Chapter 11
Standard Costs and Operating Performance Measures

Solutions to Questions

11-1 A quantity standard indicates how much of an input should be used to make a unit of output. A price standard indicates how much the input should cost.

11-2 Ideal standards assume perfection and do not allow for any inefficiency. Ideal standards are rarely, if ever, attained. Practical standards can be attained by employees working at a reasonable, though efficient pace and allow for normal breaks and work interruptions.

11-3 Under management by exception, managers focus their attention on results that deviate from expectations. It is assumed that results that meet expectations do not require investigation.

11-4 Separating an overall variance into a price variance and a quantity variance provides more information. Moreover, price and quantity variances are usually the responsibilities of different managers.

11-5 The materials price variance is usually the responsibility of the purchasing manager. The materials quantity and labor efficiency variances are usually the responsibility of production managers and supervisors.

11-6 The materials price variance can be computed either when materials are purchased or when they are placed into production. It is usually better to compute the variance when materials are purchased because that is when the purchasing manager, who has responsibility for this variance, has completed his or her work. In addition, recognizing the price variance when materials are purchased allows the company to carry its raw materials in the inventory accounts at standard cost, which greatly simplifies bookkeeping.

11-7 This combination of variances may indicate that inferior quality materials were purchased at a discounted price, but the low-quality materials created production problems.

11-8 If standards are used to find who to blame for problems, they can breed resentment and undermine morale. Standards should not be used to find someone to blame for problems.

11-9 Several factors other than the contractual rate paid to workers can cause a labor rate variance. For example, skilled workers with high hourly rates of pay can be given duties that require little skill and that call for low hourly rates of pay, resulting in an unfavorable rate variance. Or unskilled or untrained workers can be assigned to tasks that should be filled by more skilled workers with higher rates of pay, resulting in a favorable rate variance. Unfavorable rate variances can also arise from overtime work at premium rates.

11-10 If poor quality materials create production problems, a result could be excessive labor time and therefore an unfavorable labor efficiency variance. Poor

quality materials would not ordinarily affect the labor rate variance.

11-11 If overhead is applied on the basis of direct labor-hours, then the variable overhead efficiency variance and the direct labor efficiency variance will always be favorable or unfavorable together. Both variances are computed by comparing the number of direct labor-hours actually worked to the standard hours allowed. That is, in each case the formula is:

Efficiency Variance = SR(AH – SH)

Only the "SR" part of the formula, the standard rate, differs between the two variances.

11-12 A statistical control chart is a graphical aid that helps identify variances that should be investigated. Upper and lower limits are set on the control chart. Any variances falling between those limits are considered to be normal. Any variances falling outside of those limits are considered abnormal and are investigated.

11-13 If labor is a fixed cost and standards are tight, then the only way to generate favorable labor efficiency variances is for every workstation to produce at capacity. However, the output of the entire system is limited by the capacity of the bottleneck. If workstations before the bottleneck in the production process produce at capacity, the bottleneck will be unable to process all of the work in process. In general, if every workstation is attempting to produce at capacity, then work in process inventory will build up in front of the workstations with the least capacity.

11-14 The difference between delivery cycle time and throughput time is the waiting period between when an order is received and when production on the order is started. Throughput time is made up of process time, inspection time, move time, and queue time. These four elements can be classified into value-added time (process time) and non-value-added time (inspection time, move time, and queue time).

11-15 An MCE of less than 1 means that the production process includes non-value-added time. An MCE of 0.40, for example, means that 40% of throughput time consists of actual processing, and that the other 60% consists of moving, inspection, and other non-value-added activities.

Exercise 11-1 (20 minutes)

1.	Cost per 15-gallon container.....	$115.00
	Less 2% cash discount.....	2.30
	Net cost.....	112.70
	Add shipping cost per container ($130 ÷ 100).....	1.30
	Total cost per 15-gallon container (a).....	$114.00
	Number of quarts per container (15 gallons × 4 quarts per gallon) (b).....	60
	Standard cost per quart purchased (a) ÷ (b).....	$1.90
2.	Content per bill of materials.....	7.6 quarts
	Add allowance for evaporation and spillage (7.6 quarts ÷ 0.95 = 8.0 quarts; 8.0 quarts – 7.6 quarts = 0.4 quarts).....	0.4 quarts
	Total.....	8.0 quarts
	Add allowance for rejected units (8.0 quarts ÷ 40 bottles).....	0.2 quarts
	Standard quantity per salable bottle of solvent..	8.2 quarts

3.

Item	*Standard Quantity*	*Standard Price*	*Standard Cost per Bottle*
Echol	8.2 quarts	$1.90 per quart	$15.58

Exercise 11-2 (20 minutes)

1.

Number of helmets	35,000
Standard kilograms of plastic per helmet	× 0.6
Total standard kilograms allowed	21,000
Standard cost per kilogram	× RM8
Total standard cost	RM168,000
Actual cost incurred (given)	RM171,000
Total standard cost (above)	168,000
Total material variance—unfavorable	RM 3,000

2.

Actual Quantity of Input, at Actual Price (AQ × AP)	Actual Quantity of Input, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
	22,500 kilograms × RM8 per kilogram	21,000 kilograms* × RM8 per kilogram
RM171,000	= RM180,000	= RM168,000

Price Variance, RM9,000 F

Quantity Variance, RM12,000 U

Total Variance, RM3,000 U

*35,000 helmets × 0.6 kilograms per helmet = 21,000 kilograms

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
22,500 kilograms (RM7.60 per kilogram* – RM8.00 per kilogram)
= RM9,000 F

* RM171,000 ÷ 22,500 kilograms = RM7.60 per kilogram

Materials quantity variance = SP (AQ – SQ)
RM8 per kilogram (22,500 kilograms – 21,000 kilograms)
= RM12,000 U

Exercise 11-3 (20 minutes)

1.

Number of meals prepared.....	4,000
Standard direct labor-hours per meal.....	× 0.25
Total direct labor-hours allowed.....	1,000
Standard direct labor cost per hour.....	× $9.75
Total standard direct labor cost.....	$9,750
Actual cost incurred.....	$9,600
Total standard direct labor cost (above).	9,750
Total direct labor variance.....	$ 150 Favorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
960 hours × $10.00 per hour = $9,600	960 hours × $9.75 per hour = $9,360	1,000 hours × $9.75 per hour = $9,750

Rate Variance, $240 U

Efficiency Variance, $390 F

Total Variance, $150 F

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH(AR – SR)
= 960 hours ($10.00 per hour – $9.75 per hour)
= $240 U

Labor efficiency variance = SR(AH – SH)
= $9.75 per hour (960 hours – 1,000 hours)
= $390 F

Exercise 11-4 (20 minutes)

1.

Number of items shipped.....	120,000
Standard direct labor-hours per item.....	× 0.02
Total direct labor-hours allowed.....	2,400
Standard variable overhead cost per hour.....	× $3.25
Total standard variable overhead cost.....	$ 7,800
Actual variable overhead cost incurred.....	$7,360
Total standard variable overhead cost (above).	7,800
Total variable overhead variance.....	$ 440 Favorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
2,300 hours × $3.20 per hour* = $7,360	2,300 hours × $3.25 per hour = $7,475	2,400 hours × $3.25 per hour = $7,800

Variable Overhead Rate Variance, $115 F	Variable Overhead Efficiency Variance, $325 F
Total Variance, $440 F	

*$7,360 ÷ 2,300 hours = $3.20 per hour

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance:

AH(AR – SR) = 2,300 hours ($3.20 per hour – $3.25 per hour)
= $115 F

Variable overhead efficiency variance:

SR(AH – SH) = $3.25 per hour (2,300 hours – 2,400 hours)
= $325 F

Exercise 11-5 (20 minutes)

1. Throughput time = Process time + Inspection time + Move time + Queue time
   = 2.7 days + 0.3 days + 1.0 days + 5.0 days
   = 9.0 days

2. Only process time is value-added time; therefore the manufacturing cycle efficiency (MCE) is:

$$\text{MCE} = \frac{\text{Value-added time}}{\text{Throughput time}} = \frac{2.7 \text{ days}}{9.0 \text{ days}} = 0.30$$

3. If the MCE is 30%, then 30% of the throughput time was spent in value-added activities. Consequently, the other 70% of the throughput time was spent in non-value-added activities.

4. Delivery cycle time = Wait time + Throughput time
   = 14.0 days + 9.0 days
   = 23.0 days

5. If all queue time is eliminated, then the throughput time drops to only 4 days (2.7 + 0.3 + 1.0). The MCE becomes:

$$\text{MCE} = \frac{\text{Value-added time}}{\text{Throughput time}} = \frac{2.7 \text{ days}}{4.0 \text{ days}} = 0.675$$

   Thus, the MCE increases to 67.5%. This exercise shows quite dramatically how lean production can improve the efficiency of operations and reduce throughput time.

Exercise 11-6 (20 minutes)

1. The standard price of a kilogram of white chocolate is determined as follows:

Purchase price, finest grade white chocolate.....	£7.50
Less purchase discount, 8% of the purchase price of £7.50..	(0.60)
Shipping cost from the supplier in Belgium.....	0.30
Receiving and handling cost.....	0.04
Standard price per kilogram of white chocolate.....	£7.24

2. The standard quantity, in kilograms, of white chocolate in a dozen truffles is computed as follows:

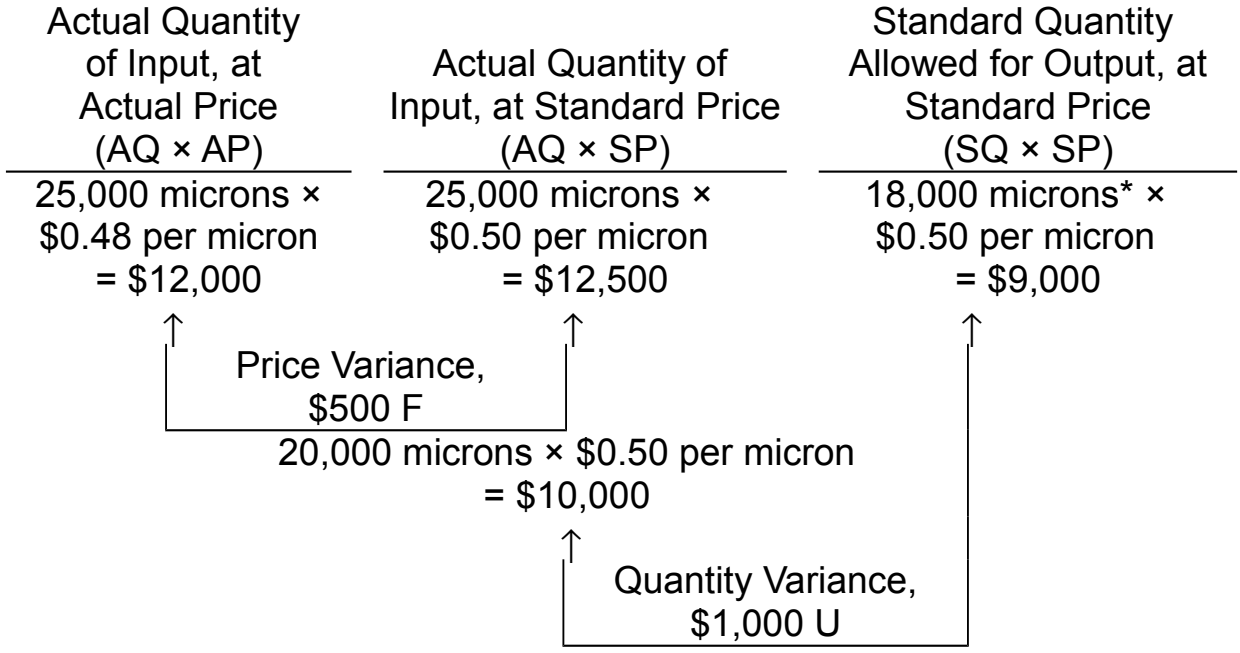
Material requirements.....	0.70
Allowance for waste.....	0.03
Allowance for rejects.....	0.02
Standard quantity of white chocolate.....	0.75

3. The standard cost of the white chocolate in a dozen truffles is determined as follows:

Standard quantity of white chocolate (a).....	0.75 kilogram
Standard price of white chocolate (b).....	£7.24 per kilogram
Standard cost of white chocolate (a) × (b)....	£5.43

Exercise 11-7 (30 minutes)

1. a. Notice in the solution below that the materials price variance is computed on the entire amount of materials purchased, whereas the materials quantity variance is computed only on the amount of materials used in production.



*3,000 toys × 6 microns per toy = 18,000 microns

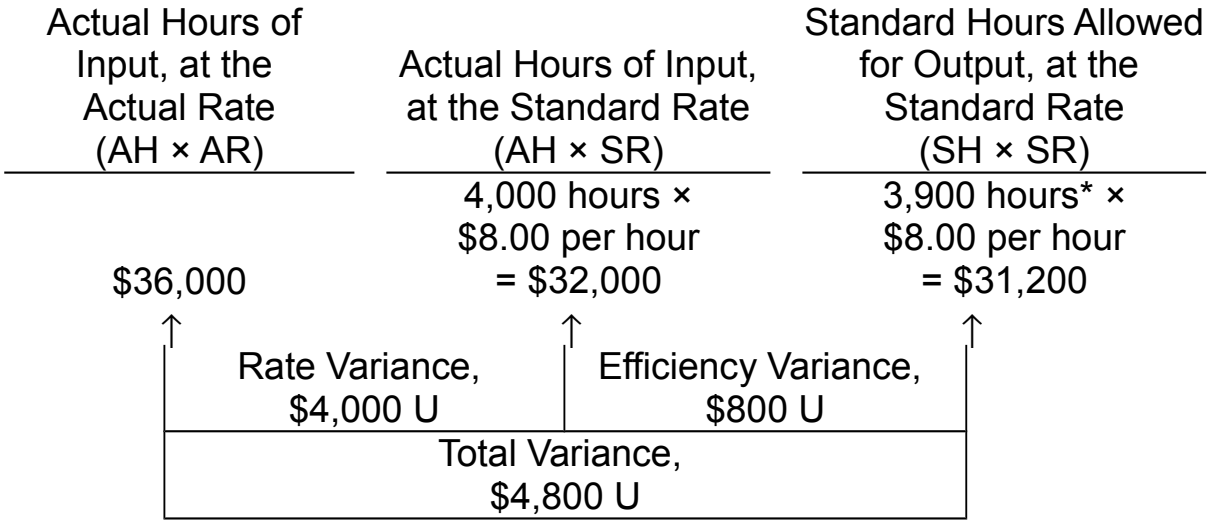
Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
25,000 microns ($0.48 per micron – $0.50 per micron) = $500 F

Materials quantity variance = SP (AQ – SQ)
$0.50 per micron (20,000 microns – 18,000 microns) = $1,000 U

Exercise 11-7 (continued)

b. Direct labor variances:



*3,000 toys × 1.3 hours per toy = 3,900 hours

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
4,000 hours ($9.00 per hour* – $8.00 per hour) = $4,000 U

*$36,000 ÷ 4,000 hours = $9.00 per hour

Labor efficiency variance = SR (AH – SH)
$8.00 per hour (4,000 hours – 3,900 hours) = $800 U

Exercise 11-7 (continued)

2. A variance usually has many possible explanations. In particular, we should always keep in mind that the standards themselves may be incorrect. Some of the other possible explanations for the variances observed at Dawson Toys appear below:

   Materials Price Variance Since this variance is favorable, the actual price paid per unit for the material was less than the standard price. This could occur for a variety of reasons including the purchase of a lower grade material at a discount, buying in an unusually large quantity to take advantage of quantity discounts, a change in the market price of the material, or particularly sharp bargaining by the purchasing department.

   Materials Quantity Variance Since this variance is unfavorable, more materials were used to produce the actual output than were called for by the standard. This could also occur for a variety of reasons. Some of the possibilities include poorly trained or supervised workers, improperly adjusted machines, and defective materials.

   Labor Rate Variance Since this variance is unfavorable, the actual average wage rate was higher than the standard wage rate. Some of the possible explanations include an increase in wages that has not been reflected in the standards, unanticipated overtime, and a shift toward more highly paid workers.

