

## WAV-Answers to Chapter 1 through 26 Exercises

### *Exercise 1.1 Supply Chain Integration Types Answer Key*

Attribute	Answer
1. Which type best applies with a supply chain that has an agile business focus?	Vertical
2. Which type controls the entire supply chain?	Vertical
3. Which type focuses on a core competency?	Horizontal
4. Which type focuses on economies of scale?	Horizontal
5. Which type focuses on improving visibility?	Vertical
6. Which type is best for improving the income and cash flow statement?	Horizontal
7. Which type is centered around a core bank?	Keiretsu
8. Which type is focused on backward integration?	Vertical
9. Which type is focused on long-term planning?	Keiretsu
10. Which type is focused on outsourcing?	Horizontal
11. Which type is focused on interlocking business relationships?	Keiretsu

### *Exercise 1.2 Value Chain, Value Stream, or Value Stream Mapping Understanding*

#### *Answer Key*

Question	Answer
1. Which is used to display a strategic business process model?	Value chain and value stream mapping
2. Which is used to identify wasteful activities?	Value chain, value stream and value stream mapping
3. Which best creates a future activity view?	Value stream mapping
4. Which best displays delivery activity processes for a product and service organization?	Value stream
5. Which best displays process metrics?	Value stream mapping
6. Which best shows a functional collaboration view?	Value chain
7. Which displays all information with a one page view?	Value stream mapping
8. Which is a lean tool?	Value stream mapping
9. Which is focused on showing a core competency view?	Value chain
10. Which shows an end-to-end supply chain view?	Value stream mapping

### *Exercise 2.1 Understanding of SCOR Processes Answer Key*

Question	Answer
1. Which process is focused on reducing scrap?	Make
2. Which process is focused on selecting suppliers?	Source
3. Which process is focused on end-of-life activity?	Return

4. Which process is focused on specifying packaging?	Source
5. Which process is focused on scheduling shipments?	Deliver
6. Which process is focused on using recovered materials?	Recycle
7. Which process is focused on determining material needs?	Plan
8. Which process is focused on using eco-friendly packaging?	Enable
9. Which process is focused on minimizing hazardous materials?	Enable
10. Which process is focused on determining how to best dispose of hazardous materials?	Plan
11. Which process is focused on supporting best recycling practices?	Enable

*Exercise 2.2 Level 1 SCOR Metrics Answer Key*

Question	Answer
1. Which level 1 metric best represents downside supply chain adaptability?	Supply chain agility
2. Which level 1 metric best represents order fulfillment cycle time?	Supply chain responsiveness
3. Which level 1 metric best represents overall value at risk?	Supply chain agility
4. Which level 1 metric best represents perfect order fulfillment?	Supply chain reliability
5. Which level 1 metric best represents return on supply chain fixed assets?	Supply chain asset management
6. Which level 1 metric best represents return on working capital?	Supply chain asset management
7. Which level 1 metric best represents the cash-to-cash cycle time?	Supply chain asset management
8. Which level 1 metric best represents total cost to serve?	Supply chain costs
9. Which level 1 metric best represents upside supply chain flexibility?	Supply chain agility
10. Which level 1 metric best represents upside supply chain adaptability?	Supply chain agility

*Exercise 3.1 3PL or 4PL Functions Answer Key*

Activity	3PL	4PL
1. Who performs a specific supply chain related function?	X	
2. Who manages and directs multiple external service providers?		X
3. Who will make the investment in the latest technology and services?	X	
4. Who may select a partner who may not be the best or cheapest service provider?		X
5. Who has the responsibility to assemble, manage, and integrate resources, and the capability, and technology to design, build, and run a comprehensive supply chain solution?		X

*Exercise 3.2 Waste Hierarchy Answer Key*

Activity	Level
1. Ship products in a returnable plastic tote	Reuse
2. Redesign the wall thickness of a water bottle	Reduce
3. Send returned products to a responsible landfill	Disposal
4. Convert plastic bottles into a salable raw material	Recycle
5. Perform a conversion process to capture energy from burning waste	Recover

*Exercise 4.1 Warehouse Capabilities Answer Key*

Scenarios	Answer
1. This activity ships different clothing sizes to a retail store.	Assortment
2. This activity ships materials from a manufacturing location to a warehouse and then breaks them apart before shipping them to a customer.	Break-bulk
3. This activity stores products until they're by seasonal customers.	Stockpiling
4. This activity receives full shipments of different products from multiple manufacturing plants. It breaks them apart and then when needed reassembles a shipment with the stored warehouse products to meet a customer order.	Mixing
5. This activity ships materials from multiple manufacturing plants to a warehouse and then ships them directly to a customer.	Cross-docking
6. This activity stores products in a warehouse from multiple suppliers until required by a manufacturing plant.	Consolidation
7. This activity receives materials and immediately ships them to a customer without going into a warehouse?	Cross-docking
8. This activity finalizes a product at a warehouse to customer specifications before shipping it.	Postponement
9. This activity receives and stores materials from multiple suppliers. It later ships a full truckload of requested materials to one factory.	Consolidation

