Chapter 4

Process Costing

Solutions to Questions

**4-1** A process costing system should be used in situations where a homogeneous product is produced on a continuous basis in large quantities.

**4-2** Job-order and processing costing are similar in the following ways:

1. Job-order costing and process costing have the same basic purposes—to assign materials, labor, and overhead cost to products and to provide a mechanism for computing unit product costs.
2. Both systems use the same basic manufacturing accounts.
3. Costs flow through the accounts in basically the same way in both systems.

**4-3** Cost accumulation is simpler under process costing because costs only need to be assigned to departments—not individual jobs. A company usually has a small number of processing departments, whereas a job-order costing system often must keep track of the costs of hundreds or even thousands of jobs.

**4-4** In a process costing system, a Work in Process account is maintained for each processing department.

**4-5** The journal entry to record the transfer of work in process from the Mixing Department to the Firing Department is:

|  |  |  |
| --- | --- | --- |
| Work in Process, Firing | XXXX |  |
| Work in Process, Mixing |  | XXXX |

**4-6** The costs that might be added in the Firing Department include: (1) costs transferred in from the Mixing Department; (2) materials costs added in the Firing Department; (3) labor costs added in the Firing Department; and (4) overhead costs added in the Firing Department.

**4-7** Under the weighted-average method, equivalent units of production consist of units transferred to the next department (or to finished goods) during the period plus the equivalent units in the department’s ending work in process inventory.

**4-8** The company will want to distinguish between the costs of the metals used to make the medallions, but the medals are otherwise identical and go through the same production processes. Thus, operation costing is ideally suited for the company’s needs.

The Foundational 15

1. The journal entries would be recorded as follows:

|  |  |  |
| --- | --- | --- |
| Work in Process—Mixing | 120,000 |  |
| Raw Materials Inventory |  | 120,000 |
|  |  |  |
| Work in Process—Mixing | 79,500 |  |
| Wages Payable |  | 79,500 |

2. The journal entry would be recorded as follows:

|  |  |  |
| --- | --- | --- |
| Work in Process—Mixing | 97,000 |  |
| Manufacturing Overhead |  | 97,000 |

3. The “units completed and transferred to finished goods” is computed as follows:

|  |  |  |
| --- | --- | --- |
|  |  | Pounds |
|  | Work in process, June 1 | 5,000 |
|  | Started into production during the month | 37,500 |
|  | Total pounds in process | 42,500 |
|  | Deduct work in process, June 30 | 8,000 |
|  | Completed and transferred out during the month | 34,500 |

4. and 5.

The equivalent units of production for materials and conversion are computed as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | | Equivalent Units | |
|  | | Materials | Conversion |
| Units transferred out | 34,500 | 34,500 |
| Work in process, ending: |  |  |
| 8,000 units × 100% | 8,000 |  |
| 8,000 units × 40% |  | 3,200 |
| Equivalent units of production | 42,500 | 37,700 |

The Foundational 15 (continued)

6. and 7.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $  16,000 | $  12,000 |
|  | Cost added during the period | 120,000 | 176,500\* |
|  | Total cost | $136,000 | $188,500 |

\* $79,500 + $97,000 = $176,500

8. and 9.

The cost per equivalent unit for materials and conversion is computed as follows:

|  |  |  |
| --- | --- | --- |
| Total cost (a) | $136,000 | $188,500 |
| Equivalent units of production (b) | 42,500 | 37,700 |
| Cost per equivalent unit (a) ÷ (b) | $3.20 | $5.00 |

10. and 11.

The cost of ending work in process inventory for materials and conversion is computed as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Materials* | *Conversion* | *Total* |
| Equivalent units of production (a) | 8,000 | 3,200 |  |
| Cost per equivalent unit (b) | $3.20 | $5.00 |  |
| Cost of ending work in process inventory (a) × (b) | $25,600 | $16,000 | $41,600\* |

\* $41,600 is the June 30 balance in the Work in Process—Mixing Department T-account.

12. and 13.

The cost of materials and conversion transferred to finished goods is computed as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Materials* | *Conversion* | *Total* |
| Units transferred out (a) | 34,500 | 34,500 |  |
| Cost per equivalent unit (b) | $3.20 | $5.00 |  |
| Cost of units transferred to finished goods (a) × (b) | $110,400 | $172,500 | $282,900 |

The Foundational 15 (continued)

14. The journal entry to record the transfer of costs from Work in Process—Mixing to Finished Goods would be recorded as follows:

Finished Goods 282,900

Work in Process—Mixing 282,900

15. The total cost to be accounted for and the total cost accounted for is:

|  |  |
| --- | --- |
| Costs to be accounted for: |  |
| Cost of beginning work in process inventory | $  28,000 | |
| Costs added to production during the period | 296,500 | |
| Total cost to be accounted for | $324,500 | |
|  |  | |
| Costs accounted for: |  | |
| Cost of ending work in process inventory | $  41,600 | |
| Cost of units completed and transferred out | 282,900 | |
| Total cost accounted for | $324,500 | |

**Exercise 4-1** (20 minutes)

a. To record issuing raw materials for use in production:

Work in Process—Molding Department 23,000

Work in Process—Firing Department 8,000

Raw Materials 31,000

b. To record direct labor costs incurred:

Work in Process—Molding Department 12,000

Work in Process—Firing Department 7,000

Wages Payable 19,000

c. To record applying manufacturing overhead:

Work in Process—Molding Department 25,000

Work in Process—Firing Department 37,000

Manufacturing Overhead 62,000

d. To record transfer of unfired, molded bricks from the Molding Department to the Firing Department:

Work in Process—Firing Department 57,000

Work in Process—Molding Department 57,000

e. To record transfer of finished bricks from the Firing Department to the finished bricks warehouse:

Finished Goods 103,000

Work in Process—Firing Department 103,000

f. To record cost of goods sold:

Cost of Goods Sold 101,000

Finished Goods 101,000

**Exercise 4-2** (10 minutes)

Weighted-Average Method

|  |  |  |
| --- | --- | --- |
|  | Equivalent Units | |
|  | Materials | Conversion |
| Units transferred out | 190,000 | 190,000 |
| Work in process, ending: |  |  |
| 15,000 units × 80% | 12,000 |  |
| 15,000 units × 40% |  | 6,000 |
| Equivalent units of production | 202,000 | 196,000 |

**Exercise 4-3** (10 minutes)

Weighted-Average Method

1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Materials | Labor | Overhead |
| Cost of beginning work in process inventory | $ 18,000 | $  5,500 | $ 27,500 |
| Cost added during the period | 238,900 | 80,300 | 401,500 |
| Total cost (a) | $256,900 | $85,800 | $429,000 |
|  |  |  |  |
| Equivalent units of production (b) | 35,000 | 33,000 | 33,000 |
| Cost per equivalent unit (a) ÷ (b) | $7.34 | $2.60 | $13.00 |

2.

|  |  |
| --- | --- |
| Cost per equivalent unit for materials | $ 7.34 |
| Cost per equivalent unit for labor | 2.60 |
| Cost per equivalent unit for overhead | 13.00 |
| Total cost per equivalent unit | $22.94 |

**Exercise 4-4** (10 minutes)

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Materials* | *Conversion* | *Total* |
| *Ending work in process inventory:* |  |  |  |
| Equivalent units of production | 2,000 | 800 |  |
| Cost per equivalent unit | $13.86 | $4.43 |  |
| Cost of ending work in process inventory | $27,720 | $3,544 | $31,264 |
|  |  |  |  |
| *Units completed and transferred out:* | |  |  |
| Units transferred to the next department | 20,100 | 20,100 |  |
| Cost per equivalent unit | $13.86 | $4.43 |  |
| Cost of units transferred out | $278,586 | $89,043 | $367,629 |

**Exercise 4-5** (10 minutes)

|  |
| --- |
| Baking Department Cost Reconciliation |

|  |  |  |
| --- | --- | --- |
| Costs to be accounted for: |  |  |
| Cost of beginning work in process inventory | $ 3,570 |  |
| Costs added to production during the period | 43,120 |  |
| Total cost to be accounted for | $46,690 |  |
|  |  |  |
| Costs accounted for as follows: |  |  |
| Cost of ending work in process inventory | $ 2,860 |  |
| Cost of units completed and transferred out | 43,830 | \* |
| Total cost accounted for | $46,690 |  |

