Chapter 9
Flexible Budgets, Standard Costs, and Variance Analysis

Solutions to Questions

9-1 The planning budget is prepared for the planned level of activity. It is static because it is not adjusted even if the level of activity subsequently changes.

9-2 A flexible budget can be adjusted to reflect any level of activity—including the actual level of activity. By contrast, a static planning budget is prepared for a single level of activity and is not subsequently adjusted.

9-3 Actual results can differ from the budget for many reasons. Very broadly speaking, the differences are usually due to a change in the level of activity, changes in prices, and changes in how effectively resources are managed.

9-4 From a manager's perspective, differences between the planning budget and actual results that are due to a change in activity are very different from variances that are due to changes in prices and changes in how effectively resources are managed. Consequently, these two factors should be clearly separated from each other. When the planning budget is directly compared to actual results, these two factors are lumped together. A flexible budget solves this problem by isolating the portion of the differences between the planning budget and actual results that is due to changes in prices and changes in how effectively resources are managed.

9-5 A revenue variance is the difference between how much the revenue should have been, given the actual level of activity, and the actual revenue for the period. A revenue variance is easy to interpret. A favorable revenue variance occurs because the revenue is greater than expected for the actual level of activity. An unfavorable revenue variance occurs because the revenue is less than expected for the actual level of activity.

9-6 A spending variance is the difference between how much a cost should have been, given the actual level of activity, and the actual amount of the cost. Like the revenue variance, the interpretation of a spending variance is straight-forward. A favorable spending variance occurs because the cost is lower than expected for the actual level of activity. An unfavorable spending variance occurs because the cost is higher than expected for the actual level of activity.

9-7 A flexible budget is created so that managers can compare what should have happened at the actual level of activity to what actually happened. A planning budget does not enable these comparisons because it is based on the planned level of activity rather than the actual level of activity. The differences between the flexible budget and the actual results are the revenue and spending variances. These variances measure differences that are due to changes in prices and the effectiveness with which resources are managed.

9-8 The only difference between a flexible budget based on a single cost driver and one based on two cost drivers is the cost formulas. When two cost drivers exist, some costs may be a function of the first cost driver, some costs may be a function of the second cost driver, and some costs may be a function of both cost drivers.

9-9 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.

9-10 Separating a spending variance into a price variance and a quantity variance provides more information. Moreover, price and quantity variances are usually the responsibilities of different managers.

9-11 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.

9-12 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.

9-13 This combination of variances may indicate that inferior quality materials were purchased at a discounted price, but the low-quality materials created production problems.

9-14 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.

9-15 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.

9-16 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:

$$\text{Efficiency variance} = SR(AH - SH)$$

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

9-17 If labor is a fixed cost in the short run and demand is insufficient to keep everyone busy (and workers are not laid off), it will result in an unfavorable labor efficiency variance. To avoid this unfavorable variance, managers may choose to produce at capacity (rather than reducing output to match customer demand) which leads to a build up of work in process and finished goods inventories.

Chapter 9: Applying Excel

The completed worksheet is shown below.

	A	B	C	D	E	F
1	Chapter 9: Applying Excel					
2						
3	**Data**					
4	***Exhibit 9-8: Standard Cost Card***					
5	*Inputs*	*Standard Quantity*		*Standard Price*		
6	Direct materials	3.0	pounds	$4.00	per pound	
7	Direct labor	0.50	hours	$22.00	per hour	
8	Variable manufacturing overhead	0.50	hours	$6.00	per hour	
9						
10	Actual results:					
11	Actual output	2,000	units			
12	Actual variable manufacturing overhead cost	$7,140				
13		*Actual Quantity*		*Actual price*		
14	Actual direct materials cost	6,500	pounds	$3.80	per pound	
15	Actual direct labor cost	1,050	hours	$21.60	per hour	
16						
17	*Enter a formula into each of the cells marked with a ? below*					
18	**Main Example: Chapter 9**					
19						
20	***Exhibit 9-11: Standard Cost Variance Analysis–Direct Materials***					
21	Actual Quantity of Input, at Actual Price	6,500	pounds ×	$3.80	per pound =	$24,700
22	Actual Quantity of Input, at Standard Price	6,500	pounds ×	$4.00	per pound =	$26,000
23	Standard Quantity Allowed for the Actual Output, at Standard Price	6,000	pounds ×	$4.00	per pound =	$24,000
24	Direct materials variances:					
25	Materials price variance	$1,300	F			
26	Materials quantity variance	$2,000	U			
27	Materials spending variance	$700	U			
28						
29	***Exhibit 9-12: Standard Cost Variance Analysis–Direct Labor***					
30	Actual Hours of Input, at Actual Rate	1,050	hours ×	$21.60	per hour =	$22,680
31	Actual Hours of Input, at Standard Rate	1,050	hours ×	$22.00	per hour =	$23,100
32	Standard Hours Allowed for the Actual Output, at Standard Rate	1,000	hours ×	$22.00	per hour =	$22,000
33	Direct labor variances:					
34	Labor rate variance	$420	F			
35	Labor efficiency variance	$1,100	U			
36	Labor spending variance	$680	U			
37						
38	***Exhibit 9-13: Standard Cost Variance Analysis–Variable Manufacturing Overhead***					
39	Actual Hours of Input, at Actual Rate	1,050	hours ×	$6.80	per hour =	$7,140
40	Actual Hours of Input, at Standard Rate	1,050	hours ×	$6.00	per hour =	$6,300
41	Standard Hours Allowed for the Actual Output, at Standard Rate	1,000	hours ×	$6.00	per hour =	$6,000
42	Variable overhead variances:					
43	Variable overhead rate variance	$840	U			
44	Variable overhead efficiency variance	$300	U			
45	Variable overhead spending variance	$1,140	U			
46						

... **Filled in Chapter 9 Form** Chapter 9 Formulas ...

Chapter 9: Applying Excel (continued)

The completed worksheet, with formulas displayed, is shown below.

	A	B	C	D	E	F
1	Chapter 9: Applying Excel					
2						
3	Data					
4	***Exhibit 9-8: Standard Cost Card***					
5	*Inputs*		*Standard Quantity*		*Standard Price*	
6	Direct materials	3	pounds	4	per pound	
7	Direct labor	0.5	hours	22	per hour	
8	Variable manufacturing overhead	0.5	hours	6	per hour	
9						
10	Actual results:					
11	Actual output	2000	units			
12	Actual variable manufacturing overhead cost	7140				
13			*Actual Quantity*		*Actual price*	
14	Actual direct materials cost	6500	pounds	3.8	per pound	
15	Actual direct labor cost	1050	hours	21.6	per hour	
16						
17	*Enter a formula into each of the cells marked with a ? below*					
18	**Main Example: Chapter 9**					
19						
20	***Exhibit 9-11: Standard Cost Variance Analysis–Direct Materials***					
21	Actual Quantity of Input, at Actual Price	=B14	pounds ×	=D14	per pound =	=B21*D21
22	Actual Quantity of Input, at Standard Price	=B14	pounds ×	=D6	per pound =	=B22*D22
23	Standard Quantity Allowed for the Actual Output, at Standard Price	=B6*B11	pounds ×	=D6	per pound =	=B23*D23
24	Direct materials variances:					
25	Materials price variance	=ABS(F22-F21)	=IF(F21>F22,"U",IF(F21<F22,"F",""))			
26	Materials quantity variance	=ABS(F23-F22)	=IF(F22>F23,"U",IF(F22<F23,"F",""))			
27	Materials spending variance	=ABS(F21-F23)	=IF(F21>F23,"U",IF(F21<F23,"F",""))			
28						
29	***Exhibit 9-12: Standard Cost Variance Analysis–Direct Labor***					
30	Actual Hours of Input, at Actual Rate	=B15	hours ×	=D15	per hour =	=B30*D30
31	Actual Hours of Input, at Standard Rate	=B15	hours ×	=D7	per hour =	=B31*D31
32	Standard Hours Allowed for the Actual Output, at Standard Rate	=B7*B11	hours ×	=D7	per hour =	=B32*D32
33	Direct labor variances:					
34	Labor rate variance	=ABS(F31-F30)	=IF(F30>F31,"U",IF(F30<F31,"F",""))			
35	Labor efficiency variance	=ABS(F32-F31)	=IF(F31>F32,"U",IF(F31<F32,"F",""))			
36	Labor spending variance	=ABS(F30-F32)	=IF(F30>F32,"U",IF(F30<F32,"F",""))			
37						
38	***Exhibit 9-13: Standard Cost Variance Analysis–Variable Manufacturing Overhea***					
39	Actual Hours of Input, at Actual Rate	=B15	hours ×	=B12/B15	per hour =	=B39*D39
40	Actual Hours of Input, at Standard Rate	=B15	hours ×	=D8	per hour =	=B40*D40
41	Standard Hours Allowed for the Actual Output, at Standard Rate	=B8*B11	hours ×	=D8	per hour =	=B41*D41
42	Variable overhead variances:					
43	Variable overhead rate variance	=ABS(F40-F39)	=IF(F39>F40,"U",IF(F39<F40,"F",""))			
44	Variable overhead efficiency variance	=ABS(F41-F40)	=IF(F40>F41,"U",IF(F40<F41,"F",""))			
45	Variable overhead spending variance	=ABS(F39-F41)	=IF(F39>F41,"U",IF(F39<F41,"F",""))			
46						

... Chapter 9 Formulas | Chapter 9 Requirement 1 | Chapter 9 Requ ...

Note: The formulas to compute whether a variance is Favorable or Unfavorable use the IF() function. For example, in cell C26, the formula is =IF(F22>F23,"U",IF(F22<F23,"F","")). This formula first checks whether the actual quantity of input at the standard price (cell F22) exceeds the standard quantity allowed for the actual output at the standard price (cell F23). If it does, the function returns the value U, which is displayed in cell C26. Otherwise, the formula checks whether the standard quantity allowed for the actual output at the standard price (cell F23) exceeds the actual quantity of input at the standard price (cell F22). If it does, the function returns the value F, which is displayed in cell C26. Otherwise, nothing is displayed in cell C26.

Chapter 9: Applying Excel (continued)

1. With the changes in data, the result is:

	A	B	C	D	E	F	G
1	Chapter 9: Applying Excel						
2							
3	**Data**						
4	***Exhibit 9-8: Standard Cost Card***						
5	*Inputs*	*Standard Quantity*		*Standard Price*			
6	Direct materials	2.9	pounds	$4.00	per pound		
7	Direct labor	0.60	hours	$22.00	per hour		
8	Variable manufacturing overhead	0.60	hours	$6.00	per hour		
9							
10	Actual results:						
11	Actual output	2,000	units				
12	Actual variable manufacturing overhead cost	$7,140					
13		*Actual Quantity*		*Actual price*			
14	Actual direct materials cost	6,500	pounds	$3.80	per pound		
15	Actual direct labor cost	1,050	hours	$21.60	per hour		
16							
17	*Enter a formula into each of the cells marked with a ? below*						
18	**Main Example: Chapter 9**						
19							
20	***Exhibit 9-11: Standard Cost Variance Analysis–Direct Materials***						
21	Actual Quantity of Input, at Actual Price	6,500	pounds ×	$3.80	per pound =	$24,700	
22	Actual Quantity of Input, at Standard Price	6,500	pounds ×	$4.00	per pound =	$26,000	
23	Standard Quantity Allowed for the Actual Output, at Standard Price	5,800	pounds ×	$4.00	per pound =	$23,200	
24	Direct materials variances:						
25	Materials price variance	$1,300	F				
26	Materials quantity variance	$2,800	U				
27	Materials spending variance	$1,500	U				
28							
29	***Exhibit 9-12: Standard Cost Variance Analysis–Direct Labor***						
30	Actual Hours of Input, at Actual Rate	1,050	hours ×	$21.60	per hour =	$22,680	
31	Actual Hours of Input, at Standard Rate	1,050	hours ×	$22.00	per hour =	$23,100	
32	Standard Hours Allowed for the Actual Output, at Standard Rate	1,200	hours ×	$22.00	per hour =	$26,400	
33	Direct labor variances:						
34	Labor rate variance	$420	F				
35	Labor efficiency variance	$3,300	F				
36	Labor spending variance	$3,720	F				
37							
38	***Exhibit 9-13: Standard Cost Variance Analysis–Variable Manufacturing Overhead***						
39	Actual Hours of Input, at Actual Rate	1,050	hours ×	$6.80	per hour =	$7,140	
40	Actual Hours of Input, at Standard Rate	1,050	hours ×	$6.00	per hour =	$6,300	
41	Standard Hours Allowed for the Actual Output, at Standard Rate	1,200	hours ×	$6.00	per hour =	$7,200	
42	Variable overhead variances:						
43	Variable overhead rate variance	$840	U				
44	Variable overhead efficiency variance	$900	F				
45	Variable overhead spending variance	$60	F				
46							

... Chapter 9 Requirement 1 Chapter 9 Requiremer ...

a. The materials quantity variance is $2,800 U. This variance is the difference between the amount of materials that should have been used to make the actual output and the actual amount of materials used, all evaluated at the standard price. This variance is unfavorable because 6,500 pounds were used, but 5,800 pounds should have been used.

b. The labor rate variance is $420 F. This variance is the difference between the standard labor rate and the actual labor rate, multiplied by the actual labor hours. It is favorable because the actual labor rate was $21.60 per hour, whereas the standard labor rate was $22.00 per hour.

2. With the revised data, the worksheet should look like this:

	A	B	C	D	E	F	G
1	Chapter 9: Applying Excel						
2							
3	**Data**						
4	***Exhibit 9-8: Standard Cost Card***						
5	*Inputs*	*Standard Quantity*		*Standard Price*			
6	Direct materials	3.0	pounds	$4.00	per pound		
7	Direct labor	0.50	hours	$22.00	per hour		
8	Variable manufacturing overhead	0.50	hours	$6.00	per hour		
9							
10	Actual results:						
11	Actual output	2,100	units				
12	Actual variable manufacturing overhead cost	$5,100					
13		*Actual Quantity*		*Actual price*			
14	Actual direct materials cost	6,350	pounds	$4.10	per pound		
15	Actual direct labor cost	1,020	hours	$22.10	per hour		
16							
17	*Enter a formula into each of the cells marked with a ? below*						
18	**Main Example: Chapter 9**						
19							
20	***Exhibit 9-11: Standard Cost Variance Analysis–Direct Materials***						
21	Actual Quantity of Input, at Actual Price	6,350	pounds ×	$4.10	per pound =	$26,035	
22	Actual Quantity of Input, at Standard Price	6,350	pounds ×	$4.00	per pound =	$25,400	
23	Standard Quantity Allowed for the Actual Output, at Standard Price	6,300	pounds ×	$4.00	per pound =	$25,200	
24	Direct materials variances:						
25	Materials price variance	$635	U				
26	Materials quantity variance	$200	U				
27	Materials spending variance	$835	U				
28							
29	***Exhibit 9-12: Standard Cost Variance Analysis–Direct Labor***						
30	Actual Hours of Input, at Actual Rate	1,020	hours ×	$22.10	per hour =	$22,542	
31	Actual Hours of Input, at Standard Rate	1,020	hours ×	$22.00	per hour =	$22,440	
32	Standard Hours Allowed for the Actual Output, at Standard Rate	1,050	hours ×	$22.00	per hour =	$23,100	
33	Direct labor variances:						
34	Labor rate variance	$102	U				
35	Labor efficiency variance	$660	F				
36	Labor spending variance	$558	F				
37							
38	***Exhibit 9-13: Standard Cost Variance Analysis–Variable Manufacturing Overhead***						
39	Actual Hours of Input, at Actual Rate	1,020	hours ×	$5.00	per hour =	$5,100	
40	Actual Hours of Input, at Standard Rate	1,020	hours ×	$6.00	per hour =	$6,120	
41	Standard Hours Allowed for the Actual Output, at Standard Rate	1,050	hours ×	$6.00	per hour =	$6,300	
42	Variable overhead variances:						
43	Variable overhead rate variance	$1,020	F				
44	Variable overhead efficiency variance	$180	F				
45	Variable overhead spending variance	$1,200	F				
46							

... Chapter 9 Requirement 2 | Sheet3

Parts a, b, and c:

Materials price variance	$635	U
Materials quantity variance	$200	U
Labor rate variance	$102	U
Labor efficiency variance	$660	F
Variable overhead rate variance	$1,020	F
Variable overhead efficiency variance...	$180	F

The Foundational 15

1., 2., and 3.