*Exercise 4.2 Impact of Adding / Removing Warehouses Answer Key*

Question	Answer
1. What is the impact on total inventory by adding warehouses? (up or down)	Up
2. What is the impact on transportation costs from going from one to three warehouses? (up or down)	Down
3. What is the impact on customer delivery speed from going from one to three warehouses? (up or down)	Up
4. What one word best describe why a company may want to add /	Tradeoffs

remove a warehouse?	
5. What two words best describe what has the greatest impact on transportation costs when going from one to three warehouses?	Full truckloads
6. What happens to overhead costs if a company goes from one to three warehouses? (up or down)	Up
7. Which manufacturing environment has more finished goods stored in a warehouse?	Make-to-stock

*Exercise 4.3 Understanding of the Various Transportation Stakeholders Answer Key*

Questions	Answer
1. Which transportation stakeholder has no shipment liability?	Recipient
2. Which transportation stakeholders want a convenient pickup time?	Shipper and carrier
3. Which transportation stakeholder wants a convenient delivery time?	Carrier
4. Which transportation stakeholder is most concerned about profitability?	Carrier
5. Which transportation stakeholder wants a scheduled pickup / delivery time?	Recipient
6. Which transportation stakeholders are most concerned about establishing safety regulations?	Government and public
7. Which transportation stakeholder is most concerned about fair pricing and no discrimination?	Public
8. Which transportation stakeholders want convenient, cost effective, and environmental sound infrastructure?	All

*Exercise 4.4 Understanding of the Various Transportation Modes Answer Key*

Question	Answer
1. Which mode is the fastest?	Air
2. Which mode is the most reliable?	Pipeline
3. Which mode is the most expensive?	Air
4. Which mode has the least flexibility?	Pipeline
5. Which mode can carry the most weight?	Water
6. Which modes have the lowest fixed costs?	Carrier / water
7. Which mode has no intermodal capability?	Pipeline
8. Which modes have the lowest rates per cwt?	Water / pipeline
9. Which modes have the highest variable costs?	Air / carrier
10. Which modes have to maintain their own infrastructure?	Rail / pipeline
11. Which mode has the greatest risk of damaging cargo?	Rail
12. Which mode has the lowest risk of being impacted by weather?	Pipeline
13. Which mode doesn't require advanced planning and scheduling?	Carrier

*Exercise 4.5 Understanding of the Various Mechanized Systems Answer Key*

Question	Answer
1. Which mechanized systems reduce the need for labor to pick materials?	Carousel and the automated storage and retrieval system
2. Which mechanized systems are the most expensive?	Bridge cranes, automated guided vehicle systems, automated conveyors, and the automated storage and retrieval system
3. Which mechanized systems can lift and move materials in all directions?	Forklift, tow tractor with trailers, and the bridge crane
4. Which mechanized system is programmed to automate material movement?	Automated guided vehicle system
5. Which mechanized system is programmed to build a unit load?	Robotics
6. Which mechanized systems are programmed to enhance order picking?	Pick to light system and the automated storage and retrieval system
7. Which mechanized system is programmed to move along a predefined path?	Automated guided vehicle system
8. Which mechanized systems maximize floor storage space?	Bridge crane, hand conveyor system, and the automated storage and retrieval system
9. Which mechanized systems require an operator to move materials?	Forklift, tow tractor with trailers, bridge and wagon cranes
10. Which systems make efficient use of floor space?	Conveyors, towlines, bridge cranes, and the automated storage and retrieval system

*Exercise 5.1 Understanding Incoterms® Answer Key*

Question	Answer
1. Which term has the seller price including the cost of the goods, the freight or transport costs, and the costs of marine insurance?	Cost, insurance and freight
2. Which term has the passing of risk occurring when the goods have been delivered into the custody of the first carrier?	Carriage and insurance paid to
3. Which term has the seller paying for transportation of the goods to the port of shipment?	Free alongside ship
4. Which of the following Incoterms is used only for sea and inland waterway transport, CIF, CIP, DAP, or DDP?	Cost, insurance and freight
5. Which term only applies for shipments moving from an ocean port to an ocean port by vessel?	Free on board
6. Which term has the seller paying for the freight to the named point of destination and the buyer paying for insurance?	Carriage paid to

7. Which term has the buyer paying all transportation costs and bearing all risks for transporting the goods to their final destination?	Ex works
8. Which term has the seller paying for costs and freight of the goods to the named destination port?	Cost and freight
9. Which term has the seller delivering the goods to the buyer who assumes responsibility for their unloading at a named destination?	Delivered at place
10. Which group has the responsibility for defining Incoterms®?	International Chamber of Commerce
11. Which term has the seller delivering the goods into the carrier custody and the buyer pays only for the transportation from the place named in the Incoterm®?	Free carrier
12. Which term has the seller paying for all transportation costs and duties, plus bearing all risks until the goods have been delivered?	Delivered duty paid
13. Which terms generally have import duties assessed as a percentage of the shipment value?	Free on board or cost insurance, and freight

