Business Environment & Concepts

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Cost Accounting & Measurement

The following is an excerpt from the Roger CPA Review Text books, which are included with purchase of the Roger CPA Review course. Written and updated by your instructor, Roger Philipp, CPA, the textbooks are the perfect companion to our dynamic lectures.
Cost Accounting & Measurement

Standard Costing

Standard costs are predetermined target costs which should be attainable under efficient conditions. Standard costs are used to aid in the budget process, pinpoint trouble areas, and evaluate performance.

In setting internal goals for the efficient production of inventory, companies establish standards for the components that determine direct materials, direct labor, and overhead. At the end of the period, these standards are compared with actual results in order to determine variances. The standards include:

- **Standard cost** – The unit purchase price of direct materials. Differences between standard cost and actual cost produce **direct materials price variances**.

- **Standard quantity** – The number of units of direct materials used to produce each unit of inventory. Differences between standard quantity allowed and actual quantity used produce **direct materials usage variances**.

- **Standard rate** – The hourly rate of pay for direct labor. Differences between standard rate of pay and actual rate of pay produce **direct labor rate variances**.

- **Standard hours** – The number of hours of direct labor used to produce each unit of inventory. Differences between standard hours allowed and actual hours used produce **direct labor efficiency variances**.

- **Predetermined overhead rate** – The amount of overhead to apply (usually based on direct labor hours). Differences between applied overhead and actual overhead produce **overhead variances**. There are several different ways to compute overhead variances.

For example, assume a company manufactures collectible life-size figurines, which are sold for $1,000 each. Typically, a single figurine is completed in a day, and the **standard** costs involved in the manufacture of each figurine are:

- **Direct materials** – 20 pounds of clay at $5 per pound
- **Direct labor** – 5 hours of labor at $10 per hour
- **Overhead** – Applied at $19 per direct labor hour
The estimated cost of manufacturing on a normal day (one figurine) is:

<table>
<thead>
<tr>
<th>Item</th>
<th>Normal</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct labor</td>
<td>$50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead</td>
<td>$95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost</td>
<td>$245</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assume that, on a particular day, the company manufactures two figurines, and incurs the following actual costs:

- Direct materials – 36 pounds of clay at $4 per pound
- Direct labor – 12 hours of labor at $11 per hour
- Overhead - $255

It is not appropriate to compare the normal costs with the actual costs, since the normal costs are based on expected production (one figurine). Instead, the actual costs are compared with standard costs allowed based on actual production (two figurines), as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Normal</th>
<th>Standard</th>
<th>Actual</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>100</td>
<td>200</td>
<td>144</td>
<td>56 F</td>
</tr>
<tr>
<td>Direct labor</td>
<td>50</td>
<td>100</td>
<td>132</td>
<td>32 U</td>
</tr>
<tr>
<td>Overhead</td>
<td>95</td>
<td>190</td>
<td>255</td>
<td>65 U</td>
</tr>
<tr>
<td>Total cost</td>
<td>245</td>
<td>490</td>
<td>531</td>
<td>41 U</td>
</tr>
</tbody>
</table>

The variances that result from actual costs being lower than standard costs are identified as favorable and those resulting from actual costs being higher are unfavorable.

The variances identified in the right column are not the ones usually requested on the exam. Instead, the 4 standards related to the direct costs each result in a variance:
Variance Analysis (SAD → Standard – Actual = Difference)

<table>
<thead>
<tr>
<th></th>
<th>DM Price Variance =</th>
<th>AQ(SP – AP)</th>
<th>While in the factory, can I control the quantity used? YES (use Actual quantity)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM Usage Variance =</td>
<td>SP(SQ – AQ)</td>
<td>While in the factory, can I control the price? NO use Standard price</td>
</tr>
<tr>
<td></td>
<td>DL Rate Variance =</td>
<td>AH(SR – AR)</td>
<td>Can I control the hours worked? YES</td>
</tr>
<tr>
<td></td>
<td>DL Efficiency</td>
<td>SR(SH – AH)</td>
<td>Can I control the pay rate while in the factory? NO</td>
</tr>
</tbody>
</table>

SQ & SH = Standard allowed for actual production

The direct materials price variance (DMPV) is the difference resulting from the actual cost per unit (AC) of the direct materials ($4 per pound) being different from the standard cost (SC) per unit ($5 per pound). It is based on the total quantity actually purchased (AQP). Assuming that the company maintains no inventories, it needs to purchase 36 pounds (if purchases are different from usage, the exam question will indicate that the calculation should be based on purchases). The variance is:

\[ \text{DMPV} = \text{AQP} \times (\text{SC} – \text{AC}) = 36 \times (5 – 4) = 36 \times 1 = 36 \text{ F} \]

