, which implies 5,000 equivalent units of labor ($20,000 \times 25\%$). These units are only 25% complete and labor is used uniformly through the process. Overhead is applied on the basis of direct labor for GenX, so equivalent units for overhead are computed identically to labor ($20,000 \times 25\%$).

The final row reflects the whole units of product that could have been manufactured with the amount of inputs used to create some complete and some incomplete units. For GenX, the amount of inputs used to produce 100,000 complete units and to start 20,000 additional units is equivalent to the amount of direct materials in 120,000 whole units, the amount of direct labor in 105,000 whole units, and the amount of overhead in 105,000 whole units.

Step 3: Compute the Cost per Equivalent Unit

Equivalent units of production for each product (from step 2) is used to compute the average cost per equivalent unit. Under the **weighted-average method**, the computation of EUP does not separate the units in beginning inventory from those started this period; similarly, this method combines the costs of beginning goods in process inventory with the costs incurred in the current period. This process is illustrated in Exhibit 3.14.

EXHIBIT 3.14

Cost per Equivalent Unit of Production—Weighted Average

Cost per Equivalent Unit of Production	Direct Materials	Direct Labor	Factory Overhead
Costs of beginning goods in process inventory	\$ 3,300	\$ 600	\$ 720
Costs incurred this period	<u>9,900</u>	<u>5,700</u>	<u>6,840</u>
Total costs	\$13,200	\$6,300	\$7,560
÷ Equivalent units of production (from Step 2)	<u>120,000 EUP</u>	<u>105,000 EUP</u>	<u>105,000 EUP</u>
= Cost per equivalent unit of production	<u>\$0.11 per EUP*</u>	<u>\$0.06 per EUP[†]</u>	<u>\$0.072 per EUP[‡]</u>

* $\$13,200 \div 120,000 \text{ EUP}$ † $\$6,300 \div 105,000 \text{ EUP}$ ‡ $\$7,560 \div 105,000 \text{ EUP}$

For direct materials, the cost averages \$0.11 per EUP, computed as the sum of direct materials cost from beginning goods in process inventory (\$3,300) and the direct materials cost incurred in April (\$9,900), and this sum (\$13,200) is then divided by the 120,000 EUP for materials (from step 2). The costs per equivalent unit for labor and overhead are similarly computed. Specifically, direct labor cost averages \$0.06 per EUP, computed as the sum of labor cost in beginning goods in process inventory (\$600) and the labor costs incurred in April (\$5,700), and this sum (\$6,300) divided by 105,000 EUP for labor. Overhead costs averages \$0.072 per EUP, computed as the sum of overhead cost in the beginning goods in process inventory (\$720) and the overhead costs applied in April (\$6,840), and this sum (\$7,560) divided by 105,000 EUP for overhead.

Step 4: Assign and Reconcile Costs

The EUP from step 2 and the cost per EUP from step 3 are used in step 4 to assign costs to (a) units that production completed and transferred to finished goods and (b) units that remain in process. This is illustrated in Exhibit 3.15.

Cost of units completed and transferred out		
Direct materials (100,000 EUP × \$0.11 per EUP)	\$11,000	
Direct labor (100,000 EUP × \$0.06 per EUP)	6,000	
Factory overhead (100,000 EUP × \$0.072 per EUP)	<u>7,200</u>	
Cost of units completed this period		\$ 24,200
Cost of ending goods in process inventory		
Direct materials (20,000 EUP × \$0.11 per EUP)	2,200	
Direct labor (5,000 EUP × \$0.06 per EUP)	300	
Factory overhead (5,000 EUP × \$0.072 per EUP)	<u>360</u>	
Cost of ending goods in process inventory		<u>2,860</u>
Total costs accounted for		<u>\$27,060</u>

EXHIBIT 3.15

Report of Costs Accounted For—Weighted Average

Cost of Units Completed and Transferred The 100,000 units completed and transferred to finished goods inventory required 100,000 EUP of direct materials. Thus, we assign \$11,000 (100,000 EUP × \$0.11 per EUP) of direct materials cost to those units. Similarly, those units had received 100,000 EUP of direct labor and 100,000 EUP of factory overhead (recall Exhibit 3.13). Thus, we assign \$6,000 (100,000 EUP × \$0.06 per EUP) of direct labor and \$7,200 (100,000 EUP × \$0.072 per EUP) of overhead to those units. The total cost of the 100,000 completed and transferred units is \$24,200 (\$11,000 + \$6,000 + \$7,200) and their average cost per unit is \$0.242 (\$24,200 ÷ 100,000 units).

Cost of Units for Ending Goods in Process There are 20,000 incomplete units in goods in process inventory at period-end. For direct materials, those units have 20,000 EUP of material (from step 2) at a cost of \$0.11 per EUP (from step 3), which yields the materials cost of goods in process inventory of \$2,200 (20,000 EUP × \$0.11 per EUP). For direct labor, the in-process units have 25% of the required labor, or 5,000 EUP (from step 2). Using the \$0.06 labor cost per EUP (from step 3) we obtain the labor cost of goods in process inventory of \$300 (5,000 EUP × \$0.06 per EUP). For overhead, the in-process units reflect 5,000 EUP (from step 2). Using the \$0.072 overhead cost per EUP (from step 3) we obtain overhead costs with in-process inventory of \$360 (5,000 EUP × \$0.072 per EUP). Total cost of goods in process inventory at period-end is \$2,860 (\$2,200 + \$300 + \$360).

As a check, management verifies that total costs assigned to those units completed and transferred plus the costs of those in process (from Exhibit 3.15) equal the costs incurred by production. Exhibit 3.16 shows the costs incurred by production this period. We then reconcile the *costs accounted for* in Exhibit 3.15 with the *costs to account for* in Exhibit 3.16.

Cost of beginning goods in process inventory		
Direct materials	\$3,300	
Direct labor	600	
Factory overhead	<u>720</u>	\$ 4,620
Cost incurred this period		
Direct materials	9,900	
Direct labor	5,700	
Factory overhead	<u>6,840</u>	<u>22,440</u>
Total costs to account for		<u>\$27,060</u>

EXHIBIT 3.16

Report of Costs to Account For—Weighted Average

At GenX, the production department manager is responsible for \$27,060 in costs: \$4,620 that is assigned to the goods in process at the start of the period plus \$22,440 of materials, labor, and overhead incurred in the period. At period-end, that manager must show where these costs are assigned. The manager for GenX reports that \$2,860 are assigned to units in process and \$24,200 are assigned to units completed (per Exhibit 3.15). The sum of these amounts equals \$27,060. Thus, the total *costs to account for* equal the total *costs accounted for* (minor differences can sometimes occur from rounding).

C4 Define a process cost summary and describe its purposes.

Point: Managers can examine changes in monthly costs per equivalent unit to help control the production process. When prices are set in a competitive market, managers can use process cost summary information to determine which costs should be cut to achieve a profit.

P5 Prepare a process cost summary.

Process Cost Summary An important managerial accounting report for a process cost accounting system is the **process cost summary** (also called *production report*), which is prepared separately for each process or production department. Three reasons for the summary are to (1) help department managers control and monitor their departments, (2) help factory managers evaluate department managers' performances, and (3) provide cost information for financial statements. A process cost summary achieves these purposes by describing the costs charged to each department, reporting the equivalent units of production achieved by each department, and determining the costs assigned to each department's output. For our purposes, it is prepared using a combination of Exhibits 3.13, 3.14, 3.15, and 3.16.

The process cost summary for GenX is shown in Exhibit 3.17. The report is divided into three sections. Section ① lists the total costs charged to the department, including direct materials, direct labor, and overhead costs incurred, as well as the cost of the beginning goods in process inventory. Section ② describes the equivalent units of production for the department. Equivalent units for materials, labor, and overhead are in separate columns. It also reports direct

EXHIBIT 3.17

Process Cost Summary

GenX COMPANY				
Process Cost Summary				
For Month Ended April 30, 2009				
Costs Charged to Production				
Costs of beginning goods in process				
	Direct materials		\$3,300	
	Direct labor		600	
	Factory overhead		720	\$ 4,620
①	Costs incurred this period			
	Direct materials		9,900	
	Direct labor		5,700	
	Factory overhead		6,840	22,440
	Total costs to account for			<u>\$27,060</u>
Unit Cost Information				
Units to account for:				
	Beginning goods in process	30,000	Units accounted for:	
	Units started this period	90,000	Completed and transferred out	100,000
	Total units to account for	<u>120,000</u>	Ending goods in process	20,000
			Total units accounted for	<u>120,000</u>
Equivalent Units of Production (EUP)				
		Direct Materials	Direct Labor	Factory Overhead
	Units completed and transferred out	100,000 EUP	100,000 EUP	100,000 EUP
	Units of ending goods in process			
	Direct materials (20,000 × 100%)	20,000		
	Direct labor (20,000 × 25%)		5,000	
	Factory overhead (20,000 × 25%)			5,000
	Equivalent units of production	<u>120,000 EUP</u>	<u>105,000 EUP</u>	<u>105,000 EUP</u>
Cost per EUP				
		Direct Materials	Direct Labor	Factory Overhead
	Costs of beginning goods in process	\$ 3,300	\$ 600	\$ 720
	Costs incurred this period	9,900	5,700	6,840
	Total costs	\$13,200	\$6,300	\$7,560
	÷ EUP	120,000 EUP	105,000 EUP	105,000 EUP
	Cost per EUP	\$0.11 per EUP	\$0.06 per EUP	\$0.072 per EUP
Cost Assignment and Reconciliation				
Costs transferred out (cost of goods manufactured)				
	Direct materials (100,000 EUP × \$0.11 per EUP)		\$11,000	
	Direct labor (100,000 EUP × \$0.06 per EUP)		6,000	
	Factory overhead (100,000 EUP × \$0.072 per EUP)		7,200	\$ 24,200
③	Costs of ending goods in process			
	Direct materials (20,000 EUP × \$0.11 per EUP)		2,200	
	Direct labor (5,000 EUP × \$0.06 per EUP)		300	
	Factory overhead (5,000 EUP × \$0.072 per EUP)		360	2,860
	Total costs accounted for			<u>\$27,060</u>

reconciled

materials, direct labor, and overhead costs per equivalent unit. Section ③ allocates total costs among units worked on in the period. The \$24,200 is the total cost of goods transferred out of the department, and the \$2,860 is the cost of partially processed ending inventory units. The assigned costs are then added to show that the total \$27,060 cost charged to the department in section ① is now assigned to the units in section ③.

Quick Check

Answers—p. 111

6. Equivalent units are (a) a measure of a production department's productivity in using direct materials, direct labor, or overhead; (b) units of a product produced by a foreign competitor that are similar to units produced by a domestic company; or (c) generic units of a product similar to brand name units of a product.
7. Interpret the meaning of a department's equivalent units with respect to direct labor.
8. A department began the period with 8,000 units that were one-fourth complete with respect to direct labor. It completed 58,000 units, and ended with 6,000 units that were one-third complete with respect to direct labor. What were its direct labor equivalent units for the period using the weighted-average method?
9. A process cost summary for a department has three sections. What information is presented in each of them?

Transfers to Finished Goods Inventory and Cost of Goods Sold

Arrow line ⑨ in Exhibit 3.4 reflects the transfer of completed products from production to finished goods inventory. The process cost summary shows that the 100,000 units of finished Profen are assigned a cost of \$24,200. The entry to record this transfer follows.

P6 Record the transfer of completed goods to Finished Goods Inventory and Cost of Goods Sold.

⑨	Finished Goods Inventory	24,200	
	Goods in Process Inventory		24,200
	<i>To record transfer of completed units.</i>		

Assets = Liabilities + Equity
 +24,200
 -24,200

The credit to Goods in Process Inventory reduces that asset balance to reflect that 100,000 units are no longer in production. The cost of these units has been transferred to Finished Goods Inventory, which is recognized as a \$24,200 increase in this asset. After this entry is posted, there remains a balance of \$2,860 in the Goods in Process Inventory account, which is the amount computed in Step 4 previously. The cost of units transferred from Goods in Process Inventory to Finished Goods Inventory is called the **cost of goods manufactured**. Exhibit 3.18 reveals the activities in the Goods in Process Inventory account for this period. The ending balance of this account equals the cost assigned to the partially completed units in section ③ of Exhibit 3.17.