\*The cost of units completed and transferred out can be deduced as follows:



**Exercise 4-6** (10 minutes)

Weighted-Average Method

|  |  |  |
| --- | --- | --- |
| 1. |  | Tons of Pulp |
|  | Work in process, June 1 | 20,000 |
|  | Started into production during the month | 190,000 |
|  | Total tons in process | 210,000 |
|  | Deduct work in process, June 30 | 30,000 |
|  | Completed and transferred out during the month | 180,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. |  | Equivalent Units | |
|  |  | *Materials* | *Labor and Overhead* |
|  | Units transferred out | 180,000 | 180,000 |
|  | Work in process, ending: |  |  |
|  | Materials: 30,000 tons × 60% complete | 18,000 |  |
|  | Labor and overhead:  30,000 tons × 40% complete |  | 12,000 |
|  | Equivalent units of production | 198,000 | 192,000 |

**Exercise 4-7** (10 minutes)

|  |  |  |
| --- | --- | --- |
| Work in Process—Cooking | 42,000 |  |
| Raw Materials Inventory |  | 42,000 |
|  |  |  |
| Work in Process—Cooking | 50,000 |  |
| Work in Process—Molding | 36,000 |  |
| Wages Payable |  | 86,000 |
|  |  |  |
| Work in Process—Cooking | 75,000 |  |
| Work in Process—Molding | 45,000 |  |
| Manufacturing Overhead |  | 120,000 |
|  |  |  |
| Work in Process—Molding | 160,000 |  |
| Work in Process—Cooking |  | 160,000 |
|  |  |  |
| Finished Goods | 240,000 |  |
| Work in Process—Molding |  | 240,000 |

**Exercise 4-8** (30 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. |  | Materials | Conversion |
|  | Units transferred to the next production department | 175,000 | 175,000 |
|  | Ending work in process: |  |  |
|  | Materials: 10,000 units × 100% complete | 10,000 |  |
|  | Conversion: 10,000 units × 30% complete |  | 3,000 |
|  | Equivalent units of production | 185,000 | 178,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. |  | Materials | Conversion |
|  | Cost of beginning work in process | $ 1,500 | $   4,000 |
|  | Cost added during the period | 54,000 | 352,000 |
|  | Total cost (a) | $55,500 | $356,000 |
|  | Equivalent units of production (b) | 185,000 | 178,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $0.30 | $2.00 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. |  | *Materials* | *Conversion* | *Total* |
|  | *Ending work in process inventory:* | |  |  |
|  | Equivalent units of production (see above) | 10,000 | 3,000 |  |
|  | Cost per equivalent unit (see above) | $0.30 | $2.00 |  |
|  | Cost of ending work in process  inventory | $3,000 | $6,000 | $9,000 |
|  |  |  |  |  |
|  | *Units completed and transferred out:* | |  |  |
|  | Units transferred to the next department | 175,000 | 175,000 |  |
|  | Cost per equivalent unit  (see above) | $0.30 | $2.00 |  |
|  | Cost of units completed and transferred out | $52,500 | $350,000 | $402,500 |

**Exercise 4-9** (15 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Materials | Labor | Overhead |
| Units transferred to the next department | 42,000 | 42,000 | 42,000 |
| Work in process, ending: |  |  |  |
| Materials:  8,000 units × 75% complete | 6,000 |  |  |
| Labor and overhead: 8,000 units × 50% complete |  | 4,000 | 4,000 |
| Equivalent units of production | 48,000 | 46,000 | 46,000 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2. |  | Materials | Labor | Overhead |
|  | Cost of beginning work in process | $ 4,320 | $ 1,040 | $ 1,790 |
|  | Cost added during the period | 52,800 | 21,500 | 32,250 |
|  | Total cost (a) | $57,120 | $22,540 | $34,040 |
|  |  |  |  |  |
|  | Equivalent units of production (b) | 48,000 | 46,000 | 46,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $1.19 | $0.49 | $0.74 |

**Exercise 4-10** (10 minutes)

Weighted-Average Method

|  |  |  |
| --- | --- | --- |
|  | *Materials* | *Labor &  Overhead* |
| Pounds transferred to the Packing Department during July\* | 375,000 | 375,000 |
| Work in process, July 31: |  |  |
| Materials: 25,000 pounds × 100% complete | 25,000 |  |
| Labor and overhead:  25,000 pounds × 60% complete |  | 15,000 |
| Equivalent units of production | 400,000 | 390,000 |

\* 20,000 + 380,000 – 25,000 = 375,000

**Exercise 4-11** (30 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent units of production |  |  |
|  |  | *Pulping* | *Conversion* |
|  | Transferred to next department | 157,000 | 157,000 |
|  | Ending work in process: |  |  |
|  | Pulping: 8,000 units x 100% complete | 8,000 |  |
|  | Conversion: 8,000 units x 25% complete |  | 2,000 |
|  | Equivalent units of production | 165,000 | 159,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per equivalent unit |  |  |
|  |  | *Pulping* | *Conversion* |
|  | Cost of beginning work in process | $   4,800 | $     500 |
|  | Cost added during the period | 102,450 | 31,300 |
|  | Total cost (a) | $107,250 | $31,800 |
|  | Equivalent units of production (b) | 165,000 | 159,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $0.65 | $0.20 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Cost of ending work in process inventory and units transferred out | | | |
|  |  | *Pulping* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 8,000 | 2,000 |  |
|  | Cost per equivalent unit | $0.65 | $0.20 |  |
|  | Cost of ending work in process inventory | $5,200 | $400 | $5,600 |
|  | Units completed and transferred out: | |  |  |
|  | Units transferred to the next department | 157,000 | 157,000 |  |
|  | Cost per equivalent unit | $0.65 | $0.20 |  |
|  | Cost of units completed and transferred out | $102,050 | $31,400 | $133,450 |

**Exercise 4-11** (continued)

|  |  |  |
| --- | --- | --- |
| 4. | Cost reconciliation |  |
|  | Costs to be accounted for: |  |
|  | Cost of beginning work in process inventory ($4,800 + $500) | $   5,300 |
|  | Costs added to production during the period ($102,450 + $31,300) | 133,750 |
|  | Total cost to be accounted for | $139,050 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $   5,600 |
|  | Cost of units completed and transferred out | 133,450 |
|  | Total cost accounted for | $139,050 |

**Exercise 4-12** (20 minutes)

Weighted-Average Method

1. Computation of equivalent units in ending inventory:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Materials | Labor | Overhead |
| Units in ending inventory | 3,000 | 3,000 | 3,000 |
| Percent completed | 80% | 60% | 60% |
| Equivalent units of production | 2,400 | 1,800 | 1,800 |

2. Cost of ending work in process inventory and units transferred out:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Materials* | *Labor* | *Overhead* | *Total* |
|  | Ending work in process inventory: | |  |  |  |
|  | Equivalent units of production | 2,400 | 1,800 | 1,800 |  |
|  | Cost per equivalent unit | $12.50 | $3.20 | $6.40 |  |
|  | Cost of ending work in process inventory | $30,000 | $5,760 | $11,520 | $47,280 |
|  |  | |  |  |  |
|  | Units completed and transferred out: | |  |  |  |
|  | Units transferred to the next department | 25,000 | 25,000 | 25,000 |  |
|  | Cost per equivalent unit | $12.50 | $3.20 | $6.40 |  |
|  | Cost of units completed and transferred out | $312,500 | $80,000 | $160,000 | $552,500 |

3. Cost reconciliation:

|  |  |  |
| --- | --- | --- |
|  | Total cost to be accounted for | $599,780 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $  47,280 |
|  | Cost of units completed and transferred out | 552,500 |
|  | Total cost accounted for | $599,780 |

**Problem 4-13** (60 minutes)

Weighted-Average Method

1. Computation of equivalent units in ending inventory:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | *Mixing* | *Materials* | *Conversion* |
|  | Units transferred to the next department | 50.0 | 50.0 | 50.0 |
|  | Ending work in process: |  |  |  |
|  | Mixing: 1 unit × 100% complete | 1.0 |  |  |
|  | Materials: 1 unit × 80% complete |  | 0.8 |  |
|  | Conversion: 1 unit × 70% complete |  |  | 0.7 |
|  | Equivalent units of production | 51.0 | 50.8 | 50.7 |