The direct materials usage variance (DMUV) is the difference resulting from the actual quantity used (AQU) of direct materials (36 pounds) being different from the standard quantity allowed (SQA) based on production (40 pounds for 2 figurines). It is based on the standard cost per unit, since there is already a separate price variance to take into account the effect of the actual cost per unit being different. The variance is:

\[ \text{DMUV} = \text{SC} \times (\text{SQA} – \text{AQU}) = 5 \times (40 – 36) = 5 \times 4 = 20 \text{ F} \]

The direct labor rate variance (DLRV) is the difference resulting from the actual rate of pay (AR) for the direct laborers ($11 per hour) being different from the standard rate of pay (SR) for those laborers ($10 per hour). The total difference is multiplied by the actual number of hours (AH) that the laborers worked (12 hours). The variance is:

\[ \text{DLRV} = \text{AH} \times (\text{SR} – \text{AR}) = 12 \times (10 – 11) = 12 \times -1 = 12 \text{ U} \]

The direct labor efficiency variance (DLEV) is the difference resulting from the actual hours worked (12 hours) being different from the standard hours allowed (SH) based on actual production (10 hours for two figurines). The total difference is multiplied by the standard rate of pay, since there is already a separate variance that takes into account the effect of the actual rate of pay being different. The variance is:

\[ \text{DLEV} = \text{SR} \times (\text{SH} – \text{AH}) = 10 \times (10 – 12) = 10 \times -2 = 20 \text{ U} \]

Notice that the sum of the two unfavorable variances is $32 (DLRV $12 + DLEV $20), equal to the total direct labor variance.
Material Variances

Labour Variances
The computational form of the labour variances is similar to the calculation of material variances — except that the price being used changes from price per pound of material to price (rate) per hour of labor, and the quantity changes from pounds, yards, etc., to hours. Therefore, the diagrams are the same, although the terminology differs.

Overhead Variances
When companies apply a standard cost system to overhead, the amount of overhead applied will be determined on the basis of the standard amount of the allocation base that should have been used in the production process based on the number of units produced. If overhead is allocated, for example, on the basis of direct labor hours, overhead applied (OA) can be calculated as follows:

\[ OA = SDLH \times POHR \]

In the formula above, POHR is the predetermined overhead rate including both the variable and fixed components.

Many companies will further analyze overhead using a 2-variance, 3-variance, or 4-variance approach. The most common is the 3-variance approach, dividing the total variance into a Spending variance, an Efficiency variance, and a Volume variance.

The overhead Spending variance (OSV) measures whether the amount of variable overhead being spent per hour is more or less than the amount expected and whether the amount of fixed overhead incurred is more or less than the budgeted amount. The overhead spending variance is the difference between the amount of overhead that would be budgeted based on actual hours worked and the amount actually spent on overhead. It is calculated as follows:

\[ OSV = (ADLH \times PVOHR + Budged \text{ fixed overhead}) - \text{Actual overhead} \]

In the above formula, if OSV is a positive number, the variance is favorable. The overhead spending variance can also be segregated into a fixed and a variable component.

The overhead Efficiency variance (OEV) is similar to the labor efficiency variance. It measures whether the units manufactured required more or less than the number of hours expected. Since variable overhead is incurred with each direct labor hour spent, the amount can be calculated as follows:
\[ OEV = PVOHR \times (SDLH - ADLH) \]

In the formula above, PVOHR is the predetermined variable overhead rate. If OEV is a positive number, the variance is favorable.

The \textit{overhead Production Volume variance} (OVV) is the one over which the manufacturing department has the least control. This is due to the fact that the variance measures whether the company produced as many units as expected. The amount can be calculated as follows:

\[ OVV = (SDLH \times PFOHR) - \text{Budgeted fixed overhead} \]

In the formula above, PFOHR is the predetermined fixed overhead rate which is calculated by dividing the budgeted fixed overhead by the standard direct labor hours based on expected production. When more units were produced than were anticipated, the amount of overhead applied will exceed the budgeted amount resulting in a favorable volume variance.

The total of the Spending variance, the Efficiency variance, and the Volume variance is the total overhead variance.