*Exercise 6.1 Understanding of the Various ISO and Non-ISO Standards and Guidelines*

*Answer Key*

Question	Answer
1. What is the name of the security management system that is a standard for managing security risks within a supply chain?	ISO 28000
2. What is the name of the world wide federation which developed voluntary market-driven international standards?	International Organization for Standardization (ISO)
3. Which ISO documents show a glossary of risk management vocabulary?	ISO Guide 73:2009 or Guide 73
4. Which ISO documents provide guidance for social responsibility?	ISO 26000 and ISO 26000:2010
5. Which ISO document is a set of principles to help manage risk in any type of organization?	ISO 31000
6. Which ISO document is a set of requirements for implementing a quality management system?	ISO 9001:2008
7. Which ISO document offers a framework for a strategic, holistic approach to an organization's environmental policy, plans, and actions?	ISO 14001:2004
8. Which ISO document provides a general / generic guideline for an environmental management system?	ISO 14001:2004

9. Which ISO document provides a guideline to explain the specific elements of an environmental management system and its implementation, and discusses the principle issues involved?	ISO 14004:2004 (updated in 2016)
10. Which ISO document provides a quality management system guideline?	ISO/PAS 17712
11. Which ISO document provides specifications that regulate classification and the use of seals on shipping containers?	ISO/PAS 17712:2003
12. Which ISO document provides the requirements for an environmental management system?	ISO 14001:2004
13. Which ISO document refers to a series of environmental management standards?	ISO 14000
14. Which ISO document refers to installing approved seals on shipping containers?	ISO/PAS 17712
15. Which ISO document starts with an executive-level mandate and commitment toward risk management?	ISO 31000
16. Which ISO family standard strives to help minimize harmful environmental effects?	ISO 14001
17. Which ISO document will help all organizations talk about risk in the same manner?	ISO 14000
18. Which ISO standard is designed to manage human rights in the workplace?	SA8000

*Exercise 7.1 Understanding of the Four 4 P Attributes Answer Key*

4 P Attributes	Product	Price	Promotion	Placement
Advertising			X	
Brand			X	
Chat room				X
Contact channels		X		
Credit terms		X		
Customer segments		X		
Discounts		X		
Inventory				X
Locations				X
Logo			X	
Package			X	
Payment period		X		
Public relations			X	
Segmentation			X	
Sizes	X			
Variety	X			
Website				X

*Exercise 8.1 Mean Absolute Deviation Calculation Answer Key*

Month	Forecast	Actual	Deviation	Absolute Deviation
July	300	285	-15	15
August	300	305	5	5
September	300	314	14	14
October	300	328	28	28
November	400	424	24	24
December	400	440	40	40
Total	2,000	2,096	-----	126 MAD = 6 / 126 = 21

*Exercise 8.2 Understanding of Forecast Measurements Answer Key*

Question	Answer
1. What best measures how closely the forecast matches history?	Mean square error
2. What is absolute error divided by actual demand for a period?	Absolute percentage error
3. What is equal to the running sum of forecast errors divided by MAD?	Tracking signal
4. Which best identifies variability of the forecast error?	Mean absolute deviation
5. Which error measurement magnifies errors by squaring each one before adding them up and dividing by the number of periods?	Mean square error
6. Which forecast error measurement predicts actual value movement?	Tracking signal
7. Which is the average of the absolute values of the percentage errors of a forecast?	Mean absolute percentage error
8. Which is the best universal indicator of forecast error?	Mean absolute percentage error

*Exercise 9.1 Customer Relationship Management Strategy by Customer Type Answer*

Key

Question	Answer
1. The goal of any customer relationship management strategy is to increase the number of this customer type.	Loyal
2. This customer type is very receptive to cross-selling or up-selling.	Loyal
3. Which customer type requires the development of a promotional retention program?	Vulnerable

4. Which customer type requires early identification of customers who no longer purchase products?	Vulnerable
5. Which customer type must be contacted within the first week after customer service has been discontinued?	Win-back
6. Product pricing and audience segmentation is used in this customer type.	Prospective

*Exercise 9.2 Customer Relationship Management Tools Answer Key*

Question	Answer
1. This tool can act like a person to answer a customer's question.	Business intelligence
2. This tool employs software to search a customer database to target customers for promotional activities.	Marketing automation
3. This tool collects customer information from transactions for use in a customer relationship management system (CRM).	Sales force automation
4. This tool utilizes enterprise marketing automation (EMA) to reach customers to automatically send out a renewal notice.	Marketing automation
5. This tool helps a sales representative to better manage and use historical customer information for marketing.	Account management
6. This tool uses a customer's product sales' history for market segmentation and sales promotions.	Account management
7. This tool utilizes an event management tool to establish a special loyalty program promotional event.	Sales force automation
8. This tool utilizes a decision support system (DSS) and data mining tools to facilitate upper management strategic decision-making.	Business intelligence

