Chapter 10: Standard Costing, Operational Performance Measures, and the Balanced Scorecard

MULTIPLE CHOICE QUESTIONS

1. A standard cost:
   A. is the "true" cost of a unit of production.
   B. is a budget for the production of one unit of a product or service.
   C. can be useful in calculating equivalent units.
   D. is normally the average cost within an industry.
   E. is almost always the actual cost from previous years.

   Answer: B LO: 1 Type: RC

2. Which of the following is a predetermined estimated cost that can be used in the calculation of a variance?
   A. Product cost.
   B. Actual cost.
   C. Standard cost.
   D. Differential cost.
   E. Marginal cost.

   Answer: C LO: 1 Type: RC

3. Variances are computed by taking the difference between which of the following?
   A. Product cost and period cost.
   B. Actual cost and differential cost.
   C. Price factors and rate factors.
   D. Actual cost and standard cost.
   E. Product cost and standard cost.

   Answer: D LO: 1 Type: RC

4. The term "management by exception" is best defined as:
   A. choosing exceptional managers.
   B. controlling actions of subordinates through acceptance of management techniques.
   C. investigating unfavorable variances.
   D. devoting management time to investigate significant variances.
   E. controlling costs so that non-zero variances are treated as "exceptional."

   Answer: D LO: 1 Type: RC, N

5. Which of the following are methods for setting standards?
   A. Analysis of historical data.
   B. Task analysis.
   C. Task analysis and the analysis of historical data.
   D. Matrix application forms.
   E. Goal congruence.

   Answer: C LO: 2 Type: RC

6. Which of the following individuals is least likely to become involved in the setting of either direct material standards or direct labor standards?
   A. The purchasing manager.
   B. A production supervisor.
   C. An engineer.
   D. A machine operator.
   E. A company's president.

   Answer: E LO: 2 Type: N

7. A perfection standard:
   A. tends to motivate employees over a long period of time.
   B. is attainable in an ideal operating environment.
   C. would make allowances for normal amounts of scrap and waste.
   D. is generally preferred by behavioral scientists.
   E. will result in a number of favorable variances on a performance report.

   Answer: B LO: 2 Type: RC, N

8. Consider the following statements:

   I. Behavioral scientists find that perfection standards often discourage employees and result in low worker morale.
   II. Practical standards are also known as attainable standards.
   III. Practical standards incorporate a certain amount of inefficiency such as that caused by an occasional machine breakdown.

   Which of the above statements is (are) true?
   A. I only.
   B. II only.
   C. III only.
   D. II and III.
   E. I, II, and III.

   Answer: E LO: 2 Type: RC

9. Which of the following would be considered if a company desires to establish a series of practical manufacturing standards?
   A. The productivity loss associated with a short-term worker slowdown.
   B. Normal defect rates in an assembly process.
   C. Highly unusual spoilage rates with direct materials.
   D. Quantity discounts associated with purchases of direct materials.
   E. Both "B" and "D"

   Answer: E LO: 2 Type: RC, N

10. Which of the following would not be considered if a company desires to establish a series of practical manufacturing standards?
   A. Production time lost during unusual machinery breakdowns.
   B. Normal worker fatigue.
   C. Freight charges on incoming raw materials.
   D. Production time lost during setup procedures for new manufacturing runs.
   E. The historical 2% defect rate associated with raw material inputs.

   Answer: A LO: 2 Type: RC, N

11. Which of the following choices correctly notes a characteristic associated with perfection standards and one associated with practical standards?

	Perfection Standards	Practical Standards
A.	Attainable in an ideal environment	Incorporate abnormal occurrences when setting quantity and efficiency targets
B.	Result in many unfavorable variances	Are often attainable by workers
C.	Tend to boost worker morale	Generally preferred by behavioral scientists
D.	Generally, are easily achieved by workers	Result in both favorable and unfavorable variances
E.	Generally preferred by behavioral scientists	Are easier to achieve than perfection standards

   Answer: B LO: 2 Type: RC, N

12. Consider the following statements:

   I. The standard cost per unit of materials is used to calculate a materials price variance.
   II. The standard cost per unit of materials is used to calculate a materials quantity variance.
   III. The standard cost per unit of materials cannot be determined until the end of the period.

   Which of the above statements is (are) true?
   A. I only.
   B. II only.
   C. III only.
   D. I and II.
   E. I, II, and III.

   Answer: D LO: 3 Type: RC

13. Which of the following choices correctly notes the use of the standard price per unit of direct material when calculating the materials price variance and the materials quantity variance?

	Price Variance	Quantity Variance
A.	Used	Always used
B.	Used	Occasionally used
C.	Used	Not used
D.	Not used	Always used
E.	Not used	Not used

Answer: A LO: 3 Type: RC

14. Most companies base the calculation of the materials price variance on the:
    A. number of units purchased.
    B. number of units spoiled.
    C. number of units that should have been used.
    D. number of units actually used.
    E. number of units to be purchased during the next accounting period.

Answer: A LO: 3 Type: RC

15. Which of the following correctly lists all the information needed to calculate a labor rate variance?
    A. Standard labor rate and actual hours worked.
    B. Actual hours worked and actual units produced.
    C. Standard labor rate, actual labor rate, and actual units produced.
    D. Actual labor rate and actual hours worked.
    E. Actual labor rate, standard labor rate, and actual hours worked.

Answer: E LO: 3 Type: RC

16. Which of the following variances are most similar with respect to the manner in which they are calculated?
    A. Labor rate variance and labor efficiency variance.
    B. Materials price variance and materials quantity variance.
    C. Materials price variance, materials quantity variance, and total materials variance.
    D. Materials price variance and labor efficiency variance.
    E. Materials quantity variance and labor efficiency variance.

Answer: E LO: 3 Type: N

17. Which of the following variances cannot occur together during the same accounting period?
    A. Unfavorable labor rate variance and favorable labor efficiency variance.
    B. Unfavorable labor efficiency variance and favorable materials quantity variance.
    C. Favorable labor rate variance and unfavorable total labor variance.
    D. Favorable labor efficiency variance and favorable materials quantity variance.
    E. None of the above, as all of these variance combinations are possible.

Answer: E LO: 3 Type: N

18. If a company has an unfavorable direct-material quantity variance, then:
    A. the direct-material price variance is favorable.
    B. the total direct-material variance is unfavorable.
    C. the total direct-material variance is favorable.
    D. the direct-labor efficiency variance is unfavorable.
    E. any of the above variances can occur.

    Answer: E LO: 3 Type: N

19. A favorable labor efficiency variance is created when:
    A. actual labor hours worked exceed standard hours allowed.
    B. actual hours worked are less than the standard hours allowed.
    C. actual wages paid are less than amounts that should have been paid.
    D. actual units produced exceed budgeted production levels.
    E. actual units produced exceed standard hours allowed.