2. Costs per equivalent unit:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | *Mixing* | *Materials* | *Conversion* |
|  | Cost of beginning work in process inventory | $ 1,670 | $    90 | $    605 |
|  | Cost added during the period | 81,460 | 6,006 | 42,490 |
|  | Total cost (a) | $83,130 | $6,096 | $43,095 |
|  | Equivalent units of production (b) | 51.0 | 50.8 | 50.7 |
|  | Cost per equivalent unit (a) ÷ (b) | $1,630 | $120 | $850 |

**Problem 4-13** (continued)

3. Costs of ending work in process inventory and units transferred out:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Mixing* | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |  |
|  | Equivalent units of production | 1.0 | 0.8 | 0.7 |  |
|  | Cost per equivalent unit | $1,630 | $120 | $850 |  |
|  | Cost of ending work in process inventory | $1,630 | $96 | $595 | $2,321 |
|  | Units completed and transferred out: |  |  |  |  |
|  | Units transferred to the next department | 50.0 | 50.0 | 50.0 |  |
|  | Cost per equivalent unit | $1,630 | $120 | $850 |  |
|  | Cost of units transferred out | $81,500 | $6,000 | $42,500 | $130,000 |

4. Cost reconciliation:

|  |  |  |
| --- | --- | --- |
|  | Cost to be accounted for: |  |
|  | Cost of beginning work in process inventory ($1,670 + $90 + $605) | $   2,365 |
|  | Cost added to production during the period ($81,460 + $6,006 + $42,490) | 129,956 |
|  | Total cost to be accounted for | $132,321 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $   2,321 |
|  | Cost of units transferred out | 130,000 |
|  | Total cost accounted for | $132,321 |

**Problem 4-14** (45 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent units of production |  |  |
|  |  | *Materials* | *Conversion* |
|  | Transferred to next department\* | 170,000 | 170,000 |
|  | Ending work in process: |  |  |
|  | Materials: 15,000 units x 100% complete | 15,000 |  |
|  | Conversion: 15,000 units x 60% complete |  | 9,000 |
|  | Equivalent units of production | 185,000 | 179,000 |

\*Units transferred to the next department = Units in beginning work in process + Units started into production − Units in ending work in process = 18,000 + 167,000 − 15,000 = 170,000

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per equivalent unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $  14,600 | $   7,200 |
|  | Cost added during the period | 133,400 | 225,500 |
|  | Total cost (a) | $148,000 | $232,700 |
|  | Equivalent units of production (b) | 185,000 | 179,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $0.80 | $1.30 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Cost of ending work in process inventory and units transferred out | | | |
|  |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 15,000 | 9,000 |  |
|  | Cost per equivalent unit | $0.80 | $1.30 |  |
|  | Cost of ending work in process inventory | $12,000 | $11,700 | $23,700 |
|  | Units completed and transferred out: | |  |  |
|  | Units transferred to the next department | 170,000 | 170,000 |  |
|  | Cost per equivalent unit | $0.80 | $1.30 |  |
|  | Cost of units completed and transferred out | $136,000 | $221,000 | $357,000 |

**Problem 4-15** (45 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent units of production: |  |  |
|  |  | *Materials* | *Conversion* |
|  | Transferred to next department | 160,000 | 160,000 |
|  | Ending work in process: |  |  |
|  | Materials: 40,000 units x 100% complete | 40,000 |  |
|  | Conversion: 40,000 units x 25% complete |  | 10,000 |
|  | Equivalent units of production | 200,000 | 170,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per Equivalent Unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $ 25,200 | $ 24,800 |
|  | Cost added during the period | 334,800 | 238,700 |
|  | Total cost (a) | $360,000 | $263,500 |
|  | Equivalent units of production (b) | 200,000 | 170,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $1.80 | $1.55 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Applying costs to units: |  |  |  |
|  |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 40,000 | 10,000 |  |
|  | Cost per equivalent unit | $1.80 | $1.55 |  |
|  | Cost of ending work in process inventory | $72,000 | $15,500 | $87,500 |
|  | Units completed and transferred out: | |  |  |
|  | Units transferred to the next department | 160,000 | 160,000 |  |
|  | Cost per equivalent unit | $1.80 | $1.55 |  |
|  | Cost of units completed and transferred out | $288,000 | $248,000 | $536,000 |

**Problem 4-15** (continued)

|  |  |  |
| --- | --- | --- |
| 4. | Cost reconciliation: |  |
|  |  |  |
|  | Costs to be accounted for: |  |
|  | Cost of beginning work in process inventory ($25,200 + $24,800) | $ 50,000 |
|  | Costs added to production during the period ($334,800 + $238,700) | 573,500 |
|  | Total cost to be accounted for | $623,500 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $ 87,500 |
|  | Cost of units completed and transferred out | 536,000 |
|  | Total cost accounted for | $623,500 |

**Problem 4-16** (45 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent units of production |  |  |
|  |  | *Materials* | *Conversion* |
|  | Transferred to next department\* | 95,000 | 95,000 |
|  | Ending work in process: |  |  |
|  | Materials: 15,000 units x 60% complete | 9,000 |  |
|  | Conversion: 15,000 units x 20% complete |  | 3,000 |
|  | Equivalent units of production | 104,000 | 98,000 |

\*Units transferred to the next department = Units in beginning work in process + Units started into production − Units in ending work in process = 10,000 + 100,000 − 15,000 = 95,000

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per equivalent unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $   1,500 | $  7,200 |
|  | Cost added during the period | 154,500 | 90,800 |
|  | Total cost (a) | $156,000 | $98,000 |
|  | Equivalent units of production (b) | 104,000 | 98,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $1.50 | $1.00 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Cost of ending work in process inventory and units transferred out | | | |
|  |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 9,000 | 3,000 |  |
|  | Cost per equivalent unit | $1.50 | $1.00 |  |
|  | Cost of ending work in process inventory | $13,500 | $3,000 | $16,500 |
|  | Units completed and transferred out: | |  |  |
|  | Units transferred to the next department | 95,000 | 95,000 |  |
|  | Cost per equivalent unit | $1.50 | $1.00 |  |
|  | Cost of units completed and transferred out | $142,500 | $95,000 | $237,500 |

**Problem 4-16** (continued)

|  |  |  |
| --- | --- | --- |
| 4. | Cost Reconciliation |  |
|  | Costs to be accounted for: |  |
|  | Cost of beginning work in process inventory ($1,500 + $7,200) | $   8,700 |
|  | Costs added to production during the period ($154,500 + $90,800) | 245,300 |
|  | Total cost to be accounted for | $254,000 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $ 16,500 |
|  | Cost of units completed and transferred out | 237,500 |
|  | Total cost accounted for | $254,000 |

**Problem 4-17** (45 minutes)

Weighted-Average Method

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | a. | Work in Process—Refining Department | 495,000 |  |
|  |  | Work in Process—Blending Department | 115,000 |  |
|  |  | Raw Materials |  | 610,000 |
|  |  |  |  |  |
|  | b. | Work in Process—Refining Department | 72,000 |  |
|  |  | Work in Process—Blending Department | 18,000 |  |
|  |  | Salaries and Wages Payable |  | 90,000 |
|  |  |  |  |  |
|  | c. | Manufacturing Overhead | 225,000 |  |
|  |  | Accounts Payable |  | 225,000 |
|  |  |  |  |  |
|  | d. | Work in Process—Refining Department | 181,000 |  |
|  |  | Manufacturing Overhead |  | 181,000 |
|  |  |  |  |  |
|  | d. | Work in Process—Blending Department | 42,000 |  |
|  |  | Manufacturing Overhead |  | 42,000 |
|  |  |  |  |  |
|  | e. | Work in Process—Blending Department | 740,000 |  |
|  |  | Work in Process—Refining Department |  | 740,000 |
|  |  |  |  |  |
|  | f. | Finished Goods | 950,000 |  |
|  |  | Work in Process—Blending Department |  | 950,000 |
|  |  |  |  |  |
|  | g. | Accounts Receivable | 1,500,000 |  |
|  |  | Sales |  | 1,500,000 |
|  |  |  |  |  |
|  |  | Cost of Goods Sold | 900,000 |  |
|  |  | Finished Goods |  | 900,000 |