Goods in Process Inventory			Acct. No. 134		
Date		Explanation	Debit	Credit	Balance
Mar.	31	Balance			4,620
Apr.	30	Direct materials usage	9,900		14,520
	30	Direct labor costs incurred	5,700		20,220
	30	Factory overhead applied	6,840		27,060
	30	Transfer completed product to warehouse		24,200	2,860

EXHIBIT 3.18

Goods in Process Inventory

Arrow line ⑩ in Exhibit 3.4 reflects the sale of finished goods. Assume that GenX sold 106,000 units of Profen this period, and that its beginning inventory of finished goods consisted of 26,000 units with a cost of \$6,292. Also assume that its ending finished goods inventory consists of 20,000 units at a cost of \$4,840. Using this information, we can compute its cost of goods sold for April as shown in Exhibit 3.19.

Point: We omit the journal entry for sales, but it totals the number of units sold times price per unit.

EXHIBIT 3.19

Cost of Goods Sold

Beginning finished goods inventory	\$ 6,292
+ Cost of goods manufactured this period	<u>24,200</u>
= Cost of goods available for sale	\$30,492
– Ending finished goods inventory	<u>4,840</u>
= Cost of goods sold	<u>\$25,652</u>

The summary entry to record cost of goods sold for this period follows.

Assets = Liabilities + Equity
 –25,652 –25,652

⑩	Cost of Goods Sold	25,652	
	Finished Goods Inventory		25,652
	<i>To record cost of goods sold for April.</i>		

The Finished Goods Inventory account now appears as shown in Exhibit 3.20.

EXHIBIT 3.20

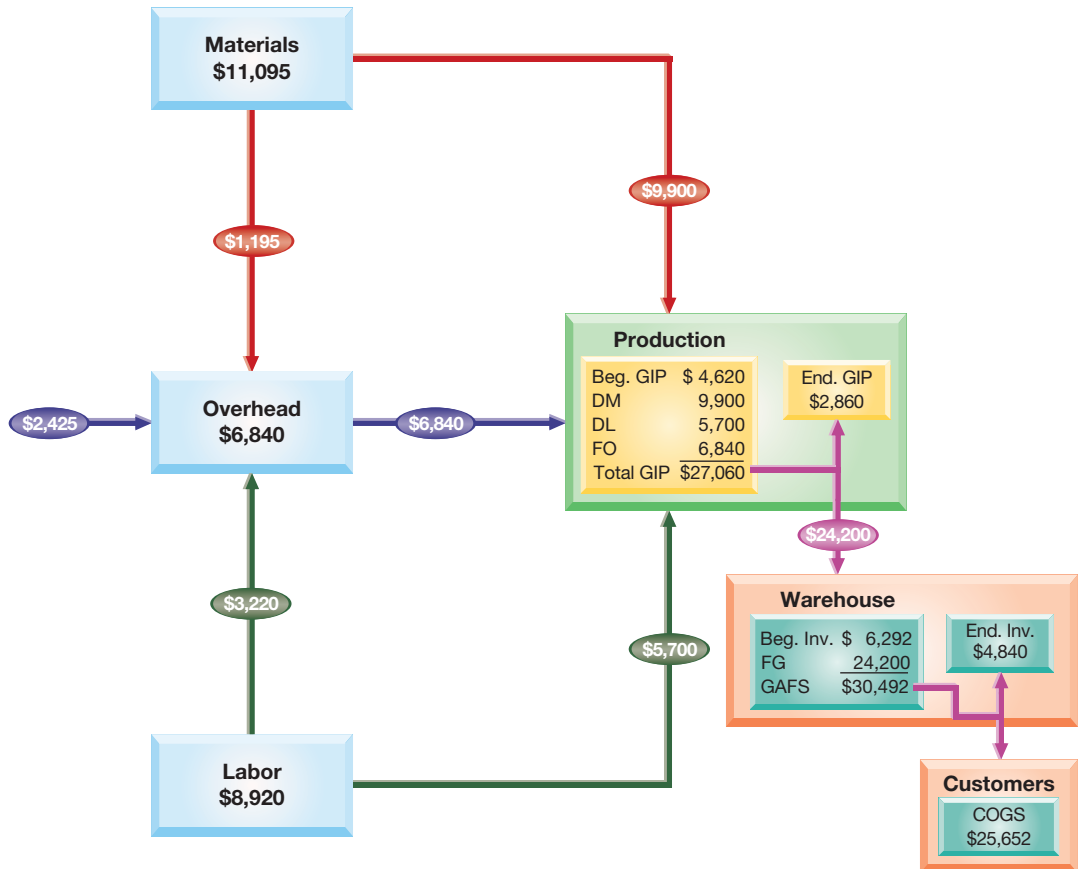
Finished Goods Inventory

Finished Goods Inventory			Acct. No. 135		
Date		Explanation	Debit	Credit	Balance
Mar.	31	Balance			6,292
Apr.	30	Transfer in cost of goods manufactured	24,200		30,492
	30	Cost of goods sold		25,652	4,840

Summary of Cost Flows Exhibit 3.21 shows GenX’s manufacturing cost flows for April. Each of these cost flows and the entries to record them have been explained. The flow of costs through the accounts reflects the flow of production activities and products.

EXHIBIT 3.21*

Cost Flows through GenX



*Abbreviations: GIP (goods in process); DM (direct materials); DL (direct labor); FO (factory overhead); FG (finished goods); GAFS (goods available for sale); COGS (cost of goods sold).

Decision Insight

Best of Both Customer orientation demands both flexibility and standardization. Flexibility allows companies to supply products or services to a customer's specifications as in a job order setting, and standardization helps achieve efficiencies and lower costs as in a process operation.

Effect of the Lean Business Model on Process Operations

Adopting lean business practices often yields changes in process operations. Management concerns with throughput and just-in-time manufacturing, for instance, cause boundary lines between departments to blur. In some cases, higher quality and better efficiency are obtained by entirely reorganizing production processes. For example, instead of producing different types of computers in a series of departments, a separate work center for each computer can be established in one department. When such a rearrangement occurs, the process cost accounting system is changed to account for each work center's costs.

To illustrate, when a company adopts a just-in-time inventory system, its inventories can be minimal. If raw materials are not ordered or received until needed, a Raw Materials Inventory account may be unnecessary. Instead, materials cost is immediately debited to the Goods in Process Inventory account. Similarly, a Finished Goods Inventory account may not be needed. Instead, cost of finished goods may be immediately debited to the Cost of Goods Sold account.

Decision Insight

Lean Machine Attention to customer orientation has led to improved processes for companies. A manufacturer of control devices improved quality and reduced production time by forming teams to study processes and suggest improvements. Another company set up project groups to evaluate its production processes.



Hybrid Costing System

Decision Analysis

This chapter explained the process costing system and contrasted it with the job order costing system. Many organizations use a *hybrid system* that contains features of both process and job order operations. A recent survey of manufacturers revealed that a majority use hybrid systems.

To illustrate, consider a car manufacturer's assembly line. On one hand, the line resembles a process operation in that the assembly steps for each car are nearly identical. On the other hand, the specifications of most cars have several important differences. At the Ford Mustang plant, each car assembled on a given day can be different from the previous car and the next car. This means that the costs of materials (subassemblies or components) for each car can differ. Accordingly, while the conversion costs (direct labor and overhead) can be accounted for using a process costing system, the component costs (direct materials) are accounted for using a job order system (separately for each car or type of car).

A hybrid system of processes requires a *hybrid costing system* to properly cost products or services. In the Ford plant, the assembly costs per car are readily determined using process costing. The costs of additional components can then be added to the assembly costs to determine each car's total cost (as in job order costing). To illustrate, consider the following information for a daily assembly process at Ford.

A2 Explain and illustrate a hybrid costing system.

Assembly process costs	
Direct materials	\$10,600,000
Direct labor	\$5,800,000
Factory overhead	\$6,200,000
Number of cars assembled	1,000
Costs of three different types of steering wheels	\$240, \$330, \$480
Costs of three different types of seats	\$620, \$840, \$1,360

The assembly process costs \$22,600 per car. Depending on the type of steering wheel and seats the customer requests, the cost of a car can range from \$23,460 to \$24,440 (a \$980 difference).

Today companies are increasingly trying to standardize processes while attempting to meet individual customer needs. To the extent that differences among individual customers' requests are large, understanding the costs to satisfy those requests is important. Thus, monitoring and controlling both process and job order costs are important.



Decision Ethics

Entrepreneur You operate a process production company making similar products for three different customers. One customer demands 100% quality inspection of products at your location before shipping. The added costs of that inspection are spread across all customers, not just the one demanding it. If you charge the added costs to that customer, you could lose that customer and experience a loss. Moreover, your other two customers have agreed to pay 110% of full costs. What actions (if any) do you take?

[Answer—pp. 110–111]

Demonstration Problem

Pennsylvania Company produces a product that passes through a single production process. Then completed products are transferred to finished goods in its warehouse. Information related to its manufacturing activities for July follows.

Raw Materials		Production Department	
Beginning inventory	\$ 100,000	Beginning goods in process inventory (units)	5,000
Raw materials purchased on credit	211,400	Percentage completed—Materials	100%
Direct materials used	(190,000)	Percentage completed—Labor and overhead	60%
Indirect materials used	<u>(51,400)</u>	Beginning goods in process inventory (costs)	
Ending inventory	<u>\$ 70,000</u>	Direct materials used	\$ 20,000
		Direct labor incurred	9,600
Factory Payroll		Overhead applied (200% of direct labor)	<u>19,200</u>
Direct labor incurred	\$ 55,500	Total costs of beginning goods in process	<u>\$ 48,800</u>
Indirect labor incurred	50,625	Units started this period	20,000
Total payroll (paid in cash)	<u>\$ 106,125</u>	Units completed this period	17,000
Factory Overhead		Ending goods in process inventory (units)	8,000
Indirect materials used	\$ 51,400	Percentage completed—Materials	100%
Indirect labor used	50,625	Percentage completed—Labor and overhead	20%
Other overhead costs	<u>71,725</u>		
Total factory overhead incurred	<u>\$ 173,750</u>	Finished Goods Inventory	
Factory Overhead Applied		Beginning finished goods inventory	\$ 96,400
Overhead applied (200% of direct labor)	<u>\$ 111,000</u>	Cost transferred in from production	321,300
		Cost of goods sold	<u>(345,050)</u>
		Ending finished goods inventory	<u>\$ 72,650</u>

Required

1. Prepare a physical flow reconciliation for July as illustrated in Exhibit 3.12.
2. Compute the equivalent units of production in July for direct materials, direct labor, and factory overhead.
3. Compute the costs per equivalent units of production in July for direct materials, direct labor, and factory overhead.
4. Prepare a report of costs accounted for and a report of costs to account for.

5. Prepare summary journal entries to record the transactions and events of July for (a) raw materials purchases, (b) direct materials usage, (c) indirect materials usage, (d) factory payroll costs, (e) direct labor usage, (f) indirect labor usage, (g) other overhead costs (credit Other Accounts), (h) application of overhead to production, (i) transfer of finished goods from production, and (j) the cost of goods sold.

Planning the Solution

- Track the physical flow to determine the number of units completed in July.
- Compute the equivalent unit of production for direct materials, direct labor, and factory overhead.
- Compute the costs per equivalent unit of production with respect to direct materials, direct labor, and overhead; and determine the cost per unit for each.
- Compute the total cost of the goods transferred to production by using the equivalent units and unit costs. Determine (a) the cost of the beginning in-process inventory, (b) the materials, labor, and overhead costs added to the beginning in-process inventory, and (c) the materials, labor, and overhead costs added to the units started and completed in the month.
- Determine the cost of goods sold using balances in finished goods and cost of units completed this period.
- Use the information to record the summary journal entries for July.