    Answer: B LO: 3 Type: N

20. Victoria, Inc., recently completed 52,000 units of a product that was expected to consume five pounds of direct material per finished unit. The standard price of the direct material was $9 per pound. If the firm purchased and consumed 268,000 pounds in manufacturing (cost = $2,304,800), the direct-materials quantity variance would be figured as:
    A. $72,000F.
    B. $72,000U.
    C. $107,200F.
    D. $107,200U.
    E. none of the above.

    Answer: B LO: 3 Type: A

21. Solo Corporation recently purchased 25,000 gallons of direct material at $5.60 per gallon. Usage by the end of the period amounted to 23,000 gallons. If the standard cost is $6.00 per gallon and the company believes in computing variances at the earliest point possible, the direct-material price variance would be calculated as:
    A. $800F.
    B. $9,200F.
    C. $9,200U.
    D. $10,000F.
    E. $10,000U.

    Answer: D LO: 3 Type: A

Use the following to answer questions 22-23:

The following data relate to product no. 89 of Des Moines Corporation:

Direct material standard: 3 square feet at $2.50 per square foot
Direct material purchases: 30,000 square feet at $2.60 per square foot
Direct material consumed: 29,200 square feet
Manufacturing activity, product no. 89: 9,600 units completed

22. The direct-material quantity variance is:
    A. $1,000F.
    B. $1,000U.
    C. $1,040F.
    D. $1,040U.
    E. $2,000F.

    Answer: B LO: 3 Type: A

23. The direct-material price variance is:
    A. $2,880U.
    B. $2,920F.
    C. $2,920U.
    D. $3,000F.
    E. $3,000U.

    Answer: E LO: 3 Type: A

24. Consider the following information:

    Direct material purchased and used, 80,000 gallons
    Standard quantity of direct material allowed for May production, 76,000 gallons
    Actual cost of direct materials purchased and used, $176,000
    Unfavorable direct-material quantity variance, $9,400

    The direct-material price variance is:
    A. $11,400F.
    B. $11,400U.
    C. $12,000F.
    D. $12,000U.
    E. none of the above.

    Answer: C LO: 3 Type: A, N

25. Courtney purchased and consumed 50,000 gallons of direct material that was used in the production of 11,000 finished units of product. According to engineering specifications, each finished unit had a manufacturing standard of five gallons. If a review of Courtney's accounting records at the end of the period disclosed a material price variance of $5,000U and a material quantity variance of $3,000F, determine the actual price paid for a gallon of direct material.
    A. $0.50.
    B. $0.60.
    C. $0.70.
    D. An amount other than those shown above.
    E. Not enough information to judge.

    Answer: C LO: 3 Type: A, N

26. Holland Enterprises recently used 20,000 labor hours to produce 8,300 completed units. According to manufacturing specifications, each unit is anticipated to take 2.5 hours to complete. The company's actual payroll cost amounted to $370,000. If the standard labor cost per hour is $18, Holland's labor rate variance is:
    A. $10,000F.
    B. $10,000U.
    C. $10,375F.
    D. $10,375U.
    E. none of the above.

    Answer: B LO: 3 Type: A

27. Denver Enterprises recently used 14,000 labor hours to produce 7,500 completed units. According to manufacturing specifications, each unit is anticipated to take two hours to complete. The company's actual payroll cost amounted to $158,200. If the standard labor cost per hour is $11, Denver's labor efficiency variance is:
    A. $11,000U.
    B. $11,000F.
    C. $11,300U.
    D. $11,300F.
    E. none of the above.

    Answer: B LO: 3 Type: A

28. Alex Company recently completed 10,600 units of its single product, consuming 32,000 labor hours that cost the firm $480,000. According to manufacturing specifications, each unit should have required 3 hours of labor time at $15.40 per hour. On the basis of this information, determine Alex's labor rate variance and labor efficiency variance.

	Rate	Efficiency
A.	$12,720F	$3,000F
B.	$12,720F	$3,000U
C.	$12,800F	$3,080F
D.	$12,800F	$3,080U
E.	$12,800U	$3,080U

    Answer: D LO: 3 Type: A

Use the following to answer questions 29-30:

The following data relate to product no. 33 of La Quinta Corporation:

Direct labor standard: 5 hours at $14 per hour
Direct labor used in production: 45,000 hours at a cost of $639,000
Manufacturing activity, product no. 33: 8,900 units completed

29. The direct-labor rate variance is:
    A. $8,900F.
    B. $8,900U.
    C. $9,000F.
    D. $9,000U.
    E. none of the above.

    Answer: D LO: 3 Type: A

30. The direct-labor efficiency variance is:
    A. $7,000F.
    B. $7,000U.
    C. $7,100F.
    D. $7,100U.
    E. none of the above.

    Answer: B LO: 3 Type: A

31. Consider the following information:

Actual direct labor hours	34,500
Standard direct labor hours	35,000
Total actual direct labor cost	$241,500
Direct-labor efficiency variance, favorable	$3,200

    The direct-labor rate variance is:
    A. $17,250U.
    B. $20,700U.
    C. $20,700F.
    D. $21,000F.
    E. none of the above.

    Answer: B LO: 3 Type: A, N

32. Simms Corporation had a favorable direct-labor efficiency variance of $6,000 for the period just ended. The actual wage rate was $0.50 more than the standard rate of $12.00. If the company's standard hours allowed for actual production totaled 9,500, how many hours did the firm actually work?
    A. 9,000.
    B. 9,020.
    C. 9,980.
    D. 10,000.
    E. None of the above.

    Answer: A LO: 3 Type: A , N

Use the following to answer questions 33-37:

Cost standards for product no. C77:		
Direct material	3 pounds at $2.50 per pound	$ 7.50
Direct labor	5 hours at $7.50 per hour	37.50
Actual results:		
Units produced	7,800 units	
Direct material purchased	26,000 pounds at $2.70	$ 70,200
Direct material used	23,100 pounds at $2.70	62,370
Direct labor	40,100 hours at $7.30	292,730

33. The direct-material quantity variance is:
    A. $750F.
    B. $750U.
    C. $6,500U.
    D. $7,250U.
    E. none of the above.

    Answer: A LO: 3 Type: A

34. The direct-material price variance is:
    A. $4,620F.
    B. $4,620U.
    C. $5,200F.
    D. $5,200U.
    E. none of the above.

    Answer: D LO: 3 Type: A

35. The direct-labor rate variance is:
    A. $7,800F.
    B. $7,950F.
    C. $8,020F.
    D. $8,000U.
    E. none of the above.