**Problem 4-17** (continued)

2.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Accounts Receivable | | | |  | Raw Materials | | | | |
| (g) | 1,500,000 |  |  |  | Bal. | | 618,000 | (a) | 610,000 |
|  |  |  |  |  | Bal. | | 8,000 |  |  |
|  | | | |  |  | | | | |
| Work in Process Refining Department | | | |  | Work in Process Blending Department | | | | |
| Bal. | 38,000 | (e) | 740,000 |  | Bal. | 65,000 | | (f) | 950,000 |
| (a) | 495,000 |  |  |  | (a) | 115,000 | |  |  |
| (b) | 72,000 |  |  |  | (b) | 18,000 | |  |  |
| (d) | 181,000 |  |  |  | (d) | 42,000 | |  |  |
| Bal. | 46,000 |  |  |  | (e) | 740,000 | |  |  |
|  |  |  |  |  | Bal. | 30,000 | |  |  |
|  | | | |  |  | | | | |
| Finished Goods | | | |  | Manufacturing Overhead | | | | |
| Bal. | 20,000 | (g) | 900,000 |  | (c) | | 225,000 | (d) | 223,000 |
| (f) | 950,000 |  |  |  | Bal. | | 2,000 |  |  |
| Bal. | 70,000 |  |  |  |  | |  |  |  |
|  | | | |  |  | | | | |
| Accounts Payable | | | |  | Salaries and Wages Payable | | | | |
|  |  | (c) | 225,000 |  |  | |  | (b) | 90,000 |
|  |  |  |  |  |  | |  |  |  |
| Sales | | | |  | Cost of Goods Sold | | | | |
|  |  | (g) | 1,500,000 |  | (g) | 900,000 | |  |  |
|  |  |  |  |  |  |  | |  |  |

**Problem 4-18** (30 minutes)

Weighted-Average Method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent units of production |  |  |
|  |  | *Materials* | *Conversion* |
|  | Transferred to next department | 190,000 | 190,000 |
|  | Ending work in process: |  |  |
|  | Materials: 40,000 units x 75% complete | 30,000 |  |
|  | Conversion: 40,000 units x 60% complete |  | 24,000 |
|  | Equivalent units of production | 220,000 | 214,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per equivalent unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $  67,800 | $  30,200 |
|  | Cost added during the period | 579,000 | 248,000 |
|  | Total cost (a) | $646,800 | $278,200 |
|  | Equivalent units of production (b) | 220,000 | 214,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $2.94 | $1.30 |

|  |  |  |
| --- | --- | --- |
| 3. | Total units transferred | 190,000 |
|  | Less units in the beginning inventory | 30,000 |
|  | Units started and completed during April | 160,000 |

Note: This answer assumes that the units in the beginning inventory are completed before any other units are completed.

4. No, the manager should not be rewarded for good cost control. The Mixing Department’s low unit cost for April occurred because the costs of the prior month have been averaged in with April’s costs. This is a major criticism of the weighted-average method. Costs computed for product costing purposes should not be used to evaluate cost control or to measure performance for the *current* period.

**Case 4-19** (45 minutes)

Weighted-Average Method

1. The revised computations follow:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Equivalent Units of Production: |  |  |  |
|  |  | *Transferred In Costs* | *Materials* | *Conversion* |
|  | Transferred to finished goods | 1,800 | 1,800 | 1,800 |
|  | Ending work in process: |  |  |  |
|  | Transferred in costs: 600 units x 100% complete | 600 |  |  |
|  | Materials: 600 units x 0% complete |  | 0 |  |
|  | Conversion: 600 units x 35% complete |  |  | 210 |
|  | Equivalent units of production | 2,400 | 1,800 | 2,010 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Cost per Equivalent Unit: |  |  |  |
|  |  | *Transferred In Costs* | *Materials* | *Conversion* |
|  | Cost of beginning work in process | $ 4,068 | $1,980 | $ 2,160 |
|  | Cost added during the period | 17,940 | 6,210 | 13,920 |
|  | Total cost (a) | $22,008 | $8,190 | $16,080 |
|  | Equivalent units of production (b) | 2,400 | 1,800 | 2,010 |
|  | Cost per equivalent unit, (a) ÷ (b) | $9.17 | $4.55 | $8.00 |

**Case 4-19** (continued)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Transferred In Costs* | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |  |
|  | Equivalent units of production (see above) | 600 | 0 | 210 |  |
|  | Cost per equivalent unit | $9.17 | $4.55 | $8.00 |  |
|  | Cost of ending work in process inventory | $5,502 | $0 | $1,680 | $7,182 |
|  | Units completed and transferred out: |  |  |  |  |
|  | Units transferred to finished goods | 1,800 | 1,800 | 1,800 |  |
|  | Cost per equivalent unit | $9.17 | $4.55 | $8.00 |  |
|  | Cost of units completed and transferred out | $16,506 | $8,190 | $14,400 | $39,096 |

2. The unit cost computed above is $21.72 (= $9.17 + $4.55 + $8.00) versus $25.71 on the original report for the units completed and transferred to finished goods. The unit cost on the original report is high because none of the cost incurred during the month was assigned to the units in the ending work in process inventory.

**Case 4-20** (90 minutes)

* This case is difficult—particularly part 3, which requires analytical skills.
* Because there are no beginning inventories, it makes no difference whether the weighted-average or FIFO method is used by the company. You may choose to specify that the FIFO method be used rather than the weighted-average method.

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Computation of the Cost of Goods Sold: |  |  |
|  |  | *Transferred In* | *Conversion* |
|  | Units completed and sold | 200,000 | 200,000 |
|  | Ending work in process: |  |  |
|  | Transferred in:  10,000 units × 100% complete | 10,000 |  |
|  | Conversion:  10,000 units × 30% complete |  | 3,000 |
|  | Equivalent units of production | 210,000 | 203,000 |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | *Transferred In* | *Conversion* |
|  | Cost of beginning work in process | $              0 | $              0 |
|  | Cost added during the period | 39,375,000 | 20,807,500 |
|  | Total cost (a) | $39,375,000 | $20,807,500 |
|  | Equivalent units of production (b) | 210,000 | 203,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $187.50 | $102.50 |

Cost of goods sold = 200,000 units × ($187.50 per unit + $102.50 per unit) = $58,000,000

2. The estimate of the percentage completion of ending work in process inventories affects the unit costs of finished goods and therefore the cost of goods sold. Gary Stevens would like the estimated percentage completion of the ending work in process to be increased. The higher the percentage of completion of ending work in process, the higher the equivalent units for the period and the lower the unit costs.

3. Increasing the percentage of completion can increase net operating income by reducing the cost of goods sold. To increase net operating income by $200,000, the cost of goods sold would have to be decreased by $200,000 from $58,000,000 down to $57,800,000. See the next page for the necessary calculations.

**Case 4-20** (continued)

The percentage of completion, X, affects the cost of goods sold by its effect on the unit cost, which can be determined as follows:

Unit cost = $187.50 + 

And the cost of goods sold can be computed as follows:

Cost of goods sold = 200,000 × Unit cost

Because the cost of goods sold must be reduced down to $57,800,000, the unit cost must be $289.00 ($57,800,000 ÷ 200,000 units). Thus, the required percentage completion, X, to obtain the $200,000 reduction in cost of goods sold can be found by solving the following equation:





Thus, changing the percentage completion to 50% will decrease cost of goods sold and increase net operating income by $200,000 as verified on the next page.

**Case 4-20** (continued)

3. (continued)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Computation of the Cost of Goods Sold: |  |  |
|  |  | *Transferred In* | *Conversion* |
|  | Units completed and sold | 200,000 | 200,000 |
|  | Ending work in process: |  |  |
|  | Transferred in:  10,000 units x 100% complete | 10,000 |  |
|  | Conversion:  10,000 units x 50% complete |  | 5,000 |
|  | Equivalent units of production | 210,000 | 205,000 |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | *Transferred In* | *Conversion* |
|  | Cost of beginning work in process | $              0 | $              0 |
|  | Cost added during the period | 39,375,000 | 20,807,500 |
|  | Total cost (a) | $39,375,000 | $20,807,500 |
|  | Equivalent units of production (b) | 210,000 | 205,000 |
|  | Cost per equivalent unit, (a) ÷ (b) | $187.50 | $101.50 |

Cost of goods sold = 200,000 units × ($187.50 per unit + $101.50 per unit) = $57,800,000

4. Mary is in a very difficult position. Collaborating with Gary Stevens in subverting the integrity of the accounting system is unethical by almost any standard. To put the situation in its starkest light, Stevens is suggesting that the production managers lie in order to get their bonus. Having said that, the peer pressure to go along in this situation may be intense. It is difficult on a personal level to ignore such peer pressure. Moreover, Mary probably prefers not to risk alienating people she might need to rely on in the future. On the other hand, Mary should be careful not to accept at face value Gary’s assertion that all of the other managers are “doing as much as they can to pull this bonus out of the hat.” Those who engage in unethical or illegal acts often rationalize their own behavior by exaggerating the extent to which others engage in the same kind of behavior. Other managers may actually be very uncomfortable “pulling strings” to make the target profit for the year.