Solution to Demonstration Problem

1. Physical flow reconciliation.

Units to Account For		Units Accounted For	
Beginning goods in process inventory	5,000 units	Units completed and transferred out	17,000 units
Units started this period	<u>20,000 units</u>	Ending goods in process inventory	<u>8,000 units</u>
Total units to account for	<u>25,000 units</u>	Total units accounted for	<u>25,000 units</u>

↑ reconciled ↑

2. Equivalent units of production.

Equivalent Units of Production	Direct Materials	Direct Labor	Factory Overhead
Equivalent units completed and transferred out	17,000 EUP	17,000 EUP	17,000 EUP
Equivalent units in ending goods in process			
Direct materials (8,000 × 100%)	8,000		
Direct labor (8,000 × 20%)		1,600	
Factory overhead (8,000 × 20%)			1,600
Equivalent units of production	<u>25,000 EUP</u>	<u>18,600 EUP</u>	<u>18,600 EUP</u>

3. Costs per equivalent unit of production.

Costs per Equivalent Unit of Production	Direct Materials	Direct Labor	Factory Overhead
Costs of beginning goods in process	\$ 20,000	\$ 9,600	\$ 19,200
Costs incurred this period	<u>190,000</u>	<u>55,500</u>	<u>111,000**</u>
Total costs	\$210,000	\$65,100	\$130,200
÷ Equivalent units of production (from part 2)	<u>25,000 EUP</u>	<u>18,600 EUP</u>	<u>18,600 EUP</u>
= Costs per equivalent unit of production	<u>\$8.40 per EUP</u>	<u>\$3.50 per EUP</u>	<u>\$7.00 per EUP</u>

**Factory overhead applied

4. Reports of costs accounted for and of costs to account for.

Report of Costs Accounted For		
Cost of units transferred out (cost of goods manufactured)		
Direct materials (\$8.40 per EUP × 17,000 EUP)	\$142,800	
Direct labor (\$3.50 per EUP × 17,000 EUP)	59,500	
Factory overhead (\$7.00 per EUP × 17,000 EUP)	<u>119,000</u>	
Cost of units completed this period		\$ 321,300
Cost of ending goods in process inventory		
Direct materials (\$8.40 per EUP × 8,000 EUP)	67,200	
Direct labor (\$3.50 per EUP × 1,600 EUP)	5,600	
Factory overhead (\$7.00 per EUP × 1,600 EUP)	<u>11,200</u>	
Cost of ending goods in process inventory		<u>84,000</u>
Total costs accounted for		<u>\$405,300</u>

Report of Costs to Account For		
Cost of beginning goods in process inventory		
Direct materials	\$ 20,000	
Direct labor	9,600	
Factory overhead	<u>19,200</u>	\$ 48,800
Cost incurred this period		
Direct materials	190,000	
Direct labor	55,500	
Factory overhead	<u>111,000</u>	<u>356,500</u>
Total costs to account for		<u>\$405,300</u>

reconciled

5. Summary journal entries for the transactions and events in July.

a.	Raw Materials Inventory	211,400	
	Accounts Payable		211,400
	<i>To record raw materials purchases.</i>		
b.	Goods in Process Inventory	190,000	
	Raw Materials Inventory		190,000
	<i>To record direct materials usage.</i>		
c.	Factory Overhead	51,400	
	Raw Materials Inventory		51,400
	<i>To record indirect materials usage.</i>		
d.	Factory Payroll	106,125	
	Cash		106,125
	<i>To record factory payroll costs.</i>		
e.	Goods in Process Inventory	55,500	
	Factory Payroll		55,500
	<i>To record direct labor usage.</i>		
f.	Factory Overhead	50,625	
	Factory Payroll		50,625
	<i>To record indirect labor usage.</i>		
g.	Factory Overhead	71,725	
	Other Accounts		71,725
	<i>To record other overhead costs.</i>		

[continued on next page]

[continued from previous page]

h.	Goods in Process Inventory	111,000	
	Factory Overhead		111,000
	<i>To record application of overhead.</i>		
i.	Finished Goods Inventory	321,300	
	Goods in Process Inventory		321,300
	<i>To record transfer of finished goods from production.</i>		
j.	Cost of Goods Sold	345,050	
	Finished Goods Inventory		345,050
	<i>To record cost of goods sold.</i>		

APPENDIX

FIFO Method of Process Costing

3A

The **FIFO method** of process costing assigns costs to units assuming a first-in, first-out flow of product. The objectives, concepts, and journal entries (not amounts) are the same as for the weighted-average method, but computation of equivalent units of production and cost assignment are slightly different.

Exhibit 3A.1 shows selected information from GenX’s production department for the month of April. Accounting for a department’s activity for a period includes four steps: (1) determine physical flow, (2) compute equivalent units, (3) compute cost per equivalent unit, and (4) determine cost assignment and reconciliation. This appendix describes each of these steps using the FIFO method for process costing.

C5 Explain and illustrate the four steps in accounting for production activity using FIFO.

Beginning goods in process inventory (March 31)	
Units of product	30,000
Percentage of completion—Direct materials	100%
Percentage of completion—Direct labor	65%
Direct materials costs	\$ 3,300
Direct labor costs	\$ 600
Factory overhead costs applied (120% of direct labor)	\$ 720
Activities during the current period (April)	
Units started this period	90,000
Units transferred out (completed)	100,000
Direct materials costs	\$ 9,900
Direct labor costs	\$ 5,700
Factory overhead costs applied (120% of direct labor)	\$ 6,840
Ending goods in process inventory (April 30)	
Units of product	20,000
Percentage of completion—Direct materials	100%
Percentage of completion—Direct labor	25%

EXHIBIT 3A.1

Production Data

Step 1: Determine Physical Flow of Units

A *physical flow reconciliation* is a report that reconciles (1) the physical units started in a period with (2) the physical units completed in that period. The physical flow reconciliation for GenX is shown in Exhibit 3A.2 for April.

EXHIBIT 3A.2

Physical Flow Reconciliation

Units to Account For		Units Accounted For	
Beginning goods in process inventory	30,000 units	Units completed and transferred out	100,000 units
Units started this period	<u>90,000 units</u>	Ending goods in process inventory	<u>20,000 units</u>
Total units to account for	<u>120,000 units</u>	Total units accounted for	<u>120,000 units</u>

↑ reconciled ↑

FIFO assumes that the 100,000 units transferred to finished goods during April include the 30,000 units from the beginning goods in process inventory. The remaining 70,000 units transferred out are from units started in April. Of the total 90,000 units started in April, 70,000 were completed, leaving 20,000 units unfinished at period-end.

Step 2: Compute Equivalent Units of Production—FIFO

GenX used its direct materials, direct labor, and overhead both to make complete units of Profen and to start some units that are not yet complete. We need to convert the physical measure of units to equivalent units based on how much of each input has been used. We do this by multiplying the number of physical units by the percentage of processing applied to those units in the current period; this is done for each input (materials, labor, and overhead). The FIFO method accounts for cost flow in a sequential manner—earliest costs are the first to flow out. (This is different from the weighted-average method, which combines prior period costs—those in beginning Goods in Process Inventory—with costs incurred in the current period.)

Three distinct groups of units must be considered in determining the equivalent units of production under the FIFO method: (a) units in beginning Goods in Process Inventory that were completed this period, (b) units started *and* completed this period, and (c) units in ending Goods in Process Inventory. We must determine how much material, labor, and overhead are used for each of these unit groups. These computations are shown in Exhibit 3A.3. The remainder of this section explains these computations.

EXHIBIT 3A.3

Equivalent Units of Production—FIFO

Equivalent Units of Production	Direct Materials	Direct Labor	Factory Overhead
(a) Equivalent units to complete beginning goods in process			
Direct materials (30,000 × 0%)	0 EUP		
Direct labor (30,000 × 35%)		10,500 EUP	
Factory overhead (30,000 × 35%)			10,500 EUP
(b) Equivalent units started and completed*	70,000	70,000	70,000
(c) Equivalent units in ending goods in process			
Direct materials (20,000 × 100%)	20,000		
Direct labor (20,000 × 25%)		5,000	
Factory overhead (20,000 × 25%)			5,000
Equivalent units of production	<u>90,000 EUP</u>	<u>85,500 EUP</u>	<u>85,500 EUP</u>

*Units completed this period 100,000 units
 Less units in beginning goods in process 30,000
 Units started and completed this period 70,000 units

(a) Beginning Goods in Process Under FIFO, we assume that production first completes any units started in the prior period. There were 30,000 physical units in beginning goods in process inventory. Those units were 100% complete with respect to direct materials as of the end of the prior period. This means that no materials (0%) are needed in April to complete those 30,000 units. So the equivalent units of *materials* to complete beginning goods in process are zero (30,000 × 0%)—see first row under row “(a)” in Exhibit 3A.3. The units in process as of April 1 had already been through 65% of production prior to this period and need only go through the remaining 35% of production. The equivalent units of *labor* to complete the beginning goods in process are 10,500 (30,000 × 35%)—

see the second row under row “(a).” This implies that the amount of labor required this period to complete the 30,000 units started in the prior period is the amount of labor needed to make 10,500 units, start-to-finish. Finally, overhead is applied based on direct labor costs, so GenX computes equivalent units for overhead as it would for direct labor.

(b) Units Started and Completed This Period After completing any beginning goods in process, FIFO assumes that production begins on newly started units. GenX began work on 90,000 new units this period. Of those units, 20,000 remain incomplete at period-end. This means that 70,000 of the units started in April were completed in April. These complete units have received 100% of materials, labor, and overhead. Exhibit 3A.3 reflects this by including 70,000 equivalent units ($70,000 \times 100\%$) of materials, labor, and overhead in its equivalent units of production—see row “(b).”

(c) Ending Goods in Process The 20,000 units started in April that GenX was not able to complete by period-end consumed materials, labor, and overhead. Specifically, those 20,000 units received 100% of materials and, therefore, the equivalent units of materials in ending goods in process inventory are 20,000 ($20,000 \times 100\%$)—see the first row under row “(c).” For labor and overhead, the units in ending goods in process were 25% complete in production. This means the equivalent units of labor and overhead for those units are 5,000 ($20,000 \times 25\%$) as GenX incurs labor and overhead costs uniformly throughout its production process. Finally, for each input (direct materials, direct labor, and factory overhead), the equivalent units for each of the unit groups (a), (b), and (c) are added to determine the total equivalent units of production with respect to each—see the final row in Exhibit 3A.3.

Step 3: Compute Cost per Equivalent Unit—FIFO

To compute cost per equivalent unit, we take the product costs (for each of direct materials, direct labor, and factory overhead from Exhibit 3A.1) added in April and divide by the equivalent units of production from step 2. Exhibit 3A.4 illustrates these computations.

Cost per Equivalent Unit of Production	Direct Materials	Direct Labor	Factory Overhead
Costs incurred this period	\$9,900	\$5,700	\$6,840
÷ Equivalent units of production (from Step 2)	90,000 EUP	85,500 EUP	85,500 EUP
Cost per equivalent unit of production	\$0.11 per EUP	\$0.067 per EUP	\$0.08 per EUP

EXHIBIT 3A.4

Cost per Equivalent Unit of Production—FIFO

It is essential to compute costs per equivalent unit for *each* input because production inputs are added at different times in the process. The FIFO method computes the cost per equivalent unit based solely on this period’s EUP and costs (unlike the weighted-average method, which adds in the costs of the beginning goods in process inventory).

Step 4: Assign and Reconcile Costs

The equivalent units determined in step 2 and the cost per equivalent unit computed in step 3 are both used to assign costs (1) to units that the production department completed and transferred to finished goods and (2) to units that remain in process at period-end.