    Answer: C LO: 3 Type: A

36. The direct-labor efficiency variance is:
    A. $8,000F.
    B. $8,000U.
    C. $8,250F.
    D. $8,250U.
    E. none of the above.

    Answer: D LO: 3 Type: A

37. The standard hours allowed for the work performed are:
    A. 5.
    B. 5.14.
    C. 39,000.
    D. 40,100.
    E. none of the above.

    Answer: C LO: 3 Type: A

38. When considering whether to investigate a variance, managers should consider all of the following except the variance's:
    A. size.
    B. pattern of recurrence.
    C. trends over time.
    D. nature, namely, whether it is favorable or unfavorable.
    E. controllability.

    Answer: D LO: 4 Type: RC

39. Which of the following combinations of direct-material variances might prompt management to undertake a detailed variance investigation?
    A. Price, unfavorable; quantity, unfavorable.
    B. Price, unfavorable; quantity, favorable.
    C. Price, favorable; quantity, unfavorable.
    D. Price favorable; quantity, favorable.
    E. All of the above.

    Answer: E LO: 4 Type: N

40. Consider the following statements about variance investigation:

    I. Variance investigation involves a look at only unfavorable variances.
    II. Variance investigation is typically based on a cost-benefit analysis.
    III. Variance investigation is often performed by establishing guidelines similar to the following: Investigate variances that are greater than $X or greater than Y% of standard cost.

    Which of the above statements is (are) true?
    A. I only.
    B. II only.
    C. III only.
    D. II and III.
    E. I, II, and III.

    Answer: D LO: 4 Type: RC

41. A statistical control chart is best used for determining:
    A. direct-material price variances.
    B. direct-labor variances.
    C. whether a variance is favorable or unfavorable.
    D. who should be held accountable for specific variances.
    E. whether a particular variance should be investigated.

    Answer: E LO: 4 Type: RC

42. The individual generally responsible for the direct-material price variance is the:
    A. sales manager.
    B. production supervisor.
    C. purchasing manager.
    D. finance manager.
    E. head of the human resources department.

    Answer: C LO: 5 Type: RC

43. A production supervisor generally has little influence over the:
    A. direct-material quantity variance.
    B. direct-labor rate variance.
    C. direct-labor efficiency variance.
    D. direct-material price variance.
    E. number of units produced.

    Answer: D LO: 5 Type: N

44. In which department would an investigation normally begin regarding an unfavorable materials quantity variance?
    A. Quality control.
    B. Purchasing.
    C. Engineering.
    D. Production.
    E. Receiving.

    Answer: D LO: 5 Type: RC

45. Cohen Corporation has a favorable materials quantity variance. Which department would likely be asked to explain the cause of this variance?
    A. Engineering.
    B. Purchasing.
    C. Production.
    D. Marketing.
    E. None, because the variance is favorable.

    Answer: C LO: 5 Type: N

46. Rogers, Inc., had an unfavorable labor efficiency variance and an unfavorable materials quantity variance. Which department might be held accountable for these variances?
    A. Purchasing, because bad materials can harm labor efficiency.
    B. Production, because inefficient workers may use more materials than allowed.
    C. Purchasing and/or production.
    D. Marketing.
    E. Shipping.

    Answer: C LO: 5 Type: N

47. A direct-material quantity variance can be caused by all of the following except:
    A. improper employee training.
    B. changes in sales volume.
    C. acquisition of materials at a very attractive price.
    D. adjustment problems with machines.
    E. disgruntled workers.

    Answer: B LO: 5 Type: N

48. A direct-labor efficiency variance cannot be caused by:
    A. inexperienced employees.
    B. poor quality raw materials.
    C. employee inefficiency.
    D. an out-of-date labor time standard.
    E. producing fewer finished units than originally planned.

    Answer: E LO: 5 Type: N

49. Justin Company recently purchased materials from a new supplier at a very attractive price. The materials were found to be of poor quality, and the company's laborers struggled significantly as they shaped the materials into finished product. In a desperation move to make up for some of the time lost, the manufacturing supervisor brought in more-senior employees from another part of the plant. Which of the following variances would have a high probability of arising from this situation?
    A. Material price variance, favorable.
    B. Material quantity variance, unfavorable.
    C. Labor rate variance, unfavorable.
    D. Labor efficiency variance, unfavorable.
    E. All of the above.

    Answer: E LO: 5 Type: N

50. Listed below are five variances (and possible causes) that are under review by management of Knox Company. Which of the following is least likely to cause the variance indicated?
    A. The need to ship goods acquired from a distant supplier via FedEx rather than via truck; material price variance.
    B. The need to complete goods on a timely basis during a period of high absenteeism; labor rate variance.
    C. A work-team that is very unhappy with its supervisor; labor efficiency variance.
    D. The need to close a plant for two days because of blizzard conditions; material quantity variance, part no. 542.
    E. A malfunctioning piece of manufacturing equipment; labor efficiency variance.

    Answer: D LO: 5 Type: N

51. Lucky Corporation's purchasing manager obtained a special price on an aluminum alloy from a new supplier, resulting in a direct-material price variance of $9,500F. The alloy produced more waste than normal, as evidenced by a direct-material quantity variance of $2,000U, and was also difficult to use. This slowed worker efficiency, generating a $2,500U labor efficiency variance. To help remedy the situation, the production manager used senior line employees, which gave rise to a $900U labor rate variance. If overall product quality did not suffer, what variance amount is best used in judging the appropriateness of the purchasing manager's decision to acquire substandard material?
    A. $4,100F.
    B. $5,000F.
    C. $7,000F.
    D. $7,500F.
    E. $9,500F.

    Answer: A LO: 5 Type: A, N

52. Standard costs:
    A. allow a manager to assess the efficiency of operations.
    B. allow a company to practice management by exception.
    C. provide management with a basis for performance evaluations.
    D. if set correctly, can provide a motivational tool for employees.
    E. will provide all of the above benefits for a company.

    Answer: E LO: 7 Type: RC, N

53. Which of the following is a criticism of standard costing, as applied to today's manufacturing environment?
    A. Automated manufacturing processes are very consistent in meeting production specifications, making variances very small and relatively unimportant.
    B. Variance information is usually aggregated (i.e., combined) rather than associated with a particular batch of goods or a specific product line.
    C. Traditional standard costing fails to focus on key business issues such as customer service and bringing products to market faster than the competition.
    D. Standard costing pays considerable attention to labor cost and labor efficiency, which are becoming a relatively unimportant factor of production.
    E. All of the above are valid criticisms.