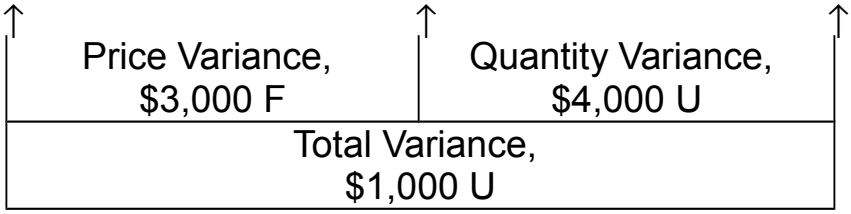
   Labor Efficiency Variance Since this variance is unfavorable, the actual number of labor hours was greater than the standard labor hours allowed for the actual output. As with the other variances, this variance could have been caused by any of a number of factors. Some of the possible explanations include poor supervision, poorly trained workers, low-quality materials requiring more labor time to process, and machine breakdowns. In addition, if the direct labor force is essentially fixed, an unfavorable labor efficiency variance could be caused by a reduction in output due to decreased demand for the company's products.

   It is worth noting that all of these variances could have been caused by the purchase of low quality materials at a cut-rate price.

Exercise 11-8 (20 minutes)

1.

Actual Quantity of Input, at Actual Price (AQ × AP)	Actual Quantity of Input, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
20,000 pounds × $2.35 per pound = $47,000	20,000 pounds × $2.50 per pound = $50,000	18,400 pounds* × $2.50 per pound = $46,000



*4,000 units × 4.6 pounds per unit = 18,400 pounds

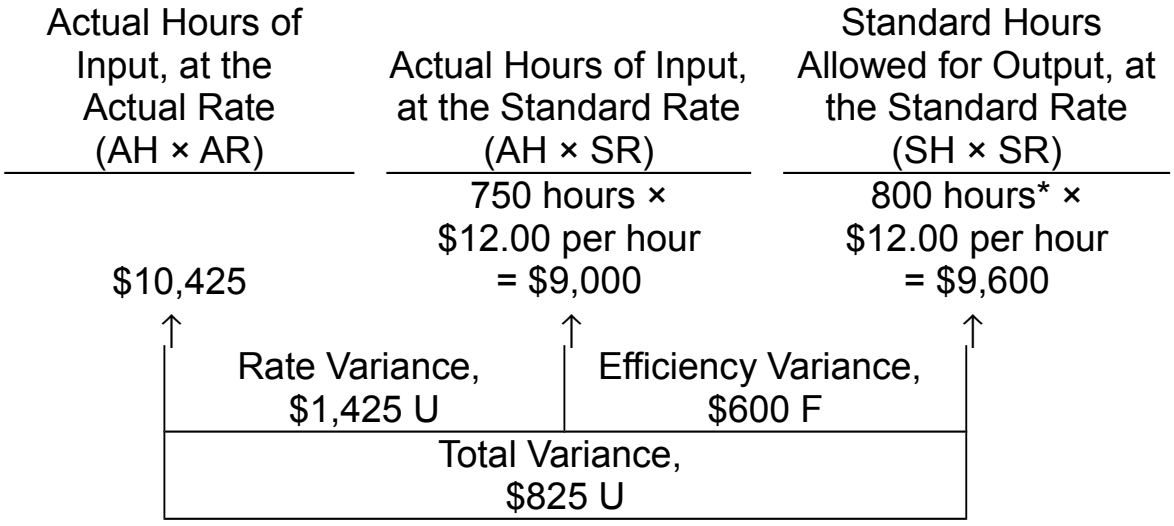
Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
20,000 pounds ($2.35 per pound – $2.50 per pound) = $3,000 F

Materials quantity variance = SP (AQ – SQ)
$2.50 per pound (20,000 pounds – 18,400 pounds) = $4,000 U

Exercise 11-8 (continued)

2.



*4,000 units × 0.2 hours per unit = 800 hours

Alternatively, the variances can be computed using the formulas:

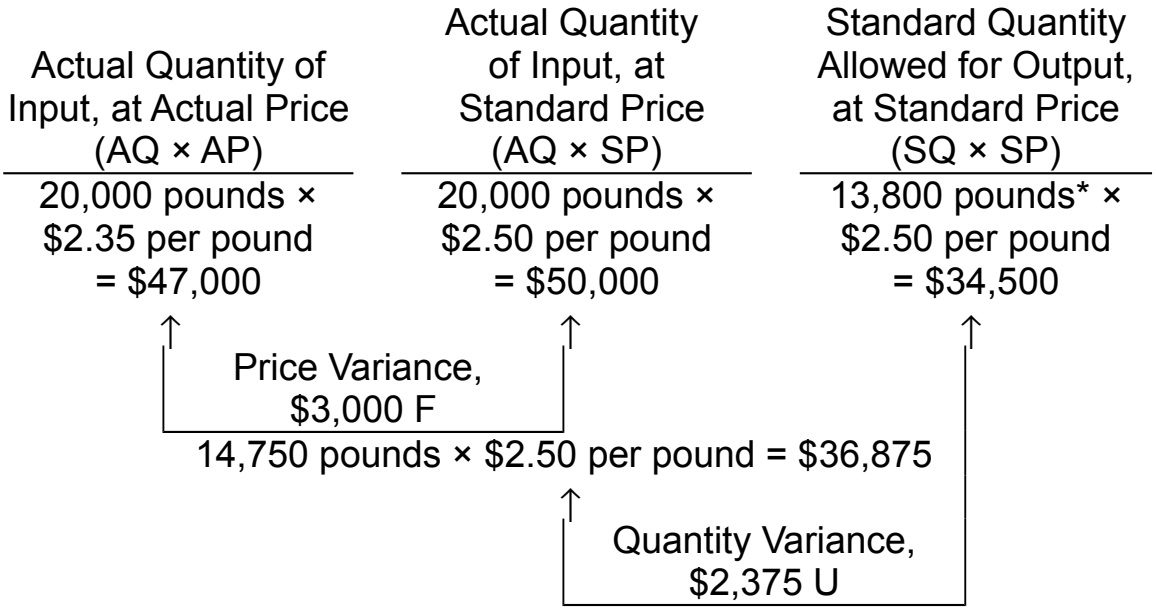
Labor rate variance = AH (AR – SR)
750 hours ($13.90 per hour* – $12.00 per hour) = $1,425 U

*10,425 ÷ 750 hours = $13.90 per hour

Labor efficiency variance = SR (AH – SH)
$12.00 per hour (750 hours – 800 hours) = $600 F

Exercise 11-9 (15 minutes)

Notice in the solution below that the materials price variance is computed for the entire amount of materials purchased, whereas the materials quantity variance is computed only for the amount of materials used in production.



*3,000 units × 4.6 pounds per unit = 13,800 pounds

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
20,000 pounds ($2.35 per pound – $2.50 per pound) = $3,000 F

Materials quantity variance = SP (AQ – SQ)
$2.50 per pound (14,750 pounds – 13,800 pounds) = $2,375 U

Exercise 11-10 (30 minutes)

1. Number of units manufactured.....	20,000
Standard labor time per unit (18 minutes ÷ 60 minutes per hour).....	× 0.3
Total standard hours of labor time allowed.....	6,000
Standard direct labor rate per hour.....	× $12
Total standard direct labor cost.....	$72,000
Actual direct labor cost.....	$73,600
Standard direct labor cost.....	72,000
Total variance—unfavorable.....	$ 1,600

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
	5,750 hours × $12.00 per hour	6,000 hours* × $12.00 per hour
$73,600	= $69,000	= $72,000

Rate Variance, $4,600 U

Efficiency Variance, $3,000 F

Total Variance, $1,600 U

*20,000 units × 0.3 hours per unit = 6,000 hours

Alternatively, the variances can be computed using the formulas:

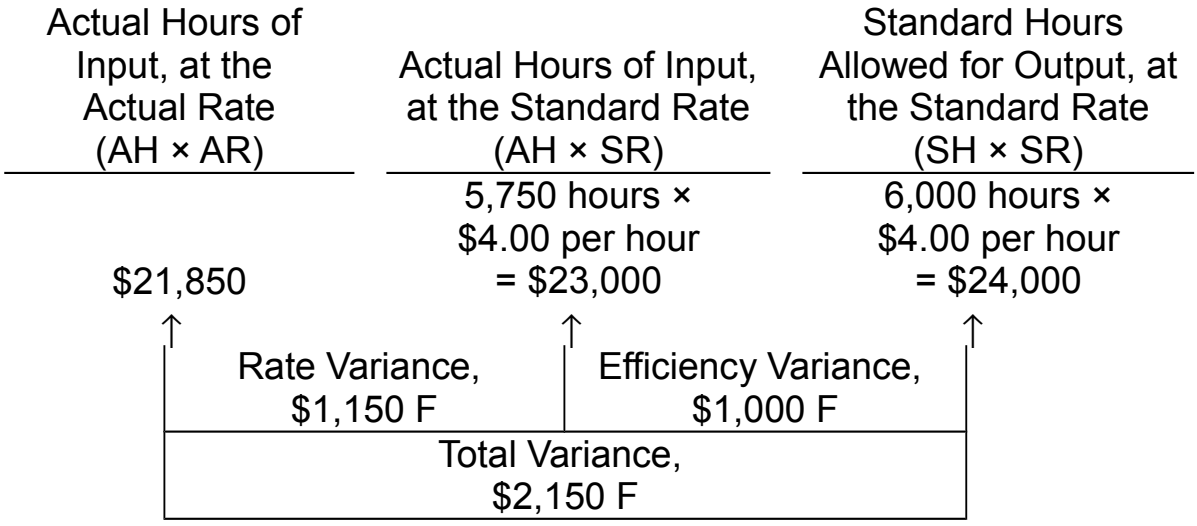
Labor rate variance = AH (AR – SR)
5,750 hours ($12.80 per hour* – $12.00 per hour) = $4,600 U

*$73,600 ÷ 5,750 hours = $12.80 per hour

Labor efficiency variance = SR (AH – SH)
$12.00 per hour (5,750 hours – 6,000 hours) = $3,000 F

Exercise 11-10 (continued)

3.



Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
5,750 hours ($3.80 per hour* – $4.00 per hour) = $1,150 F

*$21,850 ÷ 5,750 hours = $3.80 per hour

Variable overhead efficiency variance = SR (AH – SH)
$4.00 per hour (5,750 hours – 6,000 hours) = $1,000 F

Exercise 11-11 (20 minutes)

1. If the total variance is $93 unfavorable, and the rate variance is $87 favorable, then the efficiency variance must be $180 unfavorable, because the rate and efficiency variances taken together always equal the total variance. Knowing that the efficiency variance is $180 unfavorable, one approach to the solution would be:

   Efficiency variance = SR (AH – SH)
   $9.00 per hour (AH – 125 hours*) = $180 U
   $9.00 per hour × AH – $1,125 = $180**
   $9.00 per hour × AH = $1,305
   AH = $1,305 ÷ $9.00 per hour
   AH = 145 hours

   *50 jobs × 2.5 hours per job = 125 hours
   **When used with the formula, unfavorable variances are positive and favorable variances are negative.

2. Rate variance = AH (AR – SR)
   145 hours (AR – $9.00 per hour) = $87 F
   145 hours × AR – $1,305 = –$87*
   145 hours × AR = $1,218
   AR = $1,218 ÷ 145 hours
   AR = $8.40 per hour

   *When used with the formula, unfavorable variances are positive and favorable variances are negative.

Exercise 11-11 (continued)

An alternative approach would be to work from known to unknown data in the columnar model for variance analysis:

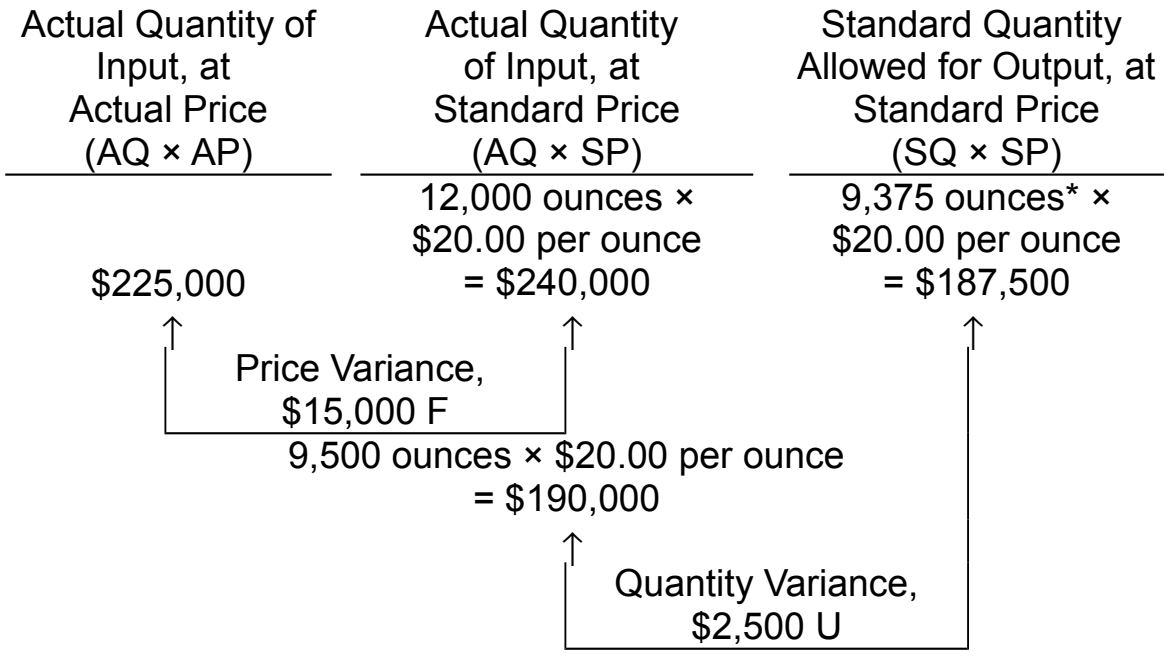
Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
145 hours × $8.40 per hour = $1,218	145 hours × $9.00 per hour* = $1,305	125 hours[§] × $9.00 per hour* = $1,125

Rate Variance, $87 F*	Efficiency Variance, $180 U
Total Variance, $93 U*	

[§]50 tune-ups* × 2.5 hours per tune-up* = 125 hours
*Given

Problem 11-12 (45 minutes)

1. a. In the solution below, the materials price variance is computed on the entire amount of materials purchased whereas the materials quantity variance is computed only on the amount of materials used in production:



*3,750 units × 2.5 ounces per unit = 9,375 ounces

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
12,000 ounces ($18.75 per ounce* – $20.00 per ounce) = $15,000 F

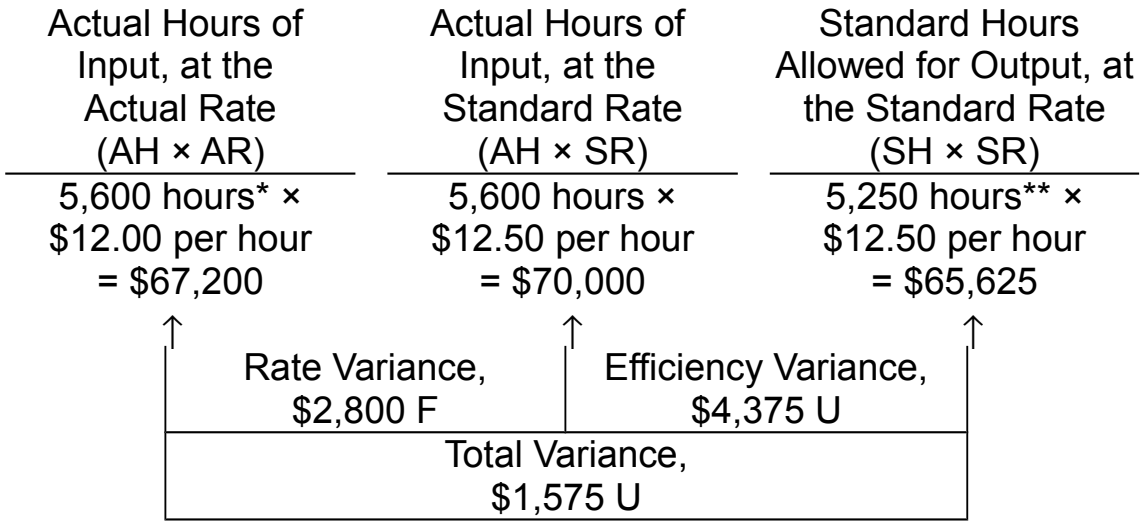
*$225,000 ÷ 12,000 ounces = $18.75 per ounce

Materials quantity variance = SP (AQ – SQ)
$20.00 per ounce (9,500 ounces – 9,375 ounces) = $2,500 U

b. Yes, the contract probably should be signed. The new price of $18.75 per ounce is substantially lower than the old price of $20.00 per ounce, resulting in a favorable price variance of $15,000 for the month. Moreover, the material from the new supplier appears to cause little or no problem in production as shown by the small materials quantity variance for the month.

