

Tenth Edition
CPA
Preparatory Program

Business Environment and Concepts

Sample Chapters:
Working Capital &
Activity-Based Costing

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Group B: Working Capital

Working capital management is a topic that many people feel comfortable with because it is something that we can relate to. Even if working capital is not something that we work with directly in our jobs, we can relate to the general concepts on a personal level because we all need to make certain that we have enough cash to pay for the costs of living as they come due. Additionally, we all like to collect the cash that is owed to us as quickly as possible and in turn, we typically like to pay the cash owed to others as slowly as possible.

You will need to be familiar with working capital as a concept and the required levels of working capital for a company. You will also need to be able to determine the effect that a specific transaction will have on the working capital of a company.

After looking at working capital in a total sense, you must understand the management of each component of working capital, including knowing the ways to speed cash collections, slow cash disbursements, and calculate the effective rate of cash discounts.

While individually none of these topics are long or difficult, it is important to be familiar with the concepts because they may represent some easy points for you to win on the exam.

Since net working capital is current assets minus current liabilities, short-term financing is a part of working capital and will be covered here, as well. Long-term financing is not a part of working capital. The two main sources of short-term financing that you need to be familiar with are bank loans and factoring of receivables. A bank loan can take a number of different forms, and you must be able to calculate the effective interest rate under all of the different types of loans. The primary concern in the factoring of receivables is how much funding is available to the seller of the receivables after the fees, commissions, holdback, and if applicable, interest are deducted.

A number of other forms of short-term financing are discussed in this material, and you'll want to know what the forms are in general and whether each is a secured or unsecured source of financing. A secured loan is one that has some sort of supporting collateral that can be used as a secondary repayment source in case of default by the borrower. Unsecured sources of financing do not have any collateral. Because they entail more risk to the lender, unsecured sources of financing are more expensive than secured sources.

Analyzing Working Capital

Working capital is measured and analyzed by means of several ratios.

Net Working Capital

A company's net working capital bridges the gap between the production process and the collection of cash from the sale of the item. The amount of liquidity a company needs depends upon the length of its operating cycle. The operating cycle is the period from the time cash is committed for investment in inventory (the purchase of, not the payment for, inventory) to the time that cash is received from the investment (from the collection on the sale of the inventory).

Note: The **operating cycle** of a company is the amount of time between the acquisition of inventory and the receipt of cash from the sale of the product. This is slightly different from the cash cycle. The **cash cycle**, or **net operating cycle**, is the length of time it takes to convert an investment of cash in inventory back into cash, recognizing that some purchases are made on credit. Thus, the cash cycle is the time between the **payment** for the inventory and the receipt of cash from the sale of the inventory. The difference between the operating cycle and the cash cycle is the number of days of sales in payables. The operating cycle will be more fully explained in this Section in the topic *The Operating Cycle*.

For example, a firm that produces and sells goods has an operating cycle that consists of four phases:

- 1) Purchase raw material and produce goods, investing in inventory.
- 2) Sell goods, generating sales, which may or may not be for cash.
- 3) Extend credit, creating accounts receivable.
- 4) Collect accounts receivable, generating cash.

Net working capital is the difference between current assets and current liabilities.

$$\text{Net Working Capital} = \text{Total Current Assets} - \text{Total Current Liabilities}$$

In the short term it is possible for an entity to have **negative working capital**. An entity can have negative working capital if it maintains minimal accounts receivable and inventory while receiving terms from its suppliers that allow it to delay payment of its accounts payable. An entity that sells its product for cash and produces only to fulfill orders after they have been received will have very little in accounts receivable and inventory.

Exam Tip: Working capital and **net working capital** are two terms that can be used interchangeably. Net working capital can be referred to as working capital, and working capital can be referred to as net working capital.

The term "working capital" may be used to refer either to current assets or to current assets minus current liabilities. Thus some interpretation may be necessary if you see the term "working capital" in an exam question.

Liquidity Ratios

Several ratios are used to evaluate a company's liquidity and the level of its net working capital. We will look at each of these ratios in turn. The liquidity ratios are:

- Current Ratio
- Quick Ratio or Acid Test Ratio
- Cash Ratio
- Cash Flow Ratio
- Net Working Capital Ratio

Current Ratio

The current ratio is the most commonly used measure of short-term liquidity, as it relates current assets to the claims of short-term creditors. Whereas net working capital expresses this relationship as an amount of currency, the current ratio expresses the relationship as a ratio.

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

Generally, a firm's current ratio should be proportional to its operating cycle. The shorter the operating cycle is, the lower the current ratio can be because the operating cycle will generate cash more quickly for a firm with a shorter operating cycle than it will for a firm with a longer operating cycle. The cash generated can be used to settle the liabilities.

The effective management of working capital requires that working capital be kept as low as possible while at the same time being balanced against the risk of illiquidity (the inability to satisfy current liabilities with current assets). Companies with an aggressive financing policy that are willing to assume more risk of

illiquidity will have lower current ratios, while companies with conservative financing policies will have higher current ratios. The less risk the company's management wants to assume, the higher its level of working capital must be.

The standard for the current ratio is 2:1. A lower ratio indicates a possible liquidity problem.

The **quality** of the accounts receivable and merchandise inventory should be considered when assessing a company's current ratio. If the inventory and receivables can be quickly converted to cash, then a lower level of working capital and thus a lower current ratio can be maintained. However, if the receivables and inventory cannot be easily converted to cash, higher levels of working capital are necessary.

The length of time required for accounts receivable and inventory to be converted to cash is measured by the receivables turnover and inventory turnover ratios, both of which are covered later in this topic. A low receivables turnover and a low inventory turnover indicate the need for a higher level of cash and cash equivalents.

In interpreting a company's current ratio, it is important to be aware of its limitations. The current ratio is actually only an indication of what would happen if cash flows were to stop completely and today's current assets had to be liquidated to pay off today's current liabilities. This is seldom the question an analyst wants answered. To answer the questions that an analyst needs answers to, cash flow projections are required. However, the current ratio continues to be used because it is simple and understandable and the information needed to calculate it is readily available.

Quick or Acid Test Ratio

The quick ratio, also called the acid test ratio, is a more conservative version of the current ratio. The quick ratio measures the firm's ability to pay its short-term debts using its most liquid assets.

$$\text{Quick Ratio (or Acid Test Ratio)} = \frac{\text{Cash + Marketable Securities + Net Accounts Receivable}}{\text{Current Liabilities}}$$

Cash equivalents are, of course, included in the numerator of the ratio. Cash equivalents are considered a part of "cash" for this purpose. Cash equivalents are very liquid, short-term debt instruments with a maturity date of less than 90 days when they were acquired that are easily converted into known amounts of cash without significant loss in value. Cash equivalents are the short-term investments a company makes in order to earn a return on excess cash for short periods until the cash is needed for operations.

Inventory is **not** included in the numerator of the quick ratio, because the company will need to replace sold inventory, and that requires cash. If a company uses its inventory to pay its liabilities without replacing it, the company will have no means of generating future cash flows. For that reason, inventory should not be liquidated to pay off short-term liabilities. Furthermore, inventory is not as liquid an asset as, for instance, accounts receivable.

Note also that prepaid expenses are also **not** included in the numerator of the quick ratio. Prepaid expenses are not current assets that can be liquidated to pay current liabilities, so they should not be included.

Accounts receivable **is** included in the numerator, for two reasons:

- Receivables are only one step away from conversion to cash in contrast to inventory, which is two steps away.
- A company can almost always collect its receivables immediately by factoring them.

The standard for the quick ratio is 1:1.

Cash Ratio

The cash ratio is another version of the current ratio. The cash ratio is even more conservative than the quick ratio. The cash ratio is the ratio between cash and current liabilities. Cash equivalents and marketable securities are included in the numerator along with cash for purposes of calculating the cash ratio.

$$\text{Cash Ratio} = \frac{\text{Cash \& Cash Equivalents + Marketable Securities}}{\text{Current Liabilities}}$$

Marketable securities may be classified on the balance sheet as trading, available-for-sale, or held-to-maturity securities, depending upon management's intentions. Most marketable securities are convertible to cash quickly regardless of any maturity date they may have, because they are traded on secondary markets. However, unlike cash equivalents, the market value of marketable securities can change and the holder can have a loss or a gain on their liquidation.

Cash Flow Ratio

The cash flow ratio compares the cash flow generated by operations with current liabilities and measures how many times greater the cash flow generated by operations is than current liabilities. If a company has positive working capital but it is not generating enough cash from operations to settle its obligations as they become due, the company is probably borrowing to settle current liabilities. Over the long term, borrowing to fulfill current liabilities will lead to solvency problems, because there is a limit to how much financing a company can obtain. Therefore, it is much better if the company is able to generate adequate cash flow from its operations to settle its current liabilities.

$$\text{Cash Flow Ratio} = \frac{\text{Operating Cash Flow}}{\text{Period-End Current Liabilities}}$$

Operating cash flow is cash flows from operations reported on the statement of cash flows.

The period-end balance for current liabilities is used instead of the average balance for current liabilities because use of the period-end balance is more conservative. The cash flow ratio is an indicator of the company's ability to pay future obligations as they come due. Future cash flow will be required to pay off current liabilities that are outstanding **as of the balance sheet date**, not the average of current liabilities over a past period. An average balance incorporates past balances, and therefore in this ratio, use of the period-end balance for current liabilities is preferred because it is more conservative.

An annualized cash flow ratio of 0.40 or higher is a standard for a healthy company. "Annualized" means that if the cash flow from operations figure is for a period of less than a year, it should be annualized by multiplying it by whatever is necessary to express it in terms of annual cash flow before dividing it by current liabilities. For example, if cash flow from operations is for a period of one quarter, it is multiplied by 4 to annualize it. If it is for a one-month period, it is multiplied by 12.

Net Working Capital Ratio

Net working capital is current assets minus current liabilities. The **net working capital ratio** compares net liquid assets (net working capital) to total capitalization (total assets). The net working capital ratio measures the firm's ability to meet its obligations and expand by maintaining sufficient working capital.

$$\text{Net Working Capital Ratio} = \frac{\text{Net Working Capital}}{\text{Total Assets}} = \frac{\text{(Current Assets - Current Liabilities)}}{\text{Total Assets}}$$

The net working capital ratio is particularly meaningful when compared with the same ratio in previous years, especially if it is decreasing. Consistent operating losses will cause net working capital to shrink relative to total assets. Net liquid assets shrinking over time relative to total assets indicates possible future business failure.

If working capital is negative (current liabilities are greater than current assets), the net working capital ratio will also be negative. Negative working capital and a negative net working capital ratio can be indicators of very serious problems. However, as mentioned previously, it is possible for an entity to have negative working capital if it sells its product for cash and produces only to fulfill orders after they have been received and therefore has very little in accounts receivable and inventory, while receiving terms from its suppliers that allow it to delay payment of its accounts payable.