    Answer: E LO: 8 Type: RC

54. Which of the following is <u>not</u> a valid way to adapt standard cost systems to today's manufacturing environment?
    A. Emphasize material and overhead costs.
    B. Use more non-traditional cost drivers such as number of setups or number of engineering change orders.
    C. Update standards more frequently to adjust for the elimination of non-value-added costs.
    D. Use additional nonfinancial measures for performance evaluation and control.
    E. Devote more resources to the tracking of direct labor cost.

    Answer: E LO: 8 Type: RC

55. To assess how customers perceive a company's products, management may study:
    A. the number of customer complaints.
    B. the number of warranty claims.
    C. the number of products returned.
    D. the cost of repairing returned products.
    E. all of the above measures.

    Answer: E LO: 9 Type: RC

56. To improve its manufacturing efficiency, companies should strive toward increasing _____ time as a percentage of processing time + inspection time + waiting time + move time. The blank is:
    A. processing time.
    B. lead time.
    C. waiting time.
    D. move time.
    E. inspection time.

    Answer: A LO: 9 Type: RC

57. In the calculation of manufacturing cycle efficiency, which of the following activities results in value-added time?
    A. Moving.
    B. Processing.
    C. Inspection.
    D. Waiting.
    E. All of the above.

    Answer: B LO: 9 Type: RC

58. The manufacturing cycle efficiency for PQR Company when the processing time is six hours and inspection, waiting, and move time are one hour each is:
    A. 0.67.
    B. 0.75.
    C. 0.78.
    D. 0.88.
    E. an amount other than those shown above.

    Answer: A LO: 9 Type: A

59. Which of the following would <u>not</u> be a concern of a company that desires to compete in a global manufacturing arena?
    A. Number of new products introduced.
    B. Manufacturing cycle efficiency.
    C. Number of customer complaints.
    D. Number of on-time deliveries.
    E. All of the above would be concerns.

    Answer: E LO: 9 Type: RC

60. An increasingly popular approach that integrates financial and customer performance measures with measures in the areas of internal operations and learning and growth is known as:
    A. the integrated performance measurement tool (IPMT).
    B. the balanced scorecard.
    C. gain sharing.
    D. cycle efficiency.
    E. overall quality assessment (OQA).

    Answer: B LO: 10 Type: RC

61. The typical balanced scorecard is best described as containing:
    A. financial performance measures.
    B. nonfinancial performance measures.
    C. neither financial nor nonfinancial performance measures.
    D. both financial and nonfinancial performance measures.
    E. both financial and nonfinancial performance measures, the latter often covering a broad range of perspectives such as customers, internal operations, and learning and growth.

    Answer: E LO: 10 Type: RC

62. Swedish Cruise Lines (SCL), which operates in a very competitive marketplace, is considering four categories of performance measures: (1) profitability measures, (2) customer-satisfaction measures, (3) efficiency and quality measures, and (4) learning and growth measures. The company assigns one manger to each ship in its fleet to oversee the ship's general operations. If SCL desired to adopt a balanced-scorecard approach, which measures should the firm use in the evaluation of its managers?
    A. 1.
    B. 1, 2.
    C. 2, 3.
    D. 1, 2, 4.
    E. 1, 2, 3, 4.

    Answer: E LO: 10 Type: N

63. Lead indicators guide management to:
    A. take actions now that will have positive effects on organizational performance now.
    B. take actions now that will have positive effects on organizational performance in the future.
    C. take actions in the future that will have positive effects on organizational performance now.
    D. take actions in the past that will have positive effects on organizational performance in the future.
    E. pursue identical strategies as those implemented with lag indicators.

    Answer: B LO: 10 Type: RC

64. When using a balanced scorecard, a company's market share is typically classified as an element of the firm's:
    A. financial performance measures.
    B. customer performance measures.
    C. learning and growth performance measures.
    D. internal-operations performance measures.
    E. interdisciplinary performance measures.

    Answer: B LO: 10 Type: RC

65. When using a balanced scorecard, which of the following is typically classified as an internal-operations performance measure?
    A. Cash flow.
    B. Number of customer complaints.
    C. Employee training hours.
    D. Number of employee suggestions.
    E. Number of suppliers used.

    Answer: E LO: 10 Type: RC

66. Which of the following perspectives is influenced by a company's vision and strategy?
    A. Financial.
    B. Customer.
    C. Internal operations.
    D. Learning and growth.
    E. All of the above.

    Answer: E LO: 10 Type: RC

67. Which of the following journal entries definitely contains an error?

A.	Raw-Material Inventory	200,000	
	Direct-Material Price Variance	5,000	
	Accounts Payable		205,000
B.	Raw-Material Inventory	38,000	
	Direct-Material Price Variance		2,000
	Accounts Payable		36,000
C.	Raw-Material Inventory	156,000	
	Direct-Material Price Variance		8,000
	Work-in-Process Inventory		148,000
D.	Work-in-Process Inventory	67,000	
	Direct-Material Quantity Variance	3,000	
	Raw-Material Inventory		70,000
E.	Work-in-Process Inventory	79,000	
	Direct-Material Quantity Variance		4,000
	Raw-Material Inventory		75,000

    Answer: C LO: 11 Type: N

68. At the end of the accounting period, most companies close variance accounts to:
    A. Raw-Material Inventory.
    B. Work-in-Process Inventory.
    C. Finished-Goods Inventory.
    D. Cost of Goods Sold.
    E. Income Summary.

    Answer: D LO: 11 Type: RC

EXERCISES

Setting a Standard

69. Cloverleaf, Inc., produces glass shelves that are used in furniture. Each shelf requires 3.6 pounds of raw material at a cost of $2 per pound. Unfortunately, given the nature of the manufacturing process, one out of every five shelves is chipped, scratched, or broken at the beginning of production and has to be scrapped.

    On average, 20 good shelves are completed during each hour. Laborers who work on these units are paid $15 per hour.

    Required:
    A. Distinguish between perfection standards and practical standards.
    B. Who within an organization would be in the best position to assist in setting:
        1. the direct-material price standard?
        2. the direct-material quantity standard?
        3. the direct-labor efficiency standard?
    C. Calculate a practical direct-material and direct-labor standard for each good shelf produced.

    LO: 2, 3, 5 Type: A, N

    Answer:
    A. Perfection standards, or those achieved under nearly perfect operating conditions, assume peak efficiency at minimum cost. Employees are pushed to reach these ideal measures, often becoming discouraged. Practical standards, on the other hand, are high but attainable, thus presenting a realistic target for personnel. Such standards incorporate allowances for normal downtime and other typical inefficiencies.

    B. 1. The purchasing manager.
        2. The production supervisor as well as production engineers.
        3. The production supervisor as well as industrial engineers.

    C.