The raw materials cost included in the flexible budget (SQ × SP = $1,200,000), the materials quantity variance ($80,000 U), and the materials price variance ($80,000 F) can be computed using the general model for cost variances as follows:

Actual Quantity of Input, at Actual Price (AQ × AP) 160,000 pounds × $7.50 per pound = $1,200,000	Actual Quantity of Input, at Standard Price (AQ × SP) 160,000 pounds × $8.00 per pound = $1,280,000	Standard Quantity Allowed for Actual Output, at Standard Price (SQ × SP) 150,000 pounds* × $8.00 per pound = $1,200,000
Materials price variance = $80,000 F		Materials quantity variance = $80,000 U
Spending variance = $0		

*30,000 units × 5 pounds per unit = 150,000 pounds

Alternatively, the variances can be computed using the formulas:

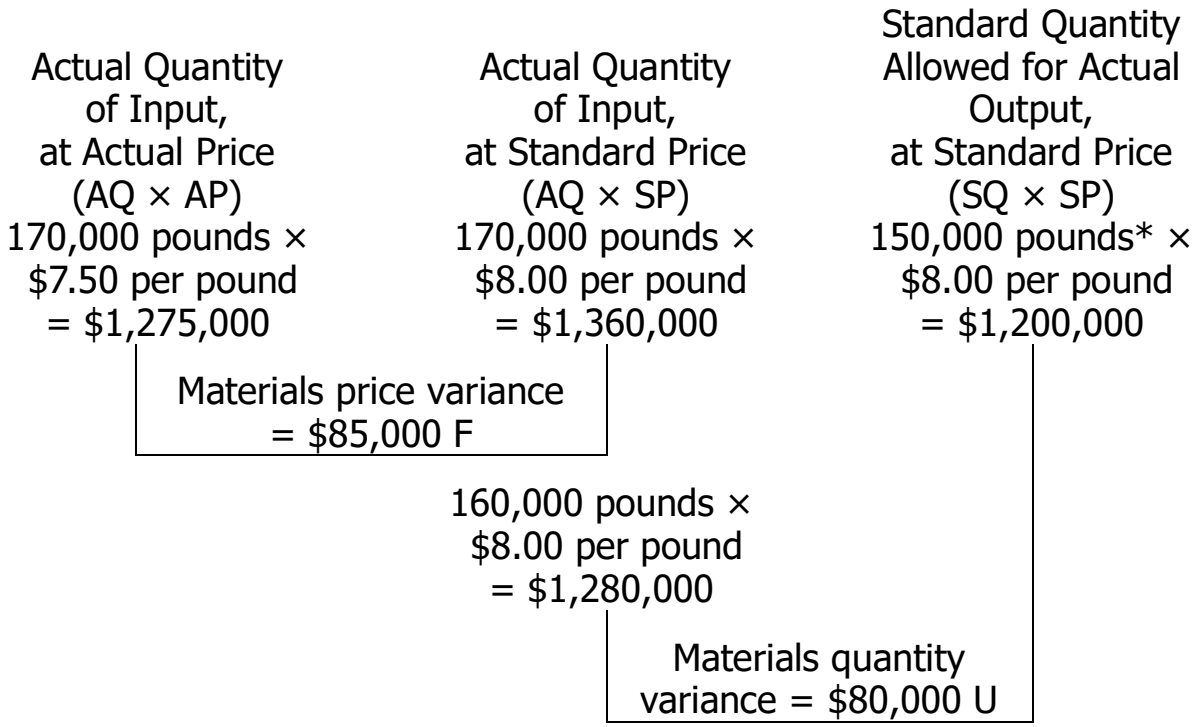
Materials price variance = AQ (AP – SP)
= 160,000 pounds ($7.50 per pound – $8.00 per pound)
= $80,000 F

Materials quantity variance = SP (AQ – SQ)
= $8.00 per pound (160,000 pounds – 150,000 pounds)
= $80,000 U

The Foundational 15 (continued)

4. and 5.

The materials quantity variance ($80,000 U) and the materials price variance ($85,000 F) can be computed as follows:



*30,000 units × 5 pounds per unit = 150,000 units

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
= 170,000 pounds ($7.50 per pound – $8.00 per pound)
= $85,000 F

Materials quantity variance = SP (AQ – SQ)
= $8.00 per pound (160,000 pounds – 150,000 pounds)
= $80,000 U

The Foundational 15 (continued)

6., 7., and 8.

The direct labor cost included in the flexible budget (SH × SR = $840,000), the labor efficiency variance ($70,000 F) and the labor rate variance ($55,000 U) can be computed using the general model for cost variances as follows:

Actual Hours of Input, at Actual Rate (AH × AR) 55,000 hours × $15 per hour = $825,000	Actual Hours of Input, at Standard Rate (AH × SR) 55,000 hours × $14.00 per hour = $770,000	Standard Hours Allowed for Actual Output, at Standard Rate (SH × SR) 60,000 hours* × $14.00 per hour = $840,000
Labor rate variance = $55,000 U	Labor efficiency variance = $70,000 F	
Spending variance = $15,000 F		

*30,000 units × 2.0 hours per unit = 60,000 hours

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
= 55,000 hours ($15.00 per hour – $14.00 per hour)
= $55,000 U

Labor efficiency variance = SR (AH – SH)
= $14.00 per hour (55,000 hours – 60,000 hours)
= $70,000 F

The Foundational 15 (continued)

9., 10., and 11.

The variable overhead cost included in the flexible budget (SH × SR = $300,000), the variable overhead efficiency variance ($25,000 F) and the variable overhead rate variance ($5,500 U) can be computed using the general model for cost variances as follows:

Actual Hours of Input, at Actual Rate (AH × AR) 55,000 hours × $5.10 per hour** = $280,500	Actual Hours of Input, at Standard Rate (AH × SR) 55,000 hours × $5.00 per hour = $275,000	Standard Hours Allowed for Actual Output, at Standard Rate (SH × SR) 60,000 hours* × $5.00 per hour = $300,000
Variable overhead rate variance = $5,500 U	Variable overhead efficiency variance = $25,000 F	
Spending variance = $19,500 F		

*30,000 units × 2.0 hours per unit = 60,000 hours
** $280,500 ÷ 55,000 hours = $5.10 per hour

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR* – SR)
= 55,000 hours ($5.10 per hour – $5.00 per hour)
= $5,500 U

*$280,500 ÷ 55,000 hours = $5.10 per hour

Variable overhead efficiency variance = SR (AH – SH)
= $5.00 per hour (55,000 hours – 60,000 hours)
= $25,000 F

The Foundational 15 (continued)

12. The amounts included in the flexible budget are computed as follows:

Preble Company
Flexible Budget
For the Month Ended March 31

Units sold (q)	30,000
Expenses:	
Advertising ($200,000)	$200,000
Sales salaries and commissions ($100,000 + 12.00q$)	$460,000
Shipping expenses (3.00q$)	90,000

13., 14., and 15.

The spending variances for advertising ($), sales salaries and commissions ($), and shipping expenses ($) are computed as follows:

Preble Company
Spending Variances
For the Month Ended March 31

	Flexible Budget	*Actual Results*	*Spending Variances*	
Units sold(q)	30,000	30,000		
Expenses:				
Advertising ($200,000)	$200,000	$210,000	$10,000	U
Sales salaries and commissions ($100,000 + 12.00q$)	$460,000	$455,000	$5,000	F
Shipping expenses (3.00q$)	$90,000	$115,000	$25,000	U

Exercise 9-1 (10 minutes)

Puget Sound Divers
Flexible Budget
For the Month Ended May 31

Actual diving-hours	105
Revenue ($365.00q)	$38,325
Expenses:	
Wages and salaries ($8,000 + $125.00q)	21,125
Supplies ($3.00q)	315
Equipment rental ($1,800 + $32.00q)	5,160
Insurance ($3,400)	3,400
Miscellaneous ($630 + $1.80q)	819
Total expense	30,819
Net operating income	$ 7,506

Exercise 9-2 (15 minutes)

Quilcene Oysteria
Revenue and Spending Variances
For the Month Ended August 31

	Actual Results	*Flexible Budget*	*Revenue and Spending Variances*	
Pounds	8,000	8,000		
Revenue ($4.00q)	$35,200	$32,000	$3,200	F
Expenses:				
Packing supplies ($0.50q)	4,200	4,000	200	U
Oyster bed maintenance ($3,200)	3,100	3,200	100	F
Wages and salaries ($2,900 + $0.30q)	5,640	5,300	340	U
Shipping ($0.80q)	6,950	6,400	550	U
Utilities ($830)	810	830	20	F
Other ($450 + $0.05q)	980	850	130	U
Total expense	21,680	20,580	1,100	U
Net operating income	$13,520	$11,420	$2,100	F

Exercise 9-3 (15 minutes)

Alyeski Tours
Flexible Budget
For the Month Ended July 31

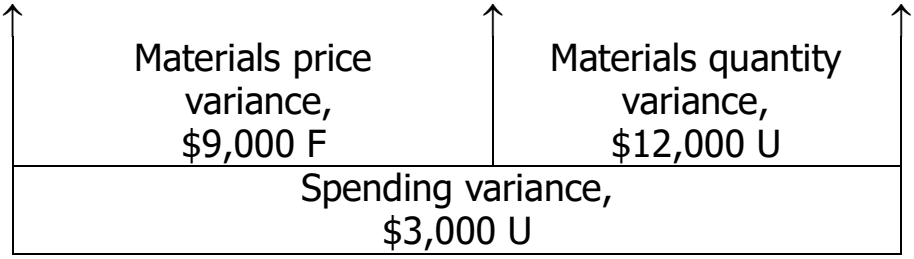
Actual cruises (q_1)	24
Actual passengers (q_2)	1,400
Revenue (25.00q_2$)	$35,000
Expenses:	
Vessel operating costs ($5,200 + 480.00q_1$ +2.00q_2$)	19,520
Advertising ($1,700)	1,700
Administrative costs ($4,300 + 24.00q_1$ +1.00q_2$)	6,276
Insurance ($2,900)	2,900
Total expense	30,396
Net operating income	$ 4,604

Exercise 9-4 (20 minutes)

1.	Number of helmets produced (a)	35,000
	Standard kilograms of plastic per helmet (b)	0.6
	Standard quantity of kilograms allowed (a) × (b) ..	21,000
2.	Standard quantity of kilograms allowed (a)	21,000
	Standard cost per kilogram (b)	$8
	Standard cost allowed for actual output (a) × (b)..	$168,000
3.	Actual cost incurred (given) (a)	$171,000
	Total standard cost allowed (b)	$168,000
	Materials spending variance (a) – (b)	$3,000 U

4.

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 × $8 per kilogram	21,000 kilograms* × $8 per kilogram
$171,000	= $180,000	= $168,000



*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 ($7.60 per kilogram* – $8.00 per kilogram)
= $9,000 F

* $171,000 ÷ 22,500 kilograms = $7.60 per kilogram

Materials quantity variance = SP (AQ – SQ)
$8 per kilogram (22,500 kilograms – 21,000 kilograms)
= $12,000 U

Exercise 9-5 (20 minutes)

1. Number of meals prepared (a)..... 4,000
   Standard direct labor-hours per meal (b) . 0.25
   Standard labor-hours allowed (a) × (b) ... 1,000

2. Standard labor-hours allowed (a) 1,000
   Standard direct labor cost per hour (b).... $19.75
   Standard labor cost allowed (a) × (b)..... $19,750

3. Actual cost incurred (a)..... $19,200
   Standard labor cost allowed (b) $19,750
   Labor spending variance (a) – (b)..... $550 F

4.

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 × $20.00 per hour = $19,200	960 hours × $19.75 per hour = $18,960	1,000 hours × $19.75 per hour = $19,750

Labor rate variance, $240 U	Labor efficiency variance, $790 F
Spending variance, $550 F	

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH(AR – SR)
= 960 hours ($20.00 per hour – $19.75 per hour)
= $240 U

Labor efficiency variance = SR(AH – SH)
= $19.75 per hour (960 hours – 1,000 hours)
= $790 F

Exercise 9-6 (20 minutes)

1. Number of items shipped (a) 120,000
   Standard labor-hours per item (b)..... 0.02
   Standard quantity of labor-hours allowed (a) × (b) 2,400

2. Standard quantity of labor-hours allowed (a)..... 2,400
   Standard variable overhead cost per hour (b)..... $3.25
   Standard variable overhead cost allowed (a) × (b) $7,800

3. Actual variable overhead cost incurred (a) $7,360
   Standard variable overhead cost allowed (b) $7,800
   Variable overhead spending variance (a) – (b) ..... $440 F

4.

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
Spending variance, $440 F	

*$7,360 ÷ 2,300 hours = $3.20 per hour
** 120,000 items × 0.02 hours per unit = 2,400 hours

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 9-7 (15 minutes)

Lavage Rapide
Planning Budget
For the Month Ended August 31

Budgeted cars washed (q)	9,000
Revenue ($4.90q)	$44,100
Expenses:	
Cleaning supplies ($0.80q)	7,200
Electricity ($1,200 + $0.15q)	2,550
Maintenance ($0.20q)	1,800
Wages and salaries ($5,000 + $0.30q)	7,700
Depreciation ($6,000)	6,000
Rent ($8,000)	8,000
Administrative expenses ($4,000 + $0.10q)	4,900
Total expense	38,150
Net operating income	$ 5,950

Exercise 9-8 (15 minutes)

Lavage Rapide
Flexible Budget
For the Month Ended August 31

Actual cars washed (q)	8,800
Revenue ($4.90q)	$43,120
Expenses:	
Cleaning supplies ($0.80q)	7,040
Electricity ($1,200 + $0.15q)	2,520
Maintenance ($0.20q)	1,760
Wages and salaries ($5,000 + $0.30q)	7,640
Depreciation ($6,000)	6,000
Rent ($8,000)	8,000
Administrative expenses ($4,000 + $0.10q)	4,880
Total expense	37,840
Net operating income	$ 5,280

Exercise 9-9 (20 minutes)

Lavage Rapide
Revenue and Spending Variances
For the Month Ended August 31

	Actual Results	*Flexible Budget*	*Revenue and Spending Variances*	
Cars washed (q)	8,800	8,800		
Revenue ($4.90q)	$43,080	$43,120	$ 40	U
Expenses:				
Cleaning supplies ($0.80q)	7,560	7,040	520	U
Electricity ($1,200 + $0.15q)	2,670	2,520	150	U
Maintenance ($0.20q)	2,260	1,760	500	U
Wages and salaries ($5,000 + $0.30q)	8,500	7,640	860	U
Depreciation ($6,000)	6,000	6,000	0	
Rent ($8,000)	8,000	8,000	0	
Administrative expenses ($4,000 + $0.10q)	4,950	4,880	70	U
Total expense	39,940	37,840	2,100	U
Net operating income	$ 3,140	$ 5,280	$2,140	U

Exercise 9-10 (30 minutes)

1. Number of units manufactured (a) 20,000
   Standard labor time per unit
   (18 minutes ÷ 60 minutes per hour) (b)..... 0.3
   Standard labor-hours allowed (a) × (b) 6,000

2. Standard labor-hours allowed (a) 6,000
   Standard direct labor rate per hour (b) $17
   Standard labor cost allowed (a) × (b)..... $102,000

3. Actual direct labor cost (a) $102,350
   Standard labor cost allowed (b) $102,000
   Labor spending variance (a) – (b) ..... $350 U

4.