**Case 4-20** (continued)

From a broader perspective, if the net profit figures reported by the managers in a division cannot be trusted, then the company would be foolish to base bonuses on the net profit figures. A bonus system based on divisional net profits presupposes the integrity of the accounting system.

The company should perhaps reconsider how it determines the bonus. It is quite common for companies to pay an “all or nothing” bonus contingent on making a particular target. This inevitably creates powerful incentives to bend the rules when the target has not quite been attained. It might be better to have a bonus without this “all or nothing” feature. For example, managers could be paid a bonus of x% of profits above target profits rather than a bonus that is a preset percentage of their base salary. Under such a policy, the effect of adding that last dollar of profits that just pushes the divisional net profits over the target profit will add a few pennies to the manager’s compensation rather than thousands of dollars. Therefore, the incentives to misstate the net operating income are reduced. Why tempt people unnecessarily?

Appendix 4A

FIFO Method

**Exercise 4A-1** (10 minutes)

FIFO Method

|  |  |  |
| --- | --- | --- |
|  | Materials | Conversion |
| To complete beginning work in process: |  |  |
| Materials: 30,000 units × (100% − 65%) | 10,500 |  |
| Conversion: 30,000 units × (100% − 30%) |  | 21,000 |
| Units started and completed during October\* | 160,000 | 160,000 |
| Ending work in process: |  |  |
| Materials: 15,000 units × 80% complete | 12,000 |  |
| Conversion: 15,000 units × 40% complete |  | 6,000 |
| Equivalent units of production | 182,500 | 187,000 |

|  |  |
| --- | --- |
| \* | 175,000 units started – 15,000 units in ending work in process  = 160,000 units started and completed |

**Exercise 4A-2** (10 minutes)

FIFO method

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Materials | Labor | Overhead |
|  | Cost added during May (a) | $193,320 | $62,000 | $310,000 |
|  | Equivalent units of production (b) | 27,000 | 25,000 | 25,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $7.16 | $2.48 | $12.40 |

|  |  |  |
| --- | --- | --- |
|  | Cost per equivalent unit for materials | $ 7.16 |
|  | Cost per equivalent unit for labor | 2.48 |
|  | Cost per equivalent unit for overhead | 12.40 |
|  | Total cost per equivalent unit | $22.04 |

**Exercise 4A-3** (15 minutes)

|  |  |  |  |
| --- | --- | --- | --- |
|  | *Materials* | *Conversion* | *Total* |
| *Ending work in process inventory:* |  |  |  |
| Equivalent units of production | 400 | 200 |  |
| Cost per equivalent unit | $2.32 | $0.75 |  |
| Cost of ending work in process inventory | $928 | $150 | $1,078 |
|  |  |  |  |
| *Units transferred out:* |  |  |  |
| Cost in beginning inventory | $3,200 | $650 | $3,850 |
| *Cost to complete the units in beginning inventory:* | |  |  |
| Equivalent units of production required to complete the beginning inventory | 600 | 1,200 |  |
| Cost per equivalent unit | $2.32 | $0.75 |  |
| Cost to complete the units in beginning inventory | $1,392 | $900 | $2,292 |
| *Cost of units started and completed this period:* | |  |  |
| Units started and completed this period (26,000 units completed and transferred to the next department – 2,000 units in beginning work in process inventory) | 24,000 | 24,000 |  |
| Cost per equivalent unit | $2.32 | $0.75 |  |
| Cost of units started and completed this period | $55,680 | $18,000 | $73,680 |
| Total cost of units transferred out |  |  | $79,822 |

**Exercise 4A-4** (10 minutes)

|  |
| --- |
| Mixing Department Cost Reconciliation |

|  |  |  |
| --- | --- | --- |
| Costs to be accounted for: |  |  |
| Cost of beginning work in process inventory | $  1,460 |  |
| Costs added to production during the period | 36,540 |  |
| Total cost to be accounted for | $38,000 |  |
|  |  |  |
| Costs accounted for as follows: |  |  |
| Cost of ending work in process inventory | $  3,120 |  |
| Cost of units completed and transferred out | 34,880 | \* |
| Total cost accounted for | $38,000 |  |

\*The cost of units completed and transferred out can be deduced as follows:



**Exercise 4A-5** (10 minutes)

|  |  |  |
| --- | --- | --- |
|  | *Materials* | *Conversion* |
| To complete beginning work in process: |  |  |
| Materials: 500 units x (100% – 80%) | 100 |  |
| Conversion: 500 units x (100% – 40%) |  | 300 |
| Units started and completed during the period (153,600 units started – 400 units in ending inventory) | 153,200 | 153,200 |
| Ending work in process |  |  |
| Materials: 400 units x 75% complete | 300 |  |
| Conversion: 400 units x 20% complete |  | 80 |
| Equivalent units of production | 153,600 | 153,580 |

**Exercise 4A-6** (15 minutes)

FIFO Method

|  |  |  |
| --- | --- | --- |
|  | *Materials* | *Labor &  Overhead* |
| To complete the beginning work in process: |  |  |
| Materials: 20,000 pounds × (100% − 100%) | 0 |  |
| Labor and overhead:  20,000 pounds × (100% − 30%) |  | 14,000 |
| Pounds started and completed during July\* | 355,000 | 355,000 |
| Ending work in process: |  |  |
| Materials: 25,000 pounds × 100% complete | 25,000 |  |
| Labor and overhead:  25,000 pounds × 60% complete |  | 15,000 |
| Equivalent units of production | 380,000 | 384,000 |

|  |  |
| --- | --- |
| \* | 380,000 pounds started – 25,000 pounds in ending work in process inventory = 355,000 pounds started and completed this month |

**Exercise 4A-7** (20 minutes)

FIFO Method

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. |  | Materials | Labor | Overhead |
|  | To complete beginning work in process: |  |  |  |
|  | Materials: 5,000 units ×  (100% − 80%) | 1,000 |  |  |
|  | Labor: 5,000 units ×  (100% − 60%) |  | 2,000 |  |
|  | Overhead: 5,000 units ×  (100% − 60%) |  |  | 2,000 |
|  | Units started and completed during the period\* | 37,000 | 37,000 | 37,000 |
|  | Ending work in process: |  |  |  |
|  | Materials: 8,000 units × 75% | 6,000 |  |  |
|  | Labor: 8,000 units × 50% |  | 4,000 |  |
|  | Overhead: 8,000 units × 50% |  |  | 4,000 |
|  | Equivalent units of production | 44,000 | 43,000 | 43,000 |

|  |  |
| --- | --- |
| \* | 45,000 units started into production – 8,000 units in ending work in process = 37,000 started and completed |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2. |  | Materials | Labor | Overhead |
|  | Cost added during the period (a) | $52,800 | $21,500 | $32,250 |
|  | Equivalent units of production (b) | 44,000 | 43,000 | 43,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $1.20 | $0.50 | $0.75 |

**Exercise 4A-8** (15 minutes)

FIFO Method

|  |  |  |
| --- | --- | --- |
| 1. |  | Tons of Pulp |
|  | Work in process, June 1 | 20,000 |
|  | Started into production during the month | 190,000 |
|  | Total tons in process | 210,000 |
|  | Deduct work in process, June 30 | 30,000 |
|  | Completed and transferred out during the month | 180,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. |  | Equivalent Units | |
|  |  | *Materials* | *Labor and Overhead* |
|  | To complete beginning work in process: |  |  |
|  | Materials: 20,000 tons × (100% − 90%) | 2,000 |  |
|  | Labor and overhead: 20,000 tons × (100% − 80%) |  | 4,000 |
|  | Units started and completed during the month\* | 160,000 | 160,000 |
|  | Ending work in process: |  |  |
|  | Materials: 30,000 tons × 60% complete | 18,000 |  |
|  | Labor and overhead:  30,000 tons × 40% complete |  | 12,000 |
|  | Equivalent units of production | 180,000 | 176,000 |

|  |  |
| --- | --- |
| \* | 190,000 tons started into production – 30,000 tons in ending work in process = 160,000 tons started and completed |