In Exhibit 3A.5, under the section for cost of units transferred out, we see that the cost of units completed in April includes the \$4,620 cost carried over from March for work already applied to the 30,000 units that make up beginning Goods in Process Inventory, plus the \$1,544 incurred in April to complete those units. This section also includes the \$17,990 of cost assigned to the 70,000 units started and completed this period. Thus, the total cost of goods manufactured in April is \$24,154 ($\$4,620 + \$1,544 + \$17,990$). The average cost per unit for goods completed in April is \$0.242 ($\$24,154 \div 100,000$ completed units).

The computation for cost of ending goods in process inventory is in the lower part of Exhibit 3A.5. The cost of units in process includes materials, labor, and overhead costs corresponding to the percentage of these resources applied to those incomplete units in April. That cost of \$2,935 ($\$2,200 + \$335 + \400) also is the ending balance for the Goods in Process Inventory account.

EXHIBIT 3A.5

Report of Costs Accounted For—FIFO

Cost of units transferred out (cost of goods manufactured)			
Cost of beginning goods in process inventory			\$ 4,620
Cost to complete beginning goods in process			
Direct materials (\$0.11 per EUP × 0 EUP)	\$ 0		
Direct labor (\$0.067 per EUP × 10,500 EUP)	704		
Factory overhead (\$0.08 per EUP × 10,500 EUP)	840	1,544	
Cost of units started and completed this period			
Direct materials (\$0.11 per EUP × 70,000 EUP)	7,700		
Direct labor (\$0.067 per EUP × 70,000 EUP)	4,690		
Factory overhead (\$0.08 per EUP × 70,000 EUP)	5,600	17,990	
Total cost of units finished this period			24,154
Cost of ending goods in process inventory			
Direct materials (\$0.11 per EUP × 20,000 EUP)	2,200		
Direct labor (\$0.067 per EUP × 5,000 EUP)	335		
Factory overhead (\$0.08 per EUP × 5,000 EUP)	400		
Total cost of ending goods in process inventory			2,935
Total costs accounted for			<u>\$27,089</u>

Management verifies that the total costs assigned to units transferred out and units still in process equal the total costs incurred by production. We reconcile the costs accounted for (in Exhibit 3A.5) to the costs that production was charged for as shown in Exhibit 3A.6.

EXHIBIT 13A.6

Report of Costs to Account For—FIFO

Cost of beginning goods in process inventory			
Direct materials	\$3,300		
Direct labor	600		
Factory overhead	720	\$ 4,620	
Costs incurred this period			
Direct materials	9,900		
Direct labor	5,700		
Factory overhead	6,840	22,440	
Total costs to account for			<u>\$27,060</u>

The production manager is responsible for \$27,060 in costs: \$4,620 that had been assigned to the department's Goods in Process Inventory as of April 1 plus \$22,440 of materials, labor, and overhead costs the department incurred in April. At period-end, the manager must identify where those costs were assigned. The production manager can report that \$24,154 of cost was assigned to units completed in April and \$2,935 was assigned to units still in process at period-end. The sum of these amounts is \$29 different from the \$27,060 total costs incurred by production due to rounding in step 3—rounding errors are common and not a concern.

The final report is the process cost summary, which summarizes key information from Exhibits 3A.3, 3A.4, 3A.5, and 3A.6. Reasons for the summary are to (1) help managers control and monitor costs, (2) help upper management assess department manager performance, and (3) provide cost information for financial reporting. The process cost summary, using FIFO, for GenX is in Exhibit 3A.7. Section ① lists the total costs charged to the department, including direct materials, direct labor, and overhead costs incurred, as well as the cost of the beginning goods in process inventory. Section ② describes the equivalent units of production for the department. Equivalent units for materials, labor, and overhead are in separate columns. It also reports direct materials, direct labor, and overhead costs per equivalent unit. Section ③ allocates total costs among units worked on in the period.



Decision Maker

Cost Manager As cost manager for an electronics manufacturer, you apply a process costing system using FIFO. Your company plans to adopt a just-in-time system and eliminate inventories. What is the impact of the use of FIFO (versus the weighted-average method) given these plans? [Answer—p. 111]

EXHIBIT 3A.7

Process Cost Summary

GenX COMPANY
Process Cost Summary
For Month Ended April 30, 2009

Costs charged to production			
Costs of beginning goods in process inventory			
	Direct materials	\$3,300	
	Direct labor	600	
	Factory overhead	<u>720</u>	\$ 4,620
①	Costs incurred this period		
	Direct materials	9,900	
	Direct labor	5,700	
	Factory overhead	<u>6,840</u>	<u>22,440</u>
	Total costs to account for		<u>\$27,060</u>
Unit cost information			
Units to account for		Units accounted for	
	Beginning goods in process	30,000	Transferred out
	Units started this period	<u>90,000</u>	Ending goods in process
	Total units to account for	<u>120,000</u>	Total units accounted for
			<u>120,000</u>
Equivalent units of production			
		Direct	Direct
		Materials	Labor
			Factory
			Overhead
Equivalent units to complete beginning goods in process			
	Direct materials (30,000 × 0%)	0 EUP	
	Direct labor (30,000 × 35%)		10,500 EUP
	Factory overhead (30,000 × 35%)		10,500 EUP
②	Equivalent units started and completed	70,000	70,000
	Equivalent units in ending goods in process		
	Direct materials (20,000 × 100%)	20,000	
	Direct labor (20,000 × 25%)		5,000
	Factory overhead (20,000 × 25%)		<u>5,000</u>
	Equivalent units of production	<u>90,000 EUP</u>	<u>85,500 EUP</u>
		Direct	Direct
		Materials	Labor
			Factory
			Overhead
Cost per equivalent unit of production			
	Costs incurred this period	\$9,900	\$5,700
	÷ Equivalent units of production	<u>90,000 EUP</u>	<u>85,500 EUP</u>
	Cost per equivalent unit of production	\$0.11 per EUP	\$0.067 per EUP
			\$0.08 per EUP
Cost assignment and reconciliation			
(cost of units completed and transferred out)			
	Cost of beginning goods in process		\$ 4,620
	Cost to complete beginning goods in process		
	Direct materials (\$0.11 per EUP × 0 EUP)	\$ 0	
	Direct labor (\$0.067 per EUP × 10,500 EUP)	704	
	Factory overhead (\$0.08 per EUP × 10,500 EUP)	<u>840</u>	1,544
	Cost of units started and completed this period		
	Direct materials (\$0.11 per EUP × 70,000 EUP)	7,700	
	Direct labor (\$0.067 per EUP × 70,000 EUP)	4,690	
	Factory overhead (\$0.08 per EUP × 70,000 EUP)	<u>5,600</u>	<u>17,990</u>
③	Total cost of units finished this period		<u>24,154</u>
	Cost of ending goods in process		
	Direct materials (\$0.11 per EUP × 20,000 EUP)	2,200	
	Direct labor (\$0.067 per EUP × 5,000 EUP)	335	
	Factory overhead (\$0.08 per EUP × 5,000 EUP)	<u>400</u>	
	Total cost of ending goods in process		<u>2,935</u>
	Total costs accounted for		<u>\$27,089*</u>

reconciled

*\$29 difference due to rounding

Summary

C1 Explain process operations and the way they differ from job order operations. Process operations produce large quantities of similar products or services by passing them through a series of processes, or steps, in production. Like job order operations, they combine direct materials, direct labor, and overhead in the operations. Unlike job order operations that assign the responsibility for each job to a manager, process operations assign the responsibility for each *process* to a manager.

C2 Define equivalent units and explain their use in process cost accounting. Equivalent units of production measure the activity of a process as the number of units that would be completed in a period if all effort had been applied to units that were started and finished. This measure of production activity is used to compute the cost per equivalent unit and to assign costs to finished goods and goods in process inventory.

C3 Explain the four steps in accounting for production activity in a period. The four steps involved in accounting for production activity in a period are (1) recording the physical flow of units, (2) computing the equivalent units of production, (3) computing the cost per equivalent unit of production, and (4) reconciling costs. The last step involves assigning costs to finished goods and goods in process inventory for the period.

C4 Define a process cost summary and describe its purposes. A process cost summary reports on the activities of a production process or department for a period. It describes the costs charged to the department, the equivalent units of production for the department, and the costs assigned to the output. The report aims to (1) help managers control their departments, (2) help factory managers evaluate department managers' performances, and (3) provide cost information for financial statements.

C5 Explain and illustrate the four steps in accounting for production activity using FIFO. The FIFO method for process costing is applied and illustrated to (1) report the physical flow of units, (2) compute the equivalent units of production, (3) compute the cost per equivalent unit of production, and (4) assign and reconcile costs.

A1 Compare process cost accounting and job order cost accounting. Process and job order manufacturing operations are similar in that both combine materials, labor, and factory overhead to produce products or services. They differ in the way they are organized and managed. In job order operations, the job order cost accounting system assigns materials, labor, and overhead to specific jobs. In process operations, the process cost accounting system assigns materials, labor, and overhead to specific processes. The total costs associated with each process are then divided by the number of units passing through that process to get cost per

equivalent unit. The costs per equivalent unit for all processes are added to determine the total cost per unit of a product or service.

A2 Explain and illustrate a hybrid costing system. A hybrid costing system contains features of both job order and process costing systems. Generally, certain direct materials are accounted for by individual products as in job order costing, but direct labor and overhead costs are accounted for similar to process costing.

P1 Record the flow of direct materials costs in process cost accounting. Materials purchased are debited to a Raw Materials Inventory account. As direct materials are issued to processes, they are separately accumulated in a Goods in Process Inventory account for that process.

P2 Record the flow of direct labor costs in process cost accounting. Direct labor costs are initially debited to the Factory Payroll account. The total amount in it is then assigned to the Goods in Process Inventory account pertaining to each process.

P3 Record the flow of factory overhead costs in process cost accounting. The different factory overhead items are first accumulated in the Factory Overhead account and are then allocated, using a predetermined overhead rate, to the different processes. The allocated amount is debited to the Goods in Process Inventory account pertaining to each process.

P4 Compute equivalent units produced in a period. To compute equivalent units, determine the number of units that would have been finished if all materials (or labor or overhead) had been used to produce units that were started and completed during the period. The costs incurred by a process are divided by its equivalent units to yield cost per unit.

P5 Prepare a process cost summary. A process cost summary includes the physical flow of units, equivalent units of production, costs per equivalent unit, and a cost reconciliation. It reports the units and costs to account for during the period and how they were accounted for during the period. In terms of units, the summary includes the beginning goods in process inventory and the units started during the month. These units are accounted for in terms of the goods completed and transferred out, and the ending goods in process inventory. With respect to costs, the summary includes materials, labor, and overhead costs assigned to the process during the period. It shows how these costs are assigned to goods completed and transferred out, and to ending goods in process inventory.

P6 Record the transfer of completed goods to Finished Goods Inventory and Cost of Goods Sold. As units complete the final process and are eventually sold, their accumulated cost is transferred to Finished Goods Inventory and finally to Cost of Goods Sold.

Guidance Answers to **Decision Maker** and **Decision Ethics**



Budget Officer By instructing you to classify a majority of costs as indirect, the manager is passing some of his department's costs to a common overhead pool that other departments will partially absorb. Since overhead costs are allocated on the basis of direct labor for this company and the new department has a relatively low direct labor cost, the new department will be assigned less overhead. Such action

suggests unethical behavior by this manager. You must object to such reclassification. If this manager refuses to comply, you must inform someone in a more senior position.

Entrepreneur By spreading the added quality-related costs across three customers, the entrepreneur is probably trying to remain

competitive with respect to the customer that demands the 100% quality inspection. Moreover, the entrepreneur is partly covering the added costs by recovering two-thirds of them from the other two customers who are paying 110% of total costs. This act likely breaches the trust placed by the two customers in this entrepreneur's application of its costing system. The costing system should be changed, and the entrepreneur should consider renegotiating the pricing and/or quality

test agreement with this one customer (at the risk of losing this currently loss-producing customer).