Thus the interpretation of this ratio, as with all ratios, is dependent upon the company's specific situation.

Managing Working Capital

Working capital management concerns the optimal level, mix and use of current assets and current liabilities used in day-to-day operations. The objective of working capital management is to minimize the cost of maintaining sufficient liquidity (access to cash) while at the same time guarding against the possibility of financial insolvency (lack of money and inability to pay liabilities as they become due), by having enough current assets on hand.

Working capital management is a process of balancing different goals by management.

- On one hand, every company must be certain that it has enough cash to be able to pay its liabilities as they come due. While not being able to pay liabilities as they come due (occasionally paying late, for example) does not, by itself, force a company into bankruptcy, it does place the company in a position of technical insolvency. If technical insolvency is not remedied, a repeated pattern of not paying liabilities as they come due may lead to bankruptcy proceedings being started against the company. At the very least, a pattern of late paying will cause the company to lose its credit privileges with its vendors and it will be forced to pay cash in advance.
- On the other hand, the short-term assets (cash, inventory, receivables) that the company holds provide very little, if any, return.

Therefore, the more short-term assets held by the company, the lower is the chance of insolvency, but the lower also is the return that is earned on company assets.

Types of Working Capital

Because a company may have different cash needs throughout the year, the company may maintain different levels of working capital at different times of the year. The minimum amount of working capital that is maintained at all times to support the firm's day-to-day sales and activities is called **permanent working capital**, and the increases that occur from time to time are called **temporary working capital**.

For example, the company will build up inventory in advance of its big selling season, and during and following the selling season, accounts receivable will increase until the customers pay their balances. After the selling season is over and the additional accounts receivable have been collected, the balances of current assets will revert to their permanent levels.

Levels of Working Capital

Management's decisions with respect to the company's level of working capital constitute a risk-return trade-off.

- A company that adopts a **conservative working capital policy** seeks to minimize liquidity risk by increasing the amount of working capital that it holds. As a result, the company gives up the potentially higher returns available from using the additional working capital to acquire long-term assets, but it is in a safer position with respect to liquidity and possible insolvency because of the greater amount of working capital.
- An **aggressive working capital policy** reduces the amount of working capital and the current ratio (calculated as current assets ÷ current liabilities). A company pursuing an aggressive working capital policy accepts a higher risk of short-term cash flow problems in exchange for a greater return on investment. A company with an aggressive policy will have a very low (or possibly even negative) level of working capital but will also have a higher amount of return on its assets.

Changes to Working Capital

A company may **increase** its net working capital by either:

- increasing current assets or
- decreasing current liabilities.

Conversely, a company may **decrease** its net working capital by either:

- decreasing current assets or
- increasing current liabilities.

Effect of Different Transactions on Working Capital

Transactions in which one current asset is exchanged for another current asset have **no effect** on net working capital. The collection of an account receivable is an example of this type of transaction, because it simply increases one current asset (cash) and decreases another current asset (the receivable) by the same amount.

A transaction in which both current assets and current liabilities are increased (or decreased) by the same amount is another type of transaction that does not affect net working capital. For example, if a company purchases inventory on short-term credit, the current assets of the company will increase, but so will current liabilities. Similarly, the payment of the payable will not have an effect on working capital because both a current asset (cash) and a current liability (payables) are reduced by equal amounts.

However, whenever current assets and current liabilities are both increased or decreased, the working capital **ratios** (for example, the current ratio and the quick ratio) **will** change even though net working capital does not change.

The main transaction that causes an increase in the level of working capital is the sale of inventory. Because the inventory is sold for more than its cost to purchase, the receivable that is created (or the cash received) for its sale is greater than the carrying value of the inventory and the amount by which inventory decreases.

Only transactions that change the relationship between current assets and current liabilities will change net working capital.

Short-Term Financial Forecasts in the Management of Working Capital

It is very important to do cash forecasting frequently in order to plan the company's liquidity position.

- The company needs to know in advance what its short-term cash needs will be so it can be certain to have the cash it needs when it is needed.
 - To be certain of having the needed cash, a company usually arranges a line of credit with a commercial bank or commercial finance company that can be drawn upon for short-term needs.
 - A company can also time its cash flows by increasing the effectiveness of credit and collection activities or by the use of cash management banking services that can speed up collections or slow down disbursements.
- Alternatively, if the company anticipates having excess cash, it should be prepared to invest the excess cash. If excess cash is not invested, it incurs an opportunity cost—loss of interest that could be earned on the excess cash.

Components of Working Capital

Having looked at working capital in general, we will now turn our attention to looking at the current asset components of working capital and the issues related to the management of these items. The management of the current asset components of working capital is critical because we must balance the need for liquidity with the desire for earning a return on our assets.

The main classifications of assets included in current assets are:

- Cash and Cash Equivalents.
- Marketable Securities.
- Accounts receivable.
- Inventory.

Note: Prepaid expenses are also classified as current assets. A prepaid expense is money the company has paid for something it has not yet received. Prepaid expenses are not covered here in specific detail because prepaids cannot be liquidated to pay current liabilities. However, you should be familiar with the fact that prepaid expenses are current assets.

Cash Management

Cash management is one of a company's most critical processes. If the company does not have enough cash at any one point in time a company will face, at worst, bankruptcy (if this situation continues for a long period of time) or at least high interest charges to obtain the necessary cash from a bank on short notice. Therefore, a company needs to manage its cash from both a short-term and a long-term perspective. In the short-term the company must have enough cash to pay its obligations as they come due, and in the long-term, the company must have enough cash to grow and expand as needed.

In this topic, we are focusing largely on the short-term issues. The amount of cash that a company will hold at any one point in time is influenced by a number of factors. Among the factors that influence how much cash is held are:

- **how much** cash will be needed in the near future.
- the **amount of risk** a company is willing to take in respect to solvency.
- the level of **other short-term assets** that a company holds.
- the available return on other short-term investments.
- at **what point in its business cycle** the company is (if a business is a seasonal business it will have more cash at the peak periods than at the slow periods).

The amount of return available on other investments is an important part of the decision of how much cash should be held. If the interest rates available on other investments are very low, the opportunity cost of holding cash is reduced. However, when interest rates are higher, the cost of holding the cash rather than other investments is increased. As a result a company may be willing to accept more solvency risk by holding less cash in return for more interest received.

Note: Prior to 2011, Regulation Q prohibited banks in the US from paying interest on business checking accounts. In lieu of paying interest, many commercial banks gave their business customers credit toward other bank fees based on the average balances in their checking accounts. Effective in 2011, the Dodd-Frank Act repealed Regulation Q, giving banks the ability to pay interest on business checking accounts. If their banks give their business customers a choice, business firms now have the choice between continuing to receive no interest on their business checking and using their unused cash balances to cover their bank fees or receiving interest and paying the bank fees.

Reasons for Holding Cash

The reasons that a company holds cash are many and varied. However, we can break the reasons for holding cash into the following categories:

- As a **medium of exchange**. Cash is still needed for some business transactions.
- As a **precautionary measure**. Cash or other very liquid investments may be held for use in unforeseen situations where cash is needed quickly.
- For **speculation**. Cash may be held in order to be able to act quickly on good investment opportunities that arise such as an acquisition of another company or something simpler like the purchase of inventory at a deeply discounted price.
- Cash may also be held as a **compensating balance** when a bank requires that a company maintain a minimum balance in its bank account while a loan is outstanding.

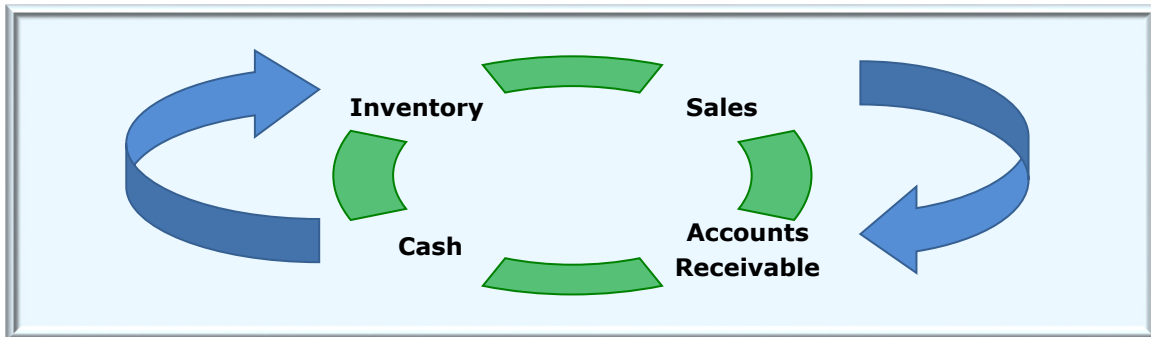
Note: John Maynard Keynes, the famous economist, identified the first three reasons listed above. The fourth was not identified by Keynes but is a reason for holding cash.

The Operating Cycle

The **operating cycle** is the average number of days inventory is held before it is sold plus the average number of days accounts receivable are held before collection. It represents the average total number of days the firm has funds invested in working capital.

The **cash conversion cycle** (also called **cash flow cycle**) is the operating cycle minus the average age of accounts payable. The cash conversion cycle represents the average number of days from the time the firm pays for the inventory until it receives cash from the sale of the inventory. The cash conversion cycle is one way of evaluating a company's cash management. Shortening the cash conversion cycle without affecting sales can add to the firm's profitability.

A company wants to do what it can to decrease its cash conversion cycle. The cash conversion cycle can be decreased either by collecting receivables faster or by delaying payment of payables. We will look at the different ways of doing both of these.



Note: The goals of cash management are to:

- 1) Accelerate collections.
- 2) Slow down payments.

Calculating the Operating Cycle and the Cash Conversion Cycle

The operating cycle and the cash conversion cycle are calculated using activity ratios for accounts receivable, inventory, and accounts payable:

- Days' sales in receivables,
- Days' sales in inventory, and
- Days' purchases in accounts payable.

The operating cycle is the number of days of sales in accounts receivable plus the number of days of sales in inventory.

$$\text{Operating Cycle} = \text{Days' Sales in Accounts Receivable} + \text{Days' Sales in Inventory}$$

The cash cycle, or cash conversion cycle, is the operating cycle minus the number of days of purchases in accounts payable.