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 × $17.00 per hour	6,000 hours* × $17.00 per hour
$102,350	= $97,750	= $102,000

Labor rate variance, $4,600 U

Labor efficiency variance, $4,250 F

Spending variance, $350 U

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

Alternatively, the variances can be computed using the formulas:

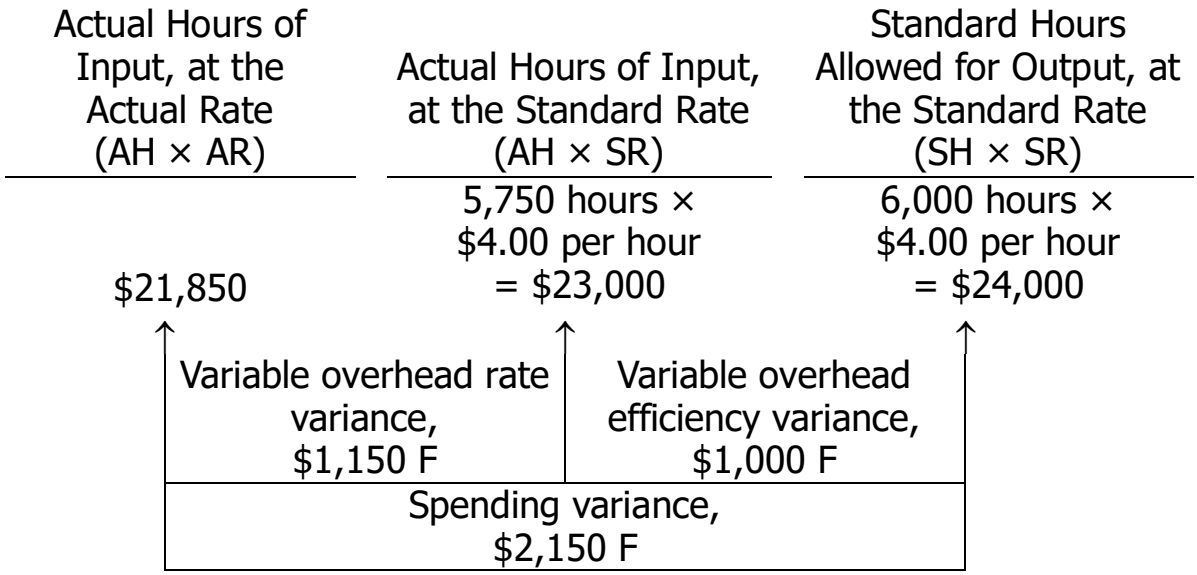
Labor rate variance = AH (AR – SR)
5,750 hours ($17.80 per hour* – $17.00 per hour) = $4,600 U

*$102,350 ÷ 5,750 hours = $17.80 per hour

Labor efficiency variance = SR (AH – SH)
$17.00 per hour (5,750 hours – 6,000 hours) = $4,250 F

Exercise 9-10 (continued)

5.



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 9-11 (20 minutes)

1. If the labor spending variance is $200 unfavorable, and the labor rate variance is $150 favorable, then the labor efficiency variance must be $350 unfavorable, because the labor rate and labor efficiency variances taken together always equal the spending variance. Knowing that the labor efficiency variance is $350 unfavorable, one approach to the solution would be:

   Labor efficiency variance = SR (AH – SH)
   $25.00 per hour (AH – 125 hours*) = $350 U
   $25.00 per hour × AH – $3,125 = $350**
   $25.00 per hour × AH = $3,475
   AH = $3,475 ÷ $25.00 per hour
   AH = 139 hours

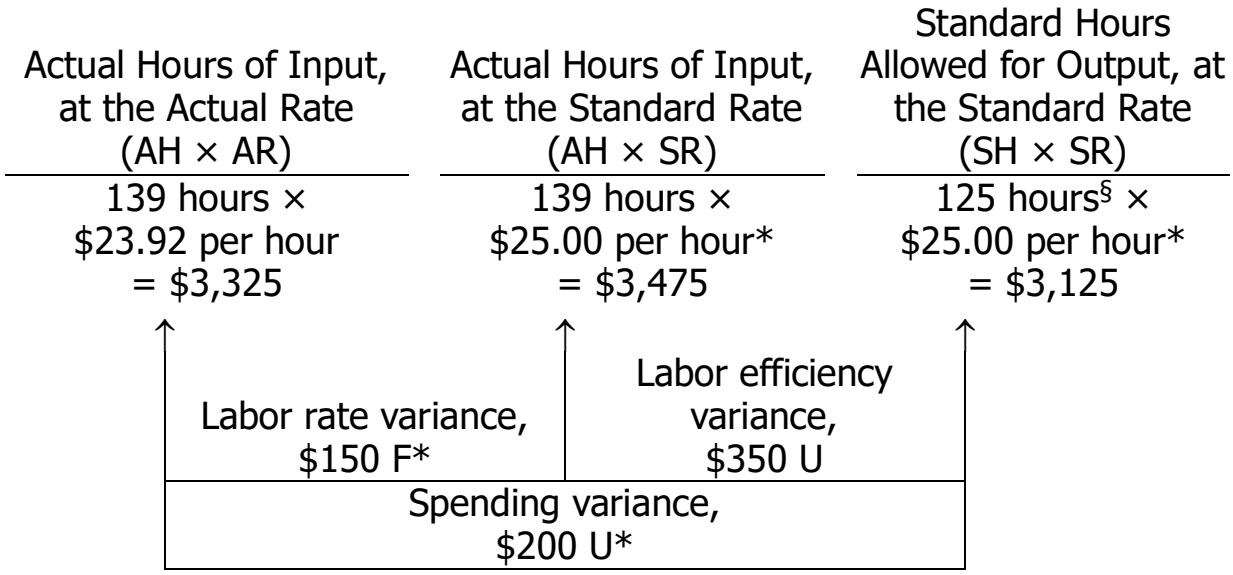
   *50 jobs × 2.5 hours per job = 125 hours
   **When used with the formula, unfavorable variances are positive and favorable variances are negative.

2. Labor rate variance = AH (AR – SR)
   139 hours (AR – $25.00 per hour) = $150 F
   139 hours × AR – $3,475 = –$150*
   139 hours × AR = $3,325
   AR = $3,325 ÷ 139 hours
   AR = $23.92 per hour (rounded)

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

Exercise 9-11 (continued)

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



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

Exercise 9-12 (45 minutes)

1. The planning budget based on 3 courses and 45 students appears below:

Gourmand Cooking School
Planning Budget
For the Month Ended September 30

Budgeted courses (q_1)	3
Budgeted students (q_2)	45
Revenue (800q_2$)	$36,000
Expenses:	
Instructor wages ($3,080$q_1$)	9,240
Classroom supplies (260q_2$)	11,700
Utilities ($870 + 130q_1$)	1,260
Campus rent ($4,200)	4,200
Insurance ($1,890)	1,890
Administrative expenses ($3,270 + 15q_1$ +4q_2$)	3,495
Total expense	31,785
Net operating income	$ 4,215

2. The flexible budget based on 3 courses and 42 students appears below:

Gourmand Cooking School
Flexible Budget
For the Month Ended September 30

Actual courses (q_1)	3
Actual students (q_2)	42
Revenue (800q_2$)	$33,600
Expenses:	
Instructor wages ($3,080$q_1$)	9,240
Classroom supplies (260q_2$)	10,920
Utilities ($870 + 130q_1$)	1,260
Campus rent ($4,200)	4,200
Insurance ($1,890)	1,890
Administrative expenses ($3,270 + 15q_1$ +4q_2$)	3,483
Total expense	30,993
Net operating income	$ 2,607

Exercise 9-12 (continued)

3. The revenue and spending variances for September appears below:

Gourmand Cooking School
Revenue and Spending Variances
For the Month Ended September 30

	Actual Results	*Revenue and Spending Variances*		*Flexible Budget*
Courses (q1)	3			3
Students (q2)	42			42
Revenue ($800q2)	$32,400	$1,200	U	$33,600
Expenses:				
Instructor wages ($3,080q1)	9,080	160	F	9,240
Classroom supplies ($260q2)	8,540	2,380	F	10,920
Utilities ($870 + $130q1)	1,530	270	U	1,260
Campus rent ($4,200)	4,200	0		4,200
Insurance ($1,890)	1,890	0		1,890
Administrative expenses ($3,270 + $15q1 +$4q2)	3,790	307	U	3,483
Total expense	29,030	1,963	F	30,993
Net operating income	$ 3,370	$ 763	F	$ 2,607

Exercise 9-13 (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

Price Variance = $3,000 F	Quantity Variance = $4,000 U
Spending Variance = $1,000 U	

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

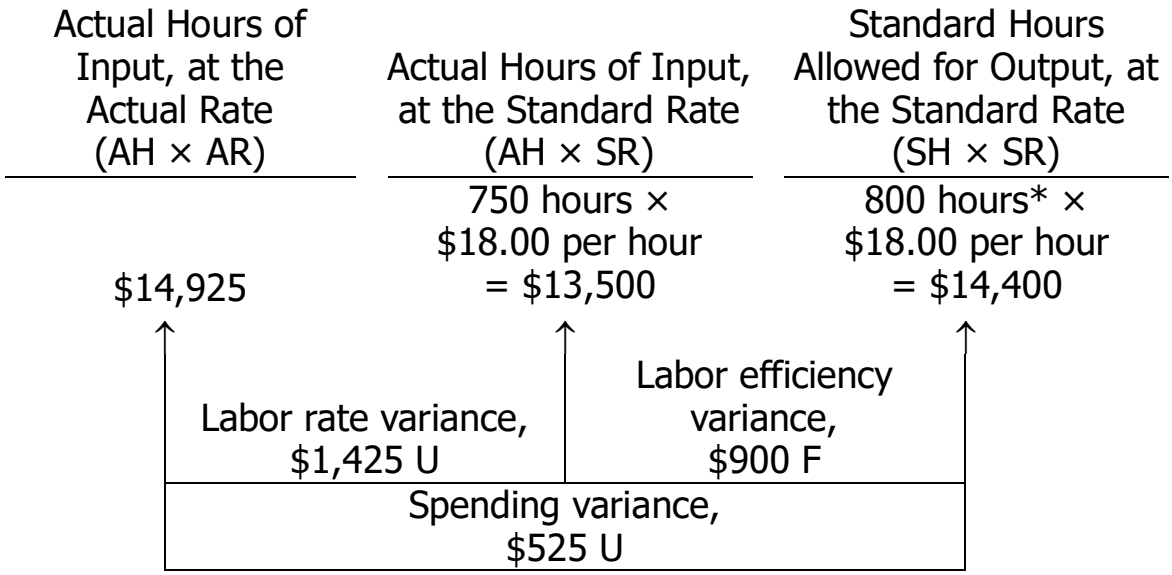
Alternatively, the variances can be computed using the formulas:

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 9-13 (continued)

2.



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

Alternatively, the variances can be computed using the formulas:

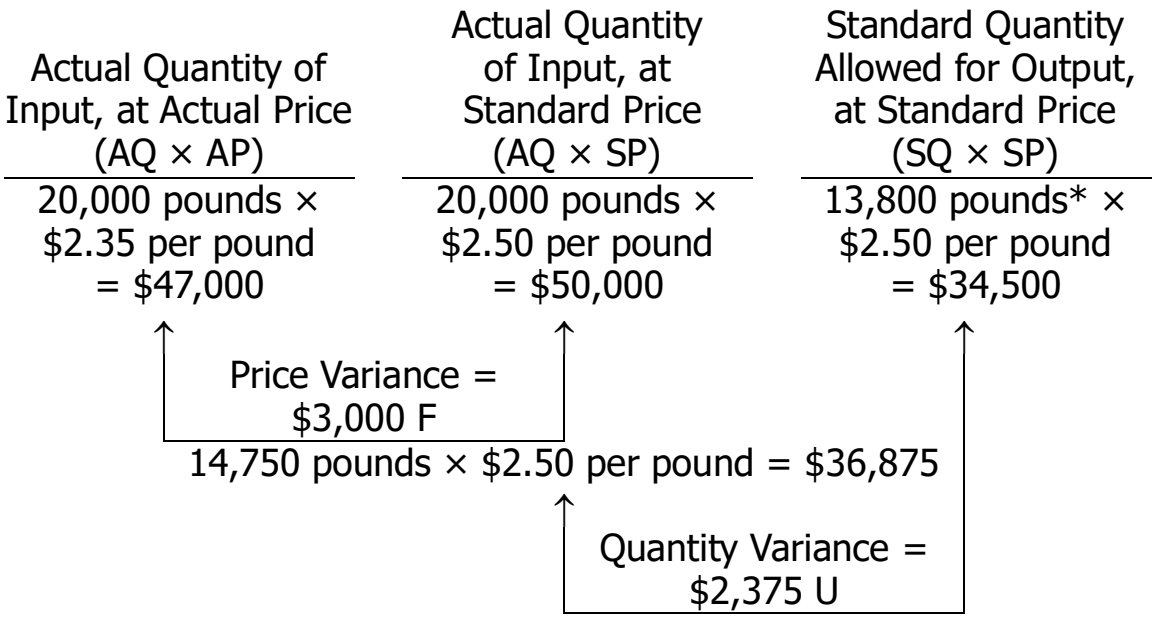
Labor rate variance = AH (AR – SR)
750 hours ($19.90 per hour* – $18.00 per hour) = $1,425 U

*14,925 ÷ 750 hours = $19.90 per hour

Labor efficiency variance = SR (AH – SH)
$18.00 per hour (750 hours – 800 hours) = $900 F

Exercise 9-14 (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 9-15 (20 minutes)

Via Gelato
Revenue and Spending Variances
For the Month Ended June 30

	Actual Results	*Flexible Budget*	*Revenue and Spending Variances*	
Liters (q)	6,200	6,200		
Revenue ($12.00q)	$71,540	$74,400	$2,860	U
Expenses:				
Raw materials ($4.65q)	29,230	28,830	400	U
Wages ($5,600 + $1.40q)	13,860	14,280	420	F
Utilities ($1,630 + $0.20q)	3,270	2,870	400	U
Rent ($2,600)	2,600	2,600	0	
Insurance ($1,350)	1,350	1,350	0	
Miscellaneous ($650 + $0.35q)	2,590	2,820	230	F
Total expense	52,900	52,750	150	U
Net operating income	$18,640	$21,650	$3,010	U

Exercise 9-16 (45 minutes)

1. The planning budget appears below. Note that the report does not include revenue or net operating income because the production department is a cost center that does not have any revenue.

Packaging Solutions Corporation
Production Department Planning Budget
For the Month Ended March 31

Budgeted labor-hours (q)	8,000
Direct labor ($15.80q)	$126,400
Indirect labor ($8,200 + $1.60q)	21,000
Utilities ($6,400 + $0.80q)	12,800
Supplies ($1,100 + $0.40q)	4,300
Equipment depreciation ($23,000 + $3.70q)	52,600
Factory rent ($8,400)	8,400
Property taxes ($2,100)	2,100
Factory administration ($11,700 + $1.90q)	26,900
Total expense	$254,500

2. The flexible budget appears below. Like the planning budget, this report does not include revenue or net operating income because the production department is a cost center that does not have any revenue.