Problem 11-12 (continued)

2. a.



*35 technicians × 160 hours per technician = 5,600 hours
**3,750 units × 1.4 hours per technician = 5,250 hrs

Alternatively, the variances can be computed using the formulas:

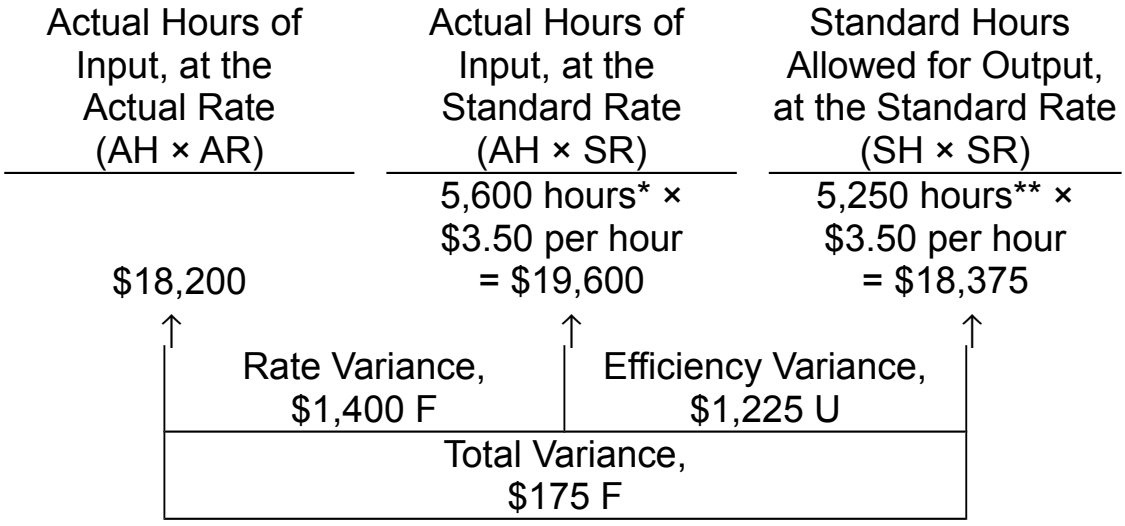
Labor rate variance = AH (AR – SR)
5,600 hours ($12.00 per hour – $12.50 per hour) = $2,800 F

Labor efficiency variance = SR (AH – SH)
$12.50 per hour (5,600 hours – 5,250 hours) = $4,375 U

b. No, the new labor mix probably should not be continued. Although it decreases the average hourly labor cost from $12.50 to $12.00, thereby causing a $2,800 favorable labor rate variance, this savings is more than offset by a large unfavorable labor efficiency variance for the month. Thus, the new labor mix increases overall labor costs.

Problem 11-12 (continued)

3.



* Based on direct labor hours:
35 technicians × 160 hours per technician = 5,600 hours

** 3,750 units × 1.4 hours per unit = 5,250 hours

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
5,600 hours ($3.25 per hour* – $3.50 per hour) = $1,400 F

*$18,200 ÷ 5,600 hours = $3.25 per hour

Variable overhead efficiency variance = SR (AH – SH)
$3.50 per hour (5,600 hours – 5,250 hours) = $1,225 U

Both the labor efficiency variance and the variable overhead efficiency variance are computed by comparing actual labor-hours to standard labor-hours. Thus, if the labor efficiency variance is unfavorable, then the variable overhead efficiency variance will be unfavorable as well.

Problem 11-13 (30 minutes)

1. a., b., and c.

	Month			
	1	*2*	*3*	*4*
Throughput time—days:				
Process time (x)	2.1	2.0	1.9	1.8
Inspection time	0.6	0.7	0.7	0.6
Move time	0.4	0.3	0.4	0.4
Queue time	4.3	5.0	5.8	6.7
Total throughput time (y)	7.4	8.0	8.8	9.5
Manufacturing cycle efficiency (MCE):				
Process time (x) ÷ Throughput time (y)	28.4%	25.0%	21.6%	18.9%
Delivery cycle time—days:				
Wait time from order to start of production	16.0	17.5	19.0	20.5
Throughput time	7.4	8.0	8.8	9.5
Total delivery cycle time	23.4	25.5	27.8	30.0

2. All of the performance measures display unfavorable trends. Throughput time per unit is increasing—largely because of an increase in queue time. Manufacturing cycle efficiency is declining and delivery cycle time is increasing. In addition, the percentage of on-time deliveries has dropped.

Problem 11-13 (continued)

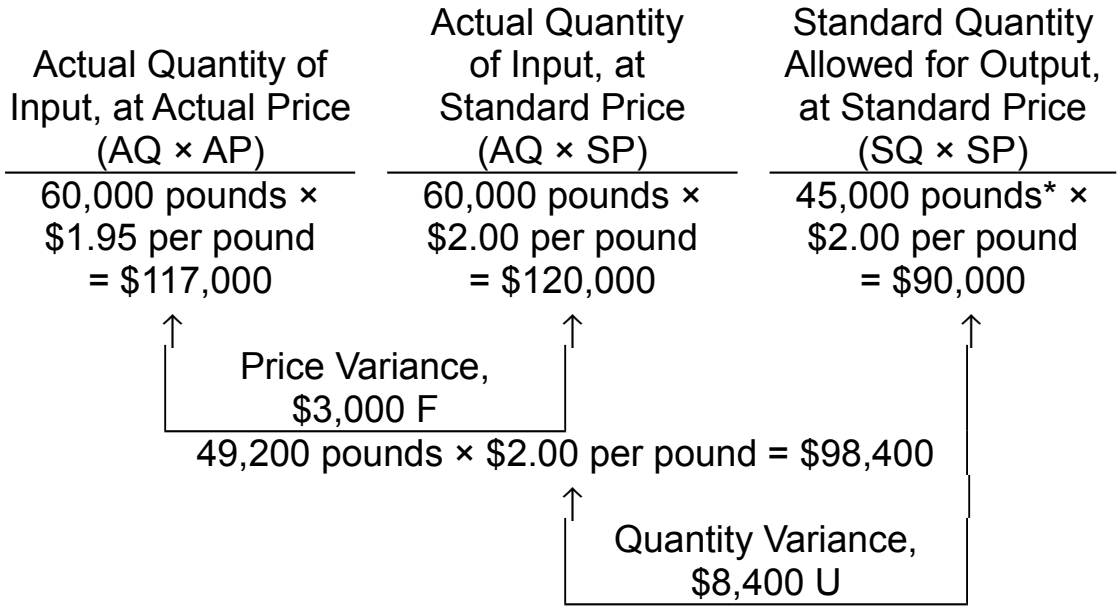
3. a. and b.

	Month	
	5	*6*
Throughput time—days:		
Process time (x)	1.8	1.8
Inspection time	0.6	0.0
Move time	0.4	0.4
Queue time	0.0	0.0
Total throughput time (y)	2.8	2.2
Manufacturing cycle efficiency (MCE):		
Process time (x) ÷ Throughput time (y)	64.3%	81.8%

As a company reduces non-value-added activities, the manufacturing cycle efficiency increases rapidly. The goal, of course, is to have an efficiency of 100%. This will be achieved when *all* non-value-added activities have been eliminated and process time is equal to throughput time.

Problem 11-14 (45 minutes)

1. a.



*15,000 pools × 3.0 pounds per pool = 45,000 pounds

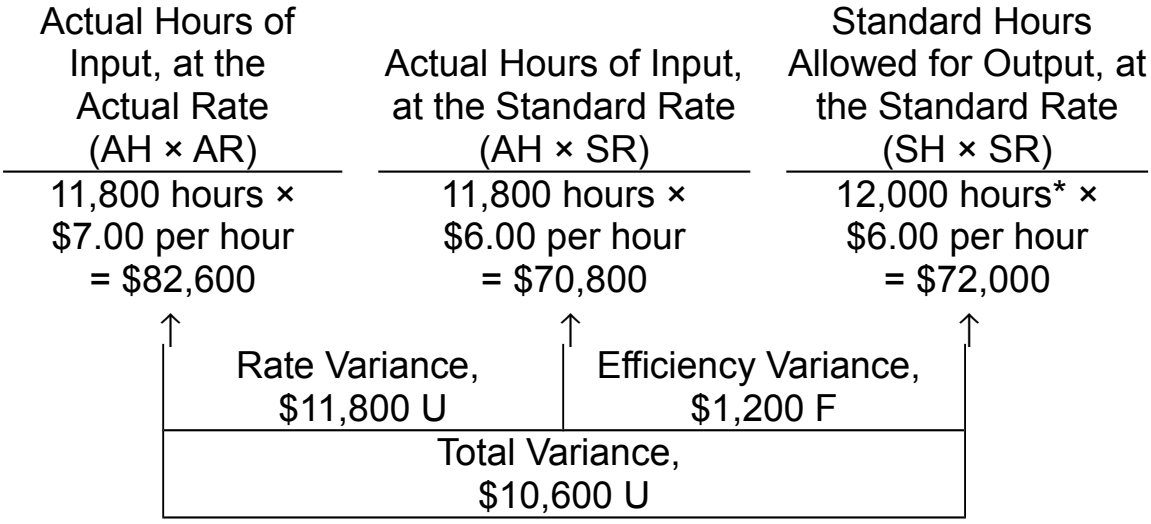
Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
60,000 pounds ($1.95 per pound – $2.00 per pound) = $3,000 F

Materials quantity variance = SP (AQ – SQ)
$2.00 per pound (49,200 pounds – 45,000 pounds) = $8,400 U

Problem 11-14 (continued)

b.



*15,000 pools × 0.8 hours per pool = 12,000 hours

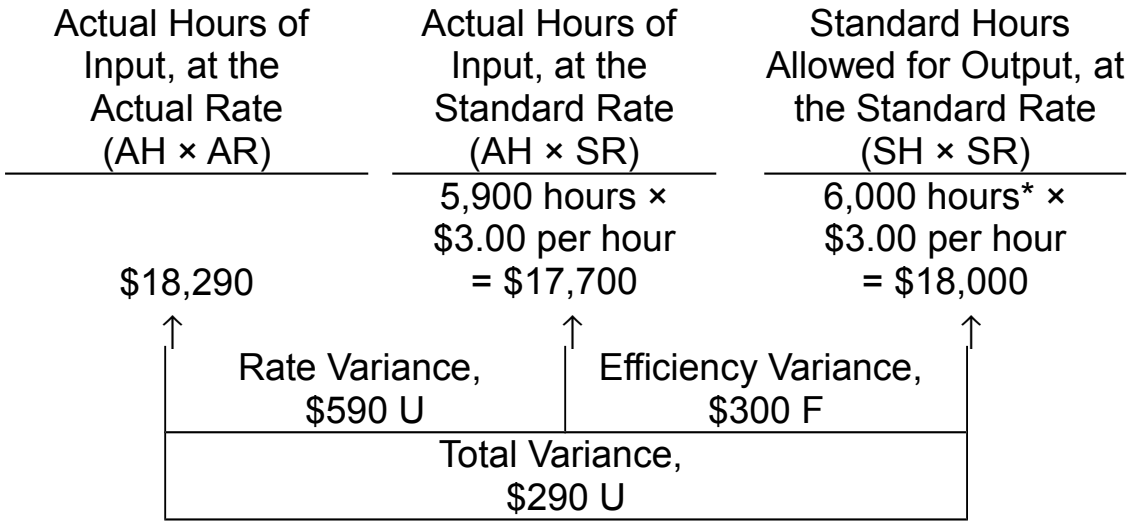
Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
11,800 hours ($7.00 per hour – $6.00 per hour) = $11,800 U

Labor efficiency variance = SR (AH – SH)
$6.00 per hour (11,800 hours – 12,000 hours) = $1,200 F

Problem 11-14 (continued)

c.



*15,000 pools × 0.4 hours per pool = 6,000 hours

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
5,900 hours ($3.10 per hour* – $3.00 per hour) = $590 U

*$18,290 ÷ 5,900 hours = $3.10 per hour

Variable overhead efficiency variance = SR (AH – SH)
$3.00 per hour (5,900 hours – 6,000 hours) = $300 F

Problem 11-14 (continued)

2. Summary of variances:

Material price variance	$ 3,000	F
Material quantity variance	8,400	U
Labor rate variance	11,800	U
Labor efficiency variance	1,200	F
Variable overhead rate variance	590	U
Variable overhead efficiency variance	300	F
Net variance	$16,290	U

The net unfavorable variance of $16,290 for the month caused the plant's variable cost of goods sold to increase from the budgeted level of $180,000 to $196,290:

Budgeted cost of goods sold at $12 per pool	$180,000
Add the net unfavorable variance, as above	16,290
Actual cost of goods sold	$196,290

This $16,290 net unfavorable variance also accounts for the difference between the budgeted net operating income and the actual net operating income for the month.

Budgeted net operating income	$36,000
Deduct the net unfavorable variance added to cost of goods sold for the month	16,290
Net operating income	$19,710

3. The two most significant variances are the materials quantity variance and the labor rate variance. Possible causes of the variances include:

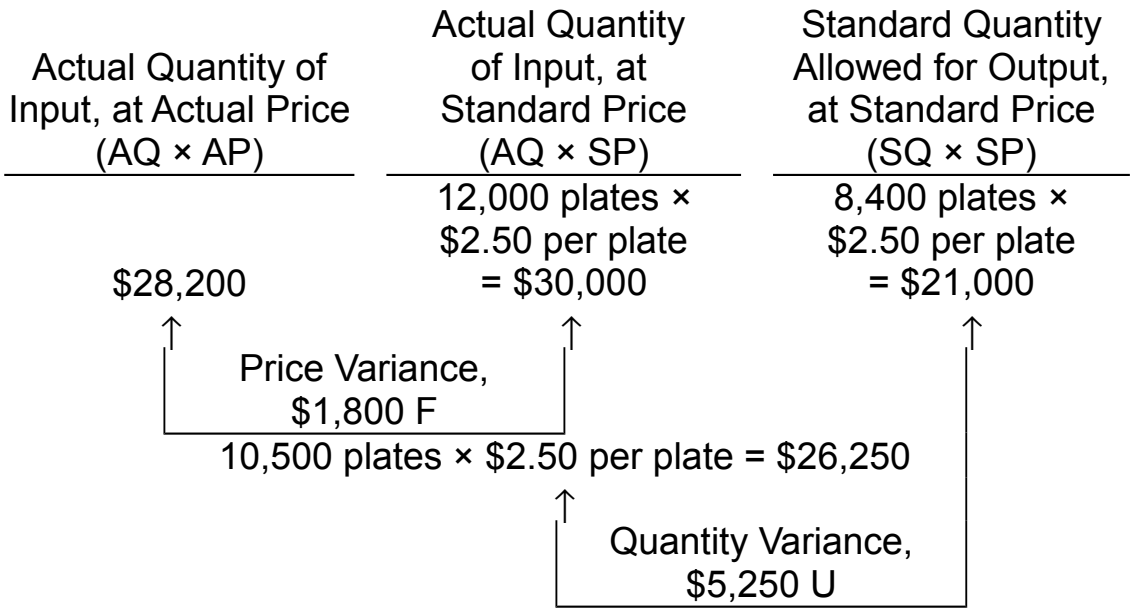
Materials quantity variance:	Outdated standards, unskilled workers, poorly adjusted machines, carelessness, poorly trained workers, inferior quality materials.
Labor rate variance:	Outdated standards, change in pay scale, overtime pay.