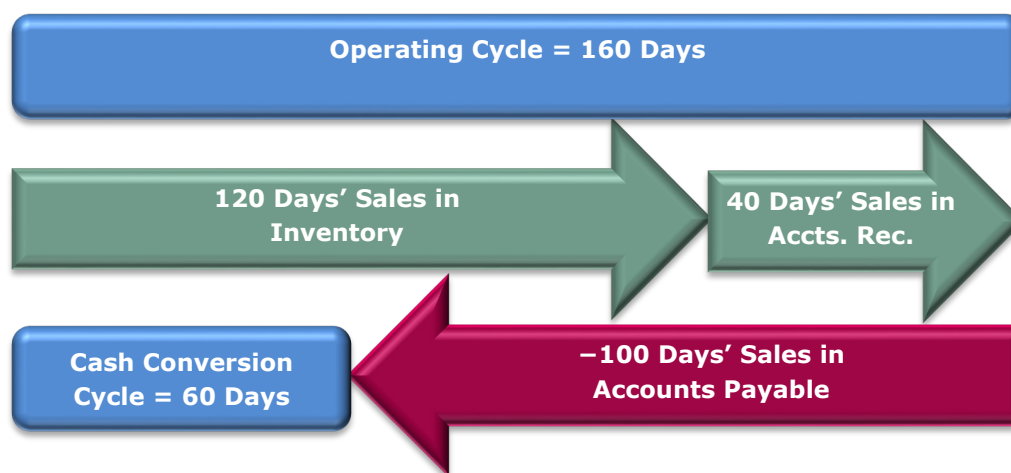
$$\text{Cash Cycle} = \text{Operating Cycle} - \text{Days' Purchases in Accounts Payable}$$

Example of calculation of the operating cycle and the cash conversion cycle:

Assume that a company has an average age of inventory of 120 days, an average age of accounts payable of 100 days and an average age of accounts receivable of 40 days.

The **operating cycle** is the number of days' sales in accounts receivable plus the number of days' sales in inventory. In this example, the operating cycle is $40 + 120 = 160$ days.

The number of days in the **cash conversion cycle** is calculated as follows: Inventory is held for an average of 120 days prior to sale, but the average age of accounts payable is 100 days. Therefore, the average time between the cash outlay for inventory and the sale of the inventory is 20 days (120 days minus 100 days). Receivables are collected an average of 40 days after the sale. Thus, the length of the cash conversion cycle is 60 days (20 days plus 40 days). The cash conversion cycle can also be calculated as 120 plus 40 minus 100, which equals 60 days, or simply the operating cycle of 160 days minus the number of days of purchases in accounts payable of 100 days, which also equals 60 days.

**Cash Flow Management**

Now that we have looked at why a company holds cash and how much cash the company should hold, we will turn our attention to the two key day-to-day issues in respect to cash management—how to collect the cash as quickly as possible, and how to delay the payment of cash as long as possible. You need to be familiar with these different terms and what they do in the process of either speeding collections or slowing payments.

Cash Inflow Management

The time between when one party mails a payment and the other party has the funds available for use is called **float**. Total float has three components—mail float, processing float and clearing float. Any action that reduces float frees funds for the company to use, thereby increasing profitability. The amount of funds that have been freed is the firm's average daily collections times the number of days that float is reduced.

A company should always endeavor to receive its cash payments as soon as possible in order to maximize its cash management position. The following measures can help to expedite cash inflows and minimize collection float (the collection of receivables):

- **Invoices should be mailed as soon as possible** under the terms of the sales agreement so that they can be paid as soon as they are due.
- The payment terms for credit should be such that they **encourage prompt payment**. Giving a discount if the invoice is paid before the due date may achieve this.

- **Electronic data interchange (EDI)** is the process of computers from two different companies communicating directly for common transactions. This electronic communication usually takes place between a supplier and purchaser.
- **Electronic funds transfer (EFT)** is a form of EDI and it has recently grown very quickly. EFT involves payment made by bank transfer from one company's checking account to another company's checking account. Electronic funds transfer is particularly useful when the buyer and seller are not geographically close to each other and mailed payments would require several days to be received. With EFT, the payer can more accurately control the timing of the funds being debited from their account. Electronic funds transfer takes place through **automated clearinghouses (ACHs)**. Automated clearinghouses are electronic networks that process financial transactions. The Federal Reserve Banks collectively operate an ACH that processes the majority of the automated financial transactions in the US.
- **Credit cards** (Visa, MasterCard and American Express, for example) can be used as an alternative method of speeding up collection rates. The merchant pays a fee equal to 1%-3% of the credit card sale. Through the credit card interchange system, the merchant's credit card processor pays less than the charged amount to the merchant, and the bank that issued the card used pays a little more to the credit card processor than the card processor paid to the merchant but still less than the charged amount. When the buyer pays the full amount of the charge to the bank that issued the card, the issuing bank receives its fee, the difference between the full amount of the charge and the amount the issuing bank paid to the card processor. The advantage to the merchant is that the funds are immediately available. The responsibility for collection has been transferred to the credit card issuing bank in exchange for the fee the issuing bank receives.
- **Wire transfers** may be used as a means of collection from customer.
- A **lockbox system** can be utilized. With a lockbox system, a company maintains special post office boxes, called lockboxes, in different locations around the country. Invoices sent to customers contain the address of the lockbox nearest to each customer as that customer's remittance address, so customers send their payments to the closest lockbox. The company then authorizes local banks to check these post office boxes as often as is reasonable, given the number of receipts expected. Because the banks are making the collections, the funds that have been received are immediately deposited into the company's accounts without first having to be processed by the company's accounting system, thereby speeding up cash collection.
 - The company receives reports from the bank(s) and copies of the items received so it can post the receipts to the correct customer accounts.
 - For a company to benefit from a lockbox system, the interest earned from the additional day(s) on the cash received (because the bank collected it directly and deposited it immediately)—or the interest cost avoided on borrowings—must be greater than the cost of the bank's fees for providing the lockbox service.
 - The benefit from a lockbox system is calculated using the following steps:
 - Calculate the amount of cash that is collected per day.
 - Multiply the cash collected per day by the number of days the collection float will be reduced to calculate the one-time increase in its cash balance the company will receive from using the lockbox.
 - Multiply the increase in the cash balance by the interest rate at which the company can invest the additional funds. This is the benefit that the company will receive each year from the increased cash.
 - The final step is to compare the amount of the annual benefit to the company to the annual cost of the lockbox system. If the benefit is greater than the cost, the company should invest in the lockbox system.

- Having several lockbox locations reduces the time a payment is in the postal system and also reduces the time from receipt to deposit in the company's checking account. Lockbox service is often used along with **concentration banking**.
- **Concentration banking** is a system in which a company uses one or more major **concentration banks** along with many different regional bank accounts that are near its various collection points. The money deposited to the regional accounts is transferred regularly to the concentration bank or banks from the regional banks. Concentration banking may be used either along with a lockbox arrangement or when regional offices process the receipts and deposit them to their local banks. When used with a lockbox arrangement, each local bank that is collecting and depositing receipts for the company transmits the deposit amount information to a central location throughout the day. At a specified cut-off time, the deposit information from all of the local banks is transmitted to the concentration bank. The concentration bank electronically moves the funds from the local banks into the concentration account. The company has faster use of its cash for investments, debt reduction or working capital uses.
- Lockboxes and concentration banking are fairly expensive services. They can benefit a company with widespread operations only if the company's receipts are great enough to make the benefit from speeding up collections greater than the cost of the services.

Example: JJF Wholesale has an average collection delay of 8 days from the time a customer mails a check to the time the funds become collected funds that it can draw on. Management has concluded that by using a lockbox system it will be able to reduce collection time to 5 days. The cost of this lockbox system is expected to be \$32,000 per year to operate.

The following information is known:

Annual bank interest	3%
Average number of daily payments to lockbox	1,000
Average size of payments	\$400

The company needs to determine whether the lockbox system is a worthwhile investment. It will need to calculate the benefits that will be received and compare them to the cost of the new system. The calculation of the benefits is as follows and decision-making process is:

- 1) The average daily collections are \$400,000 (1,000 checks per day × \$400 average amount per payment).
- 2) If the new system is adopted, the collection period will be reduced by three days. This three-day reduction in the collection float will lead to an increase in the average cash balance of \$1,200,000.
- 3) The company will be able to invest that \$1,200,000 and earn an annual return of 3%, or \$36,000 over the course of a year ($\$1,200,000 \times 0.03$).
- 4) Given that the benefit of the lockbox system is \$36,000 per year and the cost of the lockbox system is \$32,000, the company should make the investment and adopt the lockbox system.

Note that the above decision to implement the lockbox system is based strictly on the financial impact of the system. In addition to financial considerations, the company needs to consider whether or not the system will operate smoothly and efficiently from the beginning. Any problems in implementation (such as inaccurate or incomplete information from the lockbox processor resulting in customer payments not being applied to their accounts in a timely manner) may cause customer ill will and/or cause the company to incur additional costs to correct the problems. Given that the cost is fairly close to the benefit, if the daily cash receipts decrease, if the interest rate earned decreases, or if the cost of the lockbox system increases, the lockbox might cease to be beneficial. So if the lockbox is adopted, the company needs to regularly monitor the results to make sure it continues to be profitable.

Disbursements, or Cash Outflow Management

There are two types of floats, depending on whether the company is making payment or receiving payment by check. The company paying has what is called the disbursement float and the company receiving the money has what is called the collections float. Obviously, a company wants to maximize its disbursement float and minimize its collections float.

Disbursement float is funds the company has spent but that have not yet been taken out of the company's bank account. Disbursement float occurs when a company writes a check. The check may be mailed, and when the payee receives it, the payee deposits it in its bank. After the check is deposited in the payee's bank, it usually takes a day before the money is deducted from the company's account, because the check needs to go through the clearing system. So disbursement float consists of mail float (time for the check to be delivered through the mail), operational float (time for the payee to record the payment and deposit it in their own bank) and clearing float (time for the check to clear). The disbursement float may be thought of as the difference between what is in the company's bank account according to the company's books and what the bank shows to be in the account. The difference arises as the result of uncleared checks.

As opposed to cash inflows, a company should slow its cash disbursements in order to increase the amount of time it has the cash in its account. The effect of this delay is an **interest free loan** for the time that the check has been paid, but not yet deducted from his cash account.

However, maximizing disbursement float is not as easy as it was just a few years ago. Banks have speeded up their check collection process to a great extent in recent years, and this opportunity is virtually gone.

Payments should be made as **close to deadline** requirements as possible. However, it is important to remember that if a company misses the payment date it may incur interest charges or lose the chance to purchase from that supplier again. Scheduling the payments to be made just before the deadline by means of electronic funds transfer permits close control over the payment date, because there is no need to rely on mail service to deliver the payment in time.

Some banks offer **zero balance checking accounts**, although a fee is charged for this service. A company might need to maintain several checking accounts at the same bank for different purposes, such as a payroll account and a general disbursements account. In a zero-balance account system, these individual account balances are maintained at zero until checks are received by the bank for payments from the accounts. The resulting "overdrafts" are automatically "covered" by the bank by transferring money from a centralized concentration account that the company holds. **A zero balance account does not do anything to slow cash outflows, but it is a technique that permits a company to carry lower cash balances.** More money can be freed up for short-term investment in accounts that pay a return because excess balances in multiple disbursement accounts are not needed. Anything that helps a company to keep its checking account balances as low as possible will help its cash management and its net income, as long as the return the company can earn on the funds invested as a result is greater than the bank's fees for the service.