Cost Manager Differences between the FIFO and weighted-average methods are greatest when large work in process inventories exist and when costs fluctuate. The method used if inventories are eliminated does not matter; both produce identical costs.

Guidance Answers to Quick Checks

1. *c*
2. When a company produces large quantities of similar products/services, a process cost system is often more suitable.
3. *b*
4. The costs are direct materials, direct labor, and overhead.
5. A goods in process inventory account is needed for *each* production department.
6. *a*
7. Equivalent units with respect to direct labor are the number of units that would have been produced if all labor had been used on units that were started and finished during the period.

Units completed and transferred out	58,000 EUP
Units of ending goods in process	
Direct labor (6,000 × 1/3)	2,000 EUP
Units of production	<u>60,000 EUP</u>

9. The first section shows the costs charged to the department. The second section describes the equivalent units produced by the department. The third section shows the assignment of total costs to units worked on during the period.



Key Terms

mhhe.com/wildMA2e

Key Terms are available at the book's Website for learning and testing in an online Flashcard Format.

Cost of goods manufactured (p. 99)
Equivalent units of production (EUP) (p. 93)
FIFO method (p. 105)

Job order cost accounting system (p. 89)
Materials consumption report (p. 90)
Process cost accounting system (p. 89)

Process cost summary (p. 98)
Process operations (p. 86)
Weighted-average method (p. 96)



Multiple Choice Quiz

Answers on p. 127

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Additional Quiz Questions are available at the book's Website.



Quiz3

1. Equivalent units of production are equal to
 - a. Physical units that were completed this period from all effort being applied to them.
 - b. The number of units introduced into the process this period.
 - c. The number of finished units actually completed this period.
 - d. The number of units that could have been started and completed given the cost incurred.
 - e. The number of units in the process at the end of the period.
2. Recording the cost of raw materials purchased for use in a process costing system includes a
 - a. Credit to Raw Materials Inventory.
 - b. Debit to Goods in Process Inventory.
 - c. Debit to Factory Overhead.
 - d. Credit to Factory Overhead.
 - e. Debit to Raw Materials Inventory.
3. The production department started the month with a beginning goods in process inventory of \$20,000. During the month, it was assigned the following costs: direct materials, \$152,000; direct labor, \$45,000; overhead applied at the rate of 40% of direct labor cost. Inventory with a cost of \$218,000 was transferred to finished goods. The ending balance of goods in process inventory is
 - a. \$330,000.
 - b. \$ 17,000.
 - c. \$220,000.
 - d. \$112,000.
 - e. \$118,000.
4. A company's beginning work in process inventory consists of 10,000 units that are 20% complete with respect to direct labor costs. A total of 40,000 units are completed this period. There

are 15,000 units in goods in process, one-third complete for direct labor, at period-end. The equivalent units of production (EUP) with respect to direct labor at period-end, assuming the weighted average method, are











- a. 45,000 EUP.
- b. 40,000 EUP.
- c. 5,000 EUP.
- d. 37,000 EUP.
- e. 43,000 EUP.

5. Assume the same information as in question 4. Also assume that beginning work in process had \$6,000 in direct labor cost and that \$84,000 in direct labor is added during this period. What is the cost per EUP for labor?

- a. \$0.50 per EUP
- b. \$1.87 per EUP
- c. \$2.00 per EUP
- d. \$2.10 per EUP
- e. \$2.25 per EUP

Assume the weighted-average inventory method is used for all assignments unless stated differently. Superscript letter ^A denotes assignments based on Appendix 3A.

Discussion Questions

1.  Can services be delivered by means of process operations? Support your answer with an example.
2.  What is the main factor for a company in choosing between the job order costing and process costing accounting systems? Give two likely applications of each system.
3. Identify the control document for materials flow when a materials requisition slip is not used.
4. The focus in a job order costing system is the job or batch. Identify the main focus in process costing.
5. Are the journal entries that match cost flows to product flows in process costing primarily the same or much different than those in job order costing? Explain.
6.  Explain in simple terms the notion of equivalent units of production (EUP). Why is it necessary to use EUP in process costing?
7.  What are the two main inventory methods used in process costing? What are the differences between these methods?
8.  Why is it possible for direct labor in process operations to include the labor of employees who do not work directly on products or services?
9. Assume that a company produces a single product by processing it first through a single production department. Direct labor costs flow through what accounts in this company's process cost system?
10. After all labor costs for a period are allocated, what balance should remain in the Factory Payroll account?
11.  Is it possible to have under- or overapplied overhead costs in a process cost accounting system? Explain.
12. Explain why equivalent units of production for both direct labor and overhead can be the same as, and why they can be different from, equivalent units for direct materials.
13. List the four steps in accounting for production activity in a reporting period (for process operations).
14. What purposes does a process cost summary serve?
15.  Are there situations where **Best Buy** can use process costing? Identify at least one and explain it. 
16.  **Apple** produces iMacs with a multiple production line. Identify and list some of its production processing steps and departments. 



Denotes Discussion Questions that involve decision making.

QUICK STUDY

QS 3-1

Matching of product to cost accounting system

CI

For each of the following products and services, indicate whether it is most likely produced in a process operation or in a job order operation.

- | | | |
|----------------------------|--------------------------|------------------------|
| 1. Door hinges | 5. Custom tailored suits | 9. Bolts and nuts |
| 2. Cut flower arrangements | 6. Grand pianos | 10. Folding chairs |
| 3. House paints | 7. Wall clocks | 11. Headphones |
| 4. Concrete swimming pools | 8. Sport shirts | 12. Designed boathouse |

QS 3-2

Recording costs of direct materials

P1


Industrial Boxes makes cardboard shipping cartons in a single operation. This period, Industrial purchased \$124,000 in raw materials. Its production department requisitioned \$100,000 of those materials for use in producing cartons. Prepare journal entries to record its (1) purchase of raw materials and (2) requisition of direct materials.

QS 3-3

Recording costs of direct labor

P2

Refer to the information in QS 3-2. Industrial Boxes incurred \$270,000 in factory payroll costs, of which \$250,000 was direct labor. Prepare journal entries to record its (1) total factory payroll incurred and (2) direct labor used in production.

Most materials in this section are available in McGraw-Hill's Connect 

Refer to the information in QS 3-2 and QS 3-3. Industrial Boxes requisitioned \$18,000 of indirect materials from its raw materials and used \$20,000 of indirect labor in its production of boxes. Also, it incurred \$312,000 of other factory overhead costs. It applies factory overhead at the rate of 135% of direct labor costs. Prepare journal entries to record its (1) indirect materials requisitioned, (2) indirect labor used in production, (3) other factory overhead costs incurred, and (4) application of overhead to production.

QS 3-4
Recording costs of factory overhead
P3

Refer to the information in QS 3-2, QS 3-3, and QS 3-4. Industrial Boxes completed 40,000 boxes costing \$550,000 and transferred them to finished goods. Prepare its journal entry to record the transfer of the boxes from production to finished goods inventory.

QS 3-5
Recording transfer of costs to finished goods P6

The following refers to units processed in Sunflower Printing's binding department in March. Compute the total equivalent units of production with respect to labor for March using the weighted-average inventory method.

QS 3-6
Computing equivalent units of production
P4

	Units of Product	Percent of Labor Added
Beginning goods in process	75,000	85%
Goods started	155,000	100
Goods completed	170,000	100
Ending goods in process	60,000	25

The cost of beginning inventory plus the costs added during the period should equal the cost of units _____ plus the cost of _____.

QS 3-7
Computing EUP cost C4 P5

Explain a hybrid costing system. Identify a product or service operation that might well fit a hybrid costing system.

QS 3-8
Hybrid costing system A2

Refer to QS 3-6 and compute the total equivalent units of production with respect to labor for March using the FIFO inventory method.

QS 3-9^A
Computing equivalent units—FIFO C2 C5 P4

connect Most materials in this section are available in McGraw-Hill's Connect

Match each of the following items A through G with the best numbered description of its purpose.

- | | |
|--|--|
| A. Raw Materials Inventory account | E. Process cost summary |
| B. Materials requisition | F. Equivalent units of production |
| C. Finished Goods Inventory account | G. Goods in Process Inventory |
| D. Factory Overhead account | |

- _____ **1.** Notifies the materials manager to send materials to a production department.
- _____ **2.** Holds costs of indirect materials, indirect labor, and similar costs until assigned to production.
- _____ **3.** Holds costs of direct materials, direct labor, and applied overhead until products are transferred from production to finished goods (or another department).
- _____ **4.** Standardizes partially completed units into equivalent completed units.
- _____ **5.** Holds costs of finished products until sold to customers.
- _____ **6.** Describes the activity and output of a production department for a period.
- _____ **7.** Holds costs of materials until they are used in production or as factory overhead.

EXERCISES

Exercise 3-1
Terminology in process cost accounting
C1 A1 P1 P2 P3

Festive Toy Company manufactures toy trucks. Prepare journal entries to record its following production activities for January.

- 1.** Purchased \$40,000 of raw materials on credit.
- 2.** Used \$17,000 of direct materials in production.
- 3.** Used \$20,500 of indirect materials.

Exercise 3-2
Journal entries in process cost accounting
P1 P2 P3

4. Incurred total labor cost of \$77,000, which is paid in cash.
5. Used \$58,000 of direct labor in production.
6. Used \$19,000 of indirect labor.
7. Incurred overhead costs of \$22,000 (paid in cash).
8. Applied overhead at 90% of direct labor costs.
9. Transferred completed products with a cost of \$137,000 to finished goods inventory.
10. Sold \$450,000 of products on credit. Their cost is \$150,000.

Check (8) Cr. Factory Overhead, \$52,200

Exercise 3-3

Recording cost flows in a process cost system

P1 P2 P3 P6

Seattle Lumber produces bagged bark for use in landscaping. Production involves packaging bark chips in plastic bags in a bagging department. The following information describes production operations for October.

Bagging Department	
1	
2	
3	Direct materials used \$ 460,000
4	Direct labor used \$ 76,000
5	Predetermined overhead rate (based on direct labor) 180%
6	Goods transferred from bagging to finished goods \$(407,000)
7	

The company's revenue for the month totaled \$900,000 from credit sales, and its cost of goods sold for the month is \$500,000. Prepare summary journal entries dated October 31 to record its October production activities for (1) direct material usage, (2) direct labor usage, (3) overhead allocation, (4) goods transfer from production to finished goods, and (5) sales.

Check (3) Cr. Factory Overhead, \$136,800

Exercise 3-4

Interpretation of journal entries in process cost accounting

P1 P2 P3 P6

The following journal entries are recorded in Lewis Co.'s process cost accounting system. Lewis produces apparel and accessories. Overhead is applied to production based on direct labor cost for the period. Prepare a brief explanation (including any overhead rates applied) for each journal entry *a* through *j*.

a.	Raw Materials Inventory	52,000	
	Accounts Payable		52,000
b.	Goods in Process Inventory	42,000	
	Raw Materials Inventory		42,000
c.	Goods in Process Inventory	26,000	
	Factory Payroll		26,000
d.	Factory Payroll	32,000	
	Cash		32,000
e.	Factory Overhead	10,000	
	Cash		10,000
f.	Factory Overhead	10,000	
	Raw Materials Inventory		10,000
g.	Factory Overhead	6,000	
	Factory Payroll		6,000
h.	Goods in Process Inventory	32,500	
	Factory Overhead		32,500
i.	Finished Goods Inventory	88,000	
	Goods in Process Inventory		88,000
j.	Accounts Receivable	250,000	
	Sales		250,000
	Cost of Goods Sold	100,000	
	Finished Goods Inventory		100,000

During April, the production department of a process manufacturing system completed a number of units of a product and transferred them to finished goods. Of these transferred units, 30,000 were in process in the production department at the beginning of April and 120,000 were started and completed in April. April's beginning inventory units were 60% complete with respect to materials and 40% complete with respect to labor. At the end of April, 41,000 additional units were in process in the production department and were 80% complete with respect to materials and 30% complete with respect to labor.