*Exercise 9.3 Four Levels of Customer Relationship Management Implementation Answer*

*Key*

Question	Answer
1. Which Customer Relationship Management (CRM) level has only one system to capture and store customer sales information from multiple sources?	Internally integrated technology
2. Which Customer Relationship Management (CRM) level stores data centrally and collects customer data from multiple sources?	Multi-enterprise integrated technology
3. Which Customer Relationship Management (CRM) level uses a non-interfacing database to store collected information?	Disconnected technology

4. Which Customer Relationship Management (CRM) level is just beginning to use stored customer data to feed other internal systems?	Interfacing technology
5. Which Customer Relationship Management (CRM) level utilizes cloud systems to capture and store external customer data?	Multi-enterprise integrated technology

*Exercise 10.1 Product Life Cycle Stages Answer Key*

Question	Answer
1. In which stage are advertising costs the highest?	Introduction
2. In which stage are distribution costs the highest?	Introduction
3. In which stage can an opportunity to create customer ownership be found?	Development
4. In which stage can customer care promote lifetime customer development?	Decline
5. In which stage do you generate the most profits?	Maturity
6. In which stage do you have rapid revenue growth?	Introduction
7. In which stage does a company entice its competitors' customers to switch?	Maturity
8. In which stage is customer care more critical than the other stages?	Decline
9. In which stage is it essential to cultivate brand loyalty and development of lifetime customers?	Development
10. In which stage must customer care be sustained?	Growth
11. In which stage must information be used to identify strong and weak customer segments?	Growth
12. In which stage do competitors begin to enter the marketplace?	Introduction
13. What stage makes the best use of customer feedback data to identify new product ideas?	Development

*Exercise 10.2 Understanding of the Various Design Processes Answer Key*

Question	Answer
1. Which types move final assembly closer to the customer?	Mass customization and postponement
2. Which type uses product design to manage logistics costs?	Design for logistics
3. Which types utilize push-pull strategy with final assembly being performed later?	Mass customization and postponement
4. Which type is used to design a flat bookcase for stacking on a pallet?	Design for logistics
5. Which type designs a product so that assembly can be initiated upon receipt of an order?	Postponement

6. Which type designs a product from a customer's perspective?	Design for quality
7. Which type design limits on the number of assembly process touch points?	Design for manufacturing and assembly
8. Which type looks at velocity, visibility, and cost improvement opportunities?	Design for supply chain
9. Which type designs a product to achieve sustainability or meet regulatory requirements?	Design for environment
10. Which type designs a product to improve the entire end-to-end supply chain?	Design for supply chain
11. Which type pre-builds sub-assembly components for fabrication based on customer orders?	Modular design
12. Which type builds a unique product from raw materials upon receipt of a customer order?	Mass customization
13. Which type transforms customer wants and needs into the design, based on quality, marketing, and manufacturing input?	Quality function deployment
14. Which type designs a product so that it's easy to recover materials at the end of its product life?	Design for the environment
15. Which type replaces silo processes with parallel design and development?	Concurrent engineering
16. Which type designs one product with features and characteristics that appeal to all global markets?	Universality
17. Which design concept helps to achieve economies of scale in design, procurement, production, and support?	Universality
18. Which type pre-produces and stores standardized sub-assembly units based on projected customer orders?	Modular design
19. Which type may facilitate product and process design for ease of manufacturing, ease of use, and ease of service?	Concurrent
20. Which type tries to maximize material value recovery and reduce logistics costs?	Reverse logistics
21. Which type uses modular and lean assembly processes, and later introduces product variety during the production activity?	Design for manufacturing and assembly
22. Which type results in the loss of product uniqueness and customer loyalty?	Universality
23. Which type replaces two or more parts with one standard part?	Component commonality
24. Which type results in the loss of product flexibility and possible reduction in quality?	Component commonality

25. Which type designs a product with all of the design considerations a company deems to be strategic?	Design for everything
26. Which type develops scenarios to pre-define the service process and project required repair parts?	Design for service
27. Which type helps to improve customer after-sale interaction and experience?	Design for service
28. Which type converts returned parts back to the equivalent of a new part?	Design for remanufacturing

*Exercise 11.1 Sales and Operations Planning Process Steps Answer Key*

Question	Answer
1. Which process activity identifies changes to the aggregate plan?	Product review
2. Which process activity involves the participation of the CEO?	Executive
3. Which process activity is attended by marketing and sales professionals to discuss their requirements?	Demand planning
4. Which process activity reviews gaps between the demand plan and the business plan?	Demand planning
5. Which process activity reviews the performance metrics in relation to demand and forecast accuracy?	Demand planning
6. Which process activity requests an increase in available capacity by working overtime?	Supply planning
7. Which process activity establishes the S&OP executive meeting agenda?	Pre-meeting
8. Which process activity recommends how to resolve demand / supply mismatches?	Pre-meeting