\textbf{Budget to Actual comparison}

For example:

\textbf{Budgeted overhead costs:}
- Fixed Rent = $400,000 ($4 \times 100,000 \text{ hrs})
- Variable Electricity = $1 \times 100,000 \text{ hrs}

\[ \text{FBE} = 4(100,000 \text{ hrs}) + 1 \times (X) \] (Note: \( X \) = Actual production x act hrs or Actual production x std hrs allowed for actual production)

\textbf{Actual costs:}
- Fixed Rent = $390,000
- Variable Electricity = $1.01 (97,000 hrs)

\begin{align*}
\text{Budget} & \text{ At Budget} \\
50,000 \text{ units(2hrs)} &= 100,000 \text{ hrs} \\
48,000 (2.02) &= 97,000 \\
48,000 (2) &= 96,000 \text{ Standard allowed for Actual production}
\end{align*}

\textbf{Mfg O/H (4 numbers + 3 variances = SEV\text{en})}
- Budgeted Overhead = $400,000 ($4 \times 100,000 \text{ hrs})
- Actual Hours = 97,000

\begin{table}
\begin{tabular}{|c|c|c|c|}
\hline
 & Actual & FBE @ Actual & FBE @ Standard & Applied \\
\hline
Fixed O/H & 390,000 & 400,000 & 400,000 & 4(96,000) \\
Variable O/H & 1.01(97,000) & 1(97,000) & 1(96,000) & 1(96,000) \\
\hline
\end{tabular}
\end{table}

\begin{align*}
\text{Spending} & \text{ Efficiency} \\
\text{Volume / Non-controllable}
\end{align*}
### 2 costing systems

**Job-order costing** is a system for allocating costs to groups of unique products. It is applicable to the production of customer-specified products. Each job becomes a cost center for which costs are accumulated. Job order costing is generally used when units are relatively expensive and when costs can be identified to specific units or batches of units.

- **Job order costing** – expensive, heterogeneous – cost based per Job.
Process costing, in contrast to job-order costing, is applicable to a continuous process of production of the same or similar goods. Since the product is uniform, there is no need to determine the costs of different groups of products and each processing department becomes a cost center. Process costing is generally used when units are relatively inexpensive and when it is difficult to trace costs to specific units being produced, such as when units are mass-produced in large quantities.

- **Process costing** – inexpensive, homogeneous - costs per Period.
  - Equivalent “whole” units \( (80 \times \frac{3}{4} \text{ cc} = 60 \text{ whole units}) \) (cc = Conversion Cost)
    - **Weighted average method** (beginning + started)
    - **FIFO** (beginning first/ then started)

There are two methods of applying process costing to production. These are the weighted average method and FIFO.

**Weighted Average**
Under the weighted average approach, equivalent production for a period will include units that are **completed** during the period, considered whole units as to all costs, and units in process at the end of the period. The ending work-in-process will be converted into equivalent units based on the level of completion.

Total equivalent production will be divided into costs for the period to determine an average cost per equivalent unit. The costs included will be the costs associated with beginning inventory and the costs incurred during the period.

**FIFO**
Under the FIFO approach, equivalent production for a period will include the units that are **started and completed** during the period, considered whole units as to all costs. Both beginning and ending work-in-process inventory will be converted into equivalent whole units.

- For beginning inventory, the portion of the work that needed to be completed during the period will be multiplied by the number of units to determine equivalent production.
- For ending inventory, the percentage of completion will be multiplied by the number of units to determine equivalent production.

Total equivalent production will be divided into costs for the period to determine an average cost per equivalent unit. The costs included, however, will only be those costs that were incurred during the period.

**Comparing Weighted Average to FIFO**
The difference between weighted average and FIFO is the handling of beginning work-in-process inventory. When there is no beginning inventory, both will have the same result. When there is a beginning work-in-process inventory, the weighted average approach will yield a number of equivalent units that will be equal to or greater than equivalent production under FIFO.

- When costs are incurred at the end of the process, or at some point in the process that the beginning inventory had not yet reached, equivalent production will be the same under both approaches.
• When costs are incurred uniformly during the process, at the beginning of the process, or at some point in the process that the beginning inventory had already reached, equivalent production under weighted average would be greater than FIFO.

**Weighted Average**

\[ \frac{TC}{\text{Total Equivalent Units}} = \text{Cost per Unit} \]

**FIFO**

\[ \frac{\text{Costs this Period}}{\text{Units Worked on this period}} = \text{Cost per Unit} \]

**Equivalent Production**

One significant aspect of process costing is the computation of equivalent units. The objective is to analyze the period’s production, including units completed and units partially completed, and determine the number of whole units the production is equivalent to.