Overdrafts are a method of slowing payments by writing checks for amounts greater than the amount on deposit in the checking account. The company will have a negative balance at the bank and as a result will need to pay various penalties and/or high interest on this amount. Because of the penalties and interest as well as the ill will generated with the bank, this should not be a common method used by a company to slow its payments. In fact, if a company regularly overdraws its account, the bank will not honor the checks for which the company has nonsufficient funds and may even close the account. However, there are some services offered by banks that have the effect of offering "overdraft" privileges at an agreed-upon interest charge.

Controlled Disbursement Account – A controlled disbursement account is a special type of account where the bank provides the company with information every morning about what checks will be clearing against the company's account in that day's banking business. The service permits accurate forecasting of daily cash needs. The company can then make full use of any cash that is not needed to cover the day's disbursements by investing it or using it to pay down debt or to meet other obligations. This technique is used by companies that need to make full use of their surplus cash while at the same time funding their disbursements. The fees

for controlled disbursement service can be quite high, so the service would be used only by large companies with a lot of cash to manage because it would not be profitable for others. **This is another banking service that does not actually slow cash outflows but instead makes it possible for the company to carry lower cash balances** and invest more excess funds in short-term investments that earn a return.

If the bank calculates compensating balances on an average daily basis rather than requiring a minimum balance to be carried at all times, the company can manage its cash more effectively, as it doesn't always need to keep a minimum balance in the bank as long as the average cash balance is at least the required amount.

Exception to the Rule of Slowing Disbursements

When a company has an opportunity to pay within a discount period and pay less, it should generally pay within the discount period and take the discount. Payment should be made within the cash discount period if taking the discount results in a lower cost of funds than not taking the discount.

The cost of **not** taking the cash discount that is offered for early payment is calculated as follows:

$$\frac{360}{\text{Total Period for Payment} - \text{Period of Discounted Payment}} \times \frac{\text{Discount \%}}{100\% - \text{Discount \%}}$$

The cost of not taking the discount arises because the company has two options: (1) it can pay the money early and take the discount and pay less money, or (2) it can wait until the full amount is due and pay it then but pay more money (the full amount due). The difference between the amount paid early and the amount paid later can be considered to be interest expense "charged" for paying later. The above formula **approximates** the annualized interest rate for the interest expense charged because of paying later.

If the cost of not taking the discount is higher than the company's cost of capital, the company should take the cash discount and pay within the discount period. The cost of not taking the discount is generally greater than the company's cost of capital, so making the payments within the cash discount period is advantageous.

Example: Organics, Inc. receives an invoice from a supplier with terms of 3/10, net 30. The terms mean if Organics pays within 10 days, it will receive a 3% discount but if payment is not made within 10 days, then the entire amount is due in 30 days. (These numbers may be different with different vendors, but their meanings and their use in this formula is unchanged.)

The cost of not taking the discount is calculated as follows:

$$[360 / (30 - 10)] \times [0.03 / (1.00 - 0.03)] = 18 \times 0.0309 = \underline{\underline{55.62\%}}$$

The annualized cost to Organics of not taking this vendor's discount, expressed as an annual interest rate, is 55.62%.

Let us illustrate this cost by looking further at the two options that the company has. Let us assume that the amount of the invoice is \$100 and the company has \$200 in its bank account when the invoice is received (April 1). The company can earn interest on its unused cash balances at the rate of 3% per annum. The two options the company has are to pay on April 10 or April 30.

The company pays on April 10:

If Organics pays on April 10, they will pay \$97 on April 10, leaving \$103 in the bank. Therefore, they will earn interest on \$200 for 10 days, then interest on \$103 for 20 days and still have \$103 in the bank in cash not counting the interest earned. Under this scenario, the company will have \$103.34 in the bank at the end of the month (using a 360-day year to annualize the interest amounts):

Interest on \$200 for 10 days ($\$200 \times 0.03 \div 360 \times 10$)	\$ 0.17
Interest on \$103 for 20 days ($\$103 \times 0.03 \div 360 \times 20$)	0.17
The \$103 in cash	<u>103.00</u>
Total	<u>\$103.34</u>

The company pays on April 30:

If they pay on April 30, they will pay \$100 on April 30. Therefore, they will earn interest on \$200 for 30 days. Under this scenario, the company will have \$100.50 in the bank at the end of the month:

Interest on \$200 for 30 days ($\$200 \times 0.03 \div 360 \times 30$)	\$ 0.50
The \$100 in cash	<u>100.00</u>
Total	<u>\$100.50</u>

If Organics pays on April 10, they will have more money in the bank at the end of the month than they would if they paid on April 30. Therefore, Organics should take the discount.

At an interest rate of 55.62% earned:

By making these same calculations using 55.62% as the interest rate earned on cash, we can see that 55.62% is the interest rate at which Organics would be indifferent between paying early and taking the discount or waiting to pay until the due date, because the total amount in the bank at the end of the month will be the same—\$109.27—whether the company pays on April 10 or on April 30:

The company pays on April 10:

Interest on \$200 for 10 days ($\$200 \times 0.5562 \div 360 \times 10$)	\$ 3.09
Interest on \$103 for 20 days ($\$103 \times 0.5562 \div 360 \times 20$)	3.18
The \$103 in cash	<u>103.00</u>
Total	<u>\$109.27</u>

The company pays on April 30:

If the company could earn 55.62% interest on its cash for 30 days, and if they paid on April 30, the two choices would be equal.

Interest on \$200 for 30 days ($\$200 \times 0.5562 \div 360 \times 30$)	\$ 9.27
The \$100 in cash	<u>100.00</u>
Total	<u>\$109.27</u>

If the company can earn any interest rate up to 55.62% on its cash, the company should pay early and take the discount. At an interest rate of 55.62%, the company is indifferent. If the company is able to earn more than 55.62% interest (which is highly doubtful), the company should pay on April 30.

Usually taking the discount and paying early will be more beneficial to the company than waiting and paying the full amount.

Marketable Securities Management

Marketable securities are securities that can be easily converted into cash. They are securities that have highly liquid secondary markets on which they can be quickly bought and sold at a reasonable price.

Most companies try to avoid holding large cash balances and prefer to borrow to meet any extraordinary short-term cash needs. However, while they do not want to hold large amounts of cash, they also do not want to invest all of their cash in long-term assets. Companies often choose to keep excess cash in the form of marketable securities. Holding cash usually does not provide any return on the cash that is held, whereas marketable securities provide some return while maintaining liquidity and the ability to be quickly converted to cash.

Because short-term investments or marketable securities are temporary, they may be purchased so that the maturity periods of the securities will match a time period of low cash balances or higher than usual cash needs. These securities may be used to synchronize the cash inflows and the cash outflows of the business. The purpose of a marketable securities portfolio is to provide a store of liquidity. The return earned on the portfolio is a secondary objective. Marketable securities should be able to be converted into cash quickly (usually in less than 24 hours) and the risk of change in value should be very low, meaning that they can be sold without a large discount.

A firm should choose its investments with a view of the **financial (repayment) risks** involved with each security. Repayment risk is the risk that any receipt of money due the future may not be received for one reason or another. Investments with a higher risk of default will generally offer a higher rate of return as compensation for the increased risk the investor accepts. Cash that is needed to pay operating costs **should not be risked in order to earn a higher rate of return**. The higher return should usually be sacrificed in exchange for greater safety (less chance of default).

Interest rate risk is the risk of a change in value of a fixed income security that occurs as a result of a change in market interest rates. Since short-term securities have a shorter investment horizon, their prices are less affected by changes in interest rates. Therefore short-term securities have lower interest rate risk than long-term securities. In order to minimize interest rate risk, marketable securities should be investments with very short-term maturities.

Liquidity is a function of how quickly an asset can be converted into cash and how safe the investment is from loss of value. Since marketable securities must be liquid so they can easily and quickly be converted into cash without a loss in value, only high quality, short-term debt instruments typically qualify as marketable securities.

The **tax position** of a firm is also a consideration in managing marketable securities. If a company has any loss carryforwards available from previous periods (losses that could not be deducted on previous tax returns), the company may be more willing to take on higher-return investments, because there is no tax effect on them. However, a company that is paying taxes on any returns may choose lower return investments and be content with the reduced risk on them.

Some securities issued by cities, states or other local governments are tax-exempt. The interest earned on tax-exempt securities is exempt from taxation by federal, state and/or other local authorities. These are frequently called "municipal bonds" even though they may not have been issued by a municipality (city). Because of the tax-exempt status of the interest, the interest rate paid on a tax-exempt security is lower than that paid on a corporate bond. The higher the tax bracket of the investor, the more attractive the tax-free alternative becomes. However, municipal bonds will generally have longer maturities and for that reason are usually not suitable for investment of funds needed for operations.

Example: If an investor is in the 30% tax bracket, a taxable corporate bond with a 10% stated coupon payment will actually return less than a tax-free municipal bond paying 7.5% because after deducting taxes, the corporate bond investor will actually have only a 7% return on investment. Municipal bond yields vary according to local economic factors, the ability of the issuing city to repay, and the security's quality rating assigned by the bond rating agencies.

Mutual funds that invest exclusively in tax-exempt securities confer the same tax advantages on their shareholders. However, while a tax-exempt fund's dividends are entirely tax-exempt on a shareholder's federal tax return, they would be free from state income tax only in proportion to the amount of interest income derived from the taxpayer's home state.

Because of the variety of factors that go into the decisions related to marketable securities, a company should have an **investment policy statement**. An investment policy statement provides guidance to the individuals who need to make investment decisions and ensures that the investments made by the company are in line with its policies.

The following investments are often used to meet a company's short-term investment needs:

- **Treasury bills** (also called T-bills) are short-term US government debt securities. Treasury bills are sold in multiples of \$100 and in terms ranging from a few days to 52 weeks. They are guaranteed by the full faith and credit of the US government. The income from T-bills is exempt from state and local taxes, but not from federal taxation. T-bills differ from obligations of federal agencies, which are guaranteed only by the agency that is issuing the bill, and not the US government.

Treasury bills do not have any stated interest rate, and they do not pay interest. T-bills are sold at a discount, which means the buyer pays less than the face value. The price of a T-bill is competitively

determined at auction. On the bill's maturity date, it is redeemed by the US government at par (face value). The difference between the amount paid and the face value is the interest and also the discount. The owner of a Treasury bill may hold it until its maturity date or sell it in the secondary market. The **calculation of the amount of the interest, or the discount** is:

$$\begin{aligned} & \text{Face value of the T-bill} \\ - & \text{Price of the T-bill (discounted basis) as determined at auction or on the secondary market} \\ = & \text{Interest earned by the T-bill while it is outstanding (amount of discount)} \end{aligned}$$

To calculate the T-bill effective interest rate, use the following formula:

$$\frac{\text{Interest earned by the T-bill while it is outstanding}}{\text{Discounted Basis}} \times \frac{360}{\text{Days to Maturity}}$$

Because of the fact that T-bills are so liquid (there is a ready market for T-bills) and so safe (being backed by the US government), they are used by some companies as a replacement for cash.