Packaging Solutions Corporation
Production Department Flexible Budget
For the Month Ended March 31

Actual labor-hours (q)	8,400
Direct labor ($15.80q)	$132,720
Indirect labor ($8,200 + $1.60q)	21,640
Utilities ($6,400 + $0.80q)	13,120
Supplies ($1,100 + $0.40q)	4,460
Equipment depreciation ($23,000 + $3.70q)	54,080
Factory rent ($8,400)	8,400
Property taxes ($2,100)	2,100
Factory administration ($11,700 + $1.90q)	27,660
Total expense	$264,180

Exercise 9-16 (continued)

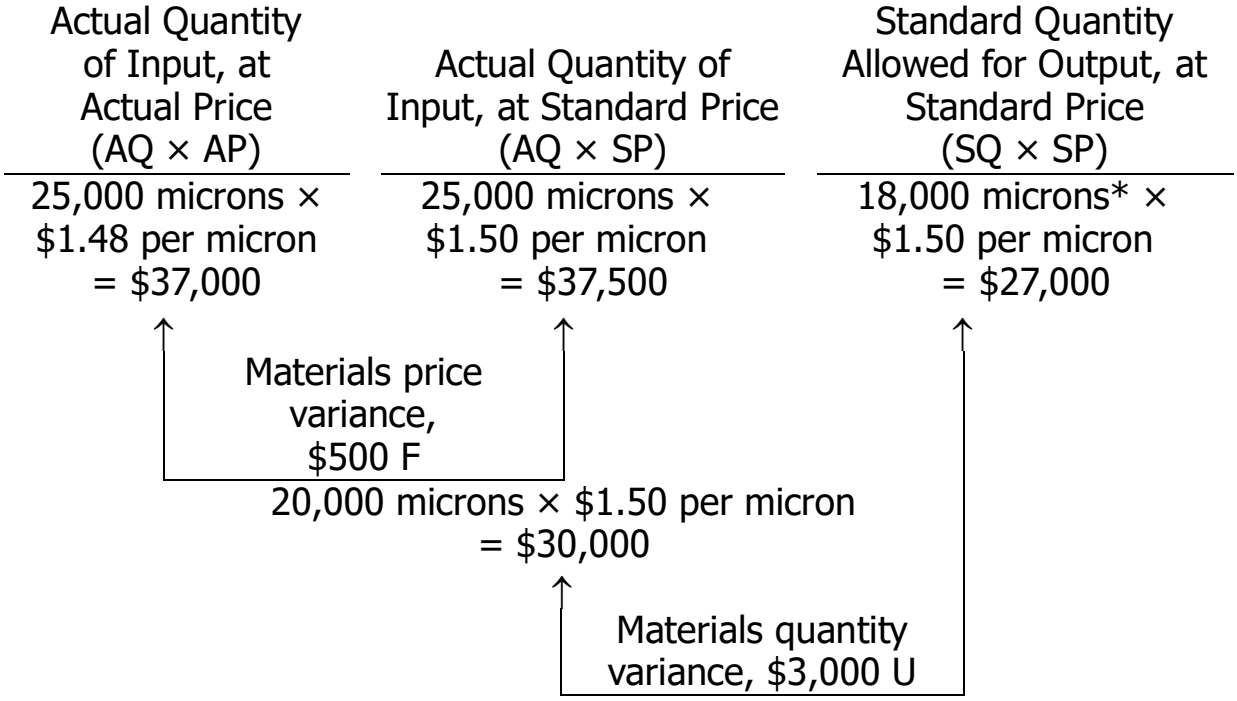
3. The spending variances appear below. This report does not include revenue or net operating income because the production department is a cost center that does not have any revenue.

Packaging Solutions Corporation
Spending Variances
For the Month Ended March 31

	Actual Results	*Spending Variances*		*Flexible Budget*
Labor-hours (q)	8,400			8,400
Direct labor ($15.80q)	$134,730	$2,010	U	$132,720
Indirect labor ($8,200 + $1.60q)	19,860	1,780	F	21,640
Utilities ($6,400 + $0.80q)	14,570	1,450	U	13,120
Supplies ($1,100 + $0.40q)	4,980	520	U	4,460
Equipment depreciation ($23,000 + $3.70q)	54,080	0		54,080
Factory rent ($8,400)	8,700	300	U	8,400
Property taxes ($2,100)	2,100	0		2,100
Factory administration ($11,700 + $1.90q)	26,470	1,190	F	27,660
Total expense	$265,490	$1,310	U	$264,180

Exercise 9-17 (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

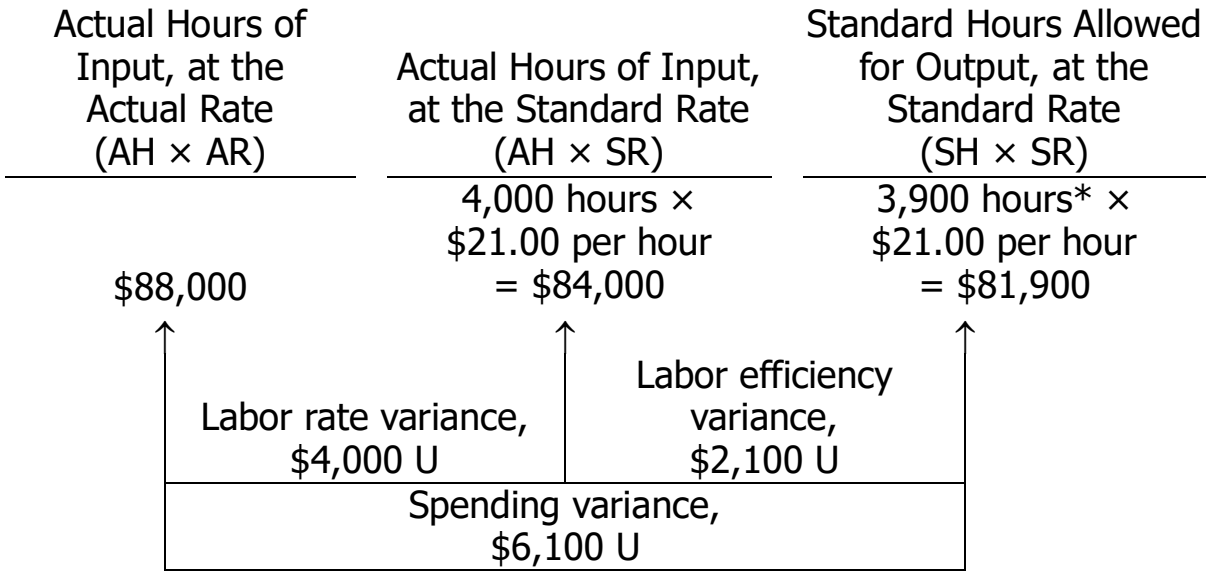
Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
25,000 microns ($1.48 per micron – $1.50 per micron) = $500 F

Materials quantity variance = SP (AQ – SQ)
$1.50 per micron (20,000 microns – 18,000 microns) = $3,000 U

Exercise 9-17 (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 ($22.00 per hour* – $21.00 per hour) = $4,000 U

*$88,000 ÷ 4,000 hours = $22.00 per hour

Labor efficiency variance = SR (AH – SH)
$21.00 per hour (4,000 hours – 3,900 hours) = $2,100 U

Exercise 9-17 (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.

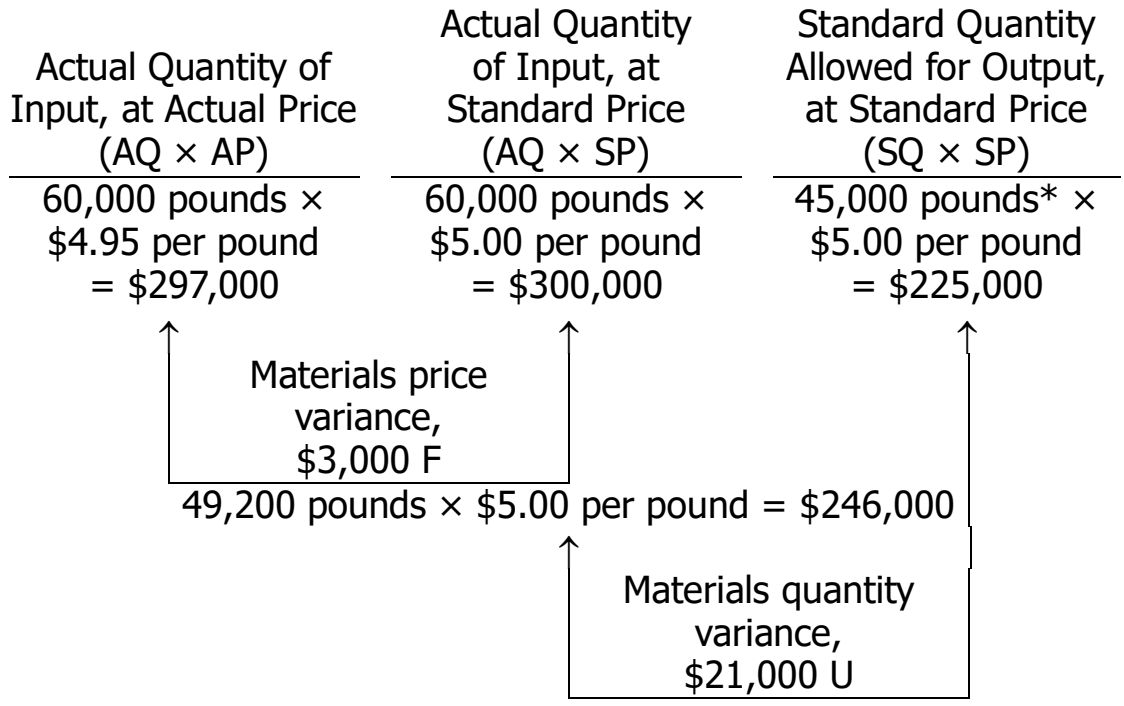
   Labor Rate Variance Since this variance is unfavorable, the actual average wage rate was higher than the standard wage rate. Some of the possible explanations include an increase in wages that has not been reflected in the standards, unanticipated overtime, and a shift toward more highly paid workers.

   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.

Problem 9-18 (45 minutes)

1. a.



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

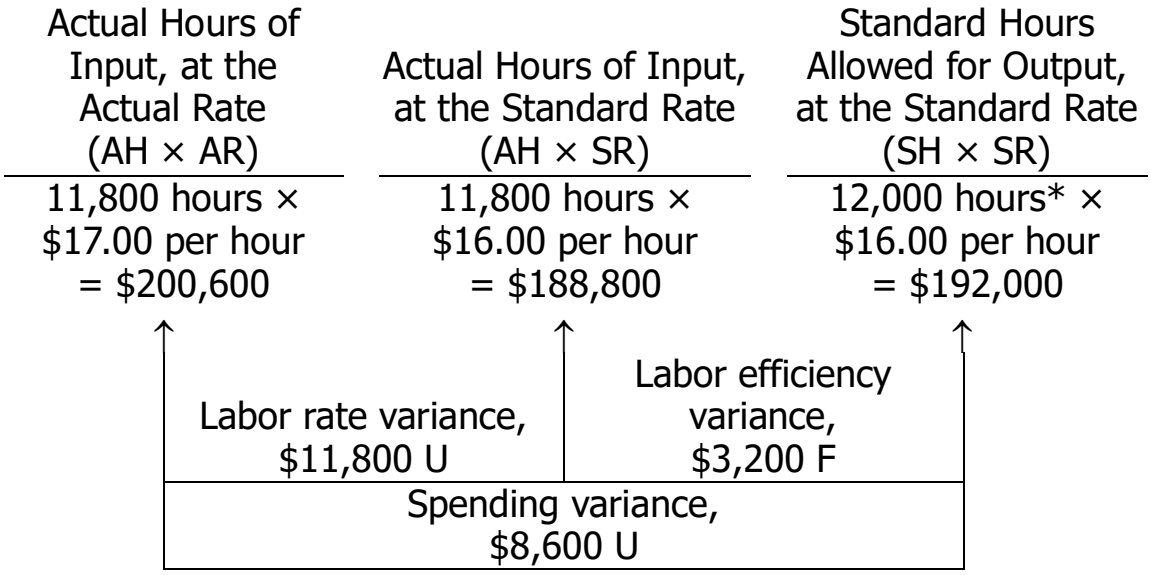
Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
60,000 pounds ($4.95 per pound – $5.00 per pound) = $3,000 F

Materials quantity variance = SP (AQ – SQ)
$5.00 per pound (49,200 pounds – 45,000 pounds) = $21,000 U

Problem 9-18 (continued)

b.



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

Alternatively, the variances can be computed using the formulas:

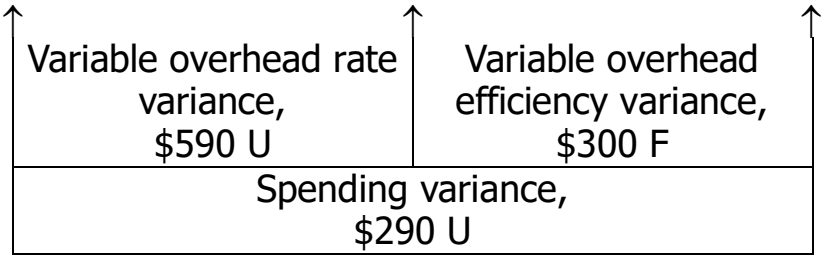
Labor rate variance = AH (AR – SR)
11,800 hours ($17.00 per hour – $16.00 per hour) = $11,800 U

Labor efficiency variance = SR (AH – SH)
$16.00 per hour (11,800 hours – 12,000 hours) = $3,200 F

Problem 9-18 (continued)

c.

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)
	5,900 hours × $3.00 per hour	6,000 hours* × $3.00 per hour
$18,290	= $17,700	= $18,000



*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 9-18 (continued)

2. Summary of variances:

Material price variance	$ 3,000	F
Material quantity variance	21,000	U
Labor rate variance	11,800	U
Labor efficiency variance	3,200	F
Variable overhead rate variance	590	U
Variable overhead efficiency variance	300	F
Net variance	$26,890	U

The net unfavorable variance of $26,890 for the month caused the plant's variable cost of goods sold to increase from the budgeted level of $435,000 to $461,890:

Budgeted cost of goods sold at $29 per pool	$435,000
Add the net unfavorable variance, as above	26,890
Actual cost of goods sold	$461,890

This $26,890 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	$ 6,000
Deduct the net unfavorable variance added to cost of goods sold for the month	26,890
Net operating loss	$(20,890)

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 9-19 (30 minutes)

1.

Milano Pizza
Revenue and Spending Variances
For the Month Ended November 30

	Actual Results	*Revenue and Spending Variances*		*Flexible Budget*
Pizzas (q_1)	1,240			1,240
Deliveries (q_2)	174			174
Revenue (13.50q_1$)	$17,420	$680	F	$16,740
Expenses:				
Pizza ingredients (3.80q_1$)	4,985	273	U	4,712
Kitchen staff ($5,220)	5,281	61	U	5,220
Utilities ($630 + 0.05q_1$)	984	292	U	692
Delivery person (3.50q_2$)	609	0		609
Delivery vehicle ($540 + 1.50q_2$)	655	146	F	801
Equipment depreciation ($275)	275	0		275
Rent ($1,830)	1,830	0		1,830
Miscellaneous ($820 + 0.15q_1$)	954	52	F	1,006
Total expense	15,573	428	U	15,145
Net operating income	$ 1,847	$252	F	$ 1,595

Problem 9-19 (continued)

2. The revenue variance of $680 F indicates that the average price per pizza was higher than expected. Perhaps customers ordered more toppings on their pizzas than expected. The pizza ingredients variance of $273 U is consistent with the prior explanation that customers may have ordered more toppings on their pizzas than anticipated. The utilities variance ($292 U) and delivery vehicle variance ($146 F) are both fairly large as a percentage of their respective total costs; therefore, management may wish to identify the underlying causes of these variances.

Problem 9-20 (45 minutes)

1. a.

Actual Quantity of Input, at Actual Price (AQ × AP) 21,600 feet** × $3.30 per foot = $71,280	Actual Quantity of Input, at Standard Price (AQ × SP) 21,600 feet** × $3.00 per foot = $64,800	Standard Quantity Allowed for Actual Output, at Standard Price (SQ × SP) 21,600 feet* × $3.00 per foot = $64,800
Materials price variance = $6,480 U		Materials quantity variance = $0
Spending variance = $6,480 U		

* 12,000 units × 1.80 feet per unit = 21,600 feet
** 12,000 units × 1.80 feet per unit = 21,600 feet

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
= 21,600 feet ($3.30 per foot – $3.00 per foot)
= $6,480 U

Materials quantity variance = SP (AQ – SQ)
= $3.00 per foot (21,600 feet – 21,600 feet)
= $0

Problem 9-20 (continued)

1. b.

Actual Hours of Input, at Actual Rate (AH × AR) 11,040 hours** × $17.50 per hour = $193,200	Actual Hours of Input, at Standard Rate (AH × SR) 11,040 hours** × $18.00 per hour = $198,720	Standard Hours Allowed for Actual Output, at Standard Rate (SH × SR) 10,800 hours* × $18.00 per hour = $194,400
Labor rate variance = $5,520 F	Labor efficiency variance = $4,320 U	
Spending variance = $1,200 F		

* 12,000 units × 0.90 hours per unit = 10,800 hours
** 12,000 units × 0.92 hours per unit = 11,040 hours

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
= 11,040 hours ($17.50 per hour – $18.00 per hour)
= $5,520 F

Labor efficiency variance = SR (AH – SH)
= $18.00 per hour (11,040 hours – 10,800 hours)
= $4,320 U

Problem 9-20 (continued)

1. c.