**Exercise 4A-9** (45 minutes)

FIFO Method

1. Computation of the total cost per equivalent unit of production:

|  |  |  |
| --- | --- | --- |
|  | Cost per equivalent unit of production for material | $25.40 |
|  | Cost per equivalent unit of production for conversion | 18.20 |
|  | Total cost per equivalent unit of production | $43.60 |

2. Computation of equivalent units in ending inventory:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Materials | | Conversion | |
|  | Units in ending inventory (a) | 300 |  | 300 |  |
|  | Percentage completed (b) | 70 | % | 60 | % |
|  | Equivalent units of production (a) × (b) | 210 |  | 180 |  |

3. Computation of equivalent units required to complete the beginning inventory:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Materials | | Conversion | |
|  | Units in beginning inventory (a) | 400 |  | 400 |  |
|  | Percentage needed to complete production of beginning inventory (b) | 20 | % | 60 | % |
|  | Equivalent units of production (a) × (b) | 80 |  | 240 |  |

|  |  |  |
| --- | --- | --- |
| 4. | Units transferred to the next department | 3,100 |
|  | Units from the beginning inventory | 400 |
|  | Units started and completed during the period | 2,700 |

**Exercise 4A-9** (continued)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5. |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 210 | 180 |  |
|  | Cost per equivalent unit | $25.40 | $18.20 |  |
|  | Cost of ending work in process inventory | $5,334 | $3,276 | $8,610 |
|  |  |  |  |  |
|  | Units transferred out: |  |  |  |
|  | Cost from the beginning work in process inventory | $8,120 | $2,920 | $11,040 |
|  | Cost to complete the units in beginning work in process inventory: |  |  |  |
|  | Equivalent units of production required to complete the units in beginning inventory | 80 | 240 |  |
|  | Cost per equivalent unit | $25.40 | $18.20 |  |
|  | Cost to complete the units in beginning inventory | $2,032 | $4,368 | $6,400 |
|  | Cost of units started and completed this period: |  |  |  |
|  | Units started and completed this period | 2,700 | 2,700 |  |
|  | Cost per equivalent unit | $25.40 | $18.20 |  |
|  | Cost of units started and completed this period | $68,580 | $49,140 | $117,720 |
|  | Total cost of units transferred out |  |  | $135,160 |

**Problem 4A-10** (45 minutes)

FIFO method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent Units of Production |  |  |
|  |  | *Materials* | *Conversion* |
|  | To complete beginning work in process: |  |  |
|  | Materials: 10,000 units x (100% − 100%) | 0 |  |
|  | Conversion: 10,000 units x (100% − 30%) |  | 7,000 |
|  | Units started and completed during the period (170,000 units started − 20,000 units in ending inventory) | 150,000 | 150,000 |
|  | Ending work in process: |  |  |
|  | Materials: 20,000 units x 100% complete | 20,000 |  |
|  | Conversion: 20,000 units x 40% complete |  | 8,000 |
|  | Equivalent units of production | 170,000 | 165,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per Equivalent Unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost added during the period (a) | $139,400 | $244,200 |
|  | Equivalent units of production (b) | 170,000 | 165,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $0.82 | $1.48 |

3. See the next page.

|  |  |  |
| --- | --- | --- |
| 4. | Cost Reconciliation |  |
|  | Costs to be accounted for: |  |
|  | Cost of beginning work in process inventory ($8,500 + $4,900) | $ 13,400 |
|  | Costs added to production during the period ($139,400 + $244,200) | 383,600 |
|  | Total cost to be accounted for | $397,000 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $ 28,240 |
|  | Costs of units transferred out | 368,760 |
|  | Total cost accounted for | $397,000 |

**Problem 4A-10** (continued)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Costs of Ending Work in Process Inventory and Units Transferred Out | |  |  |
|  |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 20,000 | 8,000 |  |
|  | Cost per equivalent unit | $0.82 | $1.48 |  |
|  | Cost of ending work in process inventory | $16,400 | $11,840 | $28,240 |
|  |  |  |  |  |
|  | Units transferred out: |  |  |  |
|  | Cost in beginning work in process inventory | $8,500 | $4,900 | $13,400 |
|  | Cost to complete the units in beginning work in process inventory: | |  |  |
|  | Equivalent units of production required to complete the beginning inventory | 0 | 7,000 |  |
|  | Cost per equivalent unit | $0.82 | $1.48 |  |
|  | Cost to complete the units in beginning inventory | $0 | $10,360 | $10,360 |
|  | Cost of units started and completed this period: |  |  |  |
|  | Units started and completed this period | 150,000 | 150,000 |  |
|  | Cost per equivalent unit | $0.82 | $1.48 |  |
|  | Cost of units started and completed this period | $123,000 | $222,000 | $345,000 |
|  | Cost of units transferred out |  |  | $368,760 |

**Problem 4A-11** (45 minutes)

FIFO method

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Equivalent Units of Production |  |  |
|  |  | *Materials* | *Conversion* |
|  | To complete beginning work in process: |  |  |
|  | Materials: 20,000 units x (100% − 100%) | 0 |  |
|  | Conversion: 20,000 units x (100% − 75%) |  | 5,000 |
|  | Units started and completed during the period (180,000 units started − 40,000 units in ending inventory) | 140,000 | 140,000 |
|  | Ending work in process: |  |  |
|  | Materials: 40,000 units x 100% complete | 40,000 |  |
|  | Conversion: 40,000 units x 25% complete |  | 10,000 |
|  | Equivalent units of production | 180,000 | 155,000 |

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | Cost per Equivalent Unit |  |  |
|  |  | *Materials* | *Conversion* |
|  | Cost added during the period (a) | $334,800 | $238,700 |
|  | Equivalent units of production (b) | 180,000 | 155,000 |
|  | Cost per equivalent unit (a) ÷ (b) | $1.86 | $1.54 |

3. See the next page.

|  |  |  |
| --- | --- | --- |
| 4. | Cost Reconciliation |  |
|  | Costs to be accounted for: |  |
|  | Cost of beginning work in process inventory ($25,200 + $24,800) | $ 50,000 |
|  | Costs added to production during the period ($334,800 + $238,700) | 573,500 |
|  | Total cost to be accounted for | $623,500 |
|  | Costs accounted for as follows: |  |
|  | Cost of ending work in process inventory | $ 89,800 |
|  | Costs of units transferred out | 533,700 |
|  | Total cost accounted for | $623,500 |

**Problem 4A-11** (continued)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. | Costs of Ending Work in Process Inventory and Units Transferred Out | |  |  |
|  |  | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |
|  | Equivalent units of production | 40,000 | 10,000 |  |
|  | Cost per equivalent unit | $1.86 | $1.54 |  |
|  | Cost of ending work in process inventory | $74,400 | $15,400 | $89,800 |
|  |  |  |  |  |
|  | Units transferred out: |  |  |  |
|  | Cost in beginning work in process inventory | $25,200 | $24,800 | $50,000 |
|  | Cost to complete the units in beginning work in process inventory: | |  |  |
|  | Equivalent units of production required to complete the beginning inventory | 0 | 5,000 |  |
|  | Cost per equivalent unit | $1.86 | $1.54 |  |
|  | Cost to complete the units in beginning inventory | $0 | $7,700 | $7,700 |
|  | Cost of units started and completed this period: |  |  |  |
|  | Units started and completed this period | 140,000 | 140,000 |  |
|  | Cost per equivalent unit | $1.86 | $1.54 |  |
|  | Cost of units started and completed this period | $260,400 | $215,600 | $476,000 |
|  | Cost of units transferred out |  |  | $533,700 |