Direct materials: 4.5 pounds* x $2 per pound	$9.00
Direct labor: 0.05 hours* x $15	0.75
Total	$9.75

    *Direct materials: (3.6 x 5) ÷ 4 = 4.5; direct labor: 1 ÷ 20 = 0.05

Direct-Material Standards, Variance Data

70. Diamond Corporation manufactures a variety of liquid lawn fertilizers, including a very popular product called Lush 'N Green. Data about Lush 'N Green and Proctol, a major ingredient, follow.

Expected operations:

- Proctol is purchased in 55-gallon drums at a cost of $45 per drum. A 2% cash discount is offered for prompt payment of invoices, and Diamond takes advantage of all discounts offered.
- Diamond normally purchases 200 drums of Proctol at a time, paying shipping fees of $420 per shipment.
- Each gallon of Lush 'N Green requires three quarts of Proctol; however, because of evaporation and spills, Diamond loses 4% of all Proctol that enters production. (Recall that there are four quarts in a gallon.)

Actual operations:

- For the period just ended, Diamond purchased 1,200 drums of Proctol at a total cost of $54,960. There was no beginning inventory, but an end-of-period inventory revealed that 15 drums were still on hand.
- Manufacturing activity output totaled 82,000 gallons of Lush 'N Green.

Required:

A. Compute the standard purchase price for one gallon of Proctol.
B. Compute the standard quantity of Proctol to be used in producing one gallon of Lush 'N Green. Express your answer in quarts.
C. Compute the direct-material price variance for Proctol.
D. How much Proctol was used in manufacturing activity and how much should have been used? Express your answer in quarts.

LO: 2, 3 Type: A, N

Answer:

A.	Purchase price per drum	$45.00
	Less: 2% discount	(0.90)
		$44.10
	Shipping fee per drum ($420 ÷ 200 drums)	2.10
	Total	$46.20

Total purchase price ($46.20) ÷ 55 gallons = $0.84 per gallon

B. Three quarts of Proctol are required for each gallon of Lush 'N Green; however, 4% of Proctol input is lost through evaporation and spills. Thus, the standard input is 3.125 quarts (3 ÷ 0.96).

C.	Standard cost of purchases (1,200 drums x $46.20)	$55,440
	Actual cost of purchases	54,960
	Direct-material price variance	$ 480F

D. Actual usage: (1,200 - 15) = 1,185 drums; 1,185 drums x 55 gallons x 4 quarts = 260,700 quarts
Standard usage: 82,000 gallons x 3.125 = 256,250 quarts

Straightforward Calculation of Variances

71. Quicksand Company has set the following standards for one unit of product:

Direct material
Quantity: 6.2 pounds per unit
Price per pound: $11 per pound
Direct labor
Quantity: 6 hours per unit
Rate per hour: $23 per hour

Actual costs incurred in the production of 2,800 units were as follows:

Direct material: $194,350 ($11.50 per pound)
Direct labor: $393,750 ($22.50 per hour)

All materials purchased were consumed during the period.

Required:
Calculate the direct-material price and quantity variances and the direct-labor rate and efficiency variances. Indicate whether each variance is favorable or unfavorable.

LO: 3 Type: A

Answer:

Actual Material Cost						Standard Material Cost		
Actual Quantity	x	Actual Price	Actual Quantity	x	Standard Price	Standard Quantity	x	Standard Price
16,900	x	$11.50	16,900	x	$11.00	17,360*	x	$11.00
	$194,350			$185,900			$190,960	
		$8,450U			$5,060F			
		Direct-material price variance			Direct-material quantity variance			

*2,800 units x 6.2 pounds

Actual Labor Cost						Standard Labor Cost		
Actual Hours	x	Actual Rate	Actual Hours	x	Standard Rate	Standard Hours	x	Standard Rate
17,500	x	$22.50	17,500	x	$23.00	16,800#	x	$23.00
	$393,750			$402,500			$386,400	
		$8,750F			$16,100U			
		Direct-labor rate variance			Direct-labor efficiency variance			

#2,800 units x 6 hours

Straightforward Calculation of Variances

72. Upstate manufactures a product that has the following standard costs:

Direct materials: 40 yards at $2.70 per yard	$108
Direct labor: 8 hours at $18.00 per hour	144
Total	$252

The following information pertains to July:

Direct material purchased: 42,500 yards at $2.78 per yard, or $118,150
Direct material used: 36,000 yards
Direct labor: 7,500 hours at $18.30 per hour, or $137,250
Actual completed production: 1,050 units

Required:
Calculate the direct-material price and quantity variances and the direct-labor rate and efficiency variances. Indicate whether each variance is favorable or unfavorable.

LO: 3 Type: A

Answer:

Actual Material Cost					
Actual Quantity	x	Actual Price	Actual Quantity	x	Standard Price
42,500	x	$2.78	42,500	x	$2.70
$118,150			$114,750		

$3,400U
Direct-material price variance

Actual Material Cost			Standard Material Cost		
Actual Quantity	x	Standard Price	Standard Quantity	x	Standard Price
36,000	x	$2.70	42,000*	x	$2.70
$97,200			$113,400		

$16,200F
Direct-material quantity variance

*1,050 units x 40 yards

Actual Labor Cost						Standard Labor Cost		
Actual Hours	x	Actual Rate	Actual Hours	x	Standard Rate	Standard Hours	x	Standard Rate
7,500	x	$18.30	7,500	x	$18.00	8,400#	x	$18.00
$137,250			$135,000			$151,200		

$2,250U
Direct-labor rate variance

$16,200F
Direct-labor efficiency variance

#1,050 units x 8 hours

Variance Calculation and Interpretation

73. Richie Ventura operates a commercial painting business in Sacramento, which has a very tight labor market. Much of his work focuses on newly constructed apartments and townhouses.

The following data relate to crew no. 5 for a recently concluded period when 85 apartment units were painted:

- Three new employees were assigned to crew no. 5. Wages averaged $18.80 per hour for each employee; the crew took 2,550 hours to complete the work.
- Based on his knowledge of the operation, articles in trade journals, and conversations with other painters, Ventura established the following standards:
  Typical hourly wage rate of crew personnel: $15
  Anticipated crew time for each unit: 34 hours
- The paint quantity variance was $6,070F.
- The operation did not go as smoothly as planned, with customer complaints and problems being much higher than expected.

Required:

A. Compute Ventura's direct-labor variances.
B. Is the direct-labor rate variance consistent with what you might expect in a tight labor market? Explain.
C. Analyze the information given and that you calculated, and determine what likely happened that would give rise to customer complaints?

LO: 3, 5 Type: A, N

Answer:

A.