Problem 11-15 (45 minutes)

1. The standard quantity of plates allowed for tests performed during the month would be:

Blood tests.....	1,800
Smears.....	2,400
Total.....	4,200
Plates per test.....	× 2
Standard quantity allowed.....	8,400

The variance analysis for plates would be:



Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
12,000 plates ($2.35 per plate* – $2.50 per plate) = $1,800 F

*$28,200 ÷ 12,000 plates = $2.35 per plate.

Materials quantity variance = SP (AQ – SQ)
$2.50 per plate (10,500 plates – 8,400 plates) = $5,250 U

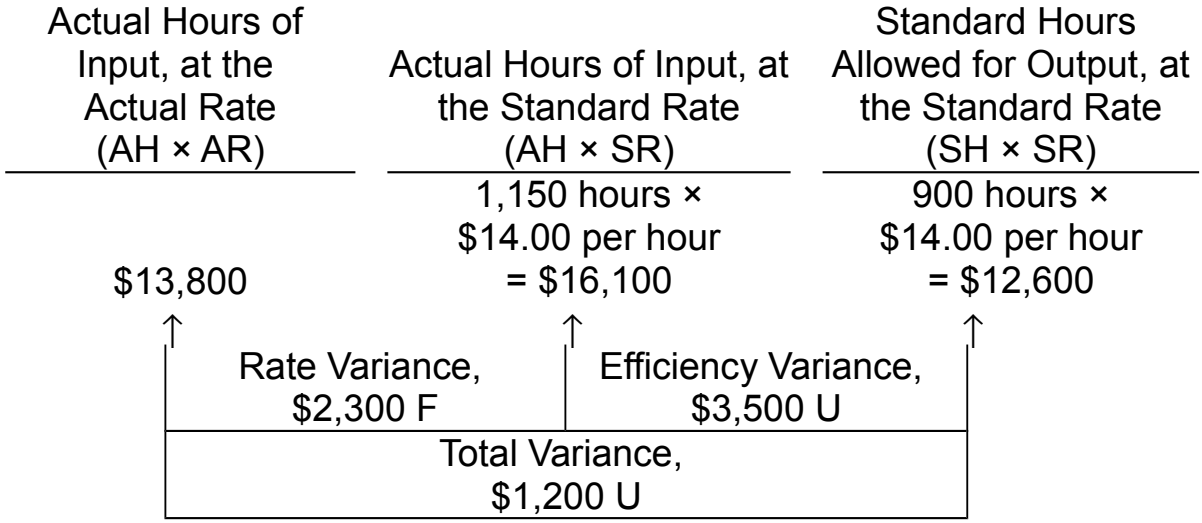
Problem 11-15 (continued)

Note that all of the price variance is due to the hospital's 6% quantity discount. Also note that the $5,250 quantity variance for the month is equal to 25% of the standard cost allowed for plates.

2. a. The standard hours allowed for tests performed during the month would be:

Blood tests: 0.3 hour per test × 1,800 tests.....	540 hours
Smears: 0.15 hour per test × 2,400 tests.....	360 hours
Total standard hours allowed.....	900 hours

The variance analysis would be:



Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
1,150 hours ($12.00 per hour* – $14.00 per hour) = $2,300 F

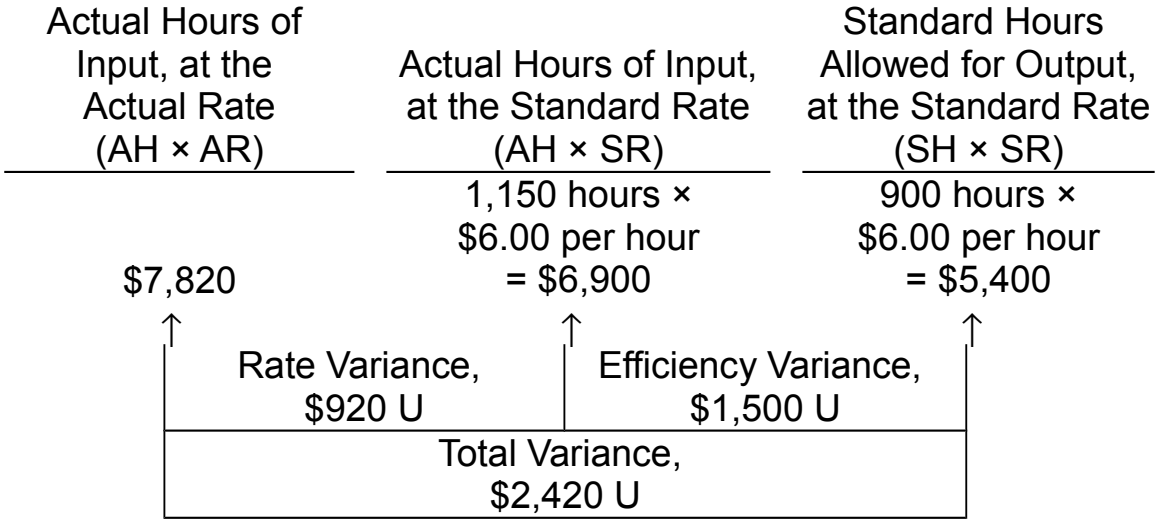
*$13,800 ÷ 1,150 hours = $12.00 per hour

Labor efficiency variance = SR (AH – SH)
$14.00 per hour (1,150 hours – 900 hours) = $3,500 U

Problem 11-15 (continued)

b. The policy probably should not be continued. Although the hospital is saving $2 per hour by employing more assistants than senior technicians, this savings is more than offset by other factors. Too much time is being taken in performing lab tests, as indicated by the large unfavorable labor efficiency variance. And, it seems likely that most (or all) of the hospital's unfavorable quantity variance for plates is traceable to inadequate supervision of assistants in the lab.

3. The variable overhead variances follow:



Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
1,150 hours ($6.80 per hour* – $6.00 per hour) = $920 U

*$7,820 ÷ 1,150 hours = $6.80 per hour

Variable overhead efficiency variance = SR (AH – SH)
$6.00 per hour (1,150 hours – 900 hours) = $1,500 U

Yes, the two variances are closely related. Both are computed by comparing actual labor time to the standard hours allowed for the output of the period. Thus, if the labor efficiency variance is favorable (or unfavorable), then the variable overhead efficiency variance will also be favorable (or unfavorable).

Problem 11-16 (30 minutes)

1. Salex quantity standard:

Required per 10-liter batch (9.6 liters ÷ 0.8).....	12.0 liters
Loss from rejected batches (1/5 × 12 liters).....	2.4 liters
Total quantity per good batch.....	14.4 liters

Nyclyn quantity standard:

Required per 10-liter batch (12 kilograms ÷ 0.8)....	15.0 kilograms
Loss from rejected batches (1/5 × 15 kilograms)…	3.0 kilograms
Total quantity per good batch.....	18.0 kilograms

Protet quantity standard:

Required per 10-liter batch.....	5.0 kilograms
Loss from rejected batches (1/5 × 5 kilograms)…..	1.0 kilograms
Total quantity per good batch.....	6.0 kilograms

2. Total minutes per 8-hour day..... 480 minutes
   Less rest breaks and cleanup..... 60 minutes
   Productive time each day..... 420 minutes

$$\frac{\text{Productive time each day}}{\text{Time required per batch}} = \frac{\text{420 minutes per day}}{\text{35 minutes per batch}}$$

$$= \text{12 batches per day}$$

Time required per batch.....	35 minutes
Rest breaks and clean up time (60 minutes ÷ 12 batches).....	5 minutes
Total.....	40 minutes
Loss from rejected batches (1/5 × 40 minutes)……	8 minutes
Total time per good batch.....	48 minutes

Problem 11-16 (continued)

3. Standard cost card:

	Standard Quantity or Time	*Standard Price or Rate*	*Standard Cost*
Salex.....	14.4 liters	$1.50 per liter	$21.60
Nyclyn.....	18.0 kilograms	$2.80 per kilogram	50.40
Protet.....	6.0 kilograms	$3.00 per kilogram	18.00
Labor time.....	48 minutes, or 0.8 hour	$9.00 per hour	7.20
Total standard cost per acceptable batch.....			$97.20

Problem 11-17 (30 minutes)

1. a., b., and c.

	Month			
	1	*2*	*3*	*4*
Throughput time in days:				
Process time	2.1	2.0	1.9	1.8
Inspection time	0.8	0.7	0.7	0.7
Move time	0.3	0.4	0.4	0.5
Queue time during production	2.8	4.4	6.0	7.0
Total throughput time	6.0	7.5	9.0	10.0
Manufacturing cycle efficiency (MCE):				
Process time ÷ Throughput time	35.0%	26.7%	21.1%	18.0%
Delivery cycle time in days:				
Wait time to start of production	9.0	11.5	12.0	14.0
Throughput time	6.0	7.5	9.0	10.0
Total delivery cycle time	15.0	19.0	21.0	24.0

2. a. Areas where the company is improving:

   Quality control. The number of defects has decreased by over 50% in the last four months. Moreover, both warranty claims and customer complaints are down sharply. In short, overall quality appears to have significantly improved.

   Material control. The purchase order lead time is only half of what it was four months ago, which indicates that purchases are arriving in less time. This trend may be a result of the company's move toward JIT purchasing.

   Delivery performance. The process time has decreased from 2.1 days to 1.8 days over the last four months.

Problem 11-17 (continued)

b. Areas of deterioration:

Material control. Scrap as a percentage of total cost has tripled over the last four months.

Machine performance. Machine downtime has doubled over the last four months. This may be a result of the greater setup time, or it may just reflect efforts to get the new equipment operating properly. Also note that use of the machines as a percentage of availability is declining rapidly.

Delivery performance. All delivery performance measures are moving in the wrong direction. Throughput time and delivery cycle time are both increasing, and the manufacturing cycle efficiency is decreasing.

3. a. and b.

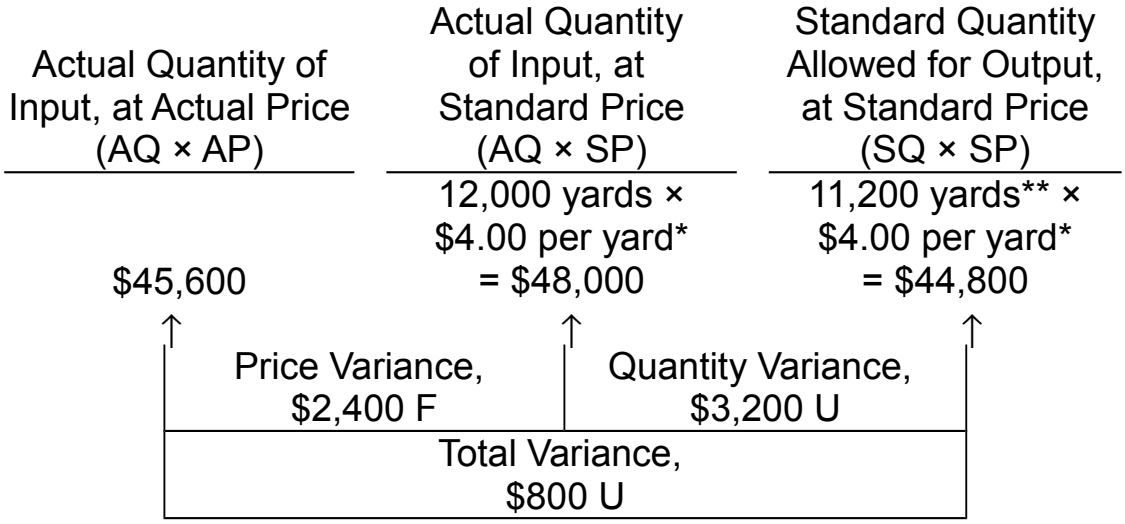
	Month	
	5	*6*
Throughput time in days:		
Process time	1.8	1.8
Inspection time	0.7	0.0
Move time	0.5	0.5
Queue time during production	0.0	0.0
Total throughput time	3.0	2.3
Manufacturing cycle efficiency (MCE):		
Process time ÷ Throughput time	60.0%	78.3%

As non-value-added activities are eliminated, the manufacturing cycle efficiency improves. The goal, of course, is to have an efficiency of 100%. This is achieved when all non-value-added activities have been eliminated and process time equals throughput time.

Problem 11-18 (45 minutes)

This problem is more difficult than it looks. Allow ample time for discussion.

1.



* $22.40 ÷ 5.6 yards = $4.00 per yard
** 2,000 sets × 5.6 yards per set = 11,200 yards

Alternatively, the variances can be computed using the formulas:

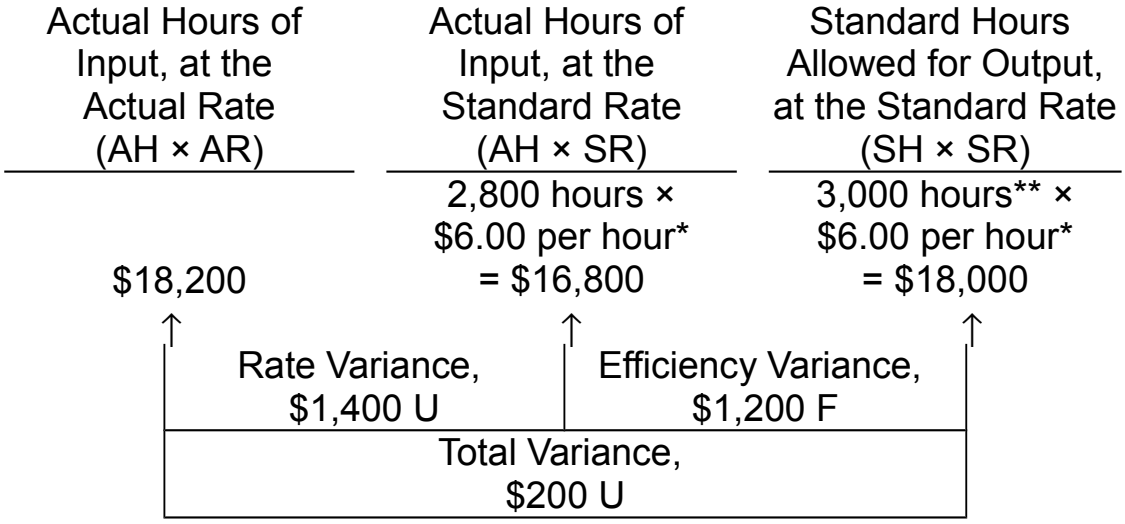
Materials price variance = AQ (AP – SP)
12,000 yards ($3.80 per yard* – $4.00 per yard) = $2,400 F

*$45,600 ÷ 12,000 yards = $3.80 per yard

Materials quantity variance = SP (AQ – SQ)
$4.00 per yard (12,000 yards – 11,200 yards) = $3,200 U

Problem 11-18 (continued)

2. Many students will miss parts 2 and 3 because they will try to use *product* costs as if they were *hourly* costs. Pay particular attention to the computation of the standard direct labor time per unit and the standard direct labor rate per hour.



* 2,850 standard hours ÷ 1,900 sets = 1.5 standard hours per set, $9.00 standard cost per set ÷ 1.5 standard hours per set = $6.00 standard rate per hour.