The calculation of equivalent production will depend on the point in time at which costs are incurred.

• When costs are incurred at the beginning of the process, partially completed units will be considered equivalent to whole units as soon as they are started.

• When costs are incurred at a specific time during the process, such as when units are 40% complete, partially completed units will be considered equivalent to nothing until they reach that point and equivalent to whole units when that point is reached.

• When costs are incurred at the end of the process, partially completed units will be considered equivalent to nothing until completed, at which time they will be equivalent to whole units.

• When costs are incurred evenly throughout the process, the percentage of completion will be multiplied by the number of units in process to determine the number of equivalent whole units.

When a company has more than one manufacturing department, the costs are assigned to work-in-process and to goods transferred to the next department. In the subsequent department, the units transferred from a previous department are considered similar to a raw material that is added to the production cycle at the beginning of the process.

**Example**: The Alexes Co. is the first of a two-stage production process. The following information concerns the conversion costs in May 20X3:

<table>
<thead>
<tr>
<th>Units</th>
<th>Conversion costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning work in process (60% complete)</td>
<td>30</td>
</tr>
<tr>
<td>Units started</td>
<td>60</td>
</tr>
<tr>
<td>Spoilage — normal</td>
<td>0</td>
</tr>
<tr>
<td>Units completed and transferred</td>
<td>50</td>
</tr>
<tr>
<td>Ending work in process (80% complete)</td>
<td>40</td>
</tr>
</tbody>
</table>

Using the Weighted-average and the FIFO methods, calculate equivalent whole units, the cost of goods completed and transferred, and ending inventory.
Weighted Average (Total Costs/Total Equivalent Whole units)

<table>
<thead>
<tr>
<th>units</th>
<th>% complete</th>
<th>Equivalent whole units</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beg. Units</td>
<td>30</td>
<td>60%</td>
<td>$68</td>
</tr>
<tr>
<td>Started</td>
<td>60</td>
<td></td>
<td>$96</td>
</tr>
<tr>
<td>Units to acct for</td>
<td>90</td>
<td></td>
<td>$164</td>
</tr>
<tr>
<td>Completed</td>
<td>50</td>
<td>100%</td>
<td>$100</td>
</tr>
<tr>
<td>Spoilage</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td>40</td>
<td>80%</td>
<td>$64</td>
</tr>
</tbody>
</table>

Units to acct for 90

W/A → What did you finish? Do not care where it came from.

TC/EU → EU = 50 completed + 40(0.8) = 82 equiv. Whole units

= $164/82 = $2 per unit

50 x $2 = $100 (COG completed)

32 x $2 = $64 (Ending Inventory)

$164

FIFO (Costs incurred THIS PERIOD/Units actually worked on THIS PERIOD)

<table>
<thead>
<tr>
<th>units</th>
<th>% complete</th>
<th>Equivalent whole units</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beg. Units</td>
<td>30</td>
<td>60%</td>
<td>$68</td>
</tr>
<tr>
<td>Started</td>
<td>60</td>
<td></td>
<td>$96</td>
</tr>
<tr>
<td>Units to acct for</td>
<td>90</td>
<td></td>
<td>$164</td>
</tr>
</tbody>
</table>
| Completed | 50 | 30 x 40%=12
20 x 100%=20 | 12 x $1.5 = 18
20 x $1.5 = 30
+ started 68
$48
$116 Cogc |
| Spoilage | 0 | | |
| End | 40 | 80% | $48 |

Units to acct for 90

FIFO → What did you finish this period?

Costs this period/Units Worked on this period

Units Worked on this period =

30 (from beginning)(.40) = 12 + 20(100%) = 32+ ending 40(.80) = 64 equiv whole units.

= $96/64 = $1.5 x 32 = $48+ 68 = 116 (COG completed)

$1.5 x 32 = 48 (Ending Inventory)

$164.00

What did it take to make it 100% complete? Came in with 60%, so 40%.
When a company produces large quantities of identical goods, it will often use **process costing** to determine the average cost per unit of products. When using this approach, costs are accumulated in work-in-process until the end of the period, and then a calculation is made of the cost per equivalent unit of products completed and incomplete at the end of the period.

For example, assume that a company had work-in-process at the beginning of the month of $30, associated with 2 units that were 50% complete at the time. During the month, it spent $150 and started an additional 8 units. At the end of the month, work-in-process consisted of 4 units that were 75% complete. Assume there was no spoilage in the production process.