Actual Hours of Input, at Actual Rate (AH × AR) 11,040 hours** × $4.50 per hour = $49,680	Actual Hours of Input, at Standard Rate (AH × SR) 11,040 hours** × $5.00 per hour = $55,200	Standard Hours Allowed for Actual Output, at Standard Rate (SH × SR) 10,800 hours* × $5.00 per hour = $54,000
Variable overhead rate variance = $5,520 F	Variable overhead efficiency variance = $1,200 U	
Spending variance = $4,320 F		

* 12,000 units × 0.90 hours per unit = 10,800 hours
** 12,000 units × 0.92 hours per unit = 11,040 hours

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)
= 11,040 hours ($4.50 per hour – $5.00 per hour)
= $5,520 F

Variable overhead efficiency variance = SR (AH – SH)
= $5.00 per hour (11,040 hours – 10,800 hours)
= $1,200 U

2.

Materials:		
Price variance ($6,480 ÷ 12,000 units)	$0.54 U	
Quantity variance ($0 ÷ 12,000 units)	0.00	$0.54 U
Labor:		
Rate variance ($5,520 ÷ 12,000 units)	0.46 F	
Efficiency variance ($4,320 ÷ 12,000 units) ...	0.36 U	0.10 F
Variable overhead:		
Rate variance ($5,520 ÷ 12,000 units)	0.46 F	
Efficiency variance ($1,200 ÷ 12,000 units) ...	0.10 U	0.36 F
Excess of actual over standard cost per unit		$0.08 U

Problem 9-20 (continued)

3. Both the labor efficiency and variable overhead efficiency variances are affected by inefficient use of labor time.

Excess of actual over standard cost per unit.....		$0.08 U
Less portion attributable to labor inefficiency:		
Labor efficiency variance.....	0.36 U	
Variable overhead efficiency variance.....	0.10 U	0.46 U
Portion due to other variances.....		$0.38 F

   In sum, had it not been for the apparent inefficient use of labor time, the total variance in unit cost for the month would have been favorable by $0.38 rather than unfavorable by $0.08.

4. Although the excess of actual cost over standard cost is only $0.08 per unit, the details of the variances are significant. The materials price variance is $6,480 U and it warrants further investigation. The labor efficiency variance is $4,320 U and the variable overhead efficiency variance is $1,200 U. Taken together, these latter two variances highlight an opportunity for the company to pursue process improvement opportunities that would improve efficiency.

Problem 9-21 (45 minutes)

1.

	Standard Quantity or Hours	*Standard Price or Rate*	*Standard Cost*
Alpha6:			
Direct materials—X442.....	1.8 kilos	$3.50 per kilo	$ 6.30
Direct materials—Y661.....	2.0 liters	$1.40 per liter	2.80
Direct labor—Sintering.....	0.20 hours	$19.80 per hour	3.96
Direct labor—Finishing.....	0.80 hours	$19.20 per hour	15.36
Total.....			$28.42
Zeta7:			
Direct materials—X442.....	3.0 kilos	$3.50 per kilo	$10.50
Direct materials—Y661.....	4.5 liters	$1.40 per liter	6.30
Direct labor—Sintering.....	0.35 hours	$19.80 per hour	6.93
Direct labor—Finishing.....	0.90 hours	$19.20 per hour	17.28
Total.....			$41.01

Problem 9-21 (continued)

2. The computations to follow will require the standard quantities allowed for the actual output for each material.

	Standard Quantity Allowed
Material X442:	
Production of Alpha6 (1.8 kilos per unit × 1,500 units).....	2,700 kilos
Production of Zeta7 (3.0 kilos per unit × 2,000 units)	6,000 kilos
Total	8,700 kilos
Material Y661:	
Production of Alpha6 (2.0 liters per unit × 1,500 units)	3,000 liters
Production of Zeta7 (4.5 liters per unit × 2,000 units).....	9,000 liters
Total	12,000 liters

Direct materials variances—Material X442:

Materials price variance = AQ (AP – SP)
= 14,500 kilos ($3.60 per kilo* – $3.50 per kilo)
= $1,450 U
*$52,200 ÷ 14,500 kilos = $3.60 per kilo

Materials quantity variance = SP (AQ – SQ)
= $3.50 per kilo (8,500 kilos – 8,700 kilos)
= $700 F

Direct materials variances—Material Y661:

Materials price variance = AQ (AP – SP)
= 15,500 liters ($1.35 per liter* – $1.40 per liter)
= $775 F
*$20,925 ÷ 15,500 liters = $1.35 per liter

Materials quantity variance = SP (AQ – SQ)
= $1.40 per liter (13,000 liters – 12,000 liters)
= $1,400 U

Problem 9-21 (continued)

3. The computations to follow will require the standard quantities allowed for the actual output for direct labor in each department.

	Standard Hours Allowed
Sintering:	
Production of Alpha6 (0.20 hours per unit × 1,500 units)	300 hours
Production of Zeta7 (0.35 hours per unit × 2,000 units)	700 hours
Total	1,000 hours
Finishing:	
Production of Alpha6 (0.80 hours per unit × 1,500 units)	1,200 hours
Production of Zeta7 (0.90 hours per unit × 2,000 units)	1,800 hours
Total	3,000 hours

Direct labor variances—Sintering:

Labor rate variance = AH (AR – SR)
= 1,200 hours ($22.50 per hour* – $19.80 per hour)
= $3,240 U
*$27,000 ÷ 1,200 hours = $22.50 per hour

Labor efficiency variance = SR (AH – SH)
= $19.80 per hour (1,200 hours – 1,000 hours)
= $3,960 U

Direct labor variances—Finishing:

Labor rate variance = AH (AR – SR)
= 2,850 hours ($21.00 per hour* – $19.20 per hour)
= $5,130 U
*$59,850 ÷ 2,850 hours = $21.00 per hour

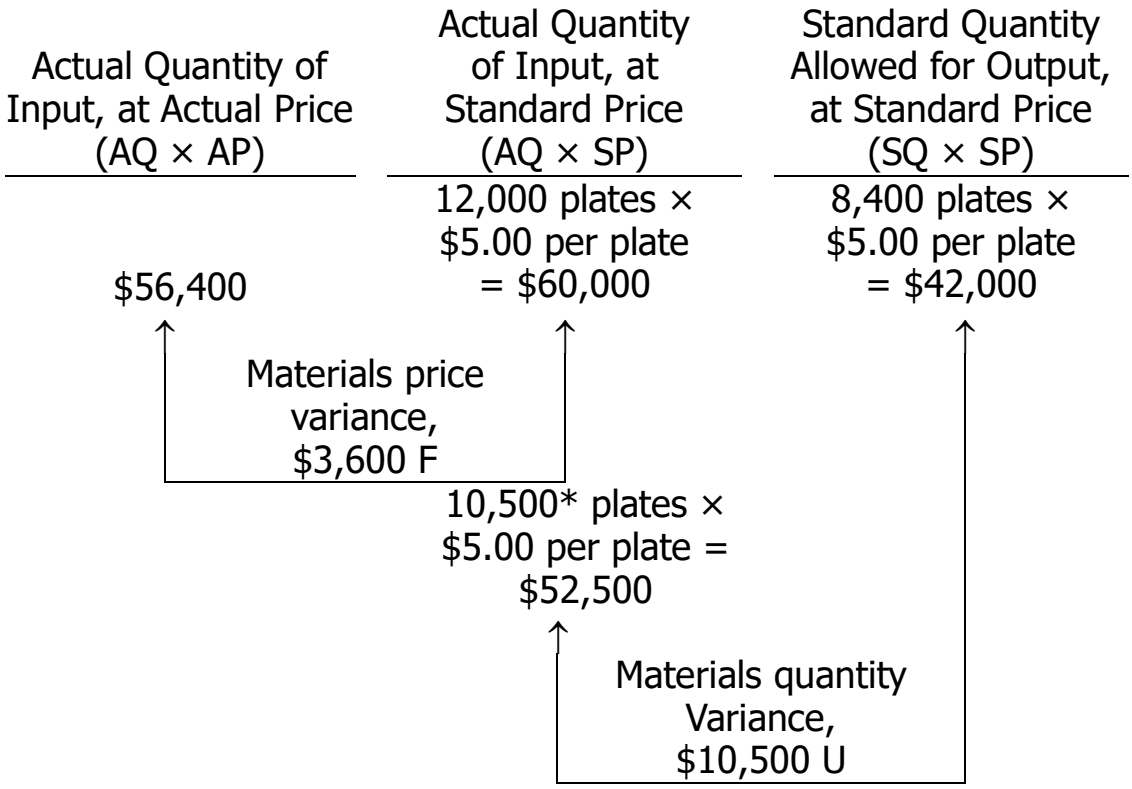
Labor efficiency variance = SR (AH – SH)
= $19.20 per hour (2,850 hours – 3,000 hours)
= $2,880 F

Problem 9-22 (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:



* 12,000 purchased – 1,500 unused = 10,500 used

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
12,000 plates ($4.70 per plate* – $5.00 per plate) = $3,600 F

*$56,400 ÷ 12,000 plates = $4.70 per plate

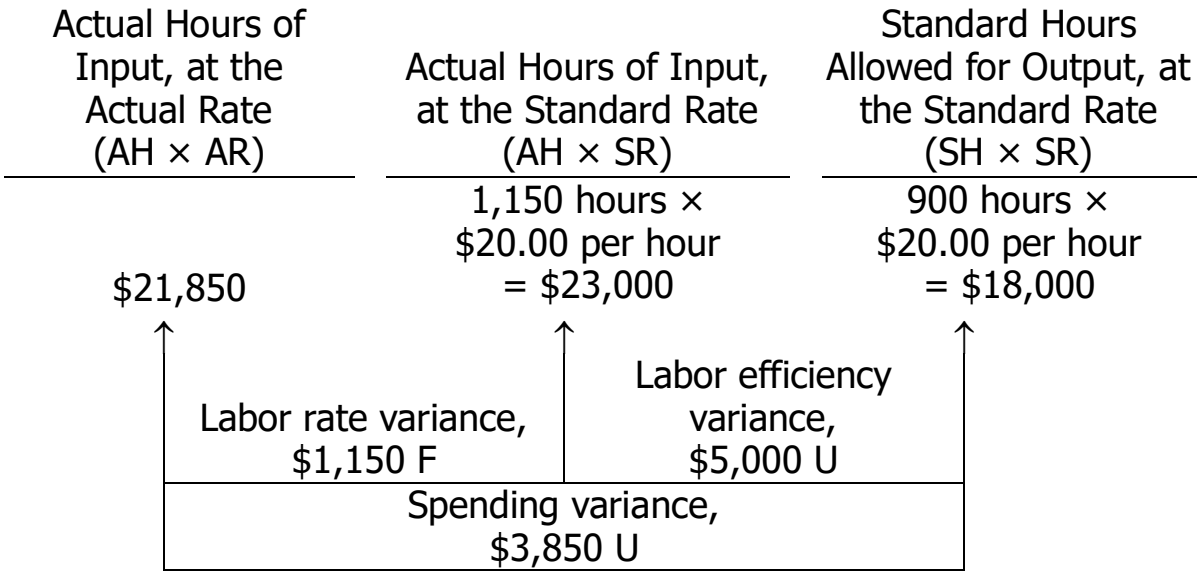
Materials quantity variance = SP (AQ – SQ)
$5.00 per plate (10,500 plates – 8,400 plates) = $10,500 U

Problem 9-22 (continued)

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 ($19.00 per hour* – $20.00 per hour) = $1,150 F

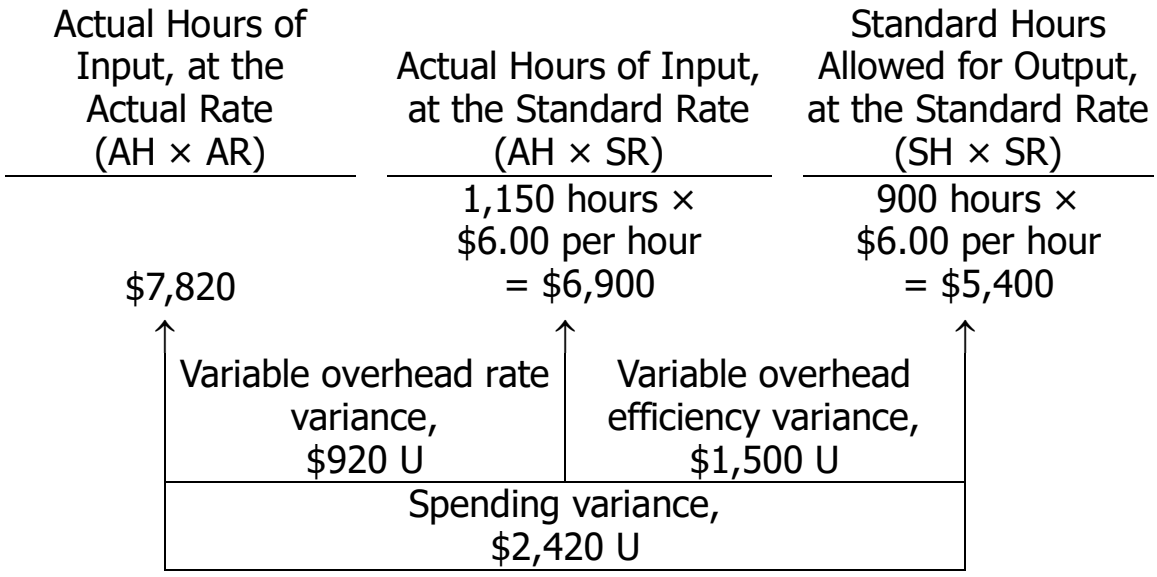
*$21,850 ÷ 1,150 hours = $19.00 per hour

Labor efficiency variance = SR (AH – SH)
$20.00 per hour (1,150 hours – 900 hours) = $5,000 U

Problem 9-22 (continued)

b. The policy probably should not be continued. Although the hospital is saving $1 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 9-23 (30 minutes)

1. The flexible budget is shown below:

FAB Corporation
Flexible Budget
For the Month Ended March 31

	Flexible Budget
Machine-hours (q)	26,000
Utilities ($20,600 + $0.10q)	$ 23,200
Maintenance ($40,000 + $1.60q)	81,600
Supplies ($0.30q)	7,800
Indirect labor ($130,000 + $0.70q)	148,200
Depreciation ($70,000)	70,000
Total	$330,800

Problem 9-23 (continued)

2. The spending variances are computed below:

FAB Corporation
Spending Variances
For the Month Ended March 31

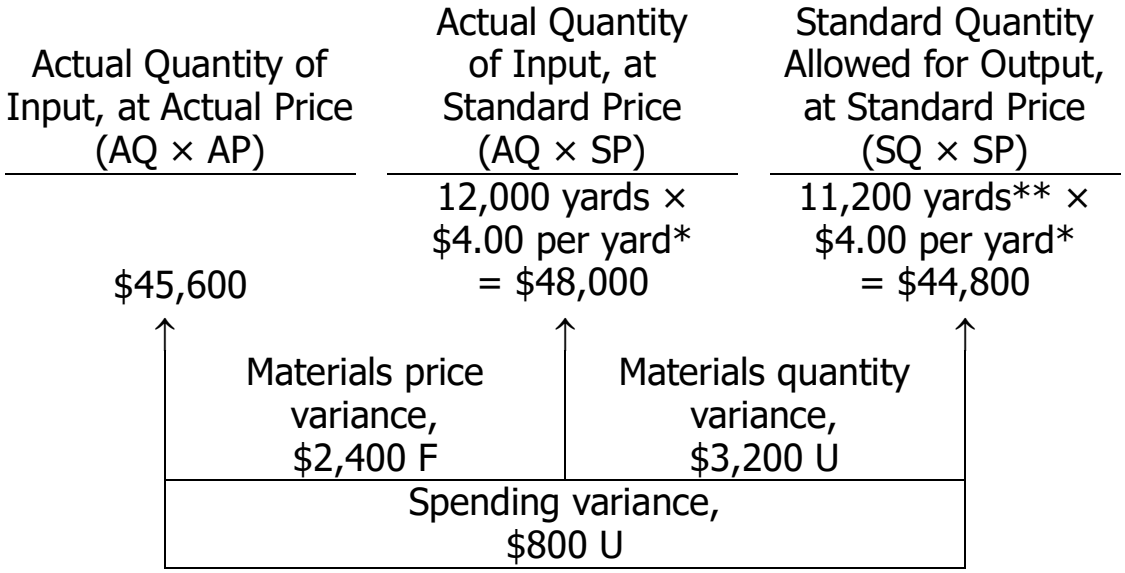
	Actual Results	*Flexible Budget*	*Spending Variances*	
Machine-hours (q)	26,000	26,000		
Utilities ($20,600 + $0.10q).....	$ 24,200	$ 23,200	$1,000	U
Maintenance ($40,000 + $1.60q)	78,100	81,600	3,500	F
Supplies ($0.30q)	8,400	7,800	600	U
Indirect labor ($130,000 + $0.70q) .	149,600	148,200	1,400	U
Depreciation ($70,000).....	71,500	70,000	1,500	U
Total	$331,800	$330,800	$1,000	U

An unfavorable spending variance means that the actual cost was greater than what the cost should have been for the actual level of activity. A favorable spending variance means that the actual cost was less than what the cost should have been for the actual level of activity. While this makes intuitive sense, sometimes a favorable variance may not be good. For example, the rather large favorable variance for maintenance might have resulted from performing less maintenance. Since these variances are all fairly large, they should all probably be investigated.