** 2,000 sets × 1.5 standard hours per set = 3,000 standard hours.

Alternatively, the variances can be computed using the formulas:

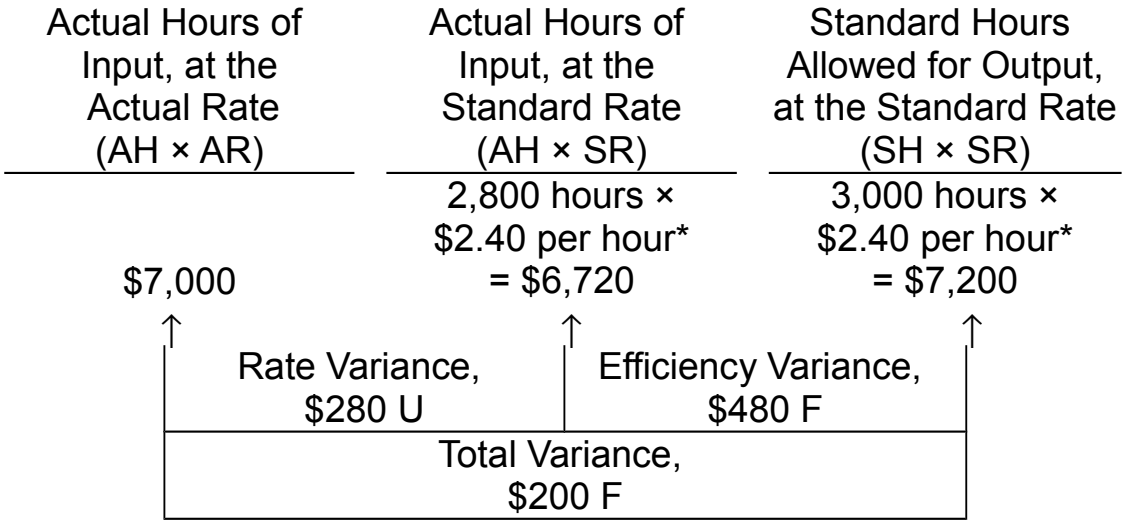
Labor rate variance = AH (AR – SR)
2,800 hours ($6.50 per hour* – $6.00 per hour) = $1,400 U

*$18,200 ÷ 2,800 hours = $6.50 per hour

Labor efficiency variance = SR (AH – SH)
$6.00 per hour (2,800 hours – 3,000 hours) = $1,200 F

Problem 11-18 (continued)

3.



*$3.60 standard cost per set ÷ 1.5 standard hours per set
= $2.40 standard rate per hour

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
2,800 hours ($2.50 per hour* – $2.40 per hour) = $280 U

*$7,000 ÷ 2,800 hours = $2.50 per hour

Variable overhead efficiency variance = SR (AH – SH)
$2.40 per hour (2,800 hours – 3,000 hours) = $480 F

Problem 11-19 (45 minutes)

1. a. Materials quantity variance = SP (AQ – SQ)
$5.00 per foot (AQ – 9,600 feet*) = $4,500 U
$5.00 per foot × AQ – $48,000 = $4,500**
$5.00 per foot × AQ = $52,500
AQ = 10,500 feet

* $3,200 units × 3 foot per unit
** When used with the formula, unfavorable variances are positive and favorable variances are negative.

Therefore, $55,650 ÷ 10,500 feet = $5.30 per foot

b. Materials price variance = AQ (AP – SP)
10,500 feet ($5.30 per foot – $5.00 per foot) = $3,150 U

The total variance for materials is:

Materials price variance.....	$3,150 U
Materials quantity variance.....	4,500 U
Total variance.....	$7,650 U

Alternative approach to parts (a) and (b):

Actual Quantity of Input, at Actual Price (AQ × AP)	Actual Quantity of Input, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
10,500 feet × $5.30 per foot = $55,650*	10,500 feet × $5.00 per foot* = $52,500	9,600 feet** × $5.00 per foot* = $48,000

Price Variance, $3,150 U | Quantity Variance, $4,500 U*

Total Variance, $7,650 U

* Given
** 3,200 units × 3 foot per unit = 9,600 feet

Problem 11-19 (continued)

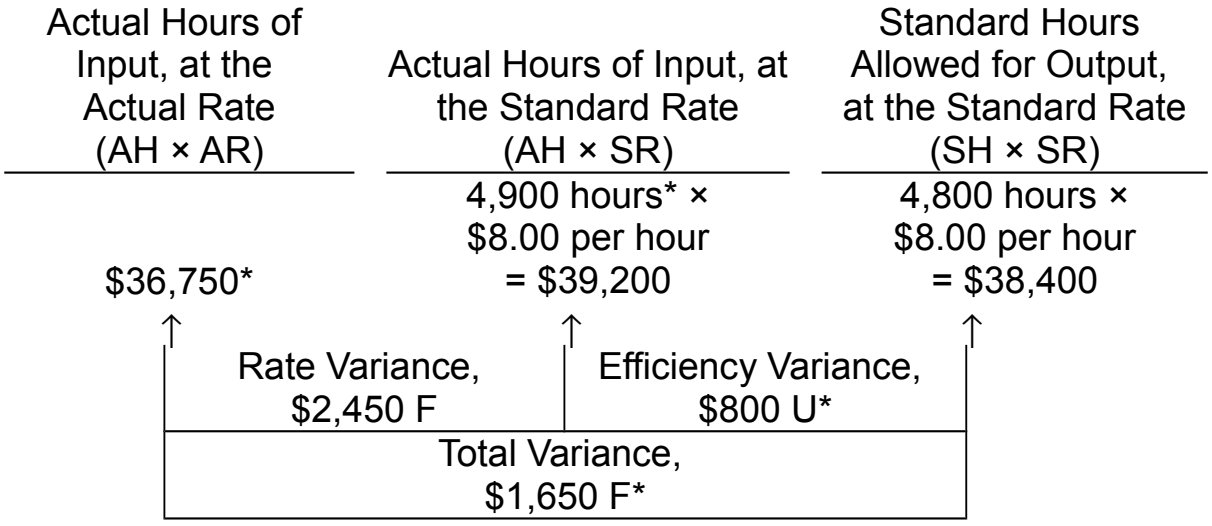
2. a. Labor rate variance = AH (AR – SR)
4,900 hours ($7.50 per hour* – SR) = $2,450 F**
$36,750 – 4,900 hours × SR = –$2,450***
4,900 hours × SR = $39,200
SR = $8.00

* $36,750 ÷ 4,900 hours
** $1,650 F + $800 U.
*** When used with the formula, unfavorable variances are positive and favorable variances are negative.

b. Labor efficiency variance = SR (AH – SH)
$8 per hour (4,900 hours – SH) = $800 U
$39,200 – $8 per hour × SH = $800*
$8 per hour × SH = $38,400
SH = 4,800 hours

* When used with the formula, unfavorable variances are positive and favorable variances are negative.

Alternative approach to parts (a) and (b):



*Given.

c. The standard hours allowed per unit of product are:
4,800 hours ÷ 3,200 units = 1.5 hours per unit

Problem 11-21 (45 minutes)

1. Standard cost for a ten-gallon batch of raspberry sherbet.

Direct material:		
Raspberries (7.5 quarts[1] × $0.80 per quart).....	$6.00	
Other ingredients (10 gallons × $0.45 per gallon).....	4.50	$10.50
Direct labor:		
Sorting (18 minutes[2] ÷ 60 minutes per hour) × $9.00 per hour.....	2.70	
Blending (12 minutes ÷ 60 minutes per hour) × $9.00 per hour.....	1.80	4.50
Packing (40 quarts[3] × $0.38 per quart).....		15.20
Standard cost per ten-gallon batch.....		$30.20

[1]6 quarts × (5 ÷ 4) = 7.5 quarts required to obtain 6 acceptable quarts.
[2]3 minutes per quart × 6 quarts.
[3]4 quarts per gallon × 10 gallons = 40 quarts.

2. a. In general, the purchasing manager is held responsible for unfavorable material price variances. Causes of these variances include the following:

   - Incorrect standards.
   - Failure to correctly forecast price increases.
   - Purchasing in nonstandard or uneconomical lots.
   - Failure to take available purchase discounts.
   - Failure to control transportation costs.
   - Purchasing from suppliers other than those offering the most favorable terms.

   However, failure to meet price standards may be caused by an unexpected increase in orders or changes in production schedules. In this case, the responsibility for unfavorable material price variances should rest with the sales manager or the manager of production planning. Variances may also be caused by external events that are uncontrollable, e.g., a strike at a supplier's plant.

Problem 11-21 (continued)

b. In general, the production manager or foreman is held responsible for unfavorable labor efficiency variances. Causes of these variances include the following:

- Incorrect standards.
- Poorly trained labor.
- Substandard or inefficient equipment.
- Inadequate supervision.
- Machine breakdowns from poor maintenance.
- Poorly motivated employees.
- Fixed labor force with demand less than capacity.

Failure to meet labor efficiency standards may also be caused by the use of inferior materials or poor production planning. In these cases, responsibility should rest with the purchasing manager or the manager of production planning. Variances may also be caused by external events that are uncontrollable, e.g., low unemployment leading to the inability to hire and retain skilled workers.

(Unofficial CMA Solution, adapted)

Case 11-22 (30 minutes)

This case may be difficult for some students to grasp because it requires looking at standard costs from an entirely different perspective. In this case, standard costs have been inappropriately used as a means to manipulate reported earnings rather than as a way to control costs.

1. Lansing has evidently set very loose standards in which the standard prices and standard quantities are far too high. This guarantees that favorable variances will ordinarily result from operations. If the standard costs are set artificially high, the standard cost of goods sold will be artificially high and thus the division's net operating income will be depressed until the favorable variances are recognized. If Lansing saves the favorable variances, he can release just enough in the second and third quarters to show some improvement and then he can release all of the rest in the last quarter, creating the annual "Christmas present."

2. Lansing should not be permitted to continue this practice for several reasons. First, it distorts the quarterly earnings for both the division and the company. The distortions of the division's quarterly earnings are troubling because the manipulations may mask real signs of trouble. The distortions of the company's quarterly earnings are troubling because they may mislead external users of the financial statements. Second, Lansing should not be rewarded for manipulating earnings. This sets a moral tone in the company that is likely to lead to even deeper trouble. Indeed, the permissive attitude of top management toward the manipulation of earnings may indicate the existence of other, even more serious, ethical problems in the company. Third, a clear message should be sent to division managers like Lansing that their job is to manage their operations, not their earnings. If they keep on top of operations and manage well, the earnings should take care of themselves.

Case 11-22 (continued)

3. Stacy Cummins does not have any easy alternatives available. She has already taken the problem to the President, who was not interested. If she goes around the President to the Board of Directors, she will be putting herself in a politically difficult position with little likelihood that it will do much good if, in fact, the Board of Directors already knows what is going on.

   On the other hand, if she simply goes along, she will be violating the Credibility standard of ethical conduct for management accountants. The Home Security Division's manipulation of quarterly earnings does distort the entire company's quarterly reports. And the Credibility standard clearly stipulates that management accountants have a responsibility to "disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations." Apart from the ethical issue, there is also a very practical consideration. If Merced Home Products becomes embroiled in controversy concerning questionable accounting practices, Stacy Cummins will be viewed as a responsible party by outsiders and her career is likely to suffer dramatically and she may even face legal problems.

   We would suggest that Ms. Cummins quietly bring the manipulation of earnings to the attention of the audit committee of the Board of Directors, carefully laying out in a non-confrontational manner the problems created by Lansing's practice of manipulating earnings. If the President and the Board of Directors are still not interested in dealing with the problem, she may reasonably conclude that the best alternative is to start looking for another job.

Case 11-23 (60 minutes)

1. The number of units produced can be computed by using the total standard cost applied for the period for *any* input—direct materials, direct labor, or variable manufacturing overhead. Using the standard cost applied for direct materials, we have:

$$\frac{\text{Total standard cost applied for the period}}{\text{Standard cost per unit}} = \frac{\$405{,}000}{\$18 \text{ per unit}}$$

$$= 22{,}500 \text{ units}$$

   The same answer can be obtained by using direct labor or variable manufacturing overhead.

2. 138,000 pounds; see below for a detailed analysis.

3. $2.95 per pound; see below for a detailed analysis.

4. 19,400 direct labor-hours; see below for a detailed analysis.

5. $15.75 per direct labor-hour; see below for a detailed analysis.

6.

Standard variable overhead cost applied	$54,000		
Add: Overhead efficiency variance.....	4,200	U	(see below)
Deduct: Overhead rate variance.....	1,300	F	
Actual variable overhead cost incurred…	$56,900		

Case 11-23 (continued)

Direct materials analysis:

Actual Quantity of Inputs, at Actual Price (AQ × AP)	Actual Quantity of Inputs, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
138,000 pounds × $2.95 per pound*** = $407,100	138,000 pounds** × $3 per pound = $414,000	135,000 pounds* × $3 per pound = $405,000

Price Variance, $6,900 F	Quantity Variance, $9,000 U
Total Variance, $2,100 U	

* 22,500 units × 6 pounds per unit = 135,000 pounds
** $414,000 ÷ $3 per pound = 138,000 pounds
*** $407,100 ÷ 138,000 pounds = $2.95 per pound

Direct labor analysis:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
19,400 DLHs × $15.75 per DLH*** = $305,550	19,400 DLHs** × $15 per DLH = $291,000	18,000 DLHs* × $15 per DLH = $270,000

Rate Variance, $14,550 U	Efficiency Variance, $21,000 U
Total Variance, $35,550 U	

* 22,500 units × 0.8 DLHs per unit = 18,000 DLHs
** $291,000 ÷ $15 per DLH = 19,400 DLHs
*** $305,550 ÷ 19,400 DLHs = $15.75 per DLH

Case 11-23 (continued)

Variable overhead analysis:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$56,900**	19,400 DLHs × $3 per DLH = $58,200	18,000 DLHs × $3 per DLH = $54,000

Rate Variance, $1,300 F	Efficiency Variance, $4,200 U*

* Computed using 19,400 actual DLHs at the $3 per DLH standard rate.
** $58,200 – $1,300 = $56,900.

Appendix 11A
Predetermined Overhead Rates and Overhead Analysis in a Standard Costing System

Exercise 11A-1 (15 minutes)

1. The total overhead cost at the denominator level of activity must be determined before the predetermined overhead rate can be computed.

Total fixed overhead cost per year.....	$250,000
Total variable overhead cost ($2 per DLH × 40,000 DLHs).....	80,000
Total overhead cost at the denominator level of activity…	$330,000

$$\text{Predetermined overhead rate} = \frac{\text{Overhead at the denominator level of activity}}{\text{Denominator level of activity}}$$

$$= \frac{\$330,000}{40,000 \text{ DLHs}} = \$8.25 \text{ per DLH}$$

2.

Standard direct labor-hours allowed for the actual output (a).....	38,000 DLHs
Predetermined overhead rate (b).....	$8.25 per DLH
Overhead applied (a) × (b).....	$313,500

Exercise 11A-2 (15 minutes)

1.

$$\text{Fixed portion of the predetermined overhead rate} = \frac{\text{Fixed overhead}}{\text{Denominator level of activity}}$$

$$= \frac{\$250{,}000}{25{,}000 \text{ DLHs}}$$

$$= \$10.00 \text{ per DLH}$$

2.

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \$254{,}000 - \$250{,}000$$

$$= \$4{,}000 \text{ U}$$

$$\text{Volume variance} = \text{Fixed portion of the predetermined overhead rate} \times \left(\text{Denominator hours} - \text{Standard hours allowed}\right)$$

$$= \$10.00 \text{ per DLH} \times (25{,}000 \text{ DLHs} - 26{,}000 \text{ DLHs})$$

$$= \$10{,}000 \text{ F}$$

Exercise 11A-3 (15 minutes)

1.

$$\text{Predetermined overhead rate} = \frac{\text{Total overhead at the denominator activity}}{\text{Denominator activity}}$$

$$= \frac{\$1.90 \text{ per DLH} \times 30{,}000 \text{ per DLH} + \$168{,}000}{30{,}000 \text{ DLHs}}$$

$$= \frac{\$225{,}000}{30{,}000 \text{ DLHs}}$$

$$= \$7.50 \text{ per DLH}$$

Variable element: ($1.90 per DLH × 30,000 DLHs) ÷ 30,000 DLHs = $57,000 ÷ 30,000 DLHs = $1.90 per DLH

Fixed element: $168,000 ÷ 30,000 DLHs = $5.60 per DLH

2. Direct materials, 2.5 yards × $8.60 per yard.....	$21.50
Direct labor, 3 DLHs* × $12.00 per DLH.....	36.00
Variable manufacturing overhead, 3 DLHs × $1.90 per DLH	5.70
Fixed manufacturing overhead, 3 DLHs × $5.60 per DLH….	16.80
Total standard cost per unit.....	$80.00

*30,000 DLHs ÷ 10,000 units = 3 DLHs per unit.