**Case 4A-12** (60 minutes)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. |  |  |  |  |
|  |  | *Transferred In* | *Materials* | *Conversion* |
|  | To complete beginning work in process: |  |  |  |
|  | Transferred in: 450 units × (100% − 100%) | 0 |  |  |
|  | Materials: 450 units × (100% − 100%) |  | 0 |  |
|  | Conversion: 450 units × (100% − 60%) |  |  | 180 |
|  | Units started and completed during the period (1,950 units started − 600 units in ending inventory) | 1,350 | 1,350 | 1,350 |
|  | Ending work in process: |  |  |  |
|  | Transferred in: 600 units x 100% complete | 600 |  |  |
|  | Materials: 600 units x 0% complete |  | 0 |  |
|  | Conversion: 600 units x 35% complete |  |  | 210 |
|  | Equivalent units of production | 1,950 | 1,350 | 1,740 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | *Transferred In* | *Materials* | *Conversion* |
|  | Cost added during the period (a) | $17,940 | $6,210 | $13,920 |
|  | Equivalent units of production (b) | 1,950 | 1,350 | 1,740 |
|  | Cost per equivalent unit (a) ÷ (b) | $9.20 | $4.60 | $8.00 |

**Case 4A-12** (continued)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | *Transferred In* | *Materials* | *Conversion* | *Total* |
|  | Ending work in process inventory: |  |  |  |  |
|  | Equivalent units of production | 600 | 0 | 210 |  |
|  | Cost per equivalent unit | $9.20 | $4.60 | $8.00 |  |
|  | Cost of ending work in process inventory | $5,520 | $0 | $1,680 | $7,200 |
|  |  |  |  |  |  |
|  | Units transferred out: |  |  |  |  |
|  | Cost in beginning work in process inventory | $4,068 | $1,980 | $2,160 | $8,208 |
|  | Cost to complete units in beginning work in process inventory: |  |  |  |  |
|  | Equivalent units of production required to complete the beginning inventory (see above) | 0 | 0 | 180 |  |
|  | Cost per equivalent unit | $9.20 | $4.60 | $8.00 |  |
|  | Cost to complete units in beginning inventory | $0 | $0 | $1,440 | $1,440 |
|  | Cost of units started and completed this period: |  |  |  |  |
|  | Units started and completed this period | 1,350 | 1,350 | 1,350 |  |
|  | Cost per equivalent unit | $9.20 | $4.60 | $8.00 |  |
|  | Cost of units started and completed this  period | $12,420 | $6,210 | $10,800 | $29,430 |
|  | Cost of units transferred out |  |  |  | $39,078 |

2. The unit cost in the report prepared by the new assistant controller is high because none of the cost incurred during the month was assigned to the units in ending work in process inventory. Because all of the cost was assigned to the units completed and transferred to finished goods, the cost of those units was incorrectly inflated.

Appendix 4B

Service Department Allocations

**Exercise 4B-1** (15 minutes)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Service Departments* | |  | *Operating Departments* | |  |  |
|  | *Admini- stration* | *Facility  Services* |  | *Undergraduate Programs* | *Graduate Programs* |  | *Total* |
| Departmental costs before allocations | $2,400,000 | $1,600,000 |  | $26,800,000 | $5,700,000 |  | $36,500,000 |
| Allocations: |  |  |  |  |  |  |  |
| Administration costs (20/25, 5/25) | (2,400,000) |  |  | 1,920,000 | 480,000 |  |  |
| Facility Services costs (70/100, 30/100)\* |  | (1,600,000) |  | 1,120,000 | 480,000 |  |  |
| Total costs after allocation | $            0 | $            0 |  | $29,840,000 | $6,660,000 |  | $36,500,000 |

\*Based on the space occupied by the two operating departments, which is 100,000 square feet.

**Exercise 4B-2** (15 minutes)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Service  Departments* | |  | *Operating  Departments* | |  |  |
|  | *Admini- stration* | *Janitorial* |  | *Groceries* | *Gifts* |  | *Total* |
| Departmental costs before allocations | $150,000 | $40,000 |  | $2,320,000 | $950,000 |  | $3,460,000 |
| Allocations: |  |  |  |  |  |  |  |
| Administration costs (160/4,000, 3,100/4,000, 740/4,000)\* | (150,000) | 6,000 |  | 116,250 | 27,750 |  |  |
| Janitorial costs (4,000/5,000, 1,000/5,000)† |  | (46,000) |  | 36,800 | 9,200 |  |  |
| Total costs after allocation | $         0 | $       0 |  | $2,473,050 | $986,950 |  | $3,460,000 |

\*Based on employee hours in the other three departments: 160 + 3,100 + 740 = 4,000.

†Based on space occupied by the two operating departments: 4,000 + 1,000 = 5,000.   
Both the Janitorial Department costs of $40,000 and the Administration costs of $6,000 that have been allocated to the Janitorial Department are allocated to the two operating departments.

**Exercise 4B-3** (20 minutes)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Service  Departments | | |  | Operating  Departments | |  |
|  | Admini-stration | Janitorial | Mainte-nance |  | Binding | Printing | Total |
| Costs | $140,000 | $105,000 | $ 48,000 |  | $275,000 | $430,000 | $998,000 |
| Allocations: |  |  |  |  |  |  |  |
| Administration costs1: (35/700, 140/700, 315/700, 210/700) | (140,000) | 7,000 | 28,000 |  | 63,000 | 42,000 |  |
| Janitorial costs2: (20/160, 40/160, 100/160) |  | (112,000) | 14,000 |  | 28,000 | 70,000 |  |
| Maintenance costs3: (30/90, 60/90) |  |  | (90,000) |  | 30,000 | 60,000 |  |
| Total cost after allocations | $        0 | $    0 | $    0 |  | $396,000 | $602,000 | $998,000 |

1Allocation base: 35 employees + 140 employees + 315 employees + 210 employees = 700 employees

2Allocation base: 20,000 square feet + 40,000 square feet + 100,000 square feet = 160,000 square feet

3Allocation base: 30,000 hours + 60,000 hours = 90,000 hours

**Exercise 4B-4** (20 minutes)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Service  Departments | | |  | Operating  Departments | |  |
|  | Admini-stration | Janitorial | Mainte-nance |  | Binding | Printing | Total |
| Overhead costs | $140,000 | $105,000 | $ 48,000 |  | $275,000 | $430,000 | $998,000 |
| Allocation: |  |  |  |  |  |  |  |
| Administration costs1:  (315/525, 210/525) | (140,000) |  |  |  | 84,000 | 56,000 |  |
| Janitorial costs2:  (40/140, 100/140) |  | (105,000) |  |  | 30,000 | 75,000 |  |
| Maintenance costs3:  (30/90, 60/90) |  |  | (48,000) |  | 16,000 | 32,000 |  |
| Total overhead costs after allocations | $    0 | $    0 | $   0 |  | $405,000 | $593,000 | $998,000 |

1Allocation base: 315 employees + 210 employees = 525 employees

2Allocation base: 40,000 square feet + 100,000 square feet = 140,000 square feet

3Allocation base: 30,000 hours + 60,000 hours = 90,000 hours

**Problem 4B-5** (45 minutes)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | House-keeping Services | Food  Services | Admini-strative Services | Laboratory | Radiology | General Hospital |
| Variable costs | $        0 | $193,860 | $158,840 | $243,600 | $304,800 | $ 74,500 |
|  |  |  |  |  |  |  |
| Food Services allocation: (800/71,800; 2,000/71,800, 1,000/71,800; 68,000/71,800) |  | (193,860) | 2,160 | 5,400 | 2,700 | 183,600 |
|  |  |  |  |  |  |  |
| Admin. Services allocation: |  |  |  |  |  |  |
| (14/46; 7/46; 25/46) |  |  | (161,000) | 49,000 | 24,500 | 87,500 |
| Total variable costs | $    0 | $    0 | $    0 | $298,000 | $332,000 | $345,600 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Fixed costs | $87,000 | $107,200 | $90,180 | $162,300 | $215,700 | $401,300 |
|  |  |  |  |  |  |  |
| Housekeeping Services allocation |  |  |  |  |  |  |
| (13/145; 6.5/145; 10/145; 7.5/145; 108/145) | (87,000) | 7,800 | 3,900 | 6,000 | 4,500 | 64,800 |
|  |  |  |  |  |  |  |
| Food Services allocation: |  |  |  |  |  |  |
| (0.8%; 2.4%; 1.6%; 95.2%) |  | (115,000) | 920 | 2,760 | 1,840 | 109,480 |
|  |  |  |  |  |  |  |
| Admin. Services allocation: |  |  |  |  |  |  |
| (30%; 20%; 50%) |  |  | ( 95,000) | 28,500 | 19,000 | 47,500 |
|  |  |  |  |  |  |  |
| Total fixed costs | $   0 | $   0 | $   0 | $199,560 | $241,040 | $623,080 |
|  |  |  |  |  |  |  |
| Total overhead costs | $   0 | $   0 | $   0 | $497,560 | $573,040 | $968,680 |