Example: Let us assume a 90-day T-bill with a face value of \$1000. The bill is sold at a discount for \$980. During the 90 days that the T-bill is outstanding, it will earn \$20 in interest. After 90 days the buyer will receive \$1,000. The effective annual percentage rate as follows: $(\$20 / \$980) \times (360 / 90) = 8.16\%$.

- **Certificates of deposits (CDs)** are a form of savings deposit with a bank that may not be withdrawn before their maturity without a high penalty. CDs usually have a higher rate of interest when compared with other savings instruments because they are for fixed, usually long-term periods (1 year or more). The longer the time to the CD's maturity, the higher the interest rate that is paid. However, the yield on CDs is less than that of commercial paper and banker's acceptances because they are a less risky investment. CDs are usually insured by the FDIC. The FDIC stands for Federal Deposit Insurance Corporation. In the US, the FDIC insures each depositor for up to \$250,000 per insured bank.

A **negotiable CD** is a CD of higher denomination (\$100,000 and over). Negotiable CDs issued by top money center banks are marketable in the national money markets, though negotiable CDs issued by other banks may have a poor secondary market. Negotiable CDs fall under the regulation of the Federal Reserve System and are insured by the FDIC up to the legal limit. Because of the FDIC insurance, the return on a negotiable CD is not as high as the return on commercial paper since the risk for a negotiable CD is lower than that of commercial paper.

- **Money market accounts** in banks operate in a manner similar to checking accounts but they pay higher interest rates, generally in line with money market mutual funds. The number of checks that can be written against the account is usually limited although unlimited transfers can generally be made via ATMs. Balances in the account may be withdrawn at any time without penalty, but in return for this flexibility, the interest rate that is earned is less than on CDs. Money market accounts in banks are insured by the FDIC up to the legal limit, but money market mutual funds are not insured by the FDIC, even if they are sold by a bank.
- **High-grade commercial paper** is marketable short-term, unsecured debt issued by large companies with solid credit histories and high credit ratings. Commercial paper is sold to other large companies and institutional investors. Commercial paper is usually issued in very large denominations (\$100,000 or more) and is **unsecured**, which means that no collateral is protecting the buyers in the case of default by the issuer. Like T-bills, commercial paper is sold at a discount and the face value is paid at maturity. The difference is the interest earned.

Commercial paper does not have an active secondary market, though it is a marketable security. Its secondary market is very small because the term of commercial paper is very short and buyers of commercial paper usually purchase it with a maturity that coincides with when they expect to need their money back from their investment. Therefore, most buyers of commercial paper hold it until it

matures. However, if an investor in commercial paper needs the money from the investment back before the maturity date, the investor can usually liquidate the commercial paper. The commercial paper can be sold back to either the issuer it was purchased from, if it was purchased directly from the company that issued it, or to the dealer it was bought from if bought from a dealer.

High-grade commercial paper may yield a higher return than CDs because of the higher risks involved with the unsecured debt. Maturities for commercial paper are at most 270 days.

Other Types of Marketable Securities

Listed below are various types of other marketable securities that can be used as short-term investments.

- **Banker's Acceptances (BAs)** – Banker's Acceptances are essentially checks written by a bank on itself. Because the bank is writing and guaranteeing the check, the check carries less risk than a corporate or personal check. As a result, many international transactions require a banker's acceptance or similar instrument.
- **Federal Agency Securities** – Agency securities are issued by agencies created for some specific purpose by the US government (not the Treasury), such as the **Federal Home Loan Banks** and other agencies that provide credit to farmers, homebuyers, etc. An example is the **Federal National Mortgage Association (Fannie Mae)**, which issues mortgage-backed securities. Agency securities may be long- or short-term, and they are backed only by the agency, not by the federal government.
- **Eurodollars** – Eurodollars do not have anything to do with the euro (the currency), nor do they have anything to do with European countries specifically. Eurodollars are deposits denominated in US dollars that are deposited in banks located outside of the US. They are called Eurodollars because the Eurodollar market developed in Europe; however, Eurodollars now can be on deposit in any bank in any country outside the US, not only a European bank. The Eurodollar market has expanded because some banks outside the US are not as highly regulated as US banks are, so they can operate with narrower margins than US banks require. Thus, they may be able to pay higher interest rates. Eurodollar deposits are generally in the millions of dollars and mature in less than 6 months. A Eurodollar CD is a certificate of deposit denominated in US dollars that is on deposit in a bank that is located outside of the US.

Eurodollars are useful if a company outside the US has large amounts of transactions that are settled in US dollars. The company is able to eliminate currency transaction costs (costs of converting from one currency to another) and is able to hedge against currency fluctuations.

- **Money Market Mutual Funds** – Money market mutual funds invest in portfolios of short-term securities such as Treasury bills, negotiable CDs, and commercial paper. Because of the large denomination of most money market instruments, they are unavailable to small investors. Money market mutual funds pool investments from many investors, and each investor owns a portion of the mutual fund. Mutual funds allow many more investors access to more of the money market instruments.
- **State and Local Government Securities** – State and local government entities issue short-term securities exempt from federal, state and local taxation.
- **Treasury Notes and Bonds** – Treasury notes and bonds are long-term debt of the US government. When they are purchased close to their maturity date, however, they act essentially as a short-term investment.
- **Repurchase Agreements** – Repurchase agreements are sales of governmental securities by a dealer who also has agreed to repurchase them at a specific time in the future at a specific price. Because of the way that repurchase agreements are structured, they are essentially guaranteed, short-term loans to the dealer who sells and then repurchases the securities. To the investor who purchases them, they are a short-term investment.

Cash and Marketable Security Management Models

The Baumol Model and the Miller-Orr Model are used by companies in an attempt to help solve the problem of how much cash to hold. They are each discussed in more detail below. These two models are presented here instead of in the *Cash Management* topic because marketable securities are a critical element of these two models and they both look at the balance between cash and marketable securities.

Baumol Cash Management Model

The Baumol Model is based on the same equation that we will see in the calculation of the **economic order quantity (EOQ)** for inventory. The Economic Order Quantity is covered in detail in this Section in the *Inventory Management* topic, but by way of brief introduction, EOQ is a calculation of how many units of inventory the company should order each time it orders inventory in order to minimize its costs of ordering and storing the inventory.

In the application of EOQ to cash management, the Baumol Cash Management Model calculates the **optimal cash (OC)** level to receive every time the company converts marketable securities to cash.

The Baumol Cash Management Model is based on the following premises:

- Cash that is not needed in the immediate future by the company is held as marketable securities.
- Thus, to get more cash the company simply needs to convert these marketable securities into cash. However, in order to convert these securities to cash, a fixed fee such as a brokerage fee is paid for each conversion.
- Any time the company holds cash, it gives up the interest that was being earned by the marketable securities.

The Baumol Cash Management Model balances the cost of converting marketable securities into cash with the interest benefit of holding marketable securities. It determines the amount of cash that should be converted from securities each time a conversion is made in order to minimize the costs of conversion and the opportunity cost that is given up by holding cash instead of marketable securities. This opportunity cost is the lost interest the company could be earning on the marketable securities converted to cash.

The formula is as follows:

$$OC = \sqrt{\frac{2bT}{i}}$$

Where:	OC	=	The optimal level of marketable securities to convert to cash
	b	=	Fixed cost per transaction
	T	=	Total demand for cash for the period
	i	=	Interest rate for marketable securities, or the opportunity cost lost by holding cash instead of marketable securities

The Baumol Model makes a number of significant assumptions that we know are not true in the real world, and this limits the effectiveness of the model. These assumptions include:

- the demand for cash is known and constant,
- the costs of converting securities to cash are known and fixed, and
- the opportunity cost is known and constant.

Even though the Baumol Model is not perfect, it is a very good place for a company to start.

Example: HJK Corporation's demand for cash during a year's time is \$500,000. Each time HJK sells securities to raise cash, it pays a brokerage commission of \$10. The interest rate HJK earns on the securities is 4% per year. How much in securities should HJK sell each time it sells securities to minimize its costs of holding the cash instead of the securities and to minimize its brokerage commissions?

$$b = \$10$$

$$T = \$500,000$$

$$i = 0.04$$

$$OC = \sqrt{\frac{2 \times \$10 \times \$500,000}{.04}}$$

$$OC = \sqrt{\frac{\$10,000,000}{.04}} = \sqrt{\$250,000,000} = \$15,811$$

Each time HJK sells securities to raise cash, it should sell \$15,811 worth of securities. Since HJK needs \$500,000 in cash during a year's time, HJK will need to sell securities valued at \$15,811 thirty-two times during the year (\$500,000 divided by \$15,811), or approximately every 11 days (365 days divided by 32).

Miller-Orr Cash Management Model

The Miller-Orr Model attempts to correct one of the limitations of the Baumol Model by addressing the issues that the demand for cash is not known and is not constant over time and the source of cash is not known and is not constant.

The Miller-Orr Model establishes a corridor and an optimal target cash balance about which the cash balance fluctuates until it reaches the upper or lower limit of the corridor. Whenever the upper limit of cash is reached, the company buys marketable securities in order to bring the cash balance down to the target balance again. If the lower limit is reached, the company sells marketable securities to bring the cash balance up to the target level. However, as long as the cash balance remains within the corridor between the upper and lower limits, the company does not need to either buy or sell securities to decrease or increase the balance.

Note: You do not need to know how to calculate these upper and lower limits or the point that the cash balance is returned to whenever the balance is outside of the corridor.

Accounts Receivable Management

Accounts receivable represent money that customers owe to the company for goods or services they have purchased on credit. Companies carry accounts receivable because it is not realistic to expect customers always to pay cash for what they purchase. Companies need to match what their competitors are doing. If all of the companies in an industry carry accounts receivable and give terms of, for instance, 2/10, net 30, a company requiring payment upfront in cash would not do much business. So for most firms, carrying accounts receivable is necessary in order to maintain their sales in a competitive environment. Furthermore, accounts receivable represent an asset to the company, so they have value.

On the other hand, accounts receivable have costs. Managing and monitoring the accounts receivable and following up on delinquent accounts is one cost of carrying accounts receivable. Cash not received represents an opportunity cost, because the firm is not able to invest the cash or use the money owed it until it receives payment from its customers. Furthermore, the firm may incur not only an opportunity cost but also a direct cost if it grants credit to a customer who does not pay the bill at all.

To manage accounts receivable a company must balance the amount of receivables outstanding and the amount of bad debts it will be unable to collect resulting from the receivables. The company must balance the trade-off between the **rewards** of credit sales (additional sales that would not be made if only cash sales were accepted) and the **costs** of having and collecting the corresponding accounts receivable (collection costs, foregone interest on uncollected balances, bad debt costs). Obviously, it would be best for a company to never have bad debts, but the only way to do this is to never make a credit sale.