Exercise 11A-4 (20 minutes)

1. $$\text{Predetermined overhead rate} = \frac{\$3 \text{ per MH} \times 60{,}000 \text{ MHs} + \$300{,}000}{60{,}000 \text{ MHs}}$$

$$= \frac{\$480{,}000}{60{,}000 \text{ MHs}}$$

$$= \$8 \text{ per MH}$$

$$\text{Variable portion of the predetermined overhead rate} = \frac{\$3 \text{ per MH} \times 60{,}000 \text{ MHs}}{60{,}000 \text{ MHs}}$$

$$= \frac{\$180{,}000}{60{,}000 \text{ MHs}}$$

$$= \$3 \text{ per MH}$$

$$\text{Fixed portion of the predetermined overhead rate} = \frac{\$300{,}000}{60{,}000 \text{ MHs}}$$

$$= \$5 \text{ per MH}$$

2. The standard hours per unit of product are:
   60,000 hours ÷ 40,000 units = 1.5 hours per unit

   Given this figure, the standard hours allowed for the actual production would be:
   42,000 units × 1.5 hours per unit = 63,000 standard hours allowed.

   60,000 denominator hours × $5 per hour = $300,000.

Exercise 11A-4 (continued)

3. Variable overhead rate variance:
   Variable overhead rate variance = (AH × AR) – (AH × SR)
   ($185,600) – (64,000 hours × $3 per hour) = $6,400 F

   Variable overhead efficiency variance:
   Variable overhead efficiency variance = SR (AH – SH)
   $3 per hour (64,000 hours – 63,000 hours) = $3,000 U

   The fixed overhead variances are as follows:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$302,400	$300,000*	63,000 hours × $5 per hour = $315,000

Budget Variance, $2,400 U	Volume Variance, $15,000 F

   *As originally budgeted.

   Alternative approach to the budget variance:

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \$302,400 - \$300,000$$

$$= \$2,400 \text{ U}$$

   Alternative approach to the volume variance:

$$\text{Volume Variance} = \text{Fixed portion of the predetermined overhead rate} \times \left(\text{Denominator hours} - \text{Standard hours allowed}\right)$$

$$= \$5 \text{ per hour} \times (60,000 \text{ hours} - 63,000 \text{ hours})$$

$$= \$15,000 \text{ F}$$

Exercise 11A-5 (10 minutes)

Company A: This company has a favorable volume variance because the standard hours allowed for the actual production are greater than the denominator hours.

Company B: This company has an unfavorable volume variance because the standard hours allowed for the actual production are less than the denominator hours.

Company C: This company has no volume variance because the standard hours allowed for the actual production and the denominator hours are the same.

Exercise 11A-6 (15 minutes)

1. 9,500 units × 4 hours per unit = 38,000 hours.

2. and 3.

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$198,700*	$200,000	38,000 hours × $5 per hour* = $190,000

Budget Variance, $1,300 F

Volume Variance, $10,000 U*

*Given.

4. $$\text{Fixed element of the predetermined overhead rate} = \frac{\text{Budgeted fixed overhead}}{\text{Denominator activity}}$$

$$= \frac{\$200{,}000}{\text{Denominator activity}}$$

$$= \$5 \text{ per hour}$$

Therefore, the denominator activity is: $200,000 ÷ $5 per hour = 40,000 hours.

Exercise 11A-7 (15 minutes)

1. 14,000 units produced × 3 MHs per unit = 42,000 MHs

2.

Actual fixed overhead incurred.....	$267,000
Add: Favorable budget variance.....	3,000
Budgeted fixed overhead cost.....	$270,000

$$\text{Fixed element of the predetermined overhead rate} = \frac{\text{Budgeted fixed overhead}}{\text{Denominator activity}}$$

$$= \frac{\$270,000}{45,000 \text{ MHs}}$$

$$= \$6 \text{ per MH}$$

3. $$\text{Volume Variance} = \left(\begin{array}{c}\text{Fixed portion of the predetermined overhead rate}\end{array}\right) \left(\begin{array}{c}\text{Denominator hours} - \text{Standard hours allowed}\end{array}\right)$$

$$= \$6 \text{ per MH } (45,000 \text{ MHs} - 42,000 \text{ MHs})$$

$$= \$18,000 \text{ U}$$

Alternative solution to parts 1-3:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$267,000*	$270,000[1]	42,000 MHs[2] × $6 per MH[3] = $252,000
	Budget Variance, $3,000 F*	Volume Variance, $18,000 U

[1] $267,000 + $3,000 = $270,000.

[2] 14,000 units × 3 MHs per unit = 42,000 MHs

[3] $270,000 ÷ 45,000 denominator MHs = $6 per MH

*Given.

Problem 11A-8 (30 minutes)

1. Direct materials, 3 yards × $4.40 per yard..... $13.20
   Direct labor, 1 DLH × $12.00 per DLH..... 12.00
   Variable manufacturing overhead, 1 DLH × $5.00 per DLH*..... 5.00
   Fixed manufacturing overhead, 1 DLH × $11.80 per DLH**..... 11.80
   Standard cost per unit..... $42.00

   * $25,000 ÷ 5,000 DLHs = $5.00 per DLH.
   ** $59,000 ÷ 5,000 DLHs = $11.80 per DLH.

2. Materials variances:

   Materials price variance = AQ (AP – SP)
   24,000 yards ($4.80 per yard – $4.40 per yard) = $9,600 U

   Materials quantity variance = SP (AQ – SQ)
   $4.40 per yard (18,500 yards – 18,000 yards*) = $2,200 U

   *6,000 units × 3 yards per unit = 18,000 yards

   Labor variances:

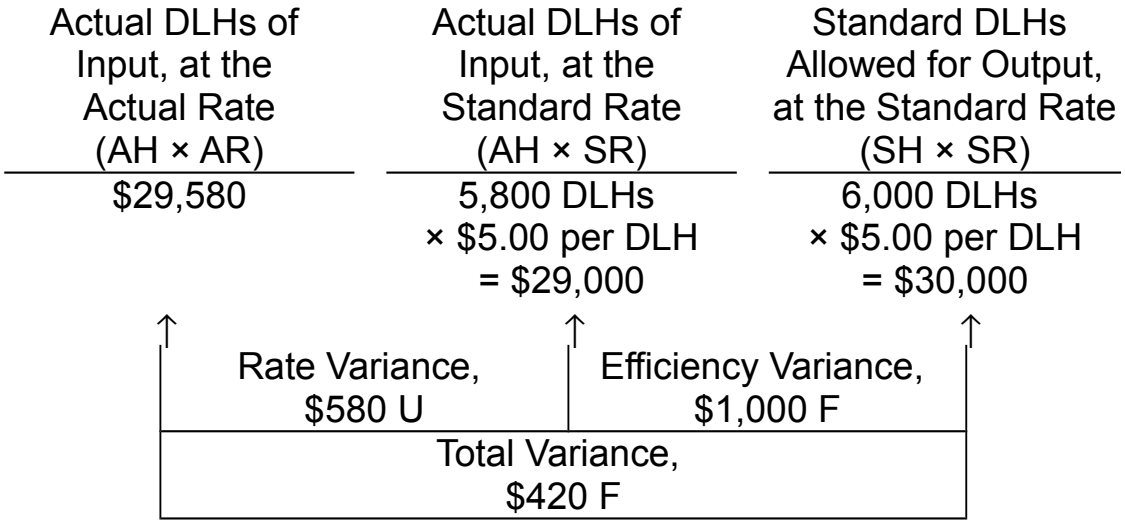
   Labor rate variance = AH (AR – SR)
   5,800 DLHs ($13.00 per DLH – $12.00 per DLH) = $5,800 U

   Labor efficiency variance = SR (AH – SH)
   $12.00 per DLH (5,800 DLHs – 6,000 DLHs*) = $2,400 F

   *6,000 units × 1 DLH per unit = 6,000 DLHs

Problem 11A-8 (continued)

3. Variable overhead variances:

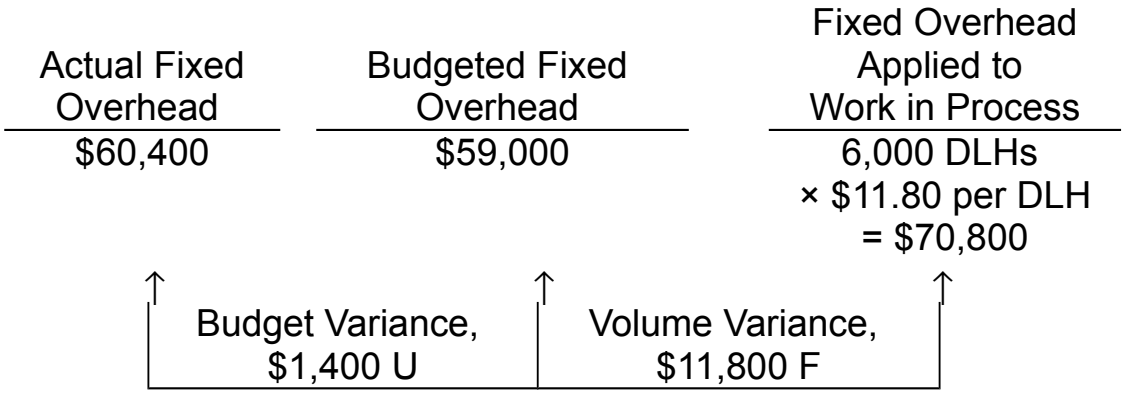


Alternative solution for the variable overhead variances:

Variable overhead rate variance = (AH × AR) – (AH × SR)
($29,580) – (5,800 DLHs × $5.00 per DLH) = $580 U

Variable overhead efficiency variance = SR (AH – SH)
$5.00 per DLH (5,800 DLHs – 6,000 DLHs) = $1,000 F

Fixed overhead variances:



Problem 11A-8 (continued)

Alternative approach to the budget variance:

$$\begin{aligned}\text{Budget variance} &= \text{Actual fixed overhead} - \text{Budgeted fixed overhead}\\ &= \$60{,}400 - \$59{,}000\\ &= \$1{,}400\ \text{U}\end{aligned}$$

Alternative approach to the volume variance:

$$\begin{aligned}\text{Volume Variance} &= \text{Fixed portion of the predetermined overhead rate} \times \left(\text{Denominator hours} - \text{Standard hours allowed}\right)\\ &= \$11.80 \text{ per DLH} \times (5{,}000 \text{ DLHs} - 6{,}000 \text{ DLHs})\\ &= \$11{,}800\ \text{F}\end{aligned}$$

4. The choice of a denominator activity level affects standard unit costs in that the higher the denominator activity level chosen, the lower standard unit costs will be. The reason is that the fixed portion of overhead costs is spread over more units as the denominator activity rises.

   The volume variance cannot be controlled by controlling spending. The volume variance simply reflects whether actual activity was greater than or less than the denominator activity. Thus, the volume variance is controllable only through activity.

Problem 11A-9 (45 minutes)

1. Direct materials price and quantity variances:

   Materials price variance = AQ (AP – SP)
   64,000 feet ($8.55 per foot – $8.45 per foot) = $6,400 U

   Materials quantity variance = SP (AQ – SQ)
   $8.45 per foot (64,000 feet – 60,000 feet*) = $33,800 U

   *30,000 units × 2 feet per unit = 60,000 feet

2. Direct labor rate and efficiency variances:

   Labor rate variance = AH (AR – SR)
   43,500 DLHs ($15.80 per DLH – $16.00 per DLH) = $8,700 F

   Labor efficiency variance = SR (AH – SH)
   $16.00 per DLH (43,500 DLHs – 42,000 DLHs*) = $24,000 U

   *30,000 units × 1.4 DLHs per unit = 42,000 DLHs

3. a. Variable overhead spending and efficiency variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$108,000	43,500 DLHs × $2.50 per DLH = $108,750	42,000 DLHs × $2.50 per DLH = $105,000
	Rate Variance, $750 F	Efficiency Variance, $3,750 U

   Alternative solution:

   Variable overhead rate variance = (AH × AR) – (AH × SR)
   ($108,000) – (43,500 DLHs × $2.50 per DLH) = $750 F

   Variable overhead efficiency variance = SR (AH – SH)
   $2.50 per DLH (43,500 DLHs – 42,000 DLHs) = $3,750 U

Problem 11A-9 (continued)

b. Fixed overhead budget and volume variances:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$211,800	$210,000*	42,000 DLHs × $6 per DLH = $252,000

Budget Variance, $1,800 U	Volume Variance, $42,000 F

*As originally budgeted. This figure can also be expressed as: 35,000 denominator DLHs × $6 per DLH = $210,000.

Alternative solution:

Budget variance:

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \$211,800 - \$210,000$$

$$= \$1,800 \text{ U}$$

Volume variance:

$$\text{Volume Variance} = \left(\text{Fixed portion of the predetermined overhead rate} \times \text{Denominator hours}\right) - \text{Standard hours allowed}$$

$$= \$6.00 \text{ per DLH} \times (35,000 \text{ DLHs} - 42,000 \text{ DLHs})$$

$$= \$42,000 \text{ F}$$

Problem 11A-9 (continued)

4. The total of the variances would be:

Direct materials variances:	
Price variance	$ 6,400 U
Quantity variance	33,800 U
Direct labor variances:	
Rate variance	8,700 F
Efficiency variance	24,000 U
Variable manufacturing overhead variances:	
Rate variance	750 F
Efficiency variance	3,750 U
Fixed manufacturing overhead variances:	
Budget variance	1,800 U
Volume variance	42,000 F
Total of variances	$18,300 U

Note that the total of the variances agrees with the $18,300 variance mentioned by the president.

It appears that not everyone should be given a bonus for good cost control. The materials quantity variance and the labor efficiency variance are 6.7% and 3.6%, respectively, of the standard cost allowed and thus would warrant investigation.

The company's large unfavorable variances (for materials quantity and labor efficiency) do not show up more clearly because they are offset by the favorable volume variance. This favorable volume variance is a result of the company operating at an activity level that is well above the denominator activity level used to set predetermined overhead rates. (The company operated at an activity level of 42,000 standard hours; the denominator activity level set at the beginning of the year was 35,000 hours.) As a result of the large favorable volume variance, the unfavorable quantity and efficiency variances have been concealed in a small "net" figure. The large favorable volume variance may have been achieved by building up inventories.

Problem 11A-10 (45 minutes)

1. $$\text{Total rate: } \frac{\text{PZ297,500}}{\text{35,000 hours}} = \text{PZ8.50 per hour}$$

$$\text{Variable rate: } \frac{\text{PZ87,500}}{\text{35,000 hours}} = \text{PZ2.50 per hour}$$

$$\text{Fixed rate: } \frac{\text{PZ210,000}}{\text{35,000 hours}} = \text{PZ6.00 per hour}$$

2. 32,000 standard hours × PZ8.50 per hour = PZ272,000.