1. Compute the number of units transferred to finished goods.
2. Compute the number of equivalent units with respect to both materials used and labor used in the production department for April using the weighted-average method.

Exercise 3-5

Computing equivalent units of production—weighted average

C2 P4

Check (2) EUP for materials, 182,800

The production department described in Exercise 3-5 had \$425,184 of direct materials and \$326,151 of direct labor cost charged to it during April. Also, its beginning inventory included \$59,236 of direct materials cost and \$22,794 of direct labor.

1. Compute the direct materials cost and the direct labor cost per equivalent unit for the department.
2. Using the weighted-average method, assign April's costs to the department's output—specifically, its units transferred to finished goods and its ending goods in process inventory.

Exercise 3-6

Costs assigned to output and inventories—weighted average

C3 P4 P5 **Check** (2) Costs accounted for, \$833,365

Refer to the information in Exercise 3-5 to compute the number of equivalent units with respect to both materials used and labor used in the production department for April using the FIFO method.

Exercise 3-7^A

Computing equivalent units of production—FIFO

C5 P4

Refer to the information in Exercise 3-6 and complete its parts (1) and (2) using the FIFO method.

Exercise 3-8^A

Costs assigned to output—FIFO


C5 P4 P5

The production department in a process manufacturing system completed 383,000 units of product and transferred them to finished goods during a recent period. Of these units, 63,000 were in process at the beginning of the period. The other 320,000 units were started and completed during the period. At period-end, 59,000 units were in process. Compute the department's equivalent units of production with respect to direct materials under each of three separate assumptions:

1. All direct materials are added to products when processing begins.
2. Direct materials are added to products evenly throughout the process. Beginning goods in process inventory was 40% complete, and ending goods in process inventory was 75% complete.
3. One-half of direct materials is added to products when the process begins and the other half is added when the process is 75% complete as to direct labor. Beginning goods in process inventory is 40% complete as to direct labor, and ending goods in process inventory is 60% complete as to direct labor.

Exercise 3-9

Equivalent units computed—weighted average

C2 P4 P5 **Check** (3) EUP for materials, 412,500

Refer to the information in Exercise 3-9 and complete it for each of the three separate assumptions using the FIFO method for process costing.

Exercise 3-10^A

Equivalent units computed—FIFO

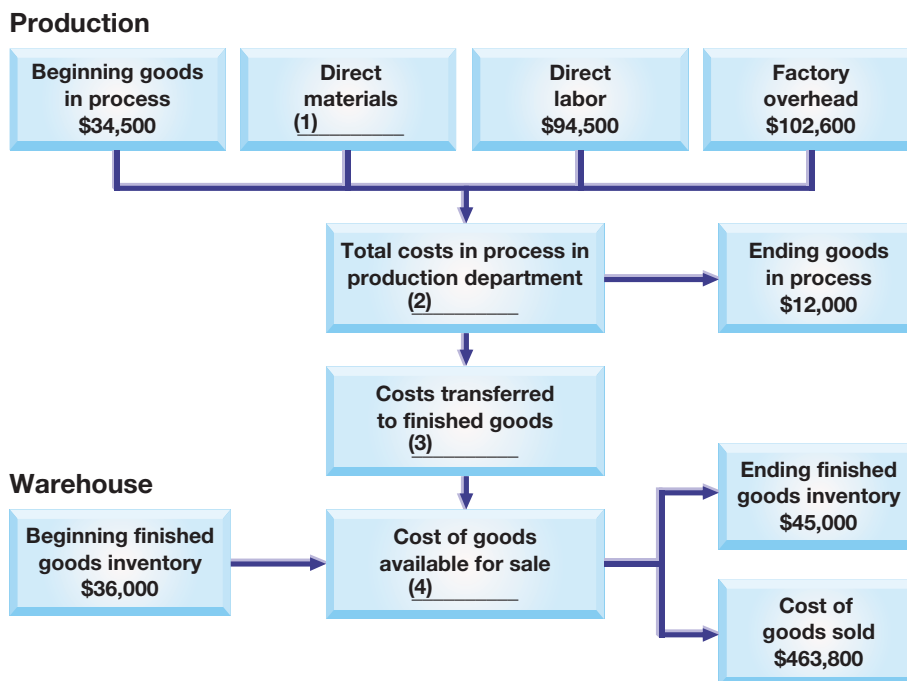
C5 P4

Check (3) EUP for materials, 381,000

The following flowchart shows the August production activity of the Jez Company. Use the amounts shown on the flowchart to compute the missing four numbers identified by blanks.

Exercise 3-11

Flowchart of costs for a process operation P1 P2 P3 P6



Exercise 3-12

Completing a process cost summary



The following partially completed process cost summary describes the July production activities of Anton Company. Its production output is sent to its warehouse for shipping. Prepare its process cost summary using the weighted-average method.

Equivalent Units of Production	Direct Materials	Direct Labor	Factory Overhead
Units transferred out	64,000	64,000	64,000
Units of ending goods in process	<u>5,000</u>	<u>3,000</u>	<u>3,000</u>
Equivalent units of production	<u>69,000</u>	<u>67,000</u>	<u>67,000</u>
Costs per EUP	Direct Materials	Direct Labor	Factory Overhead
Costs of beginning goods in process	\$ 37,100	\$ 1,520	\$ 3,040
Costs incurred this period	<u>715,000</u>	<u>125,780</u>	<u>251,560</u>
Total costs	<u>\$752,100</u>	<u>\$127,300</u>	<u>\$254,600</u>
Units in beginning goods in process			4,000
Units started this period			65,000
Units completed and transferred out			64,000
Units in ending goods in process			5,000

Exercise 3-13

Process costing—weighted average

P1 P2 P6

Nu-Test Company uses the weighted-average method of process costing to assign production costs to its products. Information for September follows. Assume that all materials are added at the beginning of its production process, and that direct labor and factory overhead are added uniformly throughout the process.

Goods in process inventory, September 1 (4,000 units, 100% complete with respect to direct materials, 80% complete with respect to direct labor and overhead; includes \$90,000 of direct material cost, \$51,200 in direct labor cost, \$61,440 overhead cost)	\$202,640
Units started in September	56,000
Units completed and transferred to finished goods inventory	46,000
Goods in process inventory, September 30 (? units, 100% complete with respect to direct materials, 40% complete with respect to direct labor and overhead)	_____?

[continued on next page]

[continued from previous page]

Costs incurred in September	
Direct materials	\$750,000
Direct labor	\$310,000
Overhead applied at 120% of direct labor cost	_____?


Required

Fill in the blanks labeled *a* through *uu* in the following process cost summary.

NU-TEST COMPANY Process Cost Summary For Month Ended September 30			
Costs Charged to Production			
Costs of beginning goods in process			
Direct materials		\$ 90,000	
Direct labor		51,200	
Factory overhead		<u>61,440</u>	\$202,640
Costs incurred this period			
Direct materials		\$750,000	
Direct labor		310,000	
Factory overhead	(a) _____		(b) _____
Total costs to account for			(c) _____
Unit Cost Information			
Units to account for		Units accounted for	
Beginning goods in process	4,000	Completed and transferred out	46,000
Units started this period	<u>56,000</u>	Ending goods in process	(d) _____
Total units to account for	(e) _____	Total units accounted for	(f) _____
Equivalent Units of Production (EUP)			
	Direct Materials	Direct Labor	Factory Overhead
Units completed and transferred out	(g) _____ EUP	(h) _____ EUP	(i) _____ EUP
Units of ending goods in process			
Materials (j) _____ × 100%	(k) _____ EUP		
Direct labor (l) _____ × 40%		(m) _____ EUP	
Factory overhead (n) _____ × 40%			(o) _____ EUP
Equivalent units of production (EUP)	(p) _____ EUP	(q) _____ EUP	(r) _____ EUP
Cost per EUP			
	Direct Materials	Direct Labor	Factory Overhead
Costs of beginning goods in process	\$ 90,000	\$ 51,200	\$61,440
Costs incurred this period	<u>750,000</u>	<u>310,000</u>	(s) _____
Total costs	\$840,000	\$361,200	(t) _____
÷ EUP	(u) _____	(v) _____	(w) _____
Cost per EUP	(x) _____	(y) _____	(z) _____
Cost Assignment and Reconciliation			
Costs transferred out	Cost/EUP × EUP		
Direct materials	(aa) _____ × (bb) _____	(cc) _____	
Direct labor	(dd) _____ × (ee) _____	(ff) _____	
Factory overhead	(gg) _____ × (hh) _____	(ii) _____	
Costs of goods completed and transferred out			(jj) _____
Costs of ending goods in process			
Direct materials	(kk) _____ × (ll) _____	(mm) _____	
Direct labor	(nn) _____ × (oo) _____	(pp) _____	
Factory overhead	(qq) _____ × (rr) _____	(ss) _____	
Costs of ending goods in process			(tt) _____
Total costs accounted for			(uu) _____

Check (c) \$1,634,640

(z) \$8.40 per EUP

Most materials in this section are available in McGraw-Hill's Connect 

PROBLEM SET A

Harvey Company manufactures woven blankets and accounts for product costs using process costing. The following information is available regarding its May inventories.

Problem 3-1A

Production cost flow and measurement; journal entries

P1 P2 P3 P6



	Beginning Inventory	Ending Inventory
Raw materials inventory	\$ 30,000	\$ 51,000
Goods in process inventory	441,500	504,000
Finished goods inventory	638,000	554,000

The following additional information describes the company's production activities for May.

Raw materials purchases (on credit)	\$ 270,000
Factory payroll cost (paid in cash)	1,583,000
Other overhead cost (Other Accounts credited)	86,000
Materials used	
Direct	\$ 187,000
Indirect	62,000
Labor used	
Direct	\$ 704,000
Indirect	879,000
Overhead rate as a percent of direct labor	110%
Sales (on credit)	\$3,000,000

Required

Check (1b) Cost of goods sold \$1,686,900

1. Compute the cost of (a) products transferred from production to finished goods, and (b) goods sold.
2. Prepare summary journal entries dated May 31 to record the following production activities during May: (a) raw materials purchases, (b) direct materials usage, (c) indirect materials usage, (d) payroll costs, (e) direct labor costs, (f) indirect labor costs, (g) other overhead costs, (h) overhead applied, (i) goods transferred from production to finished goods, and (j) sale of finished goods.

Problem 3-2A

Cost per equivalent unit; costs assigned to products

P4 P5



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Carmen Company uses weighted-average process costing to account for its production costs. Direct labor is added evenly throughout the process. Direct materials are added at the beginning of the process. During November, the company transferred 735,000 units of product to finished goods. At the end of November, the goods in process inventory consists of 207,000 units that are 90% complete with respect to labor. Beginning inventory had \$244,920 of direct materials and \$69,098 of direct labor cost. The direct labor cost added in November is \$1,312,852, and the direct materials cost added is \$1,639,080.

Required

Check (2) Direct labor cost per equivalent unit, \$1.50
(3b) \$693,450

1. Determine the equivalent units of production with respect to (a) direct labor and (b) direct materials.
2. Compute both the direct labor cost and the direct materials cost per equivalent unit.
3. Compute both direct labor cost and direct materials cost assigned to (a) units completed and transferred out, and (b) ending goods in process inventory.

Analysis Component

4. The company sells and ships all units to customers as soon as they are completed. Assume that an error is made in determining the percentage of completion for units in ending inventory. Instead of being 90% complete with respect to labor, they are actually 75% complete. Write a one-page memo to the plant manager describing how this error affects its November financial statements.

Crystal Company produces large quantities of a standardized product. The following information is available for its production activities for March.