**Problem 4B-6** (60 minutes)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. |  |  | | | | | |
|  |  | Factory Admini-stration | Custodial Services | Personnel | Mainte-nance | Machining | Assembly |
|  | *Step-down method* |  |  |  |  |  |  |
|  | Operating department costs |  |  |  |  | $376,300 | $175,900 |
|  | Costs to be allocated | $270,000 | $ 68,760 | $ 28,840 | $ 45,200 |  |  |
|  | Allocations: |  |  |  |  |  |  |
|  | Factory Administration  @ $1.80 per labor-hour | (270,000) | 5,400 | 9,000 | 39,600 | 54,000 | 162,000 |
|  | Custodial Services  @ $0.72 per square foot. |  | (74,160) | 2,160 | 7,200 | 50,400 | 14,400 |
|  | Personnel  @ $320 per employee |  |  | (40,000) | 8,000 | 12,800 | 19,200 |
|  | Maintenance  @ $1.25 per machine-hour |  |  |  | (100,000) | 87,500 | 12,500 |
|  | Total overhead after  allocations | $         0 | $         0 | $         0 | $         0 | $581,000 | $384,000 |
|  | Divide by machine-hours |  |  |  |  | ÷ 70,000 |  |
|  | Divide by direct labor-hours |  |  |  |  |  | ÷ 80,000 |
|  | Overhead rate |  |  |  |  | $8.30 | $4.80 |

**Problem 4B-6** (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2. |  |  | | | | | |
|  |  | Factory Admini-stration | Custodial Services | Personnel | Mainte-nance | Machining | Assembly |
|  | *Direct method* |  |  |  |  |  |  |
|  | Operating department costs |  |  |  |  | $376,300 | $175,900 |
|  | Costs to be allocated | $270,000 | $68,760 | $28,840 | $45,200 |  |  |
|  | Allocations: |  |  |  |  |  |  |
|  | Factory Administration (30/120, 90/120) | (270,000) |  |  |  | 67,500 | 202,500 |
|  | Custodial Services (70/90, 20/90) |  | (68,760) |  |  | 53,480 | 15,280 |
|  | Personnel (40/100, 60/100) |  |  | (28,840) |  | 11,536 | 17,304 |
|  | Maintenance (70/80, 10/80) |  |  |  | (45,200) | 39,550 | 5,650 |
|  | Total overhead after allocations | $          0 | $       0 | $       0 | $         0 | $548,366 | $416,634 |
|  | Divide by machine-hours |  |  |  |  | ÷ 70,000 |  |
|  | Divide by direct labor-hours |  |  |  |  |  | ÷ 80,000 |
|  | Overhead rate (rounded) |  |  |  |  | $7.834 | $5.208 |

**Problem 4B-6** (continued)

3. *Plantwide rate*



4. The amount of overhead cost assigned to the job would be:

|  |  |
| --- | --- |
| Step-down method: |  |
| Machining Department: $8.30 per machine-hour × 190 machine-hours | $1,577 |
| Assembly Department: $4.80 per direct labor-hour × 75 direct labor-hours | 360 |
| Total overhead cost | $1,937 |
|  |  |
| Direct method: |  |
| Machining Department: $7.834 per machine-hour × 190 machine-hours | $1,488 |
| Assembly department: $5.208 per direct labor-hour × 75 direct labor-hours | 391 |
| Total overhead cost | $1,879 |
|  |  |
| Plantwide method: |  |
| $9.65 per direct labor-hour × 100 direct labor-hours | $965 |

The plantwide method, which is based on direct labor-hours, assigns very little overhead cost to the job because it requires little labor time. Assuming that Factory Administrative costs really do vary in proportion to labor-hours, Custodial Services with square feet occupied, and so on, the company will tend to undercost such jobs if a plantwide overhead rate is used (and it will tend to overcost jobs requiring large amounts of labor time). The direct method is better than the plantwide method, but the step-down method will generally provide the most accurate overhead rates of the three methods.

**Case 4B-7** (60 minutes)

1. Step-down method:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Personnel | Custodial Services | Mainte-nance | Printing | Binding |
| Total cost before allocations | $360,000 | $141,000 | $201,000 | $525,000 | $373,500 |
| Allocations: |  |  |  |  |  |
| Personnel (15/200, 25/200, 40/200, 120/200)1 | (360,000) | 27,000 | 45,000 | 72,000 | 216,000 |
| Custodial services  (20/140, 80/140, 40/140)2 |  | (168,000) | 24,000 | 96,000 | 48,000 |
| Maintenance (150/180, 30/180)3 |  |  | (270,000) | 225,000 | 45,000 |
| Total overhead cost after allocations | $    0 | $    0 | $    0 | $918,000 | $682,500 |
| Divide by machine-hours |  |  |  | ÷150,000 |  |
| Divide by direct labor-hours |  |  |  |  | ÷175,000 |
| Predetermined overhead rate |  |  |  | $6.12 | $3.90 |

|  |  |
| --- | --- |
| 1 | Based on 15 + 25 + 40 + 120 = 200 employees |
| 2 | Based on 20,000 + 80,000 + 40,000 = 140,000 square feet |
| 3 | Based on 150,000 + 30,000 = 180,000 machine-hours |

**Case 4B-7** (continued)

2. Direct method:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Personnel | Custodial Services | Mainte-nance | Printing | Binding |
| Total costs before allocations | $360,000 | $141,000 | $201,000 | $525,000 | $373,500 |
| Allocations: |  |  |  |  |  |
| Personnel (40/160, 120/160)1 | (360,000) |  |  | 90,000 | 270,000 |
| Custodial Services (80/120, 40/120)2 |  | (141,000) |  | 94,000 | 47,000 |
| Maintenance (150/180, 30/180)3 |  |  | (201,000) | 167,500 | 33,500 |
| Total overhead cost after allocations | $    0 | $    0 | $    0 | $876,500 | $724,000 |
| Divide by machine-hours |  |  |  | ÷150,000 |  |
| Divide by direct labor-hours |  |  |  |  | ÷175,000 |
| Predetermined overhead rate |  |  |  | $5.84 | $4.14 |

|  |  |
| --- | --- |
| 1 | Based on 40 + 120 = 160 employees |
| 2 | Based on 80,000 + 40,000 = 120,000 square feet |
| 3 | Based on 150,000 + 30,000 = 180,000 machine-hours |

**Case 4B-7** (continued)

3. a. The amount of overhead cost assigned to the job would be:

|  |  |
| --- | --- |
| *Step-down method*: |  |
| Printing department: |  |
| $6.12 per machine-hour × 15,400 machine-hours | $ 94,248 |
| Binding department: |  |
| $3.90 per direct labor-hour × 2,000 direct labor-hours | 7,800 |
| Total overhead cost | $102,048 |
|  |  |
| *Direct method*: |  |
| Printing department: |  |
| $5.84 per machine-hour × 15,400 machine-hours | $ 89,936 |
| Binding department: |  |
| $4.14 per direct labor-hour × 2,000 direct labor-hours | 8,280 |
| Total overhead cost | $ 98,216 |

b. The step-down method provides a better basis for computing predetermined overhead rates than the direct method because it gives recognition to services provided between service departments. If this interdepartmental service is not recognized, then either too much or too little of a service department’s costs may be allocated to a producing department. The result will be an inaccuracy in the producing department’s predetermined overhead rate.

Inaccuracies in the predetermined overhead rate can cause corresponding inaccuracies in bids for jobs. Because the direct method in this case understates the overhead rate in the Printing Department and overstates the overhead rate in the Binding Department, it is not surprising that the company tends to bid low on jobs requiring a lot of printing work and tends to bid too high on jobs that require a lot of binding work.