3. Variable overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
PZ78,000	30,000 hours × PZ2.50 per hour = PZ75,000	32,000 hours × PZ2.50 per hour = PZ80,000
	Rate Variance, PZ3,000 U	Efficiency Variance, PZ5,000 F

Alternative solution:

Variable overhead rate variance = (AH × AR) – (AH × SR)
(PZ78,000) – (30,000 hours × PZ2.50 per hour) = PZ3,000 U

Variable overhead efficiency variance = SR (AH – SH)
PZ2.50 per hour (30,000 hours – 32,000 hours) = PZ5,000 F

Problem 11A-10 (continued)

Fixed overhead variances:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
PZ209,400	PZ210,000	32,000 hours × PZ6 per hour = PZ192,000

Budget Variance, PZ600 F | Volume Variance, PZ18,000 U

Alternative solution:

Budget variance:

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \text{PZ209,400} - \text{PZ210,000}$$

$$= \text{PZ600 F}$$

Volume variance:

$$\text{Volume Variance} = \left(\text{Fixed portion of the predetermined overhead rate} \times \text{Denominator hours}\right) - \text{Standard hours allowed}$$

$$= \text{PZ6.00 per hour} \times (35{,}000 \text{ hours} - 32{,}000 \text{ hours})$$

$$= \text{PZ18,000 U}$$

Verification:

Variable overhead rate variance.....	PZ 3,000 U
Variable overhead efficiency variance	5,000 F
Fixed overhead budget variance.....	600 F
Fixed overhead volume variance.....	18,000 U
Underapplied overhead.....	PZ15,400 U

Problem 11A-10 (continued)

4. Variable overhead

   Rate variance: This variance includes both price and quantity elements. The overhead spending variance reflects differences between actual and standard prices for variable overhead items. It also reflects differences between the amounts of variable overhead inputs that were actually used and the amounts that should have been used for the actual output of the period. Because the variable overhead spending variance is unfavorable, either too much was paid for variable overhead items or too many of them were used.

   Efficiency variance: The term “variable overhead efficiency variance” is a misnomer, because the variance does not measure efficiency in the use of overhead items. It measures the indirect effect on variable overhead of the efficiency or inefficiency with which the activity base is utilized. In this company, the activity base is labor-hours. If variable overhead is really proportional to labor-hours, then more effective use of labor-hours has the indirect effect of reducing variable overhead. Because 2,000 fewer labor-hours were required than indicated by the labor standards, the indirect effect was presumably to reduce variable overhead spending by about PZ5,000 (PZ2.50 per hour × 2,000 hours).

   Fixed overhead

   Budget variance: This variance is simply the difference between the budgeted fixed cost and the actual fixed cost. In this case, the variance is favorable which indicates that actual fixed costs were lower than anticipated in the budget.

   Volume variance: This variance occurs as a result of actual activity being different from the denominator activity in the predetermined overhead rate. In this case, the variance is unfavorable, so actual activity was less than the denominator activity. It is difficult to place much of a meaningful economic interpretation on this variance. It tends to be large, so it often swamps the other, more meaningful variances if they are simply netted against each other.

Problem 11A-11 (45 minutes)

1. Total rate: $\frac{\$600,000}{60,000 \text{ DLHs}} = \$10 \text{ per DLH}$

   Variable rate: $\frac{\$120,000}{60,000 \text{ DLHs}} = \$2 \text{ per DLH}$

   Fixed rate: $\frac{\$480,000}{60,000 \text{ DLHs}} = \$8 \text{ per DLH}$

2. | | |
   |---|---|
   | Direct materials: 3 pounds at $7 per pound..... | $21 |
   | Direct labor: 1.5 DLHs at $12 per DLH..... | 18 |
   | Variable overhead: 1.5 DLHs at $2 per DLH..... | 3 |
   | Fixed overhead: 1.5 DLHs at $8 per DLH..... | 12 |
   | Standard cost per unit..... | $54 |

3. a. 42,000 units × 1.5 DLHs per unit = 63,000 standard DLHs.

   b.

Manufacturing Overhead			
Actual costs	606,500	Applied costs	630,000 *
		Overapplied overhead	23,500

   *63,000 standard DLHs × $10 per DLH = $630,000.

4. Variable overhead variances:

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
$123,500	65,000 DLHs × $2 per DLH = $130,000	63,000 DLHs × $2 per DLH = $126,000
	Rate Variance, $6,500 F	Efficiency Variance, $4,000 U

Problem 11A-11 (continued)

Alternative solution:

Variable overhead rate variance = (AH × AR) – (AH × SR)
($123,500) – (65,000 DLHs × $2 per DLH) = $6,500 F

Variable overhead efficiency variance = SR (AH – SH)
$2 per DLH (65,000 DLHs – 63,000 DLHs) = $4,000 U

Fixed overhead variances:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$483,000	$480,000*	63,000 DLHs × $8 per DLH = $504,000

Budget Variance, $3,000 U | Volume Variance, $24,000 F

*Can be expressed as: 60,000 denominator DLHs × $8 per DLH = $480,000

Alternative solution:

Budget variance:

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \$483{,}000 - \$480{,}000$$

$$= \$3{,}000 \text{ U}$$

Volume variance:

$$\text{Volume Variance} = \text{Fixed portion of the predetermined overhead rate} \times (\text{Denominator hours} - \text{Standard hours allowed})$$

$$= \$8 \text{ per DLH} \times (60{,}000 \text{ DLHs} - 63{,}000 \text{ DLHs})$$

$$= \$24{,}000 \text{ F}$$

Problem 11A-11 (continued)

The company's overhead variances can be summarized as follows:

Variable overhead:	
Rate variance	$ 6,500 F
Efficiency variance	4,000 U
Fixed overhead:	
Budget variance	3,000 U
Volume variance	24,000 F
Overapplied overhead—see part 3	$23,500 F

5. Only the volume variance would have changed. It would have been unfavorable because the standard DLHs allowed for the year's production (63,000 DLHs) would have been less than the denominator DLHs (65,000 DLHs).

Problem 11A-12 (45 minutes)

1. and 2.

	Per Direct Labor-Hour		
	Variable	*Fixed*	*Total*
Denominator of 30,000 DLHs:			
$135,000 ÷ 30,000 DLHs	$4.50		$ 4.50
$270,000 ÷ 30,000 DLHs		$9.00	9.00
Total predetermined rate			$13.50
Denominator of 40,000 DLHs:			
$180,000 ÷ 40,000 DLHs	$4.50		$ 4.50
$270,000 ÷ 40,000 DLHs		$6.75	6.75
Total predetermined rate			$11.25

3.

	Denominator Activity: 30,000 DLHs		*Denominator Activity: 40,000 DLHs*	
Direct materials, 4 feet × $8.75 per foot		$35.00	Same	$35.00
Direct labor, 2 DLHs × $15 per DLH		30.00	Same	30.00
Variable overhead, 2 DLHs × $4.50 per DLH		9.00	Same	9.00
Fixed overhead, 2 DLHs × $9.00 per DLH		18.00	Fixed overhead, 2 DLHs × $6.75 per DLH	13.50
Standard cost per unit		$92.00	Standard cost per unit	$87.50

4. a. 18,000 units × 2 DLHs per unit = 36,000 standard DLHs.

b.

Manufacturing Overhead			
Actual costs	446,400	Applied costs	486,000 *
		Overapplied overhead	39,600

*36,000 standard DLHs × $13.50 predetermined rate per DLH = $486,000.

Problem 11A-12 (continued)

c. Variable overhead variances:

Actual DLHs of Input, at the Actual Rate (AH × AR)	Actual DLHs of Input, at the Standard Rate (AH × SR)	Standard DLHs Allowed for Output, at the Standard Rate (SH × SR)
$174,800	38,000 DLHs × $4.50 per DLH = $171,000	36,000 DLHs × $4.50 per DLH = $162,000
	Rate Variance, $3,800 U	Efficiency Variance, $9,000 U

Alternative solution:

Variable overhead rate variance = (AH × AR) – (AH × SR)
($174,800) – (38,000 DLHs × $4.50 per DLH) = $3,800 U

Variable overhead efficiency variance = SR (AH – SH)
$4.50 per DLH (38,000 DLHs – 36,000 DLHs) = $9,000 U

Fixed overhead variances:

Actual Fixed Overhead	Budgeted Fixed Overhead	Fixed Overhead Applied to Work in Process
$271,600	$270,000*	36,000 DLHs × $9 per DLH = $324,000
	Budget Variance, $1,600 U	Volume Variance, $54,000 F

*Can be expressed as: 30,000 denominator DLHs × $9 per DLH = $270,000.

Problem 11A-12 (continued)

Alternative solution:

Budget variance:

$$\text{Budget variance} = \text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

$$= \$271,600 - \$270,000$$

$$= \$1,600 \text{ U}$$

Volume variance:

$$\text{Volume Variance} = \left(\text{Fixed portion of the predetermined overhead rate} \times \text{Denominator hours}\right) - \text{Standard hours allowed}$$

$$= \$9.00 \text{ per DLH} \times (30,000 \text{ DLHs} - 36,000 \text{ DLHs})$$

$$= \$54,000 \text{ F}$$

Summary of variances:

Variable overhead rate variance.....	$ 3,800 U
Variable overhead efficiency variance.....	9,000 U
Fixed overhead budget variance.....	1,600 U
Fixed overhead volume variance.....	54,000 F
Overapplied overhead.....	$39,600 F

Problem 11A-12 (continued)

5. The major disadvantage of using normal activity is the large volume variance that ordinarily results. This occurs because the denominator activity used to compute the predetermined overhead rate is different from the activity level that is anticipated for the period. In the case at hand, the company has used a long-run normal activity figure of 30,000 DLHs to compute the predetermined overhead rate, whereas activity for the period was expected to be 40,000 DLHs. This has resulted in a large favorable volume variance that may be difficult for management to interpret. In addition, the large favorable volume variance in this case has masked the fact that the company did not achieve the budgeted level of activity for the period. The company had planned to work 40,000 DLHs, but managed to work only 36,000 DLHs (at standard). This unfavorable result is concealed due to using a denominator figure that is out of step with current activity.

   On the other hand, using long-run normal activity as the denominator results in unit costs that are stable from year to year. Thus, management's decisions are not clouded by unit costs that jump up and down as the activity level rises and falls.

Appendix 11B
Journal Entries to Record Variances

Exercise 11B-1 (20 minutes)

1. The general ledger entry to record the purchase of materials for the month is:

Raw Materials		
(12,000 meters at $3.25 per meter).....	39,000	
Materials Price Variance		
(12,000 meters at $0.10 per meter F).....		1,200
Accounts Payable		
(12,000 meters at $3.15 per meter).....		37,800

2. The general ledger entry to record the use of materials for the month is:

Work in Process		
(10,000 meters at $3.25 per meter).....	32,500	
Materials Quantity Variance		
(500 meters at $3.25 per meter U).....	1,625	
Raw Materials		
(10,500 meters at $3.25 per meter).....		34,125

3. The general ledger entry to record the incurrence of direct labor cost for the month is:

Work in Process (2,000 hours at $12.00 per hour)	24,000	
Labor Rate Variance		
(1,975 hours at $0.20 per hour U).....	395	
Labor Efficiency Variance		
(25 hours at $12.00 per hour F).....		300
Wages Payable		
(1,975 hours at $12.20 per hour).....		24,095

Exercise 11B-2 (45 minutes)

1. a.

Actual Quantity of Input, at Actual Price (AQ × AP)	Actual Quantity of Input, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
10,000 yards × $13.80 per yard = $138,000	10,000 yards × $14.00 per yard = $140,000	7,500 yards* × $14.00 per yard = $105,000

Price Variance, $2,000 F

8,000 yards × $14.00 per yard = $112,000

Quantity Variance, $7,000 U

*3,000 units × 2.5 yards per unit = 7,500 yards

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
10,000 yards ($13.80 per yard – $14.00 per yard) = $2,000 F

Materials quantity variance = SP (AQ – SQ)
$14.00 per yard (8,000 yards – 7,500 yards) = $7,000 U

Exercise 11B-2 (continued)

b. The journal entries would be:

Raw Materials		
(10,000 yards × 14.00 per yard).....	140,000	
Materials Price Variance		
(10,000 yards × $0.20 per yard F).....		2,000
Accounts Payable		
(10,000 yards × $13.80 per yard).....		138,000
Work in Process		
(7,500 yards × $14.00 per yard).....	105,000	
Materials Quantity Variance		
(500 yards U × $14.00 per yard).....	7,000	
Raw Materials		
(8,000 yards × $14.00 per yard).....		112,000

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
	5,000 hours × $8.00 per hour	4,800 hours* × $8.00 per hour
$43,000	= $40,000	= $38,400

Rate Variance, $3,000 U

Efficiency Variance, $1,600 U

Total Variance, $4,600 U

*3,000 units × 1.6 hours per unit = 4,800 hours

Exercise 11B-2 (continued)

Alternative Solution:

Labor rate variance = AH (AR – SR)
5,000 hours ($8.60 per hour* – $8.00 per hour) = $3,000 U
*$43,000 ÷ 5,000 hours = $8.60 per hour

Labor efficiency variance = SR (AH – SH)
$8.00 per hour (5,000 hours – 4,800 hours) = $1,600 U

b. The journal entry would be:

Work in Process		
(4,800 hours × $8.00 per hour).....	38,400	
Labor Rate Variance		
(5,000 hours × $0.60 per hour U).....	3,000	
Labor Efficiency Variance		
(200 hours U × $8.00 per hour).....	1,600	
Wages Payable		
(5,000 hours × $8.60 per hour).....		43,000

3. The entries are: entry (a), purchase of materials; entry (b), issue of materials to production; and entry (c), incurrence of direct labor cost.

Raw Materials			
(a)	140,000	(b)	112,000
Bal.*	28,000		

Work in Process			
(b)	105,000		
(c)	38,400		

Accounts Payable			
		(a)	138,000

Wages Payable			
		(c)	43,000

Materials Price Variance			
		(a)	2,000

Materials Quantity Variance			
(b)	7,000		

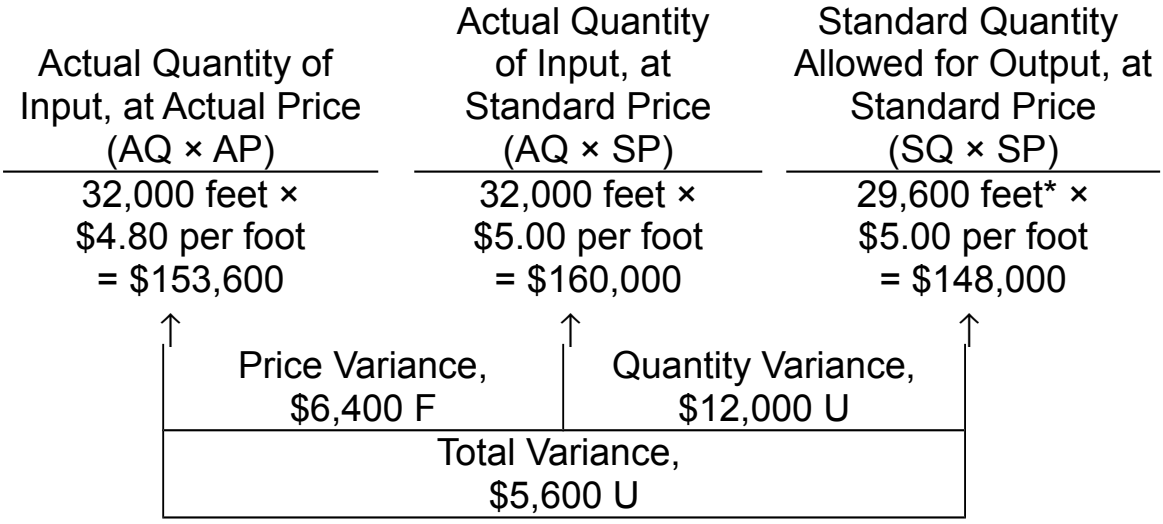
Labor Rate Variance			
(c)	3,000		

Labor Efficiency Variance			
(c)	1,600		

*2,000 yards of material at a standard cost of $14.00 per yard

Problem 11B-3 (60 minutes)

1. a.