Problem 9-24 (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:

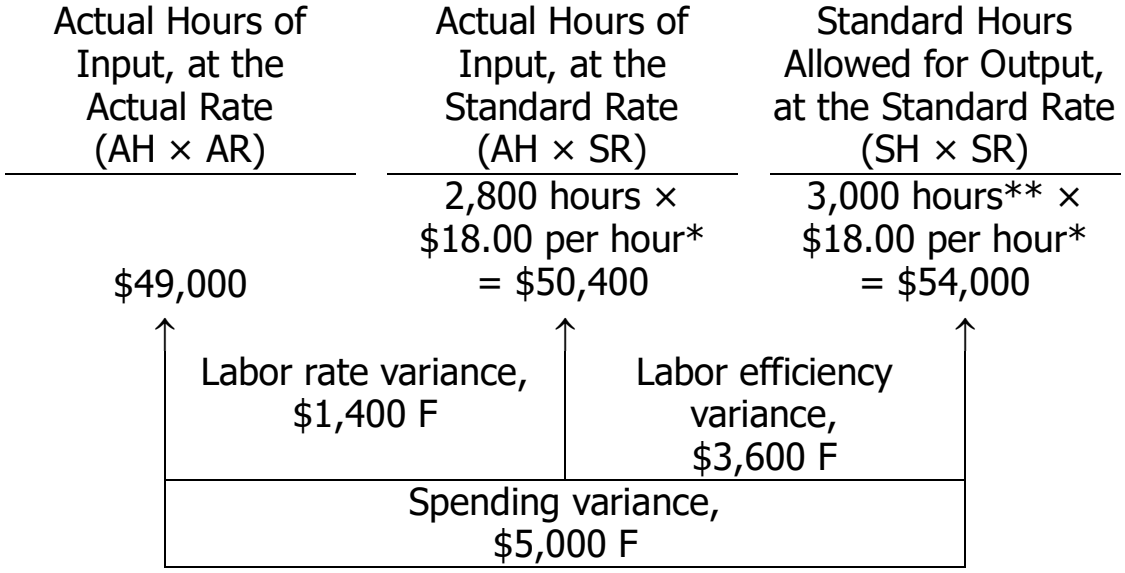
Materials price variance = AQ (AP – SP)
12,000 yards ($3.80 per yard* – $4.00 per yard) = $2,400 F

*$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 9-24 (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, $27.00 standard cost per set ÷ 1.5 standard hours per set = $18.00 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:

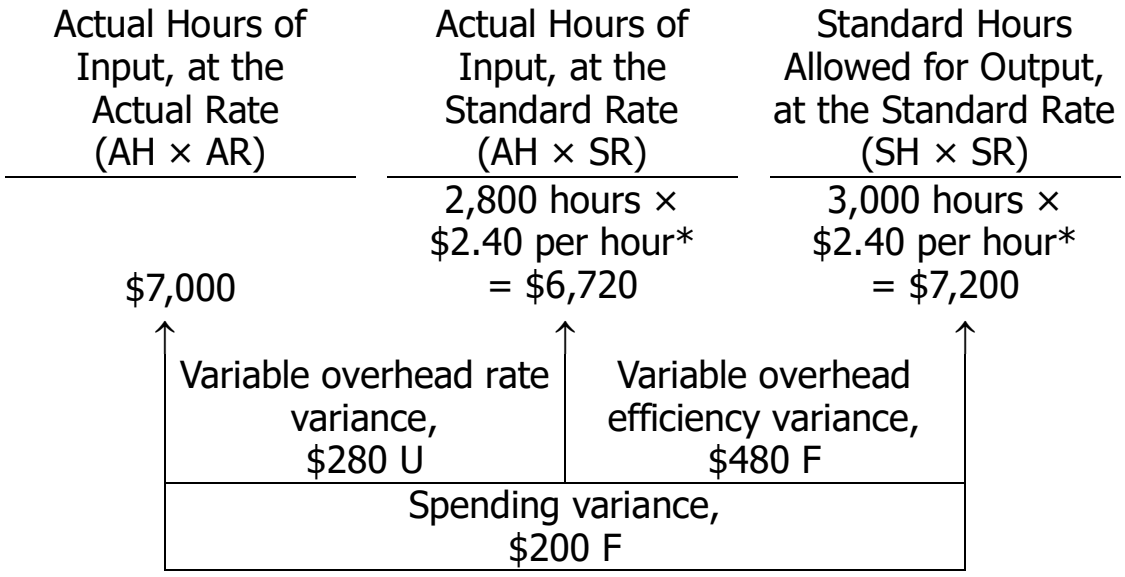
Labor rate variance = AH (AR – SR)
2,800 hours ($17.50 per hour* – $18.00 per hour) = $1,400 F

*$49,000 ÷ 2,800 hours = $17.50 per hour

Labor efficiency variance = SR (AH – SH)
$18.00 per hour (2,800 hours – 3,000 hours) = $3,600 F

Problem 9-24 (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 9-25 (45 minutes)

1. a. Materials quantity variance = SP (AQ – SQ)
$11.00 per foot (AQ – 9,600 feet*) = $4,400 U
$11.00 per foot × AQ – $105,600 = $4,400**
$11.00 per foot × AQ = $110,000
AQ = 10,000 feet

* $3,200 units × 3 foot per unit = 9,600 feet
** When used with the formula, unfavorable variances are positive and favorable variances are negative.

Therefore, $111,300 ÷ 10,000 feet = $11.13 per foot

b. Materials price variance = AQ (AP – SP)
10,000 feet ($11.13 per foot – $11.00 per foot) = $1,300 U

The total variance for materials is:

Materials price variance	$1,300 U
Materials quantity variance.....	4,400 U
Spending variance.....	$5,700 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)
10,000 feet × $11.13 per foot = $111,300*	10,000 feet × $11.00 per foot* = $110,000	9,600 feet** × $11.00 per foot* = $105,600

Materials price variance, $1,300 U	Materials quantity variance, $4,400 U*
Spending variance, $5,700 U	

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

Problem 9-25 (continued)

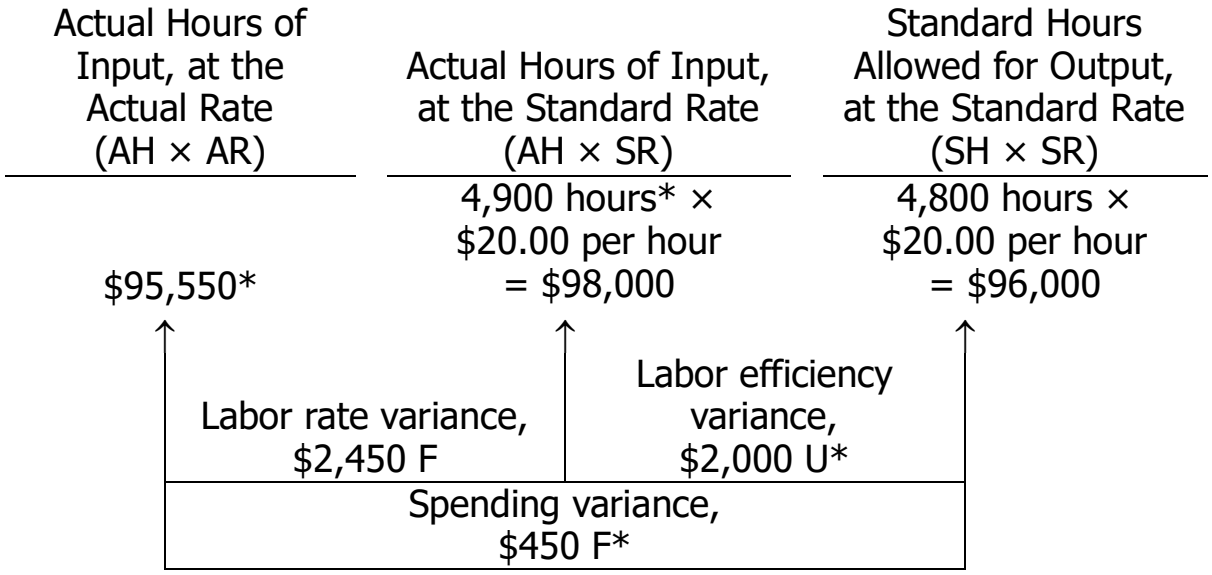
2. a. Labor rate variance = AH (AR – SR)
4,900 hours ($19.50 per hour* – SR) = $2,450 F**
$95,550 – 4,900 hours × SR = –$2,450***
4,900 hours × SR = $98,000
SR = $20.00

* $95,550 ÷ 4,900 hours = $19.50 per hour
** $450 F + $2,000 U
*** When used with the formula, unfavorable variances are positive and favorable variances are negative.

b. Labor efficiency variance = SR (AH – SH)
$20.00 per hour (4,900 hours – SH) = $2,000 U
$98,000 – $20.00 per hour × SH = $2,000*
$20.00 per hour × SH = $96,000
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 9-26 (60 minutes)

1. Standard cost for March production:

Materials	$16,800
Direct labor	21,000
Variable manufacturing overhead	4,200
Total standard cost (a)	$42,000
Number of backpacks produced (b)	1,000
Standard cost of a single backpack (a) ÷ (b)	$42.00

2.

Standard cost of a single backpack (above)	$42.00
Deduct difference between standard and actual cost	0.15
Actual cost per backpack	$41.85

3.

Total standard cost of materials during March (a)	$16,800
Number of backpacks produced during March (b)	1,000
Standard materials cost per backpack (a) ÷ (b)	$16.80

$$\frac{\text{Standard materials cost per backpack}}{\text{Standard materials cost per yard}} = \frac{\$16.80 \text{ per backpack}}{\$6.00 \text{ per yard}}$$

$$= 2.8 \text{ yards per backpack}$$

4.

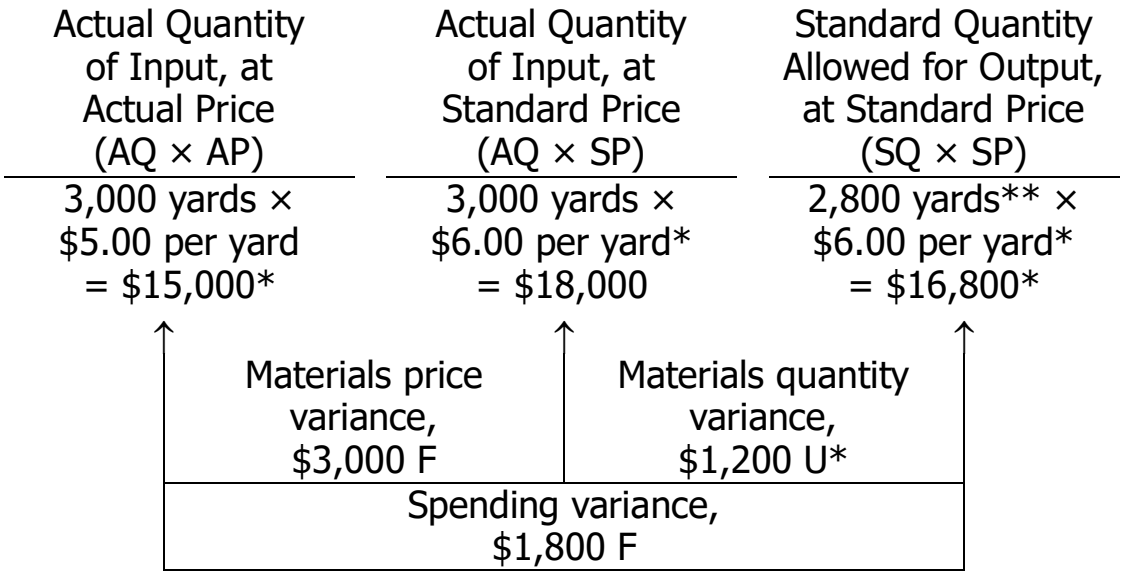
Standard cost of material used	$16,800
Actual cost of material used	15,000
Spending variance	$ 1,800 F

The materials price and quantity variances together equal the spending variance. If the materials quantity variance is $1,200 U, then the materials price variance must be $3,000 F:

Materials price variance	$ 3,000 F
Materials quantity variance	1,200 U
Spending variance	$ 1,800 F

Problem 9-26 (continued)

Alternative Solution:



* Given

** 1,000 units × 2.8 yards per unit = 2,800 yards

5. The first step in computing the standard direct labor rate is to determine the standard direct labor-hours allowed for the month's production. The standard direct labor-hours can be computed by working with the variable manufacturing overhead costs, because they are based on direct labor-hours worked:

Standard variable manufacturing overhead cost for March (a).	$4,200
Standard variable manufacturing overhead rate per direct labor-hour (b).....	$3.00
Standard direct labor-hours for March (a) ÷ (b).....	1,400

$$\frac{\text{Total standard direct labor cost for March}}{\text{Total standard direct labor-hours for March}} = \frac{\$21{,}000}{1{,}400 \text{ DLHs}}$$

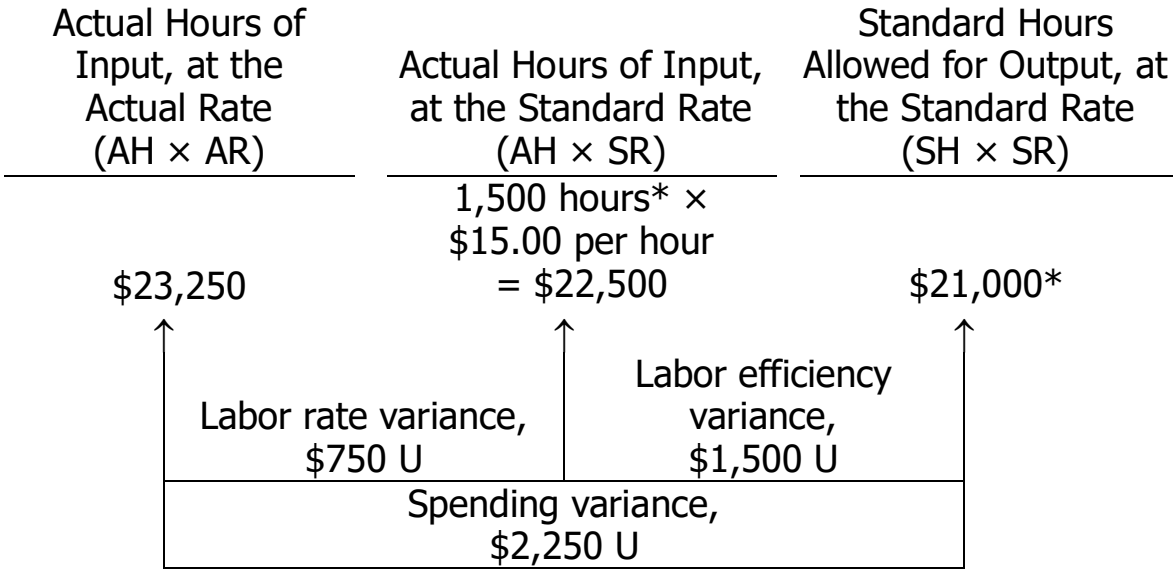
$$= \$15.00 \text{ per DLH}$$

Problem 9-26 (continued)