The question the manager must answer is “how much credit should the firm grant and to whom?” Relaxing credit standards will cause sales to increase, a benefit. But relaxing credit standards also increases costs because more accounts will become uncollectible. The decision is a cost/benefit tradeoff. The goal is to extend credit as long as the benefits outweigh the costs. Financial managers must manage accounts receivable carefully to make sure that the asset adds to the firm’s profits rather than reducing them because the costs have come to be greater than the benefits.

Therefore, a balance between accounts receivable and bad debt expense must be reached. If a company does not make any credit sales it will not have any bad debts. However, if it makes no credit sales, the company may be losing revenue because of lost sales.

Three elements that make up the credit policy of a company are:

- 1) **Credit standards** determine to whom the company grants credit. Relaxed terms mean that the company gives credit to more customers that may have a higher risk of default, and strict terms means that the company gives credit to only those with a very low risk of default.
- 2) **Credit terms** include the terms of sale, including the payment period, discount for early payment or penalty for late payment, and the size of the discount or penalty.
- 3) **Collection efforts** are the amount of time and money spent on trying to collect past due accounts before writing them off as bad debts.

Any action that changes any of these elements will have both costs and benefits. The benefits may be in the form of increased sales revenues (as would result from the relaxation of credit standards), the reduction of opportunity costs due to lower accounts receivable balances, fewer bad debts or lower collection expenses. The costs may include lost sales revenue (from tighter credit standards), increased discounts taken (a cost of collecting the receivables sooner), the opportunity cost of higher accounts receivable balances, higher bad debts, or higher collection expenses.

Some companies use a system called **credit scoring** in an attempt to manage their credit policies and extend credit only to credit-worthy customers. In a credit scoring system, a potential customer is graded against specific criteria and they get points for meeting certain criteria. The “score” that a potential customer receives then determines whether or not it will receive credit.

Impact of a Change in Credit Policy Variables

If the credit standards are relaxed (changed so that more customers are able to obtain credit), sales will increase, but bad debts and collection costs will also increase because more credit sales will be made to customers with worse credit histories (that are therefore a higher risk). In other words, as the credit terms are relaxed and more customers obtain credit, there is an increase in the default risk. The **default risk** is the risk that one or more of the debtors will not make the necessary payments, defaulting on their payable to the firm.

Conversely, a change to stricter (or tighter) credit policies will have the opposite effect: lower levels of accounts receivable and fewer bad debts but also lower levels of credit sales.

Changes in credit terms and/or interest charged on unpaid balances (if the firm charges interest on unpaid receivable balances, and some do) will also impact the number of customers who will apply for credit to make purchases. A lower interest rate on the credit or a longer time to pay will cause more customers to buy on credit, increasing sales. However, if the interest rate is low, it is possible that some people who would have purchased an item for cash will instead choose to purchase the item on credit. If that occurs, the level of sales

may not change, but the amount of bad debts will increase—not a very good situation for the company as risk is increased without a corresponding reward.

As you can see, the terms under which credit is granted will greatly impact the level of sales (including the balance between cash and credit sales), bad debts, interest revenue, cash flows and other items within the company's financial picture.

All of this also affects the cash position of the firm. If the company allows a longer credit payment period, the company is giving up cash (and the earnings potential of cash) by allowing the customers to keep the cash for a longer time before paying it to the company. Similarly, by encouraging customers to pay early with cash discounts, the company can gain the benefits of holding the cash—though it must give up some of the cash it would have received because it must offer a discount to get the money earlier.

Exam Tip: You may need to be able to calculate the net benefit or cost of a company's changing its credit terms.

Other Types of Receivables

In addition to the regular trade accounts receivable (called an **invoice**), a company has other options for ways to make sales and then collect the money at a later date. Among these other options are:

- **Promissory Note** – A promissory note is an unconditional promise by one party to pay another party a certain amount of money at a time in the future.
- **Conditional Sales Contract** – Conditional sales contracts can be used for larger-cost items that have titles such as vehicles. The seller sells the item to the buyer but retains the actual title to the item until all of the payments have been made. After all of the payments have been made, title is transferred to the buyer.
- **Commercial Draft** – A commercial draft is a business-to-business order for payment. It is essentially an invoice issued between businesses.
- **Credit Cards** – Credit cards are in a sense another form of a credit sale, but credit card sales are much closer to cash sales because the seller collects the money from the credit card company almost immediately. The credit card company then collects from the buyer, the cardholder. One cost to this type of sale is that the seller does not receive 100% of the sales price because the credit card company charges a processing fee.

Monitoring Accounts Receivable

An **aging schedule** is a common analytical tool used in conjunction with receivables and their evaluation. An aging schedule is developed from a company's accounts receivable ledger and breaks the accounts receivable into different categories, based upon the time period that they have been outstanding. The purpose of an aging for receivables is to classify them by their due date. Those that are current (not past due) are listed in one column, those less than 30 days' past due are in another column, and so forth. An aging schedule is used to determine the allowance for uncollectible accounts that should be established and/or the amount of bad debt expense that should be booked. In the calculation of bad debt expense and allowance for uncollectible accounts, the amount in each category can be multiplied by an estimated bad debt percentage that is based on a company's credit experience and other factors. The theory is that the oldest receivables are the least likely to be collectible and therefore the most likely to become uncollectible.

Receivables Measurement

Recall that the **Accounts Receivable Turnover Ratio** is used to measure the number of times receivables “turn over” during a year’s time. Thus, it tracks the efficiency of a firm’s accounts receivable collections and indicates the amount of investment in receivables that is needed to maintain the firm’s level of sales.

$$\text{Accounts Receivable Turnover Ratio} = \frac{\text{Net Annual Credit Sales}}{\text{Average Gross Accounts Receivable}}$$

By comparing this ratio from year to year for a company, we can see how the company’s collection rate can change over time. An **increase** in the accounts receivable turnover ratio indicates that receivables are being collected more rapidly. A **decrease** indicates slower collections.

A company should extend credit until the marginal benefit (profit) of extending credit is equal to the marginal cost of extending credit and thus the net marginal benefit is zero. In other words, the marginal cost of a credit and collection policy should not exceed the marginal revenue that it generates.

The days’ sales in receivables, or the average collection period, tells us how many days an average receivable is held before it is collected. The calculation of days’ sales in receivables has already been covered in this Subsection, but for convenience we will repeat the calculation. The days’ sales in receivables can be calculated in two ways, and which is used is a matter of personal preference.

$$\text{Days' Sales in Receivables (Average Collection Period)} = \frac{365}{\text{Receivables Turnover}}$$

Or,

$$\text{Days' Sales in Receivables (Average Collection Period)} = \frac{\text{Average Accounts Receivable}}{\text{Average Daily Sales (Annual Credit Sales} \div 365)}$$

The average collection period **should be lower than the credit terms the company offers**. If the average collection period is higher than the length of the credit terms, it may mean that the company is having trouble collecting its receivables.

Inventory Management

Inventory management is a critical part of working capital management for any company that produces or sells a product. If a company is a seller of finished goods or a producer of goods, inventory may well be the largest, or one of the largest, items on the company’s balance sheet. Because inventory is such a large item on the balance sheet, a small incremental percentage increase or decrease in the cost of inventory can translate into a very large dollar amount of increase or decrease in cost of goods sold and thus in net income.

Reasons for Holding Inventory

A company that resells goods but does not manufacture them needs to hold inventory if it needs to have goods available for customers to purchase. Resellers have various business models. A reseller might choose to place orders for goods only on demand, when a customer places an order. A reseller who orders only on demand might have the order “drop-shipped” to the customer by the supplier, meaning the supplier will ship directly to the customer. When goods are shipped directly to customers by suppliers, the reseller can keep its inventory very low or eliminate it entirely. However, a reseller with a physical location where customers make purchases—a retailer—must keep inventory on hand in order to have it available for purchase.

A company that manufactures products must have a certain amount of inventory during production. The inventory held by a manufacturer is raw materials inventory and work-in-process inventory. Raw materials

inventory and work-in-process inventory form a link between the production and sale of the product. Raw materials inventory allows the firm to be flexible in its purchasing. Without a raw materials inventory, the firm would have to buy raw materials on an as-needed basis according to its production schedule. If something were to happen that required a change in the production schedule and the firm did not have the necessary raw materials, the firm might not be able to respond to the need in a timely manner. Work-in-process inventory is inventory that is being worked on, and a manufacturer cannot avoid having inventory that is being worked on.

However, holding inventory creates costs for the firm. Well-managed inventory ties up a minimum of a firm's funds. Manufacturers and resellers can minimize the levels of their inventories, thereby minimizing their inventory costs. Just-in-time inventory management is a method of ordering in order to receive a required item just when it is needed.

Costs of Inventory

Because of the potential impact of inventory costs on cost of goods sold, a firm should minimize its total inventory costs. Inventory costs, including the cost of the inventory itself and the costs associated with holding inventory, are classified as follows.

1) Purchasing Costs

Purchasing costs are the cost of goods purchased from suppliers. For a manufacturer, goods purchased from suppliers are the raw materials used in manufacturing. For a reseller, goods purchased are the finished goods purchased for resale. The purchasing cost of inventory includes the cost of the inventory itself plus landing costs, or incoming freight costs. Purchasing costs can be affected by discounts for size of purchases, by missed discounts for not ordering enough to qualify for the discount, and by suppliers' credit terms, such as discounts for early payment.

2) Ordering Costs

Ordering costs include the costs of:

- Placing an order (obtaining purchase approvals, preparing and issuing purchase orders).
- Receiving orders and inspecting items received.
- Matching invoices received with purchase orders and receiving reports to make payments.
- Any other special processing associated with ordering.

3) Carrying Costs

Carrying costs are costs of holding inventory for sale, such as:

- Rental or depreciation of facilities used for storing the inventory.
- Insuring and securing the inventory.
- Inventory taxes.
- Obsolescence and spoilage of the inventory.
- The opportunity cost of the investment in inventory. This opportunity cost is the cost of capital and it represents the amount of interest that is lost by investing cash in inventory instead of in some other longer-term investment that returns dividends or interest. If the inventory has been financed, it is the cost of the interest on the borrowed funds.

4) Stockout Costs

Stockout costs are the costs that result from lost sales when a company does not have inventory available to sell when customers want to buy it. Stockout costs can include:

- Costs for placing an expedited order in an attempt to meet customer demand when the inventory is out of stock. Ordering costs can be increased as can shipping costs for overnight or other expedited types of shipment.
- The revenue and profit lost if the inventory cannot be received in time to make an individual sale.
- The cost of customer ill will. The cost of the customer ill will is potentially very large as it can cause the customer to not return for future purchases. Once a customer has found another source, that customer could be gone permanently. Ill will is almost impossible to measure.