*Exercise 11.2 Sales and Operations Planning Process Ownership Answer Key*

Question	Answer
1. Who chairs the demand planning meeting?	Highest ranking demand-side professional
2. What is the output of the demand planning meeting?	Agreed upon demand consensus plan
3. In which step is the production plan developed?	Supply planning
4. In which step is the production plan consensus achieved?	Pre-meeting
5. In which step does a discussion on forecast accuracy occur?	Demand planning
6. What is the role of the demand manager in the demand planning meeting?	Facilitator
7. In which step does cash flow and capital need to be	Financial review

reviewed?	
8. In which step does the authorization of additional resource take place to resolve supply / demand conflicts?	Executive meeting

*Exercise 12.1 Material Type Understanding Answer Key*

Question	Material Type
1. Which type best focuses on material reliability?	Leveragable
2. Which type best focuses on material availability?	Direct/core
3. Which type best focuses on material fulfillment?	Bottleneck
4. Which type best focuses on material cost reduction?	Commodity
5. Which type limits the bargaining power of the supplier?	Commodity

*Exercise 13.1 Projected Available Balance Calculation Answer Key*

	Periods					
	1	2	3	4	5	6
Forecast	5	5	5	5	5	5
Customer Orders	5	3	2			
Projected Available Balance   20	15	12	10	5	0	25
Available-to-Promise						
Master Production Schedule						30

The calculation for each period is:

Projected Available Balance (PAB) = Current on-hand + Master Production Schedule (MPS) -

Customer Orders (first period only)

Period one =  $(20 + 0) - 5 = 15$

PAB = Prior period PAB + MPS - Customer Orders (after the first period

and prior to the Demand Time Fence (DTF))

Period two =  $(15 + 0) - 3 = 12$

Period three =  $(12 + 0) - 2 = 10$

PAB = Prior period PAB + MPS - Greater of Forecast or Customer Orders

(after the DTF)

$$\text{Period four} = (10 + 0) - 5 = 5$$

$$\text{Period five} = (5 + 0) - 5 = 0$$

$$\text{Period six} = (0 + 30) - 5 = 25$$

PAB Hint: Always look for the DTF to help you determine if you should use customer orders or the forecast.

*Exercise 13.2 Projected Available Balance Calculation Answer Key*

	Periods					
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Forecast	5	5	5	5	5	5
Customer Orders	5	3	2			
Projected Available Balance   20	15	12	10	5	0	25
Available-to-Promise	10					30
Master Production Schedule						30

The calculation for each period is:

Available-to-Promise (ATP) = on hand + master production schedule receipt quantity - sum of customer orders before next MPS

(first period only)

$$\text{Period one} = (20 + 0) - (5 + 3 + 2 + 0 + 0) = 10 \text{ (need to look at periods one through five)}$$

$$\text{Period two} = 0 \text{ (No MPS orders)}$$

$$\text{Period three} = 0 \text{ (No MPS orders)}$$

$$\text{Period four} = 0 \text{ (No MPS orders)}$$

$$\text{Period five} = 0 \text{ (no orders)}$$

ATP = MPS receipt quantity - sum of customer orders before next MPS (perform a calculation only in those periods where there is an MPS receipt quantity)

$$\text{Period six} = (0 + 30) - 0 = 30 \text{ (need to look only at period six) ATP}$$

Hint: The on-hand inventory has to cover all existing customer orders until the next scheduled MPS quantity is shown. It's the uncommitted portion of a company's inventory and planned production. Assume that no inventory will be carried forward as it will be used in its intended period. Also, don't consider the time fences in your calculations.

*Exercise 14.1 Material Requirements Planning Calculation Answer Key*

Technique:	Fixed	Demand time fence:	2
Order quantity:	600	Planning time fence:	5
Allocated quantity:		Low level code:	2
Safety stock:	50	Beginning inventory:	300
Lead time (weeks):	1	Scrap / yield factor:	

Periods

		1	2	3	4	5	6
Gross requirements		200	200	200	250	200	200
Scheduled receipts							
Projected available balance	300	100	500	300	50	450	250
Net requirements			150			200	
Planned order receipt			600			600	
Planned order release		600			600		

Period one = inventory of 300 minus gross requirement of 200 equals projected inventory of 100 (no other action required)

Period two = projected inventory of 100 minus gross requirement of 200 equals a negative requirement of 100. Need to add the safety stock of 50 pieces to calculate a net requirement of 150. The order quantity is 600 so a planned order receipt is shown in period two. It's offset by the one period of lead time to identify the first planned order receipt of 600 in period one, which is the correct answer.

Period three = projected inventory of 500 minus gross requirement of 200 equals projected inventory of 300 (no other action required).

Period four = projected inventory of 300 minus gross requirement of 250 (don't forget to increase the gross requirement by 50) equals projected inventory of 50 (no other action required).

Period five = projected inventory of 50 minus gross requirement of 200 equals a negative requirement of 150. Need to add the safety stock of 50 pieces to calculate a net requirement of 200. The order quantity is 600, so a planned order receipt is shown in period two which is then offset by the one period of lead time to identify the first planned order receipt of 600 in period one. The PAB quantity becomes 450 (600 - 150).