Problem 3-3A

Journalizing in process costing; equivalent units and costs

P1 P2 P3 P4 P6



Raw materials		Factory overhead incurred	
Beginning inventory	\$ 26,000	Indirect materials used	\$ 81,500
Raw materials purchased (on credit) . . .	255,000	Indirect labor used	50,000
Direct materials used	(172,000)	Other overhead costs	<u>159,308</u>
Indirect materials used	<u>(81,500)</u>	Total factory overhead incurred	<u>\$290,808</u>
Ending inventory	<u>\$ 27,500</u>	Factory overhead applied	
Factory payroll		(140% of direct labor cost)	
Direct labor used	\$207,720	Total factory overhead applied	<u>\$290,808</u>
Indirect labor used	50,000		
Total payroll cost (paid in cash)	<u>\$257,720</u>		

Additional information about units and costs of production activities follows.

Units		Costs	
Beginning goods in process inventory	2,200	Beginning goods in process inventory	
Started	30,000	Direct materials	\$3,500
Ending goods in process inventory	5,900	Direct labor	3,225
Status of ending goods in process inventory		Factory overhead	<u>4,515</u> \$ 11,240
Materials—Percent complete	50%	Direct materials added	172,000
Labor and overhead—Percent complete	65%	Direct labor added	207,720
		Overhead applied (140% of direct labor) . . .	<u>290,808</u>
		Total costs	<u>\$681,768</u>
		Ending goods in process inventory	\$ 82,128

During March, 25,000 units of finished goods are sold for \$85 cash each. Cost information regarding finished goods follows.

Beginning finished goods inventory	\$155,000
Cost transferred in	599,640
Cost of goods sold	<u>(612,500)</u>
Ending finished goods inventory	<u>\$142,140</u>

Required

1. Prepare journal entries dated March 31 to record the following March activities: (a) purchase of raw materials, (b) direct materials usage, (c) indirect materials usage, (d) factory payroll costs, (e) direct labor costs used in production, (f) indirect labor costs, (g) other overhead costs—credit Other Accounts, (h) overhead applied, (i) goods transferred to finished goods, and (j) sale of finished goods.
2. Prepare a process cost summary report for this company, showing costs charged to production, units cost information, equivalent units of production, cost per EUP, and its cost assignment and reconciliation.

Check (2) Cost per equivalent unit: materials, \$6.00; labor, \$7.00; overhead, \$9.80

Analysis Component

3. The company provides incentives to its department managers by paying monthly bonuses based on their success in controlling costs per equivalent unit of production. Assume that the production department underestimates the percentage of completion for units in ending inventory with the result that its equivalent units of production in ending inventory for March are understated. What impact does this error have on the March bonuses paid to the production managers? What impact, if any, does this error have on April bonuses?

Problem 3-4AProcess cost summary;
equivalent units

P4 P5 P6



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King Co. produces its product through a single processing department. Direct materials are added at the start of production, and direct labor and overhead are added evenly throughout the process. The company uses monthly reporting periods for its weighted-average process cost accounting system. Its Goods in Process Inventory account follows after entries for direct materials, direct labor, and overhead costs for October.

Goods in Process Inventory			Acct. No. 133		
Date		Explanation	Debit	Credit	Balance
Oct.	1	Balance			348,638
	31	Direct materials	104,090		452,728
	31	Direct labor	416,360		869,088
	31	Applied overhead	244,920		1,114,008

Its beginning goods in process consisted of \$60,830 of direct materials, \$176,820 of direct labor, and \$110,988 of factory overhead. During October, the company started 140,000 units and transferred 153,000 units to finished goods. At the end of the month, the goods in process inventory consisted of 20,600 units that were 80% complete with respect to direct labor and factory overhead.

Required

Check (1) Costs transferred to finished goods, \$1,002,150

1. Prepare the company's process cost summary for October using the weighted-average method.
2. Prepare the journal entry dated October 31 to transfer the cost of the completed units to finished goods inventory.

Problem 3-5AProcess cost summary;
equivalent units; cost estimates

P4 P5



Cisneros Co. manufactures a single product in one department. All direct materials are added at the beginning of the manufacturing process. Direct labor and overhead are added evenly throughout the process. The company uses monthly reporting periods for its weighted-average process cost accounting. During May, the company completed and transferred 11,100 units of product to finished goods inventory. Its 1,500 units of beginning goods in process consisted of \$9,900 of direct materials, \$61,650 of direct labor, and \$49,320 of factory overhead. It has 1,200 units (100% complete with respect to direct materials and 80% complete with respect to direct labor and overhead) in process at month-end. After entries to record direct materials, direct labor, and overhead for May, the company's Goods in Process Inventory account follows.

Goods in Process Inventory			Acct. No. 133		
Date		Explanation	Debit	Credit	Balance
May	1	Balance			120,870
	31	Direct materials	248,400		369,270
	31	Direct labor	601,650		970,920
	31	Applied overhead	481,320		1,452,240

Required

Check (1) EUP for labor and overhead, 12,060 EUP
(2) Cost transferred to finished goods, \$1,332,000

1. Prepare the company's process cost summary for May.
2. Prepare the journal entry dated May 31 to transfer the cost of completed units to finished goods inventory.

Analysis Components

3. The cost accounting process depends on numerous estimates.
 - a. Identify two major estimates that determine the cost per equivalent unit.
 - b. In what direction might you anticipate a bias from management for each estimate in part 3a (assume that management compensation is based on maintaining low inventory amounts)? Explain your answer.

Problem 3-6A^AProcess cost summary; equivalent
units; cost estimates—FIFO

C5 P5 P6

Refer to the data in Problem 3-5A. Assume that Cisneros uses the FIFO method to account for its process costing system. The following additional information is available:

- Beginning goods in process consisted of 1,500 units that were 100% complete with respect to direct materials and 40% complete with respect to direct labor and overhead.
- Of the 11,100 units completed, 1,500 were from beginning goods in process. The remaining 9,600 were units started and completed during May.

Required

1. Prepare the company's process cost summary for May using FIFO.
2. Prepare the journal entry dated May 31 to transfer the cost of completed units to finished goods inventory.

Check (1) EUP for labor and overhead, 11,460 EUP
(2) Cost transferred to finished goods, \$1,333,920

Select Toys Company manufactures video game consoles and accounts for product costs using process costing. The following information is available regarding its June inventories.

	Beginning Inventory	Ending Inventory
Raw materials inventory	\$36,000	\$ 55,000
Goods in process inventory	78,000	125,000
Finished goods inventory	80,000	99,000

PROBLEM SET B

Problem 3-1B

Production cost flow and measurement; journal entries

P1 P2 P3 P6

The following additional information describes the company's production activities for June.

Raw materials purchases (on credit)	\$100,000
Factory payroll cost (paid in cash)	200,000
Other overhead cost (Other Accounts credited)	85,250
Materials used	
Direct	\$ 60,000
Indirect	21,000
Labor used	
Direct	\$175,000
Indirect	25,000
Overhead rate as a percent of direct labor	75%
Sales (on credit)	\$500,000

Required

1. Compute the cost of (a) products transferred from production to finished goods, and (b) goods sold.
2. Prepare journal entries dated June 30 to record the following production activities during June: (a) raw materials purchases, (b) direct materials usage, (c) indirect materials usage, (d) payroll costs, (e) direct labor costs, (f) indirect labor costs, (g) other overhead costs, (h) overhead applied, (i) goods transferred from production to finished goods, and (j) sale of finished goods.

Check (1b) Cost of goods sold, \$300,250

Maximus Company uses process costing to account for its production costs. Direct labor is added evenly throughout the process. Direct materials are added at the beginning of the process. During September, the production department transferred 40,000 units of product to finished goods. Beginning goods in process had \$116,000 of direct materials and \$172,800 of direct labor cost. At the end of September, the goods in process inventory consists of 4,000 units that are 25% complete with respect to labor. The direct materials cost added in September is \$1,424,000, and direct labor cost added is \$3,960,000.

Problem 3-2B

Cost per equivalent unit; costs assigned to products

P4 P5

Required

1. Determine the equivalent units of production with respect to (a) direct labor and (b) direct materials.
2. Compute both the direct labor cost and the direct materials cost per equivalent unit.
3. Compute both direct labor cost and direct materials cost assigned to (a) units completed and transferred out, and (b) ending goods in process inventory.

Check (2) Direct labor cost per equivalent unit, \$100.80
(3b) \$240,800

Analysis Component

4. The company sells and ships all units to customers as soon as they are completed. Assume that an error is made in determining the percentage of completion for units in ending inventory. Instead of being 25% complete with respect to labor, they are actually 75% complete. Write a one-page memo to the plant manager describing how this error affects its September financial statements.

Problem 3-3B

Journalizing in process costing; equivalent units and costs

P1 P2 P3 P4 P6



Fantasia Company produces large quantities of a standardized product. The following information is available for its production activities for May.

Raw materials		Factory overhead incurred	
Beginning inventory	\$ 16,000	Indirect materials used	\$20,280
Raw materials purchased (on credit) . . .	110,560	Indirect labor used	18,160
Direct materials used	(98,560)	Other overhead costs	17,216
Indirect materials used	<u>(20,280)</u>	Total factory overhead incurred	<u>\$55,656</u>
Ending inventory	<u>\$ 7,720</u>	Factory overhead applied	
Factory payroll		(90% of direct labor cost)	
Direct labor used	\$ 61,840	Total factory overhead applied	<u>\$55,656</u>
Indirect labor used	<u>18,160</u>		
Total payroll cost (paid in cash)	<u>\$ 80,000</u>		

Additional information about units and costs of production activities follows.

Units		Costs	
Beginning goods in process inventory	8,000	Beginning goods in process inventory	
Started	24,000	Direct materials	\$2,240
Ending goods in process inventory	6,000	Direct labor	1,410
Status of ending goods in process inventory		Factory overhead	<u>1,269</u> \$ 4,919
Materials—Percent complete	100%	Direct materials added	98,560
Labor and overhead—Percent complete	25%	Direct labor added	61,840
		Overhead applied (90% of direct labor) . . .	<u>55,656</u>
		Total costs	<u>\$220,975</u>
		Ending goods in process inventory	<u>\$ 25,455</u>

During May, 30,000 units of finished goods are sold for \$30 cash each. Cost information regarding finished goods follows.

Beginning finished goods inventory	\$ 74,200
Cost transferred in from production	195,520
Cost of goods sold	<u>(225,000)</u>
Ending finished goods inventory	<u>\$ 44,720</u>

Required

1. Prepare journal entries dated May 31 to record the following May activities: (a) purchase of raw materials, (b) direct materials usage, (c) indirect materials usage, (d) factory payroll costs, (e) direct labor costs used in production, (f) indirect labor costs, (g) other overhead costs—credit Other Accounts, (h) overhead applied, (i) goods transferred to finished goods, and (j) sale of finished goods.
2. Prepare a process cost summary report for this company, showing costs charged to production, unit cost information, equivalent units of production, cost per EUP, and its cost assignment and reconciliation.

Check (2) Cost per equivalent unit: materials, \$3.15; labor, \$2.30; overhead, \$2.07

Analysis Component

3. This company provides incentives to its department managers by paying monthly bonuses based on their success in controlling costs per equivalent unit of production. Assume that production overestimates the percentage of completion for units in ending inventory with the result that its equivalent units of production in ending inventory for May are overstated. What impact does this error have on bonuses paid to the managers of the production department? What impact, if any, does this error have on these managers' June bonuses?

Paloma Company produces its product through a single processing department. Direct materials are added at the beginning of the process. Direct labor and overhead are added to the product evenly throughout the process. The company uses monthly reporting periods for its weighted-average process cost accounting. Its Goods in Process Inventory account follows after entries for direct materials, direct labor, and overhead costs for November.

Problem 3-4B
Process cost summary;
equivalent units
P4 P5 P6

Goods in Process Inventory			Acct. No. 133		
Date		Explanation	Debit	Credit	Balance
Nov.	1	Balance			10,650
	30	Direct materials	58,200		68,850
	30	Direct labor	213,400		282,250
	30	Applied overhead	320,100		602,350


The 3,750 units of beginning goods in process consisted of \$3,400 of direct materials, \$2,900 of direct labor, and \$4,350 of factory overhead. During November, the company finished and transferred 50,000 units of its product to finished goods. At the end of the month, the goods in process inventory consisted of 6,000 units that were 100% complete with respect to direct materials and 25% complete with respect to direct labor and factory overhead.