5) Inventory Shrinkage

Inventory shrinkage is the difference between the cost of the inventory as recorded on the books and the cost of inventory when it is counted physically. Inventory shrinkage can be caused by:

- Theft by outsiders or embezzlement (theft) by employees.
- Clerical errors in recording and tracking the inventory.

Other Inventory Management Terms

Lead Time

The lead time is the amount of time a company must wait to receive the next shipment of inventory after it places an order. The longer the lead time is, the greater is the risk of stockouts for the company while it is waiting to receive the order.

Safety Stock

The level of safety stock a company carries is one of its protections against stockouts. The safety stock is the amount of inventory the company plans to have on hand when the next shipment of inventory is due to arrive. Therefore, safety stock is inventory that is held at all times. A high level of safety stock means that even if the inventory is delayed in its receipt, the company will have sufficient levels of inventory to continue to operate while it waits for the shipment to arrive.

The amount of safety stock a company needs to hold will be affected by:

- The variability of the lead time.
- The variability of the demand for the product.
- The cost of a stockout.

The more that either the lead time or the demand varies, the more safety stock the company will need to carry to guard against stockouts in the case of an unusually high demand or an unusually long lead time. If the lead time and the demand are consistent and predictable, the company can reduce the amount of its safety stock because the chance will be less that the company will need a lot of items in stock to prevent a stockout.

The higher the cost of a stockout to the company, the more inventory the company will need to keep on hand in order to reduce the chances of a stockout. As an extreme example, if the company has no costs when it experiences a stockout, the company does not need to carry any safety stock, because even if they run out, they do not lose anything.

The company needs to balance the **probability** of a stockout and the **cost** of a stockout against the cost of carrying enough safety stock to avoid a stockout. The bottom line is that management needs to decide how

much probability of an inventory stockout it is willing to accept. Generally, the probability of a stockout decreases at a decreasing rate as the level of safety stock increases. For example, a company may be able to reduce the probability of a stockout's occurring by 25% if it adds 150 units to its safety stock; but if it adds another 150 units, the probability can be reduced only by an additional 10%. So at some point, it will cost more in terms of added carrying costs than it is worth to further reduce the probability of a stockout. The incremental cost will become greater than the incremental benefit.

Reorder Point

The reorder point is the level of remaining inventory that indicates when the company needs to place the order for inventory. The reorder point is calculated as follows:

$$\begin{aligned} & \text{Expected demand during the lead time (average daily usage} \times \text{average lead time in days)} \\ & + \text{Amount of safety stock} \\ & = \text{Reorder point} \end{aligned}$$

Average Inventory

The average inventory the company holds is the number of units ordered each time an order is placed divided by two, plus the safety stock, which is assumed to be there all the time. The number of units ordered each time will usually be determined by the Economic Order Quantity (covered in the next section).

Example: The average lead time is 10 days and the average daily usage of widgets is 20. The company has determined that safety stock should be 100 units. The reorder point will be when inventory on hand gets down to 300 units, as follows:

$$\text{Reorder point} = (\text{Average daily usage} \times \text{Average lead time}) + \text{Safety Stock}$$

$$\text{Reorder point} = (20 \times 10) + 100 = 300 \text{ units}$$

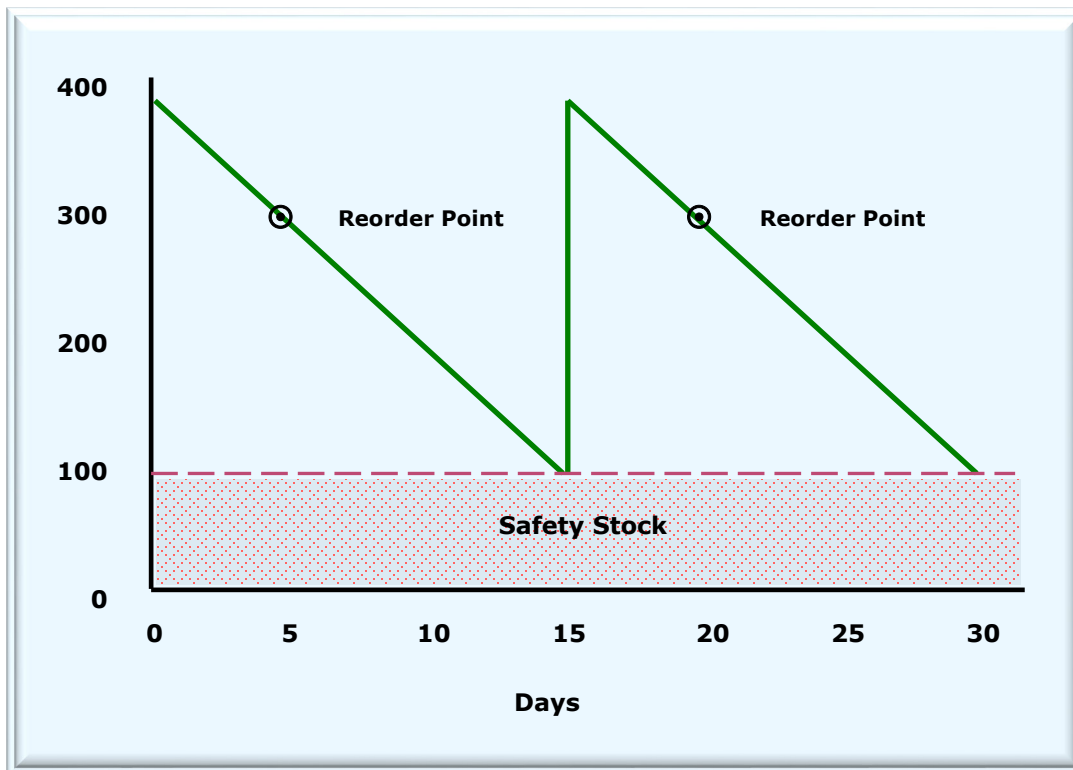
The average inventory level will be:

$$\text{Average inventory} = [(\text{Number of units ordered each time an order is placed}) \div 2] + \text{Safety Stock}$$

If the company orders a 15-day supply each time it places an order, it will order 300 units each time (15 days \times 20 units per day). Therefore, its average inventory level will be $(300 \div 2) + 100$, or 250 units.

Note: Each unit of the company's safety stock will increase its average inventory by one unit because both the maximum and minimum number of units that the company holds will be increased by one unit for each unit of safety stock held.

A graph of our example company's inventory on hand will look like the following, if everything is as planned:



However, everything will not always be as planned. There will be times when the company will need to use some inventory from its safety stock while waiting to receive a new order, and there will be times when the inventory on hand will not get down to the safety stock level before the new order is received.

Inventory cost management involves calculation of the Economic Order Quantity. Just-In-Time inventory management is an alternate approach that is gaining in popularity.

Economic Order Quantity (EOQ)

The Economic Order Quantity (EOQ) is the optimal number of units that a company should order of a given product each time it orders that item. The EOQ is calculated using a decision model. It is a traditional inventory management approach, and if it is used correctly it can help minimize the company's costs of ordering and holding inventory.

The three factors incorporated into the EOQ model are:

- 1) The annual demand for inventory.
- 2) The cost to carry one unit of inventory for one year (this includes the interest on funds invested in inventory).
- 3) The cost of placing an order.

For the EOQ calculation to work, the following six assumptions are made:

- 1) The same quantity is ordered each time an order is placed.
- 2) The annual demand for the item is known and constant.
- 3) The unit ordering and carrying costs are assumed to be known and constant throughout the period.
- 4) Purchase order lead time—the time between placing an order and its receipt—is known and is constant.

- 5) Purchasing cost per unit is not affected by the quantity ordered, which makes purchasing costs irrelevant since they will be the same for all units acquired.
- 6) There are no stockout costs included in the EOQ model because it is assumed that demand can be determined and planned for.

Obviously these assumptions limit the usefulness of EOQ because we know that they are not always true in reality. However, the model can provide a useful starting point for a company.

The EOQ is calculated as follows:

$$EOQ = \sqrt{\frac{2aD}{k}}$$

Where: a = Variable cost of placing an order
 D = Demand in units for a given period
 k = Carrying cost of one unit for the same time period used for D

If this formula looks familiar, it is because it is similar to the Baumol Cash Management Model. In fact, the Baumol Cash Management Model is based on the EOQ Model.

Another variation of the Economic Order Quantity formula is used in production planning. The Economic Lot Size in production corresponds to the Economic Order Quantity. It is used by manufacturers to determine how many units they should manufacture in each production run in order to balance their setup costs with the carrying cost of the completed inventory. The goal is to minimize both the setup costs and the carrying cost while still meeting customer demand. The calculation of the Economic Lot Size is based on the same equation as is used for the Economic Order Quantity, except it uses the setup cost to manufacture a batch of the product in place of the variable cost of placing an order.

Example: Assume that Medina Co. makes footballs and is trying to determine the quantity of leather it should order every time an order is placed. The relevant information is as follows:

- over the course of a year 12,000 square meters of leather will be needed,
- the cost of storing 1 square meter of leather is \$3 and
- the cost of placing an order is \$450.

The EOQ for inventory is calculated as follows:

$$EOQ = \sqrt{\frac{2 \times 450 \times 12,000}{3}} = 1,897.4$$

Every time Medina orders inventory, it should order 1,898 square meters in order to minimize its costs of ordering and carrying inventory.

Furthermore, we can use the EOQ to determine the number of times that Medina will need to order inventory per year. Given a demand of 12,000 square meters per year and an EOQ of 1,898 square meters per order, Medina will need to order inventory 7 times per year in order to have enough leather for production ($12,000 \div 1,898 = 6.3$).

Answering EOQ questions is simply a matter of putting the information that is given in the question into the formula.

Activity-Based Costing

Activity-based costing (ABC) is another way of allocating overhead costs to products, and in ABC the method of allocation is based on cost drivers. As with the other methods, ABC is a mathematical process of allocation and requires identification of the costs to be allocated, followed by some manner of allocating them to the produced products. We can use ABC in a variety of situations and apply it to both manufacturing and nonmanufacturing overheads. It can also be used in service businesses.

By definition, according to the Statement of Management Accounting, activity-based costing:

“identifies the causal relationship between the incurrence of cost and activities, determines the underlying driver of activities, establishes cost pools related to individual drivers, develops costing rates, and applies cost to product on the basis of resources consumed (drivers).”

Activity-based Costing is a costing system that focuses on individual activities as the fundamental cost objects.

- An **activity** is an event, task or unit of work with a specified purpose. Examples of activities are designing products, setting up machines, operating machines, making orders or distributing products.
- A **cost object** is anything for which costs are accumulated for managerial purposes. Examples of cost objects are a specific job, a product line, a market or certain customers.
- A **cost driver** is anything (it can be an activity, an event or a volume of something) that causes costs to be incurred each time the driver occurs. Cost drivers can be **structural** or **executional**.
 - **Structural cost drivers** relate to the actual structure of the company’s operations and the complexity of the technologies the company uses. A more complex working environment leads to higher structural costs.
 - **Executional cost drivers** relate to the actual processes performed. The cost of executing activities is determined by the company’s effective use of staff and processes used. Examples of executional cost drivers are set-ups, moving, number of parts, casting, packaging or handling.