Period six = projected inventory of 450 minus gross requirement of 200 equals projected inventory of 250 (no other action required).

*Exercise 15.1 Capacity Attributes Answer Key*

Attribute	Increase Capacity	Decrease Capacity	Increase Load	Decrease Load	Redistribute Load
Add resources	X				
Cut lot size in half				X	
Early work order release			X		
Eliminate second shift		X			
Hold orders in planning				X	
Increase lot size			X		
Increase the master production schedule			X		
Make previously purchased items			X		
Reduce the master production schedule				X	
Reduce setup times	X				
Split orders					X
Subcontract work out				X	

*Exercise 16.1 Takt Time Calculation Answer Key*

In order to find the takt time you take 960 minutes divided by the 240 cars per day which equates to a car being produced every four minutes (or 240 seconds).
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*Exercise 16.2 Understanding Quality Type Costs*

Question	Answer
1. A customer product recall is what type of quality type cost?	External failure costs
2. A line defect is what type of quality type cost?	Internal failure costs
3. A poka-yoke device is what type of quality type cost?	Preventive costs
4. A visual product inspection is what type of quality type cost?	Appraisal costs
5. The salary of a quality control inspector is what type of quality type cost?	Appraisal costs
6. Which quality type cost is always the overall lowest cost?	Preventive costs
7. Which quality type cost is the highest overall cost?	External failure costs

*Exercise 17.1 Understanding of Single, Sole, and Multi-sourcing Suppliers Answer Key*

Question	Answer
1. The customer consolidates all requirements for a commodity item and places it with one supplier.	Single
2. The customer places all orders with one supplier in order to gain a volume discount on a supplier customized designed product.	Sole
3. The customer places an order with the only supplier who can produce the desired part.	Sole
4. The customer purchases similar goods from more than one supplier.	Multi
5. The customer selects one supplier even if others suppliers exist.	Single

*Exercise 17.2 Auction Attributes Answer Key*

Auction Type	Number of Sellers (one or multiple)	Number of buyers (one or multiple)	Bid (up, down, ask, bid)	Winning bid (highest, lowest, negotiated dynamic)
Classic or forward	One	Multiple	Up	Highest
Reverse	Multiple	One	Down	Lowest
Dutch	One	Multiple	Down	Lowest
Demand	Multiple	Multiple	Ask	Negotiated
Stock market	Multiple	Multiple	Bid	Dynamic

*Exercise 18.1 Understanding of the Various Trading Partner Types Answer Key*

Question	Answer
1. Which trading partner type best permits all participants to share their inventory stocking level balance?	Distributor integration
2. Which trading partner type creates a jointly developed plan to best satisfy customer demand?	Collaborative planning, forecasting, and replenishment
3. Which trading partner type defines inventory ownership in a formal contract?	Vendor managed inventory
4. Which trading partner type focuses on retail sales and passes point-of-sale data (POS) to their suppliers without generating a purchase order?	Quick response
5. Which trading partner type jointly develops a forecast and then decides on inventory levels with the supplier assuming inventory replenishment responsibility?	Vendor managed inventory
6. Which trading partner type shares point-of-sale (POS) data, production schedules, and inventory levels amongst all participants?	Collaborative planning, forecasting, and replenishment
7. Which trading partner type has the supplier retaining inventory ownership until a product is sold?	Consignment
8. Which trading partner type has to overcome an obstacle against sharing inventory information with others?	Distributor integration
9. Which trading partner type requires a purchase order to be generated to request material replenishment?	Continuous replenishment

*Exercise 19.1 – Economic Order Quantity Change Answer Key*

Impact	Order Quantity Change (higher or lower)
1. Carrying cost increases	Lower
2. Carrying cost decreases	Higher
3. Demand quantity increases	Higher
4. Demand quantity decreases	Lower
5. Setup increases	Higher
6. Setup decreases	Lower
7. Item cost increases	Lower
8. Item cost decreases	Higher

*Exercise 19.2 Inventory Functional Types Answer Key*

Question	Answer
1. Which type best build inventory in excess of requirements?	Decoupling and lot size
2. Which types best provides protection against supply and demand variability?	Safety stock and fluctuation
3. Which type best breaks apart supply and demand?	Decoupling
4. Which type bests build up inventory for a plant shutdown?	Anticipation
5. Which type best maintains a material backlog kept behind a critical work center?	Buffer
6. Which type best manages event risk by buying extra inventory?	Hedge
7. Which type best provides protection for seasonal inventory?	Anticipation
8. Which type best provides results in different lot-size work center quantities?	Decoupling
9. Which type best replenishes cyclical inventory?	Cycle stock