Required

1. Prepare the company's process cost summary for November using the weighted-average method.
2. Prepare the journal entry dated November 30 to transfer the cost of the completed units to finished goods inventory.

Check (1) Cost transferred to finished goods, \$580,000

Foster Co. manufactures a single product in one department. Direct labor and overhead are added evenly throughout the process. Direct materials are added as needed. The company uses monthly reporting periods for its weighted-average process cost accounting. During January, Foster completed and transferred 220,000 units of product to finished goods inventory. Its 10,000 units of beginning goods in process consisted of \$8,400 of direct materials, \$13,960 of direct labor, and \$34,900 of factory overhead. 40,000 units (50% complete with respect to direct materials and 30% complete with respect to direct labor and overhead) are in process at month-end. After entries for direct materials, direct labor, and overhead for January, the company's Goods in Process Inventory account follows.

Problem 3-5B
Process cost summary;
equivalent units; cost estimates
P4 P5 

Goods in Process Inventory			Acct. No. 133		
Date		Explanation	Debit	Credit	Balance
Jan.	1	Balance			57,260
	31	Direct materials	111,600		168,860
	31	Direct labor	176,280		345,140
	31	Applied overhead	440,700		785,840

Required

1. Prepare the company's process cost summary for January.
2. Prepare the journal entry dated January 31 to transfer the cost of completed units to finished goods inventory.

Check (1) EUP for labor and overhead, 232,000
(2) Cost transferred to finished goods, \$741,400

Analysis Components

3. The cost accounting process depends on several estimates.
 - a. Identify two major estimates that affect the cost per equivalent unit.
 - b. In what direction might you anticipate a bias from management for each estimate in part 3a (assume that management compensation is based on maintaining low inventory amounts)? Explain your answer.

Problem 3-6B^A

Process cost summary; equivalent units; cost estimates—FIFO

C5 P5 P6

Refer to the information in Problem 3-5B. Assume that Foster uses the FIFO method to account for its process costing system. The following additional information is available.

- Beginning goods in process consists of 10,000 units that were 75% complete with respect to direct materials and 60% complete with respect to direct labor and overhead.
- Of the 220,000 units completed, 10,000 were from beginning goods in process; the remaining 210,000 were units started and completed during January.

Required

Check (1) Labor and overhead EUP, 226,000
(2) Cost transferred, \$743,480

1. Prepare the company's process cost summary for January using FIFO. Round cost per EUP to one-tenth of a cent.
2. Prepare the journal entry dated January 31 to transfer the cost of completed units to finished goods inventory.

SERIAL PROBLEM

(This serial problem began in Chapter 1 and continues through most of the book. If previous chapter segments were not completed, the serial problem can begin at this point.)

Success Systems

C1 A1

SP 3 The computer workstation furniture manufacturing that Adriana Lopez started is progressing well. At this point, Adriana is using a job order costing system to account for the production costs of this product line. Adriana has heard about process costing and is wondering whether process costing might be a better method for her to keep track of and monitor her production costs.

Required

1. What are the features that distinguish job order costing from process costing?
2. Do you believe that Adriana should continue to use job order costing or switch to process costing for her workstation furniture manufacturing? Explain.

COMPREHENSIVE PROBLEM**Major League Bat Company**

(Review of Chapters 1, 3)

CP 3 Major League Bat Company manufactures baseball bats. In addition to its goods in process inventories, the company maintains inventories of raw materials and finished goods. It uses raw materials as direct materials in production and as indirect materials. Its factory payroll costs include direct labor for production and indirect labor. All materials are added at the beginning of the process, and direct labor and factory overhead are applied uniformly throughout the production process.

Required

You are to maintain records and produce measures of inventories to reflect the July events of this company. Set up the following general ledger accounts and enter the June 30 balances: Raw Materials Inventory, \$25,000; Goods in Process Inventory, \$8,135 (\$2,660 of direct materials, \$3,650 of direct labor, and \$1,825 of overhead); Finished Goods Inventory, \$110,000; Sales, \$0; Cost of Goods Sold, \$0; Factory Payroll, \$0; and Factory Overhead, \$0.

1. Prepare journal entries to record the following July transactions and events.
 - a. Purchased raw materials for \$125,000 cash (the company uses a perpetual inventory system).
 - b. Used raw materials as follows: direct materials, \$52,440; and indirect materials, \$10,000.
 - c. Incurred factory payroll cost of \$227,250 paid in cash (ignore taxes).
 - d. Assigned factory payroll costs as follows: direct labor, \$202,250; and indirect labor, \$25,000.
 - e. Incurred additional factory overhead costs of \$80,000 paid in cash.
 - f. Allocated factory overhead to production at 50% of direct labor costs.
2. Information about the July inventories follows. Use this information with that from part 1 to prepare a process cost summary, assuming the weighted-average method is used.

Check (1f) Cr. Factory Overhead, \$101,125

Check (2) EUP for overhead, 14,200

Units	
Beginning inventory	5,000 units
Started	14,000 units
Ending inventory	8,000 units
Beginning inventory	
Materials—Percent complete	100%
Labor and overhead—Percent complete	75%
Ending inventory	
Materials—Percent complete	100%
Labor and overhead—Percent complete	40%

3. Using the results from part 2 and the available information, make computations and prepare journal entries to record the following:
 - a. Total costs transferred to finished goods for July (label this entry g). (3a) \$271,150
 - b. Sale of finished goods costing \$265,700 for \$625,000 in cash (label this entry h).
4. Post entries from parts 1 and 3 to the ledger accounts set up at the beginning of the problem.
5. Compute the amount of gross profit from the sales in July. (*Note:* Add any underapplied overhead to, or deduct any overapplied overhead from, the cost of goods sold. Ignore the corresponding journal entry.)

BEYOND THE NUMBERS

BTN 3-1 Best Buy reports in notes to its financial statements that, in addition to its merchandise sold, it includes the following costs (among others) in cost of goods sold: freight expenses associated with moving inventories from vendors to distribution centers, costs of services provided, customer shipping and handling expenses, costs associated with operating its distribution network, and freight expenses associated with moving merchandise from distribution centers to retail stores.

REPORTING IN ACTION



Required

1. Why do you believe Best Buy includes these costs in its cost of goods sold?
2. What effect does this cost accounting policy for its cost of goods sold have on Best Buy’s financial statements and any analysis of these statements? Explain.

Fast Forward

3. Access Best Buy’s financial statements for the fiscal years after March 3, 2007, from its Website (BestBuy.com) or the SEC’s EDGAR Website (sec.gov). Review its footnote relating to Cost of Goods Sold and Selling, General, and Administrative Expense. Has Best Buy changed its policy with respect to what costs are included in the cost of goods sold? Explain.

BTN 3-2 Retailers such as **Best Buy**, **Circuit City**, and **RadioShack** usually work to maintain a high-quality and low-cost operation. One ratio routinely computed for this assessment is the cost of goods sold divided by total expenses. A decline in this ratio can mean that the company is spending too much on selling and administrative activities. An increase in this ratio beyond a reasonable level can mean that the company is not spending enough on selling activities. (Assume for this analysis that total expenses equal the cost of goods sold plus selling, general, and administrative expenses.)

COMPARATIVE ANALYSIS



Required

1. For Best Buy, Circuit City, and RadioShack refer to Appendix A and compute the ratios of cost of goods sold to total expenses for their two most recent fiscal years.
2. Comment on the similarities or differences in the ratio results across both years among the companies.



ETHICS CHALLENGEC1 C3 

BTN 3-3 Many accounting and accounting-related professionals are skilled in financial analysis, but most are not skilled in manufacturing. This is especially the case for process manufacturing environments (for example, a bottling plant or chemical factory). To provide professional accounting and financial services, one must understand the industry, product, and processes. We have an ethical responsibility to develop this understanding before offering services to clients in these areas.

Required

Write a one-page action plan, in memorandum format, discussing how you would obtain an understanding of key business processes of a company that hires you to provide financial services. The memorandum should specify an industry, a product, and one selected process and should draw on at least one reference, such as a professional journal or industry magazine.

COMMUNICATING IN PRACTICEA1 C1 P1 P2 

BTN 3-4 You hire a new assistant production manager whose prior experience is with a company that produced goods to order. Your company engages in continuous production of homogeneous products that go through various production processes. Your new assistant e-mails you questioning some cost classifications on an internal report—specifically why the costs of some materials that do not actually become part of the finished product, including some labor costs not directly associated with producing the product, are classified as direct costs. Respond to this concern via memorandum.

TAKING IT TO THE NET

C1 C3



BTN 3-5 Many companies acquire software to help them monitor and control their costs and as an aid to their accounting systems. One company that supplies such software is **proDacapo** (prodacapo.com). There are many other such vendors. Access proDacapo's Website, click on "Business Process Management," and review the information displayed.

Required

How is process management software helpful to businesses? Explain with reference to costs, efficiency, and examples, if possible.

TEAMWORK IN ACTION

C1 P1 P2 P3 P6

BTN 3-6 The purpose of this team activity is to ensure that each team member understands process operations and the related accounting entries. Find the activities and flows identified in Exhibit 3.4 with numbers ①–⑩. Pick a member of the team to start by describing activity number ① in this exhibit, then verbalizing the related journal entry, and describing how the amounts in the entry are computed. The other members of the team are to agree or disagree; discussion is to continue until all members express understanding. Rotate to the next numbered activity and next team member until all activities and entries have been discussed. If at any point a team member is uncertain about an answer, the team member may pass and get back in the rotation when he or she can contribute to the team's discussion.

ENTREPRENEURIAL DECISIONC4 A2  

BTN 3-7 Read the chapter opener about **Hood River Juice Company**. David Ryan explained that purchasing apples year-round and processing them immediately reduces costs, and that his company blends juices to fit customer needs.

Required

1. How does not holding raw materials inventories (apples) reduce costs? If the items are not used in production, how can they affect profits? Explain.
2. Explain why Hood River Juice Company might use a hybrid costing system.

BTN 3-8 In process costing, the process is analyzed first and then a unit measure is computed in the form of equivalent units for direct materials, direct labor, overhead, and all three combined. The same analysis applies to both manufacturing and service processes.

Required

Visit your local **U.S. Mail** center. Look into the back room, and you will see several ongoing processes. Select one process, such as sorting, and list the costs associated with this process. Your list should include materials, labor, and overhead; be specific. Classify each cost as fixed or variable. At the bottom of your list, outline how overhead should be assigned to your identified process. The following format (with an example) is suggested.

Cost Description	Direct Material	Direct Labor	Overhead	Variable Cost	Fixed Cost
Manual sorting		X		X	
:					
:					
Overhead allocation suggestions:					

HITTING THE ROAD



Point: The class can compare and discuss the different processes studied and the answers provided.

BTN 3-9 **DSG international plc**, **Best Buy**, **Circuit City**, and **RadioShack** are competitors in the global marketplace. Selected data for DSG follow.

(millions of pounds)	Current Year	Prior Year
Cost of goods sold	£7,285	£6,369
General, selling, and administrative expenses	<u>381</u>	<u>339</u>
Total expenses	£7,666	£6,708

GLOBAL DECISION



Required

- Review the discussion of the importance of the cost of goods sold divided by total expenses ratio in BTN 3-2. Compute the cost of goods sold to total expenses ratio for DSG for the two years of data provided.
- Comment on the similarities or differences in the ratio results calculated in part 1 and in BTN 3-2 across years and companies.

ANSWERS TO MULTIPLE CHOICE QUIZ

- d
- e
- b; $\$20,000 + \$152,000 + \$45,000 + \$18,000 - \$218,000 = \underline{\underline{\$17,000}}$
- a; $40,000 + (15,000 \times 1/3) = \underline{\underline{45,000 \text{ EUP}}}$
- c; $(\$6,000 + \$84,000) \div 45,000 \text{ EUP} = \underline{\underline{\$2 \text{ per EUP}}}$