The total cost in work-in-process before allocating is $30 + $150 = $180. With 2 units at the start and 8 more begun during the month, there were 10 units to account for at the end of the month. Since 4 were in process, 6 must have been completed. The **equivalent units** include the 6 that were completed and 4 x 75% = 3 equivalent units for the ending work-in-process, for a total 9 equivalent units. The costs of $180 are allocated over 9 equivalent units at $20 per equivalent unit. Ending work-in-process is $20 x 3 equivalent units, or $60, and the remaining $120 must represent the costs associated with the 6 units completed and transferred to finished goods. To summarize:

<table>
<thead>
<tr>
<th>Units</th>
<th>Costs</th>
<th>Cost / EU</th>
<th>Allocation @ $20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beg WIP (50%)</td>
<td>2</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Added</td>
<td>8</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>To account for</td>
<td>10</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>End WIP (75%)</td>
<td>4</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>Completed</td>
<td>6</td>
<td>6</td>
<td>120</td>
</tr>
<tr>
<td>Accounted for</td>
<td>10</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Cost / EU</td>
<td>10</td>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

For costs added at the beginning of a process, the equivalent units are the same for work-in-process as they are for completed units. For example, if raw materials are added at the beginning of the process, the 4 units in process at the end of the month already have all the raw materials, and are assigned 4 equivalent units instead of 3.

**Joint Product Costing**

Joint products are two or more products produced together up to a split-off point where they become separately identifiable. They cannot be produced by themselves. When more than one product is being produced, certain costs are associated with the production of more than one product, and are known as **joint product costs**. These costs are allocated to the different products using an appropriate method. One method is called **Units of volume of output**, but this method is not as frequently tested. The most popular is the **relative sales value at split**-
off approach. The total sales value of the products involved is determined, and is reduced by separate costs incurred in the manufacture of each product after the split from the joint process, to determine the approximate value of each product at the point the joint process ended. This is used to allocate the joint costs. Under the Relative Sales Value Method:

- The **sales value** of each joint product is determined by multiplying the amount produced by the sales price per unit.
- The sales value is reduced by **separable costs**. Separable costs are the costs incurred after the mutual manufacturing process is complete. They are the costs necessary to prepare a joint product to be sold and may not be incurred for each joint product.
- The resulting reduced amount is considered the **relative sales value** of the joint product at split-off point. The split-off point is that point, at the conclusion of the joint manufacturing process, when individual joint products can be identified.
- The relative sales values for each of the joint products are combined to obtain a total amount.

The joint product costs to be allocated to a specific joint product will be determined by the following formula:

\[
\text{Relative sales value of product/Total of relative sales values } \times \text{Joint product costs}
\]

### Joint Costs

- **A** → $50,000 + $30,000 = $80,000
  - If work on it more (put in an extra cost of $30,000), it could be worth $80,000

- **B** → $30,000 + $30,000 = $60,000
  - If work on it more (put in an extra cost of $30,000), it could be worth $60,000

- **Z** → 4 + 1 = 5
  - Can use to offset cost or add to revenue
  - $54,000 – $4,000 = $50,000 Costs to allocate.
For example, assume a company produces a standard and deluxe version of a product. The standard version is produced starting in department A and finishing in department B. The deluxe version is produced starting in department A and finishing in department C. The total sales are $30 of the standard version and $50 of the deluxe. The costs incurred are $10 in department A, $6 in department B, and $34 in department C. While it is not a problem to determine total gross profit for the company, a breakdown by product line is more difficult, as the following schedule shows:

<table>
<thead>
<tr>
<th></th>
<th>STANDARD</th>
<th>DELUXE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>30</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Separate costs</td>
<td>6</td>
<td>34</td>
<td>40</td>
</tr>
<tr>
<td>Sales value at split-off</td>
<td>24</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>Joint costs</td>
<td>?</td>
<td>?</td>
<td>10</td>
</tr>
<tr>
<td>Gross profit</td>
<td>?</td>
<td>?</td>
<td>30</td>
</tr>
</tbody>
</table>

Using the sales value at split-off approach, the standard version is allocated $24 / $40 = 60% of the joint costs of $10, or $6, and the deluxe version is allocated $16 / $40 = 40% of $10, or $4.