6. Before the labor variances can be computed, it is necessary to compute the actual direct labor cost for the month:

Actual cost per backpack produced (see requirement 2)		$ 41.85
Number of backpacks produced		× 1,000
Total actual cost of production		$41,850
Less: Actual cost of materials	$15,000	
Actual cost of variable manufacturing overhead	3,600	18,600
Actual cost of direct labor		$23,250

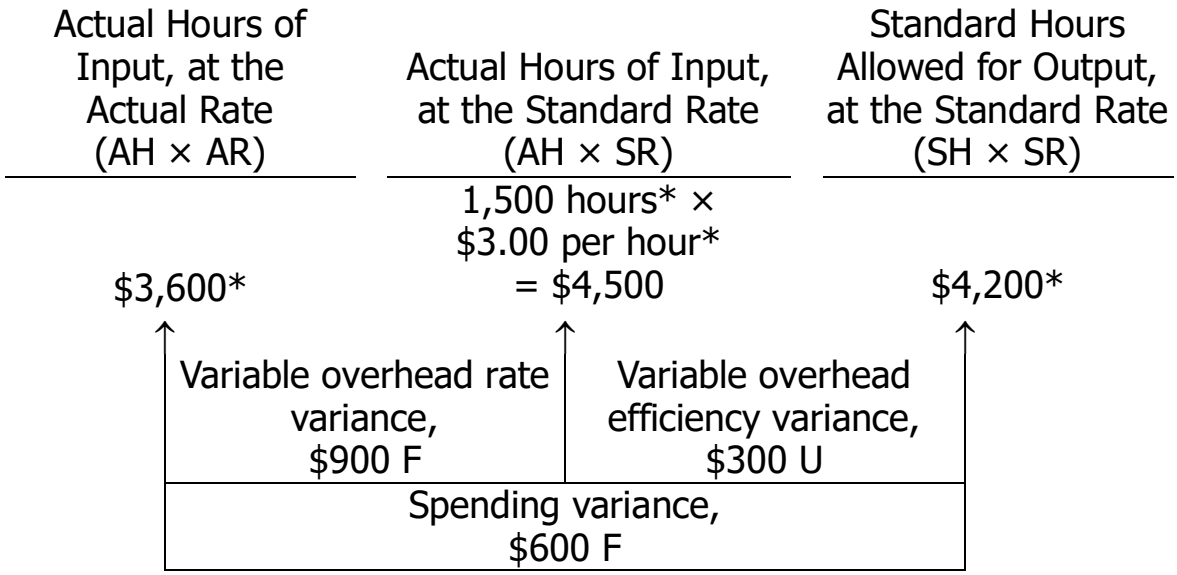
With this information, the variances can be computed:



*Given

Problem 9-26 (continued)

7.



*Given

8.

	Standard Quantity or Hours	*Standard Price or Rate*	*Standard Cost*
Direct materials.....	2.8 yards[1]	$6 per yard	$16.80
Direct labor.....	1.4 hours[2]	$15.00 per hour[3]	21.00
Variable manufacturing overhead.....	1.4 hours	$3 per hour	4.20
Total standard cost			$42.00

[1]From requirement 3.
[2]1,400 standard hours (from part 5) ÷ 1,000 backpacks = 1.4 hours per backpack.
[3]From requirement 5.

Ethics Challenge (30 minutes)

It is difficult to imagine how Tom Kemper could ethically agree to go along with reporting the favorable $21,000 variance for industrial engineering on the final report, even if the bill were not actually received by the end of the year. It would be misleading to exclude part of the final cost of the contract. Collaborating in this attempt to mislead corporate headquarters violates the credibility standard in the Statement of Ethical Professional Practice promulgated by the Institute of Management Accountants. The credibility standard requires that management accountants "disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations." Failing to disclose the entire amount owed on the industrial engineering contract violates this standard.

Individuals will differ in how they think Kemper should handle this situation. In our opinion, he should firmly state that he is willing to call Laura, but even if the bill does not arrive, he is ethically bound to properly accrue the expenses on the report—which will mean an unfavorable variance for industrial engineering and an overall unfavorable variance. This would require a great deal of personal courage. If the general manager insists on keeping the misleading $21,000 favorable variance on the report, Kemper would have little choice except to take the dispute to the next higher managerial level in the company.

It is important to note that the problem may be a consequence of inappropriate use of performance reports by corporate headquarters. If the performance report is being used as a way of "beating up" managers, corporate headquarters may be creating a climate in which managers such as the general manager at the Wichita plant will feel like they must always turn in positive reports. This creates pressure to bend the truth since reality isn't always positive.

Analytical Thinking (15 minutes)

1. The mozzarella cheese spending variance is computed as follows:

	Actual Results	*Flexible Budget*	*Spending Variance*
Number of pizzas (*q*)	1,100	1,100	
Mozzarella cheese ($2.40*q*)	$2,632	$2,640	$8 F

2. a., 2.b., and 2.c.

The materials price, quantity, and spending variances are computed as follows:

Actual Quantity of Input, at Actual Price (AQ × AP) 9,400 ounces × $0.28 per ounce* = $2,632	Actual Quantity of Input, at Standard Price (AQ × SP) 9,400 ounces × $0.30 per ounce = $2,820	Standard Quantity Allowed for Actual Output, at Standard Price (SQ × SP) 8,800 ounces** × $0.30 per ounce = $2,640
Materials price variance = $188 F	Materials quantity variance = $180 U	
Spending variance = $8 F		

* $2,632 ÷ 9,400 ounces = $0.28 per ounce

**1,100 pizzas × 8 ounces per pizza = 8,800 ounces

Case (75 minutes)

1. The cost formulas for The Little Theatre appear below, where q_1 is the number of productions and q_2 is the number of performances:
   - Actors' and directors' wages: $\$2{,}000q_2$. Variable with respect to the number of performances. \$2,000 = \$216,000 ÷ 108.
   - Stagehands' wages: $\$300q_2$. Variable with respect to the number of performances. \$300 = \$32,400 ÷ 108.
   - Ticket booth personnel and ushers' wages: $\$150q_2$. Variable with respect to the number of performances. \$150 = \$16,200 ÷ 108.
   - Scenery, costumes, and props: $\$18{,}000q_1$. Variable with respect to the number of productions. \$18,000 = \$108,000 ÷ 6.
   - Theater hall rent: $\$500q_2$. Variable with respect to the number of performances. \$500 = \$54,000 ÷ 108.
   - Printed programs: $\$250q_2$. Variable with respect to the number of performances. \$250 = \$27,000 ÷ 108.
   - Publicity: $\$2{,}000q_1$. Variable with respect to the number of productions. \$2,000 = \$12,000 ÷ 6.
   - Administrative expenses: $\$32{,}400 + \$1{,}080q_1 + \$40q_2$.
     - \$32,400 = 0.75 × \$43,200
     - \$1,080 = (0.15 × \$43,200) ÷ 6
     - \$40 = (0.10 × \$43,200) ÷ 108

The Little Theatre
Flexible Budget
For the Year Ended December 31

Actual number of productions (q_1)	7
Actual number of performances (q_2)	168
Actors' and directors' wages ($\$2{,}000q_2$)	\$336,000
Stagehands' wages ($\$300q_2$)	50,400
Ticket booth personnel and ushers' wages ($\$150q_2$)	25,200
Scenery, costumes, and props ($\$18{,}000q_1$)	126,000
Theater hall rent ($\$500q_2$)	84,000
Printed programs ($\$250q_2$)	42,000
Publicity ($\$2{,}000q_1$)	14,000
Administrative expenses ($\$32{,}400 + \$1{,}080q_1 + \$40q_2$)	46,680
Total expense	\$724,280

Case (continued)

2. The spending variances are computed as follows:

The Little Theatre
Spending Variances
For the Year Ended December 31

	Actual Results	*Spending Variances*		*Flexible Budget*
Number of productions (q_1)	7			7
Number of performances (q_2)	168			168
Actors' and directors' wages ($2,000$q_2$)	$341,800	$5,800	U	$336,000
Stagehands' wages (300q_2$)	49,700	700	F	50,400
Ticket booth personnel and ushers' wages (150q_2$)	25,900	700	U	25,200
Scenery, costumes, and props ($18,000$q_1$)	130,600	4,600	U	126,000
Theater hall rent (500q_2$)	78,000	6,000	F	84,000
Printed programs (250q_2$)	38,300	3,700	F	42,000
Publicity ($2,000$q_1$)	15,100	1,100	U	14,000
Administrative expenses ($32,400 + $1,080$q_1$ +40q_2$)	47,500	820	U	46,680
Total expense	$726,900	$2,620	U	$724,280

Case (continued)

3. The overall unfavorable spending variance is a very small percentage of the total cost, less than 0.4%. This suggests that costs are under control. In addition, the pattern of the variances may reflect good management. The largest unfavorable variances are for value-added activities (scenery, costumes, props, actors, and directors) that may warrant additional spending. These unfavorable variances are offset by favorable variances for theater hall rent and the printed programs. Assuming that the quality of the printed programs has not noticeably declined and that the favorable variance for the rent reflects a lower negotiated rental fee, management should be congratulated. They have saved in some areas and have apparently transferred the funds to other areas that may favorably impact the quality of the theater's productions.

4. Average costs may not be very good indicators of the additional costs of any particular production or performance. The averages gloss over considerable variations in costs. For example, a production of Peter Rabbit may require only half a dozen actors and actresses and fairly simple costumes and props. On the other hand, a production of Cinderella may require dozens of actors and actresses and very elaborate and costly costumes and props. Consequently, both the production costs and the cost per performance will be much higher for Cinderella than for Peter Rabbit. Managers of theater companies know that they must estimate the costs of each new production individually—the average costs are of little use for this purpose.

Appendix 9A
Predetermined Overhead Rates and Overhead Analysis in a Standard Costing System

Exercise 9A-1 (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 9A-2 (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

Exercise 9A-2 (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 9A-3 (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 9A-4 (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 9A-5 (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 9A-6 (15 minutes)

1.

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

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

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

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

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

2.

	Standard Quantity or Hours	*Standard Price or Rate*	*Standard Cost*
Direct materials	2.5 yards	$8.60 per yard	$21.50
Direct labor	3.0 hours*	$12.00 per hour	36.00
Variable manufacturing overhead	3.0 hours	$1.90 per hour	5.70
Fixed manufacturing overhead	3.0 hours	$5.60 per hour	16.80
Total standard cost			$80.00

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

Exercise 9A-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

3.

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

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

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

4.

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

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

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

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 9A-8 (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
	Variable overhead rate variance, $6,500 F	Variable overhead efficiency variance, $4,000 U

Problem 9A-8 (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:

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

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

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

Problem 9A-8 (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 requirement 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 9A-9 (45 minutes)

1. Total rate: $\frac{\$297,500}{35,000 \text{ hours}} = \$8.50 \text{ per hour}$

   Variable rate: $\frac{\$87,500}{35,000 \text{ hours}} = \$2.50 \text{ per hour}$

   Fixed rate: $\frac{\$210,000}{35,000 \text{ hours}} = \$6.00 \text{ per hour}$

2. 32,000 standard hours × $8.50 per hour = $272,000

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)
$78,000	30,000 hours × $2.50 per hour = $75,000	32,000 hours × $2.50 per hour = $80,000
	Variable overhead rate variance, $3,000 U	Variable overhead efficiency variance, $5,000 F

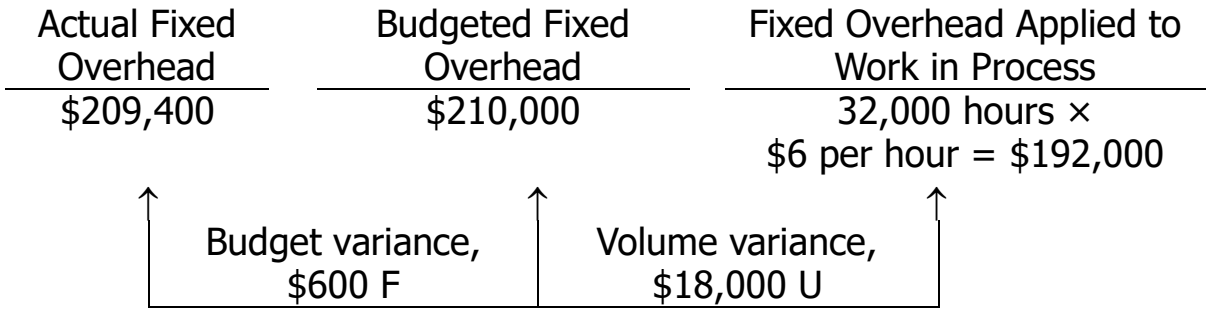
   Alternative solution:

   Variable overhead rate variance = (AH × AR) – (AH × SR)
   ($78,000) – (30,000 hours × $2.50 per hour) = $3,000 U

   Variable overhead efficiency variance = SR (AH – SH)
   $2.50 per hour (30,000 hours – 32,000 hours) = $5,000 F

Problem 9A-9 (continued)

Fixed overhead variances:



Alternative solution:

Budget variance:

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

$$= \$209{,}400 - \$210{,}000$$

$$= \$600 \text{ F}$$

Volume variance:

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

$$= \$6.00 \text{ per hour } (35{,}000 \text{ hours} - 32{,}000 \text{ hours})$$

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

Verification:

Variable overhead rate variance	$ 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	$15,400 U

Problem 9A-9 (continued)

4. Variable overhead

   Rate variance: This variance reflects differences between actual and standard prices for variable overhead items. Because the variable overhead rate variance is unfavorable, too much was paid for variable overhead items.

   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 $5,000 ($2.50 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 9A-10 (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

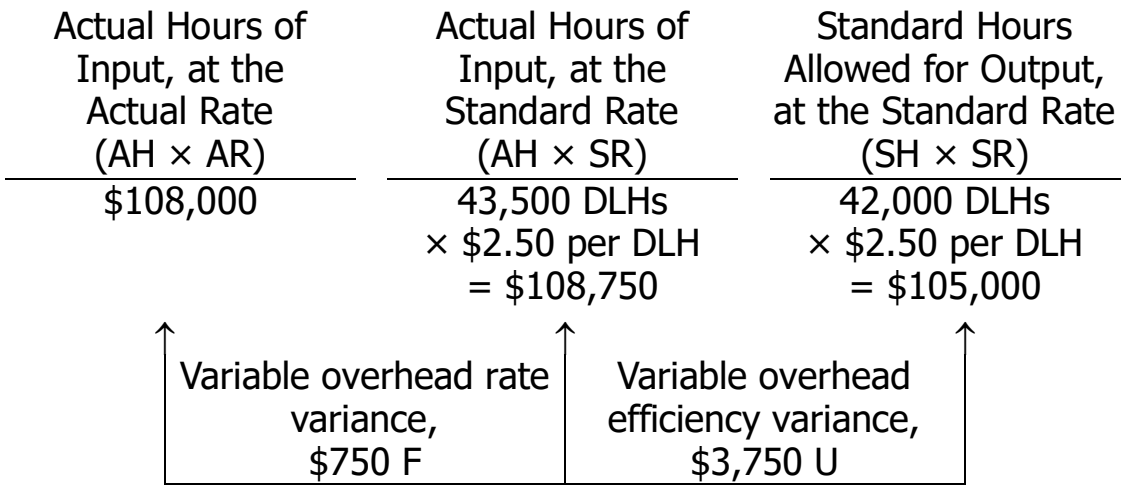
2. Direct labor rate and efficiency variances:

   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:



   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 9A-10 (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:

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

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

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

Problem 9A-10 (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 9A-11 (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:

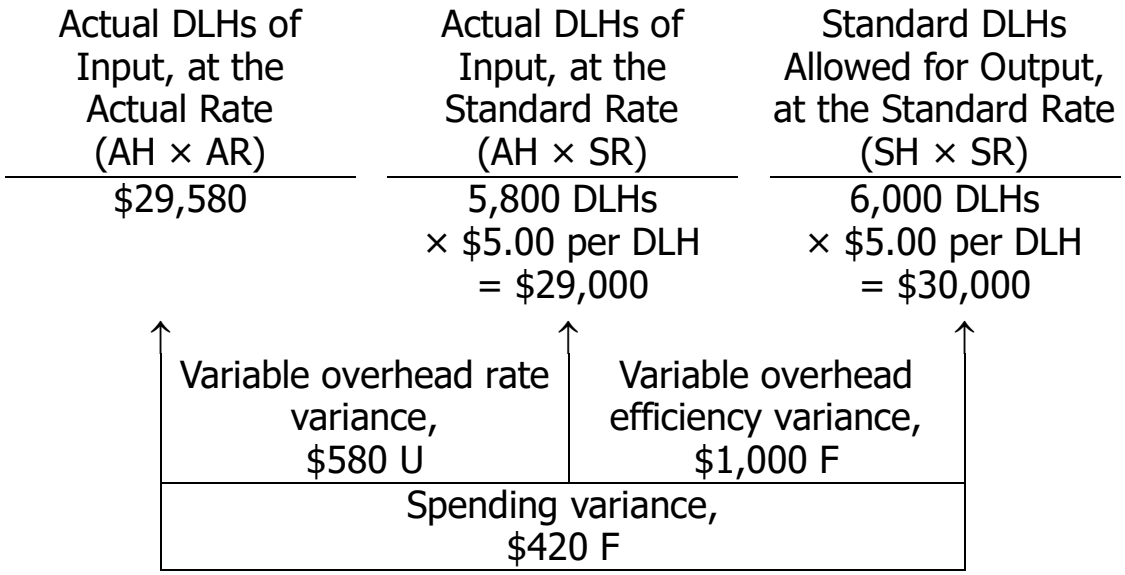
   Labor rate variance = AH (AR – SR)
   5,800 DLHs ($13.00 per DLH – $12.00 per DLH) = $5,800 U

   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 9A-11 (continued)

3. Variable overhead variances:

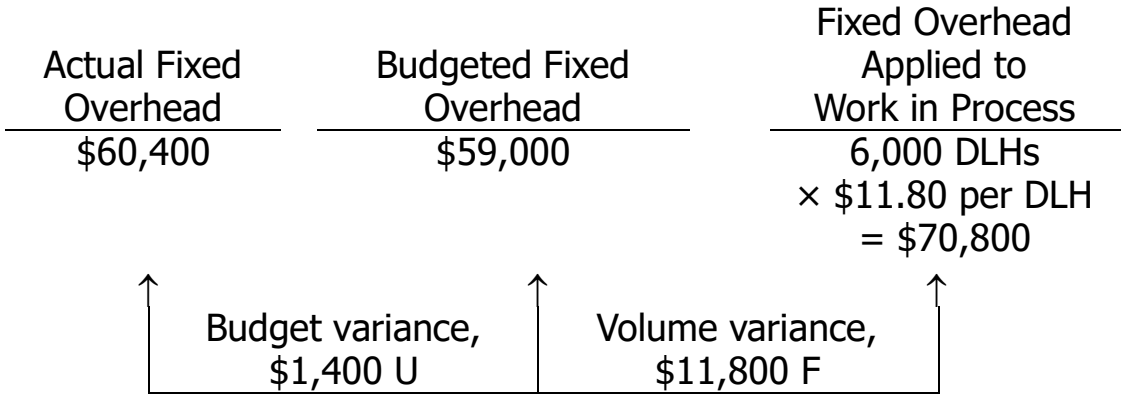


Alternative solution for the variable overhead variances:

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 9A-11 (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 9A-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 9A-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
	Variable overhead rate variance, $3,800 U	Variable overhead 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 9A-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:

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

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

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

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 9A-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 9B
Journal Entries to Record Variances

Exercise 9B-1 (20 minutes)

1. The cost of goods sold will decrease by:

Materials price variance	$ (6,500)
Materials quantity variance	10,200
Labor rate variance	3,500
Labor efficiency variance	(4,400)
Fixed overhead budget variance	(2,500)
Fixed overhead volume variance	(12,000)
Decrease in cost of goods sold	$(11,700)

2. The income statement is as follows:

Sales (10,000 units × $135)		$1,350,000
Cost of goods sold at standard (10,000 units × $105)	$1,050,000	
Total variance adjustments	(11,700)	
Cost of goods sold		1,038,300
Gross margin		311,700
Selling and administrative expenses		235,000
Net operating income		$ 76,700

Exercise 9B-2 (15 minutes)

1. The cost of goods sold will increase by:

Materials price variance	$ 3,400
Materials quantity variance	(9,000)
Labor rate variance	3,900
Labor efficiency variance	6,600
Fixed overhead budget variance	1,300
Fixed overhead volume variance	(5,500)
Increase in cost of goods sold	$ 700

2. The first step is to compute the number of units sold as follows:

Total sales (a)	$577,500
Selling price per unit (b)	$165
Number of units sold (a) ÷ (b)	3,500

The income statement is as follows:

Sales		$577,500
Cost of goods sold at standard (3,500 units × $143)	$500,500	
Total variance adjustments	700	
Cost of goods sold		501,200
Gross margin		76,300
Selling and administrative expenses		54,000
Net operating income		$ 22,300

3. The ending balance in Retained Earnings is computed as follows:

Beginning balance in retained earnings	$70,000
Net operating income	22,300
Ending balance in retained earnings	$92,300

Exercise 9B-3 (20 minutes)

1a. The Raw Materials will increase by $300,000 computed as follows:

Actual quantity purchased (a)	30,000 yards
Standard price per yard (b)	$10.00
Increase in Raw Materials (a) × (b)	$300,000

1b. The Cash will decrease by $294,000 computed as follows:

Actual quantity purchased (a)	30,000 yards
Actual price per yard (b)	$9.80
Decrease in Cash (a) × (b)	$294,000

2a. The Raw Materials will decrease by $300,000 computed as follows:

Actual quantity used (a)	30,000 yards
Standard price per yard (b)	$10.00
Decrease in Raw Materials (a) × (b)	$300,000

2b. The Work in Process will increase by $243,000 computed as follows:

Standard quantity allowed (8,100 units × 3 yards per unit) (a)	24,300 yards
Standard price per yard (b)	$10.00
Increase in Work in Process (a) × (b)	$243,000

3a. The Work in Process will increase by $272,160 computed as follows:

Standard hours allowed (8,100 units × 2.4 hours per unit) (a)	19,440 hours
Standard rate per hour (b)	$14.00
Increase in Work in Process (a) × (b)	$272,160

3b. The Cash will decrease by $290,000—the amount of cash paid to direct laborers.

Exercise 9B-3 (continued)

4. The Work in Process will increase by $388,800 computed as follows:

Standard hours allowed (a)	19,440 hours
Predetermined overhead rate per hour (b)	$20.00
Increase in Work in Process (a) × (b)	$388,800

5. The Finished Goods will increase by $903,960 computed as follows:

Number of units completed (a)	8,100 units
Standard cost per unit (b)	$111.60
Increase in Finished Goods (a) × (b)	$903,960

Exercise 9B-4 (30 minutes)

1a. The Raw Materials will increase by $720,000 computed as follows:

Actual quantity purchased (a)	60,000 yards
Standard price per yard (b)	$12.00
Increase in Raw Materials (a) × (b).....	$720,000

1b. The Cash will decrease by $660,000 computed as follows:

Actual quantity purchased (a)	60,000 yards
Actual price per yard (b)	$11.00
Decrease in Cash (a) × (b).....	$660,000

1c. The materials price variance is computed as follows:

Materials price variance = AQ(AP – SP)
60,000 yards ($11.00 per yard – $12.00 per yard) = $60,000 F

2a. The Raw Materials will decrease by $720,000 computed as follows:

Actual quantity used (a)	60,000 yards
Standard price per yard (b)	$12.00
Decrease in Raw Materials (a) × (b).....	$720,000

2b. The Work in Process will increase by $672,000 computed as follows:

Standard quantity allowed (28,000 units × 2 yards per unit) (a).....	56,000 yards
Standard price per yard (b)	$12.00
Increase in Work in Process (a) × (b).....	$672,000

2c. The materials quantity variance is computed as follows:

Materials quantity variance = SP (AQ – SQ)
$12.00 per yard (60,000 yards – 56,000 yards) = $48,000 U

3a. The Work in Process will increase by $630,000 computed as follows:

Standard hours allowed (28,000 units × 1.5 hours per unit) (a).....	42,000 hours
Standard rate per hour (b)	$15.00
Increase in Work in Process (a) × (b).....	$630,000

Exercise 9B-4 (continued)

3b. The Cash decrease by $600,000 computed as follows:

Actual hours (a)	40,000 hours
Actual rate per hour (b)	$15.00
Decrease in Cash (a) × (b).....	$600,000

3c. The labor rate variance is zero because the actual rate (see requirement 3b) and the standard rate are both $15.00 per hour. The labor efficiency variance is computed as follows:

Labor efficiency variance = SR(AH – SH)
$15.00 per hour (40,000 hours – 42,000 hours) = $30,000 F

4a. The Work in Process will increase by $1,680,000 computed as follows:

Standard hours allowed (28,000 units × 1.5 hours) (a).....	42,000 hours
Predetermined overhead rate per hour (b).....	$40.00
Increase in Work in Process (a) × (b).....	$1,680,000

4b. The fixed overhead budget and volume variances are computed as follows:

Budget variance = Actual fixed overhead – Budgeted fixed overhead
Budget variance = $1,780,000 – $1,760,000 = $20,000 U

Volume variance = Budgeted fixed overhead – Fixed overhead applied
Volume variance = $1,760,000 – $1,680,000 = $80,000 U

5. The Finished Goods will increase by $2,982,000 computed as follows:

Number of units completed (a)	28,000 units
Standard cost per unit (b)	$106.50
Increase in Finished Goods (a) × (b).....	$2,982,000

Problem 9B-5 (60 minutes)

1. The manufacturing cost variances are computed as follows:

   Materials price variance = AQ(AP – SP)
   230,000 pounds ($29.50 per pound – $30.00 per pound) = $115,000 F

   Materials quantity variance = SP(AQ – SQ)
   $30.00 per pound (215,000 pounds – 190,000 pounds*) = $750,000 U

   *95,000 units × 2 pounds per unit = 190,000 pounds

   Labor rate variance = AH(AR – SR)
   245,000 hours ($16.00 per hour – $15.00 per hour) = $245,000 U

   Labor efficiency variance = SR(AH – SH)
   $15.00 per hour (245,000 hours – 285,000 hours*) = $600,000 F

   *95,000 units × 3 hours per unit = 285,000 hours

   Budget variance = Actual fixed overhead – Budgeted fixed overhead
   Budget variance = $2,740,000 – $2,880,000 = $140,000 F

   Volume variance = Budgeted fixed overhead – Fixed overhead applied
   Volume variance = $2,880,000 – $2,850,000* = $30,000 U

   * 95,000 units × 3 hours per unit × $10 per hour = $2,850,000

Problem 9B-5 (continued)

2 and 3: The transactions (including the ending balances) are recorded as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1						Wallis Company								
2						Transaction Analysis								
3						For the Year Ended 12/31/XX								
4						(dollars in thousands)								
5														
6		Cash	Raw Materials	Work-in-Process	Finished Goods	PP&E (net)	=	Materials Price Variance	Materials Quantity Variance	Labor Rate Variance	Labor Efficiency Variance	Fixed Overhead Budget Variance	Fixed Overhead Volume Variance	Retained Earnings
7	1/1	$ 700	$ 150	$ -	$ 270	$ 8,500	=	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,620
8	a.	(6,785)	6,900				=	115						
9	b.		(6,450)	5,700			=		(750)					
10	c.	(3,920)		4,275			=			(245)	600			
11	d.	(1,340)		2,850		(1,400)	=					140	(30)	
12	e.			(12,825)	12,825		=							
13	f.	15,640					=							15,640
14	g.				(12,420)		=							(12,420)
15	h.	(2,120)					=							(2,120)
16	i.						=	(115)	750	245	(600)	(140)	30	(170)
17	12/31	$ 2,175	$ 600	$ -	$ 675	$ 7,100	=	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,550
18														

Problem 9B-5(1) | Problem 9B-5 (2) | Problem 9B5(3) | ...

Problem 9B-5 (continued)

4. The income statement is computed as follows:

	A	B	C
1	**Wallis Company**		
2	**Income Statement**		
3	**For Year Ended 12/31/XX**		
4	**(dollars in thousands)**		
5			
6	Sales		$ 15,640
7	Cost of goods sold at standard	$ 12,420	
8	Total variance adjustments	170	
9	Cost of goods sold		12,590
10	Gross margin		3,050
11	Selling and administrative expenses		2,120
12	Net operating income		$ 930
13			
14			

... Problem 9B5(3) ...

Problem 9B-6 (60 minutes)

1. The manufacturing cost variances are computed as follows:

   Materials price variance = AQ(AP – SP)
   460,000 pounds ($26.50 per pound – $25.00 per pound) = $690,000 U

   Materials quantity variance = SP(AQ – SQ)
   $25.00 per pound (430,000 pounds – 375,000 pounds) = $1,375,000 U

   Labor rate variance = AH(AR – SR)
   265,000 hours ($15.00 per hour – $16.00 per hour) = $265,000 F

   Labor efficiency variance = SR(AH – SH)
   $16.00 per hour (265,000 hours – 250,000 hours) = $240,000 U

   Variable overhead rate variance = AH(AR – SR)
   265,000 hours ($1.81 per hour – $2.00 per hour) = $50,000 F

   Note: The variable overhead rate variance of $50,000 F agrees with cell L11 in the Excel screen capture solution for requirements 2 and 3. An answer of $50,000 F is correct when the actual rate (AR) is *not* rounded to $1.81.

   Variable overhead efficiency variance = SR(AH – SH)
   $2.00 per hour (265,000 hours – 250,000 hours) = $30,000 U

   Budget variance = Actual fixed overhead – Budgeted fixed overhead
   Budget variance = $2,450,000 – $2,400,000 = $50,000 U

   Volume variance = Budgeted fixed overhead – Fixed overhead applied
   Volume variance = $2,400,000 – $2,500,000 = $100,000 F

   Note: The budgeted fixed overhead of $2,400,000 is computed as:

Total budgeted overhead (a)	$2,880,000
Variable portion of the budget (240,000 DLH ×$2.00 per DLH) (b).....	$480,000
Total budgeted fixed overhead (a) – (b)	$2,400,000

   Note: The fixed overhead applied of $2,500,000 is computed as follows:

Standard labor-hours allowed (a)	250,000
Fixed portion of the predetermined overhead rate per DLH (b).....	$10
Fixed overhead applied (a) × (b)	$2,500,000

Problem 9B-6 (continued)

2 and 3. The transactions (including the ending balances) are recorded as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Phoenix Company**															
2	**Transaction Analysis**															
3	**For the Year Ended 12/31/XX**															
4	**(dollars in thousands)**															
5																
6		**Cash**	**Raw Materials**	**Work-in-Process**	**Finished Goods**	**PP&E (net)**	=	**Materials Price Variance**	**Materials Quantity Variance**	**Labor Rate Variance**	**Labor Efficiency Variance**	**Variable Overhead Rate Variance**	**Variable Overhead Efficiency Variance**	**Fixed Overhead Budget Variance**	**Fixed Overhead Volume Variance**	**Retained Earnings**
7	1/1	$ 1,200	$ 300	$ -	$ 540	$12,000	=	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$14,040
8	a.	(12,190)	11,500				=	(690)								
9	b.		(10,750)	9,375			=		(1,375)							
10	c.	(3,975)		4,000			=			265	(240)					
11	d.	(480)		500			=					50	(30)			
12	e.	(1,300)		2,500		(1,150)	=							(50)	100	
13	f.			(16,375)	16,375		=									
14	g.	21,525					=									21,525
15	h.				(16,113)		=									(16,113)
16	i.	(3,300)					=									(3,300)
17	j.						=	690	1,375	(265)	240	(50)	30	50	(100)	(1,970)
18	12/31	$ 1,480	$ 1,050	$ -	$ 802	$10,850	=	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$14,182
19																

Problem 9B-6 (continued)

4. The income statement is computed as follows:

	A	B	C
1	**Phoenix Company**		
2	**Income Statement**		
3	**For Year Ended 12/31/XX**		
4	**(dollars in thousands)**		
5			
6	Sales		$21,525
7	Cost of goods sold at standard	$16,113	
8	Total variance adjustments	1,970	
9	Cost of goods sold		18,083
10	Gross margin		3,442
11	Selling and administrative expenses		3,300
12	Net operating income		$ 142
13			

... Problem 9B-6(3)