*8,000 footballs × 3.7 ft. per football = 29,600 feet

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
32,000 feet ($4.80 per foot – $5.00 per foot) = $6,400 F

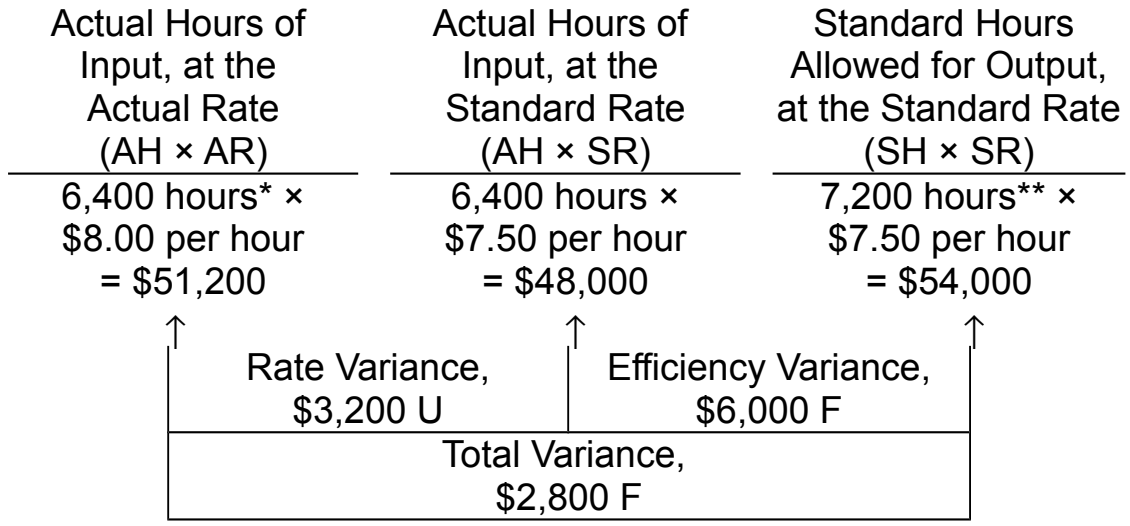
Materials quantity variance = SP (AQ – SQ)
$5.00 per foot (32,000 feet – 29,600 feet) = $12,000 U

b.

Raw Materials (32,000 feet × $5.00 per foot). .		160,000	
Materials Price Variance			
(32,000 feet × $0.20 per foot F).....			6,400
Accounts Payable			
(32,000 feet × $4.80 per foot).....			153,600
Work in Process			
(29,600 feet × $5.00 per foot).....		148,000	
Materials Quantity Variance			
(2,400 feet U × $5.00 per foot).....		12,000	
Raw Materials			
(32,000 feet × $5.00 per foot).....			160,000

Problem 11B-3 (continued)

2. a.



* 8,000 footballs × 0.8 hours per football = 6,400 hours
** 8,000 footballs × 0.9 hours per football = 7,200 hours

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
6,400 hours ($8.00 per hour – $7.50 per hour) = $3,200 U

Labor efficiency variance = SR (AH – SH)
$7.50 per hour (6,400 hours – 7,200 hours) = $6,000 F

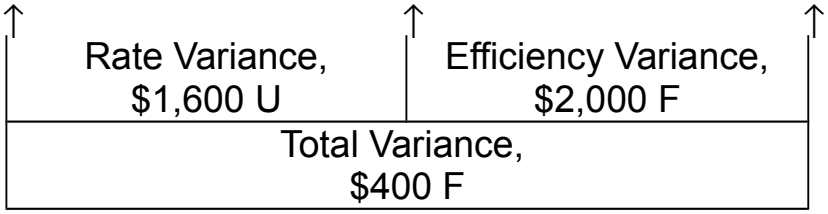
b.

Work in Process (7,200 hours × $7.50 per hour).	54,000	
Labor Rate Variance (6,400 hours × $0.50 per hour U).....	3,200	
Labor Efficiency Variance (800 hours F × $7.50 per hour)		6,000
Wages Payable (6,400 hours × $8.00 per hour).....		51,200

Problem 11B-3 (continued)

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
6,400 hours × $2.75 per hour = $17,600	6,400 hours × $2.50 per hour = $16,000	7,200 hours × $2.50 per hour = $18,000



Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
6,400 hours ($2.75 per hour – $2.50 per hour) = $1,600 U

Variable overhead efficiency variance = SR (AH – SH)
$2.50 per hour (6,400 hours – 7,200 hours) = $2,000 F

4. No. He is not correct in his statement. The company has a large, unfavorable materials quantity variance that should be investigated. Also, the overhead rate variance equals 10% of standard, which should also be investigated.

   It appears that the company's strategy to increase output by giving raises was effective. Although the raises resulted in an unfavorable rate variance, this variance was more than offset by a large, favorable efficiency variance.

Problem 11B-3 (continued)

5. The variances have many possible causes. Some of the more likely causes include the following:

   Materials variances:

   Favorable price variance: Good price, inferior quality materials, unusual discount due to quantity purchased, drop in market price, less costly method of freight, outdated or inaccurate standards.

   Unfavorable quantity variance: Carelessness, poorly adjusted machines, unskilled workers, inferior quality materials, outdated or inaccurate standards.

   Labor variances:

   Unfavorable rate variance: Use of highly skilled workers, change in pay scale, overtime, outdated or inaccurate standards.

   Favorable efficiency variance: Use of highly skilled workers, high-quality materials, new equipment, outdated or inaccurate standards.

   Variable overhead variances:

   Unfavorable rate variance: Increase in costs, waste, theft, spillage, purchases in uneconomical lots, outdated or inaccurate standards.

   Favorable efficiency variance: Same as for labor efficiency variance.

Problem 11B-4 (75 minutes)

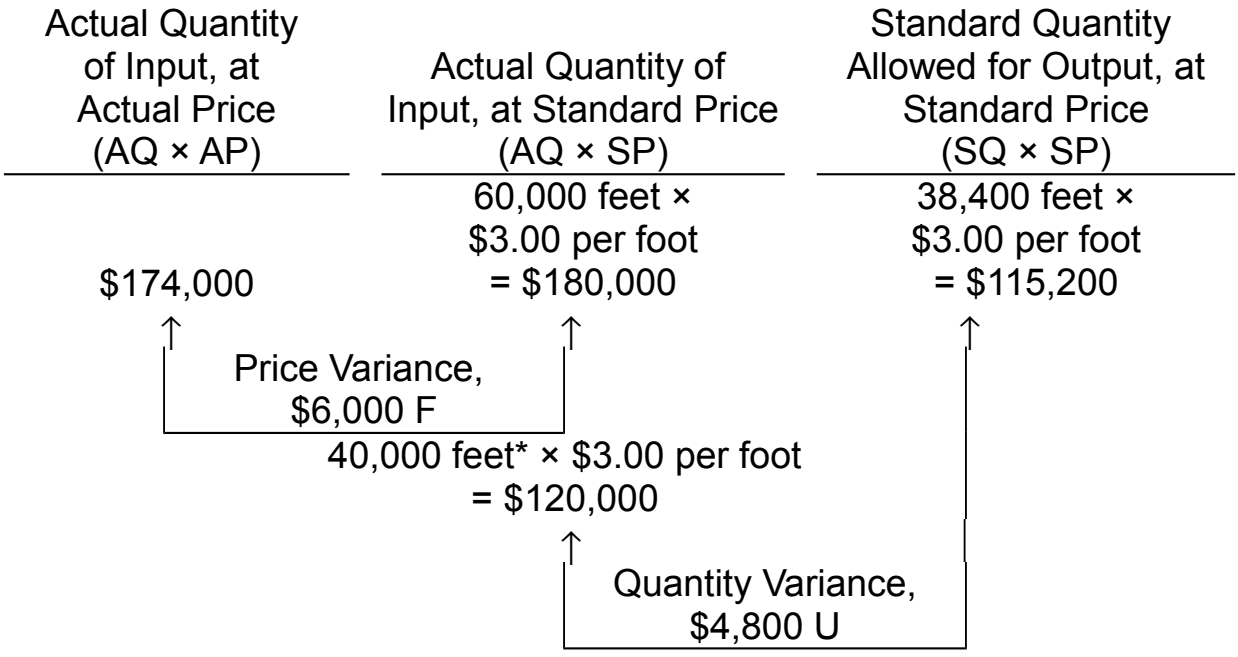
1. a. Before the variances can be computed, we must first compute the standard and actual quantities of material per hockey stick. The computations are:

Direct materials added to work in process (a). .	$115,200
Standard direct materials cost per foot (b).....	$3.00
Standard quantity of direct materials (a) ÷ (b). .	38,400 feet

Standard quantity of direct materials (a).....	38,400 feet
Number of sticks produced (b).....	8,000
Standard quantity per stick (a) ÷ (b).....	4.8 feet

Actual quantity of direct materials used per stick last year:
4.8 feet + 0.2 feet = 5.0 feet.

With these figures, the variances can be computed as follows:



*8,000 units × 5.0 feet per unit = 40,000 feet

Problem 11B-4 (continued)

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
60,000 feet ($2.90 per foot* – $3.00 per foot) = $6,000 F

*$174,000 ÷ 60,000 feet = $2.90 per foot

Materials quantity variance = SP (AQ – SQ)
$3.00 per foot (40,000 feet – 38,400 feet) = $4,800 U

b. Raw Materials (60,000 feet × $3.00 per foot).....	180,000	
Materials Price Variance		
(60,000 feet × $0.10 per foot F).....		6,000
Accounts Payable		
(60,000 feet × $2.90 per foot).....		174,000
Work in Process (38,400 feet × $3.00 per foot)…	115,200	
Materials Quantity Variance		
(1,600 feet U × $3.00 per foot).....	4,800	
Raw Materials (40,000 feet × $3.00 per foot).		120,000

Problem 11B-4 (continued)

2. a. Before the variances can be computed, we must first determine the actual direct labor hours worked for last year. This can be done through the variable overhead efficiency variance, as follows:

Variable overhead efficiency variance = SR (AH – SH)
$1.30 per hour × (AH – 16,000 hours*) = $650 U
$1.30 per hour × AH – $20,800 = $650**
$1.30 per hour × AH = $21,450
AH = $21,450 ÷ $1.30 per hour
AH = 16,500 hours

* 8,000 units × 2.0 hours per unit = 16,000 hours
** When used in the formula, an unfavorable variance is positive.

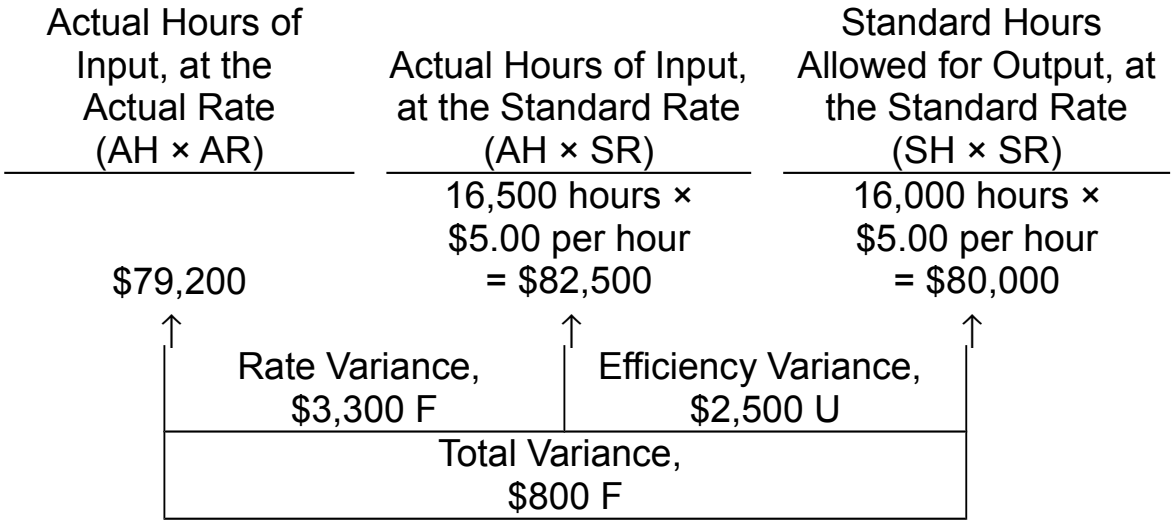
We must also compute the standard rate per direct labor hour. The computation is:

Labor rate variance = (AH × AR) – (AH × SR)
$79,200 – (16,500 hours × SR) = $3,300 F
$79,200 – 16,500 hours × SR = –$3,300*
16,500 hours × SR = $82,500
SR = $82,500 ÷ 16,500 hours
SR = $5.00 per hour

* When used in the formula, a favorable variance is negative.

Problem 11B-4 (continued)

Given these figures, the variances are:



Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
16,500 hours ($4.80 per hour* – $5.00 per hour) = $3,300 F

*79,200 ÷ 16,500 hours = $4.80 per hour

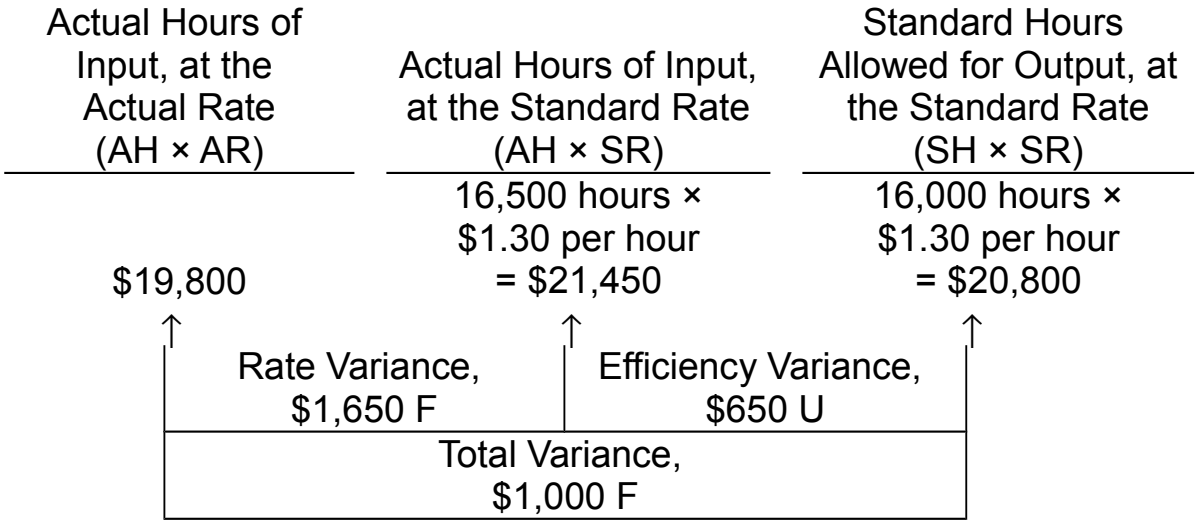
Labor efficiency variance = SR (AH – SH)
$5.00 per hour (16,500 hours – 16,000 hours) = $2,500 U

b.

Work in Process		
(16,000 hours × $5.00 per hour).....	80,000	
Labor Efficiency Variance		
(500 hours U × $5.00 per hour).....	2,500	
Labor Rate Variance		
(16,500 hours × $0.20 per hour F).....		3,300
Wages Payable		
(16,500 hours × $4.80 per hour).....		79,200

Problem 11B-4 (continued)

3.



Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
16,500 hours ($1.20 per hour* – $1.30 per hour) = $1,650 F

*$19,800 ÷ 16,500 hours = $1.20 per hour

Variable overhead efficiency variance = SR (AH – SH)
$1.30 per hour (16,500 hours – 16,000 hours) = $650 U

Problem 11B-4 (continued)

4. *For materials:*

   Favorable price variance: Decrease in outside purchase price; fortunate buy; inferior quality materials; unusual discounts due to quantity purchased; less costly method of freight; inaccurate standards.

   Unfavorable quantity variance: Inferior quality materials; carelessness; poorly adjusted machines; unskilled workers; inaccurate standards.

   For labor:

   Favorable rate variance: Unskilled workers (paid lower rates); piecework; inaccurate standards.

   Unfavorable efficiency variance: Poorly trained workers; poor quality materials; faulty equipment; work interruptions; fixed labor and insufficient demand to fill capacity; inaccurate standards.

   For variable overhead:

   Favorable rate variance: Decrease in supplier prices; less usage of lubricants or indirect materials than planned; inaccurate standards.

   Unfavorable efficiency variance: See comments under direct labor efficiency variance above.

5.

	Standard Quantity or Hours	*Standard Price or Rate*	*Standard Cost*
Direct materials.....	4.8 feet	$3.00 per foot	$14.40
Direct labor.....	2.0 hours	$5.00 per hour	10.00
Variable overhead.....	2.0 hours	$1.30 per hour	2.60
Total standard cost.....			$27.00