If one of the products resulting from production is considered a by-product, and is only being produced as an incidental result of production of the main product or products, then the net realizable value of the by-product is simply subtracted from the cost of production of the main. For example, oil refining involves the removal of impurities from crude oil. The impurities are actually useful in the manufacture of glue, so oil companies sell them and subtract the net proceeds (sales price less costs of disposal) from the cost of refining oil.

If there are two or more main products in addition to a by-product, the net realizable value of the by-product is subtracted from the joint product costs, which are then allocated to the main products based on relative sales value at split-off approach or a comparable method. Sometimes, rather than recognizing by-product market value as a reduction of production costs, it is sometimes recognized when sold and disclosed as either ordinary income, other income or as a contra to cost of sales.
Class Questions

1. Carr Co. had an unfavorable materials usage variance of $900. What amounts of this variance should be charged to each department?

<table>
<thead>
<tr>
<th>Purchasing</th>
<th>Warehousing</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $0</td>
<td>$0</td>
<td>$900</td>
</tr>
<tr>
<td>b. $0</td>
<td>$900</td>
<td>$0</td>
</tr>
<tr>
<td>c. $300</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>d. $900</td>
<td>$0</td>
<td>$0</td>
</tr>
</tbody>
</table>

2. The standard direct material cost to produce a unit of Lem is four meters of material at $2.50 per meter. During May 20X9, 4,200 meters of material costing $10,080 were purchased and used to produce 1,000 units of Lem. What was the material price variance for May 20X9?

   a. $400 favorable.
   b. $420 favorable.
   c. $80 unfavorable.
   d. $480 unfavorable.

3. Which of the following standard costing variances would be least controllable by a production supervisor?

   a. Overhead volume.
   b. Overhead efficiency.
   c. Labor efficiency.
   d. Material usage.

4. Under the 2-variance method for analyzing overhead, which of the following variances consists of both variable and fixed overhead elements?

<table>
<thead>
<tr>
<th>Controllable (budget)</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance</td>
<td>Variance</td>
</tr>
<tr>
<td>a. Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>b. Yes</td>
<td>No</td>
</tr>
<tr>
<td>c. No</td>
<td>No</td>
</tr>
<tr>
<td>d. No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

5. The following information pertains to Roe Co.’s 20X3 manufacturing operations:

   - Standard direct manufacturing labor hours per unit: 2
   - Actual direct manufacturing labor hours: 10,500
   - Number of units produced: 5,000
   - Standard variable overhead per standard direct manufacturing labor hour: $3
   - Actual variable overhead: $28,000

   Roe’s 20X3 unfavorable variable overhead efficiency variance was

   a. $0
   b. $1,500
   c. $2,000
   d. $3,500
6. In a process cost system, the application of factory overhead usually would be recorded as an increase in
   a. Finished goods inventory control.
   b. Factory overhead control.
   c. Cost of goods sold.
   d. Work in process inventory control.

7. The Forming Department is the first of a two-stage production process. Spoilage is identified when the units have completed the Forming process. Costs of spoiled units are assigned to units completed and transferred to the second department in the period spoilage is identified. The following information concerns Forming’s conversion costs in May 20X3:

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Conversion costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning work in process (50% complete)</td>
<td>2,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Units started during May</td>
<td>8,000</td>
<td>75,500</td>
</tr>
<tr>
<td>Spoilage—normal</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Units completed and transferred</td>
<td>7,000</td>
<td></td>
</tr>
<tr>
<td>Ending work in process (80% complete)</td>
<td>2,500</td>
<td></td>
</tr>
</tbody>
</table>

Using the weighted-average method, what was Forming’s conversion cost transferred to the second production department?
   a. $59,850
   b. $64,125
   c. $67,500
   d. $71,250

Question numbers 8 and 9 are based on the following:

8. Kerner Manufacturing uses a process cost system to manufacture laptop computers. The following information summarizes operations relating to laptop computer model #KJK20 during the quarter ending March 31:

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Direct Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in process inventory, January 1</td>
<td>100</td>
<td>$50,000</td>
</tr>
<tr>
<td>Started during the quarter</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Completed during the quarter</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Work-in-process inventory, March 31</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Costs added during the quarter</td>
<td></td>
<td>$720,000</td>
</tr>
</tbody>
</table>

Beginning work in process inventory was 50% complete for direct materials. Ending work in process inventory was 75% complete for direct materials. What were the equivalent units of production with regard to materials for March using the FIFO method?
   a. 450
   b. 500
   c. 550
   d. 600

9. What is the total value of material costs in ending work in process inventory using the FIFO unit cost, inventory valuation method?
   a. $183,000
   b. $194,000
c. $210,000
d. $216,000

10. In computing the current period’s manufacturing cost per equivalent unit, the FIFO method of process costing considers current period costs
   a. Only.
   b. Plus cost of beginning work in process inventory.
   c. Less cost of beginning work in process inventory.
   d. Plus cost of ending work in process inventory.