Actual Labor Cost						Standard Labor Cost		
Actual Hours	x	Actual Rate	Actual Hours	x	Standard Rate	Standard Hours	X	Standard Rate
2,550	x	$18.80	2,550	x	$15.00	2,890*	x	$15.00
$47,940			$38,250			$43,350		

$9,690U Direct-labor rate variance

$5,100F Direct-labor efficiency variance

*85 units x 34 hours

B. Yes. A tight labor market often means that premium wages are needed to attract qualified employees. These wages would give rise to an unfavorable rate variance.

C. Ventura has two favorable variances: labor efficiency and material (paint) quantity. The favorable efficiency variance indicates that the crew is spending less time than budgeted, perhaps rushing the jobs and being a bit sloppy. It is also possible that employees are being somewhat skimpy in their use of paint, using less than expected (e.g., applying one coat rather than two in certain applications).

Variance Computation, Analysis of Performance

74. Diablo Products uses a standard costing system to assist in the evaluation of operations. The company has had considerable employee difficulties in recent months, so much so that management has hired a new production supervisor (Joe Simms). Simms has been on the job for six months and has seemingly brought order to an otherwise chaotic situation.

The vice-president of manufacturing recently commented that "… Simms has really done the trick. Joe's team-building/morale-boosting exercises have truly brought things under control." The vice-president's comments were based on both a plant tour, where he observed a contented work force, and review of a performance report that showed a total labor variance of $14,000F. This variance is truly outstanding, given that it is less than 2% of the company's budgeted labor cost. Additional data follow.

- Total completed production amounted to 20,000 units.
- A review of the firm's standard cost records found that each completed unit requires 2.75 hours of labor at $14 per hour. Diablo's production actually required 42,000 labor hours at a total cost of $756,000.

Required:

A. As judged by the information contained in the performance report, should the vice-president be concerned about the company's labor variances? Why?
B. Calculate Diablo's direct-labor variances.
C. On the basis of your answers to requirement "B," should Diablo be concerned about its labor situation? Why?
D. Briefly analyze and explain the direct-labor variances.

LO: 3, 4, 5 Type: A, N

Answer:

A. No. The variance is favorable and small, being less than 2% of the budgeted amount.

B.

Actual Labor Cost						Standard Labor Cost		
Actual Hours	x	Actual Rate	Actual Hours	x	Standard Rate	Standard Hours	x	Standard Rate
42,000	x	$18.00*	42,000	x	$14.00	55,000#	x	$14.00
	$756,000			$588,000			$770,000	

$168,000U Direct-labor rate variance

$182,000F Direct-labor efficiency variance

*$756,000 ÷ 42,000 hours
#20,000 units x 2.75 hours

C. Yes. Although the combined variance of $14,000F is small, a more detailed analysis reveals the presence of sizable, offsetting variances. Both the rate variance and the efficiency variance are in excess of 21% of budgeted amounts ($770,000). A variance investigation should be undertaken if benefits of the investigation exceed the costs. Put simply, things are not going as smoothly as the vice-president believes.

D. The favorable efficiency variance means that the company is producing units by consuming fewer hours than expected. This may be the result of the team-building/morale-boosting exercises, as a contented, well-trained work force tends to be efficient in nature. However, another totally plausible explanation could be that Diablo is paying premium wages (as indicated by the unfavorable rate variance) to hire laborers with above-average skill levels.

Variance Analysis: Working Backward

75. A manufacturing company is expected to complete a task in 45 minutes. During a recent accounting period, 3,200 completed units were produced, resulting in the following labor variances:

    Labor rate variance: $520 favorable
    Labor efficiency variance: $2,800 unfavorable

    The standard labor rate is $14 per hour.

    Required:
    Calculate (1) the standard hours allowed for the work performed, (2) the actual hours worked, and (3) the actual wage rate.

    LO: 3 Type: A

    Answer:

Actual Labor Cost						Standard Labor Cost		
Actual Hours	x	Actual Rate	Actual Hours	x	Standard Rate	Standard Hours	x	Standard Rate
2,600	x	$13.80	2,600	x	$14.00	2,400*	x	$14.00
	$35,850			$36,400			$33,600	
		$520F			$2,800U			
		Direct-labor rate variance			Direct-labor efficiency variance			

*3,200 units x 0.75 hours

1. Standard hours allowed: 2,400
2. Actual hours worked: 2,600
3. Actual wage rate: $13.80

Variance Analysis: Working Backward

76. Hermosa Enterprises recently experienced a fire, forcing the company to use incomplete information to analyze operations. Consider the following data and assume that all materials purchased during the period were used in production:

    Direct materials:
    Standard price per pound: $9
    Actual price per pound: $8
    Price variance: $20,000F
    Total of direct-material variances: $2,000F

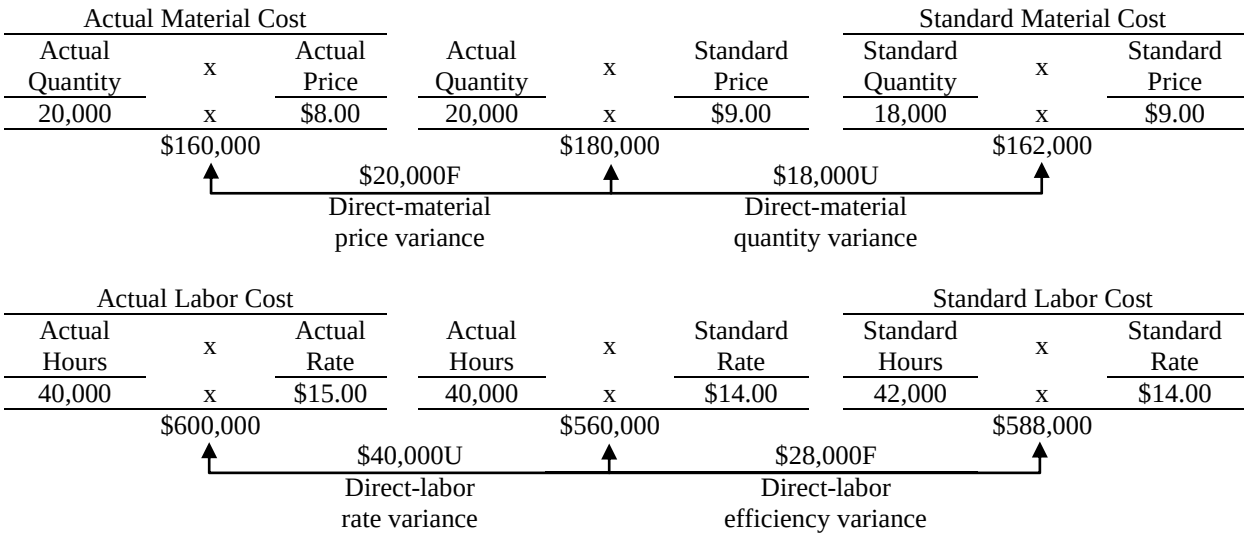
    Direct labor:
    Actual hours worked: 40,000
    Actual rate per hour: $15
    Efficiency variance: $28,000F
    Total of direct-labor variances: $12,000U

    Hermosa completed 12,000 units.