Exercise 20.1 Impact of Process Changes on A Company's Financials Answer Key

Question	Answer
1. The company produced more units than planned. What was the impact on gross profit?	Up (building the additional units absorbed more overhead than planned which resulted in higher short-term profits)
2. The company outsourced its warehousing operations. What will be the impact on cost of goods sold?	Down (this action reduced its labor pool resulting in a reduction in overhead)
3. The company implemented a lean initiative. What will most likely be the impact on inventory levels?	Down (this most likely will reduce all forms of available inventory, especially work-in-process)
4. Management has implemented an overall 10% inventory reduction program to reduce inventory levels at year end. What will most likely be the impact on customer service?	Down (an overall inventory reduction can cause material shortages)
5. The company purchased an automatic storage and retrieval system. What will be the impact on fixed assets on the income statement?	None (fixed assets are on the balance sheet)
6. The company increased its country-specific asset footprint. What is the impact on its transportation costs?	Down (this action is normally taken to reduce transportation costs by building products in the local country)
7. The company decided to utilize a demand shaping technique to move excess inventory. How will this	Up (cash flow will become positive as more cash is being

action impact cash flow?	obtained from product sales, and it also reduces inventory levels and carrying costs)
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Exercise 21.1 Understanding of the Aggregate Demand-Aggregate Supply Model Curve Shift

Answer Key

Question	Answer
1. A country has reached full employment. What will be the impact on the demand curve?	It will shift the AD curve to the left.
2. A manufacturing company is notified that a critical raw material is going to increase in price by 33%. What will be the impact on the demand curve?	It will shift the AD curve to shift to the left.
3. A product reached equilibrium. What will be the impact on the supply curve?	It will have no impact as supply and demand are balanced.
4. Technology has created a new improved phone. What will be the impact on the demand curve?	It will shift the AD curve to the right.
5. What will be the impact on the demand curve if a country increases its duty on imports by 25%?	It will shift the AS curve to the left.
6. What will be the impact on the supply curve if a country reduces its income tax rate by 20%?	It will shift the AS curve to the right.
7. What will be the impact on the supply curve if the borrowing interest rate is increased?	It will shift the AS curve to the left.
8. A manufacturing company can't find a sufficient number of skilled factory workers. What will be the impact on supply?	It will shift the AS curve to the left.

*Exercise 22.1 Four Basic Risk Response Types Answer Key*

Question	Response
1. A company decided to remove all lead paint from toys being sold at children's stores.	Avoid
2. A company decided to purchase business interruption insurance to minimize the financial risk of a fire at its manufacturing location.	Transfer
3. A company with a low probability, low magnitude risk, will most likely utilize this type of risk response?	Accept
4. A company decided to implement additional training on its product installation process. The goal is to prevent incorrect setup information from being given to customers looking for assistance.	Mitigate
5. A company is concerned about pending government certificate of origin regulations. It decides to source all components locally.	Avoid

6. A company elected to ignore the possibility that a foreign based oil refinery and distribution system may be nationalized by the local oil-producing country's government.	Accept
7. A company decided to hold inventory in local warehouses so it can quickly deliver raw materials to its key customers.	Mitigate
8. A retail store implemented a vendor managed inventory (VMI) program with its suppliers. The program made its suppliers responsible for maintaining adequate inventory levels at the store.	Transfer

*Exercise 23.1 Understanding of Middleware*

Question	Answer
1. What are the five forms of middleware?	Data-oriented, process-oriented, business process management (BPM), smart middleware, and electronic data interchange (EDI).
2. What are three reasons why a company might select to use custom linkage rather than middleware?	Custom linkage is simpler, doesn't require extensive data configuration and conversion, is less expensive, and it can be performed in-house.
3. What is the best name of the software that interconnects two otherwise incompatible applications?	Middleware
4. What is the name of the electronic communication method used by middleware that provides standards for exchanging data via any electronic means?	Electronic data transfer (EDT)
5. Which form of middleware focuses on shared processes?	Process-oriented
6. Which form of middleware passes converted, electronic, standard, formatted business data between users?	Electronic data interchange (EDI)
7. Which form of middleware requires field-by-field mapping?	Data-oriented
8. Which is the most costly form of middleware?	Data-oriented

*Exercise 24.1 Understanding Radio Frequency Identification Tags Answer Key*

Question	Answer
1. Which form of radio frequency identification (RFID) tag contains its own battery source and is self-powered?	Active tag

2. Which form of RFID doesn't broadcast any electronic information, nor does it contain a battery power source?	Passive tag
3. What supply chain development stage will a company be at, if they are using RFID?	Internal integration
4. Which form of RFID obtains its transmission power from a reader?	Semi-passive tag
5. Which form of RFID responds when queried by a reader, and sends power to read a device?	Passive tag
6. Which form of RFID uses an electronic product code (EPC) tag that doesn't broadcast information or contain its own power source?	Passive tag
7. Who or what most likely will drive an RFID implementation?	Channel master