11. Lane Co. produces main products Kul and Wu. The process also yields by-product Zef. Net realizable value of by-product Zef is subtracted from joint production cost of Kul and Wu. The following information pertains to production in July 20X3 at a joint cost of $54,000:

<table>
<thead>
<tr>
<th>Product</th>
<th>Units Produced</th>
<th>Market value after split-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kul</td>
<td>1,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Wu</td>
<td>1,500</td>
<td>40,000</td>
</tr>
<tr>
<td>Zef</td>
<td>500</td>
<td>7,000</td>
</tr>
</tbody>
</table>

   If Lane uses the net realizable value method for allocating joint cost, how much of the joint cost should be allocated to product Kul?
   a. $18,800
   b. $20,000
   c. $26,667
   d. $27,342

12. The diagram below represents the production and sales relationships of joint products P and Q. Joint costs are incurred until split-off, then separable costs are incurred in refining each product. Market values of P and Q at split-off are used to allocate joint costs.

   If the market value of P at split-off increases and all other costs and selling prices remain unchanged, then the gross margin of
   
   \[
   \frac{P}{Q}
   \]
   a. Increases    b. Increases
   c. Decreases    d. Decreases
   e. Decreases    f. Increases
Class Solutions

1. (a) The materials usage variance measures the actual amount of materials used versus the standard amount that should have been used given the level of output. Normally the only department with controls over usage of materials is the manufacturing department. The purchasing department normally controls the cost of materials purchased, and not the amounts used (materials price variance). The warehouse department has little or no control over the materials used.

2. (b) The requirement is to determine Lem’s material price variance for May. The direct materials price variance is the difference between actual unit prices and standard unit prices multiplied by the actual quantity, as shown below.

\[
\begin{array}{c}
\text{AQ} \times \text{AP} \\
\$10,080 \\
\text{AQ} \times \text{SP} \\
\$10,500 \\
\hline
\text{Material price variance, $420F}
\end{array}
\]

The $420 price variance is favorable because the actual purchase price of the material was lower than the standard price. Since the material was purchased for only $2.40 per meter ($10,080 cost ÷ 4,200m), Lem saved $.10 per meter compared to the standard price, for a total price savings of $420 (4,200m × $.10/m). Note that the standard quantity of materials is ignored in order to isolate these price differences; differences in quantity are addressed by the materials usage variance.

3. (a) The requirement is to determine the standard costing variance which would be least controllable by a production supervisor. The overhead output level (volume) variance arises because the actual production volume level achieved usually does not coincide with the production level used as a denominator volume for calculating a budgeted overhead application rate. The overhead output level variance results from treating a fixed cost as if it were a variable cost. Answers (b), (c), and (d) are incorrect because all of these variances arise when the quantity of actual inputs used differs from the quantity of inputs that should have been used. A production manager would have more control over inputs to production than over the determination of the denominator volume.

4. (b) The requirement is to determine which of the variances given consist of both variable and fixed overhead elements under a two-variance method. As shown in the diagram below, the controllable or budget variance includes both variable and fixed overhead elements, because the actual overhead amount, the first vertical line, includes both elements as does the budgeted overhead amount, the middle vertical line.

The output level (volume) variance includes only the variance of fixed overhead, because the SQ x SVR is common to both amounts (i.e., it is included in the STR) used to determine the output level variance. The difference in the two amounts is the output level variance. It arises because the middle vertical line includes the total amount of budgeted fixed overhead, whereas the third vertical line includes the amount of fixed overhead applied using a per unit
amount based on normal volume or level of activity. Whenever the standard activity level based on good output (SQ) is different than the normal activity level, a volume variance will arise. Therefore, both variable and fixed overhead elements are included in the controllable variance but not in the output level variance.