    Required:
    Determine the following: (1) actual materials used, (2) materials quantity variance, (3) labor rate variance, (4) standard labor rate per hour, and (5) standard labor time per finished unit.

    LO: 3 Type: A

Answer:



1. Actual materials used: 20,000 pounds
2. Materials quantity variance: $18,000U
3. Labor rate variance: $40,000U
4. Standard labor rate per hour: $14
5. Standard labor time per finished unit: 3.5 hours (42,000 hours ÷ 12,000 units)

Variance Interpretation: Restaurant

77. Nancy Simon is the long-time catering director of Naples-on-the-Beach, a hotel noted throughout the industry for quality, profitability, and cost control. The hotel recently catered a steak dinner for a 2,000-person convention. Strict standards were in place for the dinner: 0.75 pounds of beef per plate at $9 per pound. A review of the accounting records shortly after the convention showed that 1,680 pounds of beef were purchased and consumed, costing the hotel $13,440.

    Required:

    A. Calculate the cost of beef budgeted for the dinner and the <u>total</u> beef variance (i.e., the difference between budgeted and actual cost). Should this variance be of concern to the hotel? Why?
    B. Assess the job that Simon did in "managing" the beef purchase by performing a variance analysis. Comment on your findings.
    C. Assume that the hotel received a number of complaints shortly after the dinner concluded. Explain a possible reason behind the conventioneers' unhappiness.

    LO: 3, 4, 5 Type: A, N

Answer:

A.

Budget: 2,000 plates x 0.75 x $9	$13,500
Actual	13,440
Total variance, unfavorable	$ 60

The variance should not be a concern to the hotel because it is less than 1% of the budget.

B. Simon did a marginal job in managing the purchase. Although the total variance is only $60U, it is composed of two sizable, offsetting amounts. She saved the hotel a considerable amount of money in the acquisition but the savings were more than consumed in excess usage.

Actual Material Cost						Standard Material Cost		
Actual Quantity	x	Actual Price	Actual Quantity	x	Standard Price	Standard Quantity	x	Standard Price
1,680	x	$8.00	1,680	x	$9.00	1,500*	x	$9.00
$13,440			$15,120			$13,500		

$1,680F — Direct-material price variance

$1,620U — Direct-material quantity variance

*2,000 plates x 0.75 pounds

C. It is possible that Simon bought a marginal product. The price variance and quantity variance may indicate that she purchased cheap beef, which turned out to be of poor quality, resulting in greater waste (trimming) than normal by the kitchen staff. The beef's overall quality (perhaps, toughness) may be the underlying reason behind the conventioneers' complaints.

Events' Impact on Variances

78. The following events occurred at Crescent Manufacturing (CM), an assembler of engine parts, during May:

    1. Because of a stock shortage at its regular supplier, CM had to rely on a new vendor for two purchases of raw material parts. The vendor required CM to pay air-freight charges; however, upon arrival, the company found the goods to be above-average in quality.
    2. The local municipality raised its property tax rates by 2%.
    3. A flu outbreak on the assembly line forced management to use more experienced, senior personnel to complete production orders on a timely basis. These workers more than made up for lost time.
    4. A shoddy maintenance program resulted in an abnormally high number of breakdowns on machine no. 76 and slowed production.
    5. The implementation of a new program had positive effects for the company with respect to material usage and worker productivity.

    Required:
    Create a table with the following headings: materials price variance, materials quantity variance, labor rate variance, and labor efficiency variance. Determine which of these variances would be affected by the individual events and whether the variance would be favorable or unfavorable.

    LO: 5 Type: N

    Answer:

	Materials Price Variance	Materials Quantity Variance	Labor Rate Variance	Labor Efficiency Variance
1.	U	F		
2.				
3.			U	F
4.				U
5.		F		F

Efficiency Measures

79. The following information for a recent project was taken from the records of Argon Company:

Processing time	15.0 days
Inspection time	0.5 days
Waiting time:	
From order receipt until start of production	6.0 days
From start of production through project completion	3.0 days
Move time	1.5 days

Required:

A. How long did it take to complete the project once production commenced?
B. Compute the manufacturing cycle efficiency.
C. As judged by the cycle efficiency, what percentage of the overall production time was spent on (1) value-adding activities and (2) non-value adding activities?
D. Compute the company's delivery cycle time.

LO: 9 Type: A, N

Answer:

A.

Processing time	15.0
Inspection time	0.5
Waiting time in production	3.0
Move time	1.5
Total	20.0

B. Processing time (15.0) ÷ [Processing time (15.0) + inspection time (0.5) + waiting time in production (3.0) + move time (1.5)] = 0.75

C. 1. 75% (cycle efficiency)
2. 25% (100% - 75%)

D.

Waiting time until start of project	6.0
Manufacturing cycle time	20.0
Total	26.0

Elements of a Balanced Scorecard

80. Balanced scorecards contain a number of factors that are important to the success of a business. These factors are often divided into four categories: financial, customer, learning and growth, and internal operations.

    Consider the twelve factors that follow.

    1. Market share
    2. Earnings per share
    3. Manufacturing cycle efficiency
    4. Machine downtime
    5. Number of patents held
    6. Employee suggestions
    7. Number of repeat sales
    8. Levels of inventories held
    9. Number of vendors used
    10. Cash flow from operations
    11. Employee training hours
    12. Gross margin

    Required:
    Determine the proper classification (financial, customer, learning and growth, or internal operations) for each of the twelve factors listed.

    LO: 10 Type: RC, N

    Answer:

    1. Customer
    2. Financial
    3. Internal operations
    4. Internal operations
    5. Learning and growth
    6. Learning and growth
    7. Customer
    8. Internal operations
    9. Internal operations
    10. Financial
    11. Learning and growth
    12. Financial

Balanced Scorecard

81. Bob's Burgers and Such, a national fast-food chain, has experienced a number of problems in the past few years, and management is considering the adoption of a balanced scorecard as part of a turnaround effort.

    Required:
    A. Briefly explain the concept of a balanced scorecard. What general factors are included in a typical balanced scorecard?
    B. Independent of your answer in requirement "A," assume that Bob's is very concerned about customer satisfaction. List four different (and specific) customer-satisfaction measures that may be appropriate for the firm (and for other fast-food providers).
    C. Independent of requirement "A," assume that Bob's wants to return to former levels of profitability. List several financial measures that would allow management to assess success or failure with respect to the following goals: (1) pay creditors on a timely basis, (2) keep shareholders happy, and (3) improve profitability over time at stores that have been open at least one year.