*Exercise 25.1 Understanding Electronic Business and Commerce Answer Key*

1. What is the electronic business type name when two independent organizations join in a long-term relationship to address a specific market opportunity, involving designing, producing, and distributing a joint product?	Virtual organization
2. What is the name of the electronic business type that best conducts business transactions electronically?	Electronic commerce (e-commerce)
3. What is the name of the electronic business type that conducts business over the Internet with another company?	Business-to-business commerce (B2B)
4. What is the name of the electronic business type that sells merchandise in a dynamic environment to consumers online?	Business-to-consumer sales (B2C)
5. Which electronic business type is considered the sales aspect of e-business?	Electronic commerce (e-commerce)
6. Which electronic commerce type looks to purchase products from a pool of suppliers?	Buy-side e-commerce
7. Which electronic commerce type sells a product to a pool of potential customers using an electronic catalog?	Sell-side e-commerce
8. Which electronic business type sells a	Business-to-consumer sales (B2C)

service from a business to an end consumer?	
9. Which electronic business type uses an electronic transaction to purchase a product from another business?	Business-to-business commerce (B2B)
10. Which electronic business type uses information and communication technologies to support supplier and customer business buying, selling, and transferring activities over a wireless network?	Electronic business (e-business)
11. Why can't a company normally conduct electronic business to sell a product to the public over the intranet?	The intranet is a privately owned network which isn't normally open to the public.

*Exercise 26.1 Understanding of the Project Management Process Groups Answer Key*

Question	Answer
1. A project manager (PM) is assigned during which process group?	Initiating
2. A quality audit is performed during which process group?	Project execution
3. A request to make a work change request is typically asked for during which process group?	Project execution
4. A user makes a request to change a report layout. During which process group activity does this occur?	Project monitoring and controlling
5. Collecting performance data on project status is performed during which process group?	Project monitoring and controlling
6. During which process group activity is a final report issued?	Project closure
7. The project scope is assigned during which process group?	Project planning and design
8. The work breakdown structure is developed during which process group?	Project planning and design

*Exercise 26.2 Understanding of the Variance Analysis Calculations Answer Key*

Question	Answer
1. A project has a \$10,000 budget to develop and build two custom machines for a customer. The project is scheduled to take four weeks. It's now two weeks into the project. Calculate the planned value (PV).	PV is calculated by taking the scheduled completion timeframe of two weeks, dividing it by the four week schedule, and then multiplying it by the budgeted amount of \$10,000. It's calculated as (two weeks / four weeks * \$10,000 = \$5,000).

<p>2. A project has a \$10,000 budget. It's determined that the project is 35% complete. Calculate the earned value (EV).</p>	<p>EV is calculated by taking the budget amount times the actual percent complete. It's calculated to be \$3,500 (<math>\\$10,000 * 35\%</math>).</p>
<p>3. Calculate the schedule variance (SV) of a project based on the following data:</p> <ul style="list-style-type: none"> <li>• Percent complete = 40%</li> <li>• Earned value (EV) = \$3,500</li> <li>• Planned value (PV) = \$5,000</li> <li>• Actual cost (AC) to date = \$3,000</li> </ul>	<p>SV is calculated by subtracting PV (\$5,000) from EV (\$3,500) to reveal that the project is \$1,500 over budget.</p>
<p>4. Calculate the cost variance (CV) of a project based on the following data:</p> <ul style="list-style-type: none"> <li>• Percent complete = 40%</li> <li>• Earned value (EV) = \$3,500</li> <li>• Planned value (PV) = \$5,000</li> <li>• Actual cost (AC) to date = \$3,000</li> </ul>	<p>The formula to calculate a cost variance (CV) is <math>(CV = EV - AC)</math>. Subtract AC (\$3,000) from EV (\$3,500) to obtain a \$500 positive variance. This indicates that the project is \$500 under budget.</p>
<p>5. Calculate the schedule performance index (SPI) of a project based on the following data:</p> <ul style="list-style-type: none"> <li>• Percent complete = 40%</li> <li>• Earned value (EV) = \$3,500</li> <li>• Planned value (PV) = \$5,000</li> <li>• Actual cost (AC) to date = \$3,000</li> </ul>	<p>SPI is calculated by taking EV and dividing it by PV times 100% (<math>(\\$3,500 / \\$5,000 * 100\%) = 70\%</math>).</p>
<p>6. What does a schedule performance index (SPI) number of 65% tell the project manager (PM) about the project?</p>	<p>A SPI number of 65% means that the project is behind schedule.</p>
<p>7. Calculate the cost performance index (CPI) of a project based on the following data:</p> <ol style="list-style-type: none"> <li>a. Percent complete = 40%</li> <li>b. Earned value (EV) = \$3,500</li> <li>c. Planned value (PV) = \$5,000</li> <li>d. Actual cost (AC) to date = \$3,000</li> </ol>	<p>The CPI is calculated by taking EV divided by AC (<math>(\\$3,500 / \\$3,000) * 100\% = 116.7\%</math>).</p>
<p>8. What does a positive cost performance index (CPI) tell the project manager (PM)?</p>	<p>A positive cost performance index (CPI) tells the project manager that the project is under budget.</p>