5. (b) The solutions approach to compute the variable overhead efficiency variance is to set up a diagram as follows:

\[
\begin{align*}
\text{AH} \times \text{SR} &= (10,500 \times 3) \\
&= 31,500 \\
\text{SH} \times \text{SR} &= (2 \times 5,000) \times 3 \\
&= 30,000 \\
\text{Variable overhead efficiency variance} &= 31,500 - 30,000 \\
&= 1,500 \text{ unfavorable}
\end{align*}
\]

6. (d) The application of factory overhead would increase the work in process inventory control account. In addition, the work in process account would be increased for other product costs (direct manufacturing labor and direct material). Only costs of completed products increase finished goods inventory control. Factory overhead control is increased by actual factory overhead costs incurred. Cost of goods sold is increased by the product costs of the finished units sold.

7. (c) The requirement is to calculate the amount of conversion cost transferred by Forming to the next production department. First, the physical flow of units must be determined.

Next, equivalent units of production (EUP) must be calculated, in this case using the weighted-average (WA) method. The WA computations of EUP and cost per equivalent unit include both work done last period on the current period’s BWIP and all work done in the current period on units completed and on EWIP. Forming’s EWIP is 80% complete. Spoiled units must be accounted for separately because Forming adds their cost only to the cost of units transferred. To ignore spoiled units would result in the same total cost being allocated to 500 fewer units, thus spreading spoilage costs over all work done during the period, including EWIP.

<table>
<thead>
<tr>
<th></th>
<th>Total units</th>
<th>Equivalent units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Started and completed</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Spoilage—normal</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>EWIP (80% complete)</td>
<td>2,500</td>
<td>2,000*</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>9,500</td>
</tr>
</tbody>
</table>

*2,500 units x 80% completion

Since conversion costs total $85,500 for the period ($10,000 for BWIP + $75,500 for units started), Forming’s conversion cost per equivalent unit is $9.00 ($85,500 ÷ 9,500 EUP).
These costs are assigned as follows:

- Good units completed (7,000 x $9) = $63,000
- Spoiled units (500 x $9) = 4,500
- Conversion cost transferred = $67,500
- EWIP (2,000 x $9) = 18,000
- Total costs accounted for = $85,500

Therefore, $67,500 was transferred to the second department.

8. (b) Equivalent units of production are calculated as follows

<table>
<thead>
<tr>
<th>Completed units</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus: Equivalent units in ending inventory (200 x 75%)</td>
<td>150</td>
</tr>
<tr>
<td>Less: Equivalent units in beginning inventory (100 x 50%)</td>
<td>(50)</td>
</tr>
<tr>
<td>Equivalent units of production</td>
<td>500</td>
</tr>
</tbody>
</table>

9. (d) Material costs in ending work in process inventory is calculated as $216,000 = 150 (equivalent units in ending inventory) x $1,440 ($720,000/500) per equivalent unit. Equivalent units of production are calculated as: 500 = 400 completed units + 150 (200 x 75%) equivalent units in ending inventory – 50 (100 x 50%) equivalent units in beginning inventory.

10. (a) The FIFO method determines equivalent units of production (EUP) based on the work done in the current period only. The work done in the current period can be dichotomized as: (1) the work necessary to complete beginning work in process (BWIP), and (2) the work performed on the units started in the current period.

11. (c) The requirement is to determine how to allocate joint cost using the net realizable value (NRV) method when a by-product is involved. NRV is the predicted selling price in the ordinary course of business less reasonably predictable costs of completion and disposal. The joint cost of $54,000 is reduced by the NRV of the by-product ($4,000) to get the allocable joint cost ($50,000). Sales value at split off is $50,000 - $10,000 = $40,000 for Kul and $40,000 - $5,000 = $35,000 for Wu. The computation is

<table>
<thead>
<tr>
<th>Sales value at split-off</th>
<th>Weighting</th>
<th>Joint costs allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kul</td>
<td>$40,000</td>
<td>40,000/75,000 x 50,000</td>
</tr>
<tr>
<td>Wu</td>
<td>35,000</td>
<td>35,000/75,000 x 50,000</td>
</tr>
<tr>
<td></td>
<td>$75,000</td>
<td>50,000</td>
</tr>
</tbody>
</table>

Therefore, $26,667 of the joint cost should be allocated to product Kul.

12. (d) When using the relative sales value at split-off method for joint products, joint costs are allocated based on the ratio of each product’s sales value at split-off to total sales value at split-off for all joint products. If the market value at split-off (sales value) of joint product P increases, then a larger proportion of the total joint costs will be allocated to that product. Because all other costs and selling prices remain unchanged, the gross margin of product P will, therefore, decrease. Product Q’s gross margin will, however, increase because a smaller proportion of the total joint costs will be allocated to it.
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