    LO: 10 Type: RC, N

    Answer:
    A. A balanced scorecard is a tool that incorporates a variety of different measures, both financial and non-financial, in the performance-evaluation process. The measures are critical to a firm's success and are tied to organizational strategy. The goal of a balanced scorecard is to allow improvement in a number of broad-reaching areas rather than permit a manager to improve only a small facet of the business at the expense of others. Typical factors are often divided into four categories: financial, customer, learning and growth, and internal operations.

    B. Answers will vary but often include market share, queue time, results of a customer quality survey, number of customer complaints, number of order errors, and number of repeat customers.

    C. Pay creditors on a timely basis: stipulated end-of-period cash balance and current ratio
    Shareholder satisfaction: growth in earnings per share, increases in per-share market price of Bob's stock, price-earnings ratio
    Profitability improvement: gross margin growth rates, earnings growth rates

Standard Costs and Journal Entries

82. Howell Company has established the following standards:

Direct materials: 2.0 pounds at $4.10
Direct labor: 1.5 hours at $7 per hour

Additional information was extracted from the accounting records:

Actual production: 32,000 completed units
Direct materials purchased: 70,000 pounds at $3.82, or $267,400
Direct materials consumed: 65,000 pounds
Actual labor incurred: 51,000 hours at $6.30, or $321,300
Direct-labor rate variance: $37,200 favorable
Direct-labor efficiency variance: $22,500 unfavorable

Required:
Prepare journal entries to record the:
A. Purchase of direct materials.
B. Usage of direct materials.
C. Incurrence of direct labor costs.

LO: 11 Type: A

Answer:

A.	Raw-Material Inventory (70,000 x $4.10)	287,000	
	Direct-Material Price Variance (70,000 x $0.28)		19,600
	Accounts Payable (70,000 x $3.82)		267,400
B.	Work-in-Process Inventory (32,000 x 2 x $4.10)	262,400	
	Direct-Material Quantity Variance (1,000 x $4.10)	4,100	
	Raw-Material Inventory (65,000 x $4.10)		266,500
C.	Work-in-Process Inventory (32,000 x 1.5 x $7.00)	336,000	
	Direct-Labor Efficiency Variance	22,500	
	Wages Payable (51,000 x $6.30)		321,300
	Direct-Labor Rate Variance		37,200

DISCUSSION QUESTIONS

Usefulness of Standard Costs in Performance Evaluations

83. Standard costs are said to be useful in performance evaluation. Assume that the standard direct materials cost per unit of finished product is $6 (three pounds at $2 per pound).

    Required:
    A. Explain how such a standard can be used to evaluate performance.
    B. Why is the degree of controllability important when utilizing standard costs to evaluate performance?

    LO: 1, 5 Type: RC

    Answer:
    A. The standard provides a measure of how much material should be used for a unit of product and how much each pound of raw material should cost. This standard serves as a basis for evaluating performance by allowing a comparison to be made of standard cost/usage against actual cost/usage.

    B. The degree of controllability is important because not all factors are subject to the same amount of control. For example, the market for the raw material may be a seller's market in which case management would have very little control over the material price variance. On the other hand, management generally has more control over the usage of materials because of the ability to influence the amount of scrap and rejected units produced.

Interaction of Material and Labor Variances

84. For the quarter just ended, BoSan, Inc., reported the following variances in one of its manufacturing departments:

    Material price variance, U
    Material quantity variance, F
    Labor efficiency variance, F
    Labor rate variance, negligible
    Machine hours efficiency, F

    The sum of the favorable variances exceeded the unfavorable materials price variance by a considerable amount. The quality of the output from the department was the same as usual. BoSan operates very close to a JIT system for materials purchases, with virtually all material acquired during the quarter being used in manufacturing activities.

    Required:
    Is there any connection among these variances? If so, explain.

    LO: 3, 5 Type: N

Answer:
While a connection between these variances cannot be guaranteed, the following scenario is plausible. Better-than-standard quality materials were purchased, leading to an unfavorable materials price variance. When these materials were used during the period (JIT basis for raw materials purchases), favorable efficiency variances arose because the material was easier for labor and machines to process.

Motivational Effects of Standard Cost Systems

85. Standard cost systems can have motivational effects; some are desirable, some are not. Consider the following situation:

The materials purchasing manager is paid a salary plus a bonus based on the net favorable materials price variance. Generally, this bonus amounts to 30 - 40% of the manager's total compensation. Due to the bankruptcy of a company in a related field, there is an opportunity to buy a key raw material. The standards for this material call for grade 2A, usually purchased for $56 per ton. Because of the bankruptcy, the company can obtain a higher grade, 4A, for $62 per ton. While the quality of the final product will be the same regardless of the grade of material used, there will be substantial savings in material yield and labor productivity if 4A is used. These savings are expected to be two to three times the additional cost of $6 per ton.

Required:
A. How would an unfavorable price variance on a particular purchase affect the overall price variance for the year?
B. Would the use of the materials price variance as a basis for the manager's bonus lead to a desirable or undesirable behavioral outcome? Explain, being sure to note whether the manager would likely pursue acquisition of the grade 4A material.

LO: 5 Type: N

Answer:
A. An unfavorable price variance reduces any net favorable variance that may have arisen during the year. A sufficient number of such events could cause the net materials price variance to be unfavorable and would eliminate the bonus to the materials purchasing manager.

B. The use of the variance in this way would lead to an undesirable behavioral outcome. The materials purchasing manager is a gatekeeper; that is, this manager observes the purchasing opportunities available and determines whether or not the firm will follow them. In this case, the manager would be unlikely to pursue the grade 4A material because of the negative effect on the bonus calculation. As a result, the overall possibility of offsetting higher purchase costs with savings in yield and productivity would not materialize.

Manufacturing Cycle Time

86. Manufacturing cycle time is a popular nonfinancial measure used to evaluate performance.

Required:

A. Define manufacturing cycle time and indicate the optimal value (i.e., number) for this measure.
B. Provide examples of two changes in a manufacturing process that would help improve a company's cycle time.

LO: 9 Type: N

Answer:

A. Cycle time is defined as processing time divided by the sum of processing, moving, waiting, and inspection time. The optimal value for this measure is one, that is, a situation where there is no waiting, moving, or inspection time.

B. There are many such examples:
   - Inspection time can be reduced by eliminating the need to inspect materials from suppliers. This could occur by dealing with better suppliers and placing a greater reliance on the suppliers' control process.
   - Waiting time can be reduced through better scheduling of bottleneck machinery.
   - Moving time can be reduced through improvements in plant layout.