Traditional Costing versus ABC

Differences between traditional costing and activity-based costing include:

Allocations Based On Different Things

Traditional costing systems allocate costs according to general **usage of resources**, such as usage of machine hours or direct labor used. These resources used may or may not have a connection with the costs being allocated.

With ABC, the cost allocations are not based on usage of resources. Instead, they are based on **activities performed** and what those activities cost. ABC is much more detailed than traditional costing, because it uses many more cost pools and each cost pool has its own cost driver.

Classification of Costs

Traditional costing methods classify costs as product costs or period costs. Product costs are direct materials, direct labor, and factory overhead and are allocated to products according to some cost driver such as machine hours used or direct labor used. Product costs are attached to units of inventory, and they are put into Inventory on the balance sheet and charged as expense when the units they are attached to are sold. Period costs include selling and general and administrative costs, and period costs are charged against income in the period they are incurred and are not allocated to products at all.

In ABC, the premise is that the cost of a finished product should include the cost of direct materials, direct labor and overhead manufacturing costs directly attributable to that product, but it should also include a portion of the administrative costs necessary to produce the product.

For example, the cost of a product under ABC also includes the administrative costs to buy the raw materials, including writing specifications, obtaining bids, issuing purchase orders, and so forth. Therefore, these costs, which are period costs under traditional costing, are analyzed and allocated to products under ABC. This means that products will be charged with the costs of both manufacturing and nonmanufacturing activities.

It also means that some costs that are considered product costs under traditional costing will not be attached to products at all, if they have no direct relationship to the production of the products. For example, the salary paid to the security guard at the plant entrance is an overhead cost in a traditional cost system and is included in the fixed overhead that is allocated to products on the basis of machine hours or direct labor hours. But in ABC, that plant guard's salary would not be directly related to the cost of producing any of the products, so it would be excluded from the product costs.

Note: Because of this difference from traditional costing methods in what is considered a product cost and what is considered a period cost, **ABC cannot be used for external financial reporting or for tax reporting unless it is modified.** If it is modified to conform to US GAAP and to US tax regulations so that all product costs and only product costs are allocated to production, ABC can be used for external financial reporting and tax reporting. If that modification is done, the same total amount would be considered product costs under ABC as under traditional costing. However, if more than one product is produced, the product costs would be allocated differently among the products. This is discussed further below.

Costs Attached to Low-Volume Products

The use of activity-based costing can result in greater per-unit costs for products produced in low volume relative to other products than would be reported under traditional costing.

If a product is produced in low volume, it will require fewer resources in total than a product that is produced in high volume. Therefore, under traditional costing, that low-volume product would be allocated a small amount of total overhead costs. However, a low-volume product may require just as much time and cost per production run as a high-volume product.

One example is product setups. It would take just as much time to set up the production process for a low-volume product as it would for a high-volume product. If the cost of product setups is included in total overhead and is allocated according to traditional costing, not much product setup cost will be allocated to the low-volume product because the volume of products produced and the total resources used to produce them is low relative to other products. If the cost of product setups is segregated from other overhead costs, as in ABC, and is allocated according to how many product setups are done for each product instead of how many units of each product are produced, then a more realistic cost for product setups will be allocated to the low-volume product. And that will probably be higher than it would be under traditional costing, so cost per unit allocated to the low-volume product will probably be higher under ABC than under traditional costing.

Note: ABC is becoming more of a necessity for many companies, since traditional systems may use direct labor to allocate overheads and direct labor is becoming a smaller part of the overall production process. Essentially, activity-based costing is **very similar to the standard method of overhead allocation**, except for the fact that we have many cost drivers, and these cost drivers should have a direct relationship to the incurrence of costs by an individual product. Therefore, in the application of ABC, you simply need to perform many different overhead allocations. The main difference is the determination of what the allocation bases are going to be. On the exam, in an ABC question that is numerical, you should be prepared to make three or four allocations of different cost pools to the final product. You may also need to determine what an appropriate allocation base would be for each of the cost pools.

ABC and External Financial and Tax Reporting

As we said above, the premise of ABC is that the cost of a finished product should include not only the cost of the direct materials, direct labor and overhead costs directly attributable to that product, but it should also include a portion of the administrative costs necessary to produce the product. US GAAP and US tax regulations require the use of absorption costing, which means that manufacturing overhead—but not administrative overhead—must be accounted for as a product cost. Furthermore, product cost for external reporting must include **all** of the manufacturing costs, whereas an ABC system may exclude some of the manufacturing costs that would actually belong there under absorption costing.

So technically, ABC **can** be used for external financial reporting, **if** it is used in accordance with US GAAP. If ABC is to be used for external financial reporting, the product cost data needs to conform to US GAAP, so that it includes all manufacturing overheads that need to be included for absorption costing and it excludes all administrative overheads. This can be time-consuming and expensive if different costs are being used for internal decision-making.

In addition, many of the overhead allocations in ABC are based upon subjective data—for example, interviews with personnel—that may not be verifiable using concrete facts and figures. Auditors are uncomfortable with the use of subjective data, because it has the potential to be manipulated by management in order to make earnings and key ratios appear more favorable.

For all the above reasons, ABC is seldom used for external financial reporting. ABC is generally used only internally for decision-making, while traditional absorption costing is used for external reporting.

The ABC Process

Setting up an ABC system is more difficult, time consuming and costly than setting up a traditional system, because a company must first analyze the production process and decide what activities cause costs to be incurred. Companies may identify a number of different cost drivers and use each of them to allocate overhead. Each cost driver requires the company to keep records and increases the complexity of the ABC system.

Identification of Activities

As part of the process of analyzing the production process, the company may identify some **non-value-adding activities**. These are activities that do not add any value for the end consumer and the company should try to reduce or eliminate them. This reduction of non-value-adding costs is an additional benefit to the company (in addition to more accurate costing of products) and can lead to a reduction in the cost of production. In turn, this will either enable the company to reduce the sales price or to recognize more profit from the sale of each unit.

Value-adding activities are the opposite of non-value-adding activities. As the name suggests, these are activities (costs) that add value to the customer. This means that these activities add something to the product that customers are willing to pay for. Even though these activities are value-adding activities, they must be monitored to make certain that the costs are not excessive. The different categories of costs are listed a little further on in this topic.

Note: On the exam you will generally not need to identify the cost drivers or cost pools in a large question because they will be provided for you. You will simply need to use the provided information to determine the amount of overhead that will need to be allocated to any product. In a smaller question it is possible that you will need to determine the appropriate driver for each cost pool from among those given. These are usually fairly direct, however, and if you simply think about what would cause costs to be incurred, you will see what cost driver should be used for each cost pool.

Calculation of Allocation Rate and the Process of Allocation

An **allocation rate** is then calculated **for each of the cost drivers**. This process is like that done under the traditional method (expected costs allocated to the cost driver ÷ the expected usage of the cost driver). The costs are then allocated to the products based upon the usage of the cost driver of each product.

The manufacturing overhead costs that the company incurs are accumulated in **cost pools**. Each cost pool is associated with one of the cost drivers (activities). A cost pool is similar to the traditional overhead account for each activity, or cost driver. These cost pools collect the costs associated with the various activities (drivers) that incur the costs, and then the costs are allocated as the drivers are used or consumed in the production of the product.

This process of cost allocation is similar to the accumulation of actual manufacturing overhead costs that we discussed in the traditional method of overhead allocation. The difference is that in ABC there are many cost pools and drivers, so the allocation calculations will need to be performed many times.

Because of the increased number of allocation bases, **ABC provides a more accurate costing** of the various products produced. If a company produces only one product, it does not need to use ABC costing. ABC is meaningful only if a company produces more than one product, because it affects how much overhead in total is allocated to each product. ABC uses many allocation bases to try to reflect the different consumptions of overhead activities between and among products.

Categories of Activities

Four categories of activities are used in ABC, based upon where the activity occurs in relation to the final product and the facility as a whole. These four categories are:

- 1) **Unit-level activities** – These activities are performed for each **unit** that is produced. Some examples are hours of work, inspecting each item, operating a machine and performing a specific assembly task.
- 2) **Batch-level activities** – These activities occur each time a **batch** is produced. Some examples are machine setup, purchasing, scheduling, materials handling and batch inspection.
- 3) **Product-sustaining activities** – These activities are incurred in order to **support the production of a different product** from what is currently produced. Examples include product design and engineering changes.
- 4) **Facility-sustaining activities** – These activities are incurred to **support production in general**, such as security, maintenance, plant management, depreciation of the factory and property taxes.

Facility-sustaining activities and associated costs present a small issue that requires a company decision. Given the broad nature of these costs, it is very difficult to allocate them in any reasonable manner to the final goods. However, a company may either try to allocate these costs, or the company may simply expense them in the period incurred. For external purposes they must be allocated in order to maintain an absorption costing that is acceptable for GAAP.

Facility-sustaining activities allocated under ABC can also include selling and administrative expenses that would be expensed for external purposes. For internal analysis, they can be included in the ABC cost allocations to products, even though for external reporting, they are period costs and are expensed as they are incurred.

Note: You need to know these different categories of activities more for word questions than for numerical questions. The allocation methods are the same for all of the activities, but what they relate to is different.

Benefits and Limitations of Activity-Based Costing	
Benefits	<ul style="list-style-type: none"> • ABC provides a more accurate product cost for use in pricing and strategic decisions. • By identifying the activities that cause costs to be incurred, ABC enables management to identify activities that do not add value to the final product.
Limitations	<ul style="list-style-type: none"> • Not everything can be allocated strictly on a cost driver basis. This is particularly true in respect to facility-sustaining costs. • ABC is expensive and time consuming to implement and maintain. Inclusion of administrative overhead in product costs is not in compliance with any generally accepted accounting principles or with US tax reporting regulations. Thus a company using ABC to allocate administrative overhead to production will need to keep two sets of records: one for external reporting with administrative overhead costs expensed as incurred and one for internal decision-making utilizing administrative overhead costs included in product costs.

ABC will **provide the most benefits to companies that produce very diverse products** or have complex activities. For companies that produce relatively similar products or have fairly straightforward processes that are consumed equally by all products, the costs of ABC would probably outweigh the benefits.

Following are three examples of how activity-based costing might be used in a real situation:

Example #1: A manufacturing firm. In a manufacturing environment, machine setup is required every time the production line changes from producing one product to producing another product.

The **cost driver** is machine setups. An engineer might be required to supervise the setup of the machine for the product change. Suppose the engineer spends 20% of his or her time supervising setups (the **resource driver**). So 20% of the engineer's salary and other expenses will be costs to be allocated according to the amount of time the engineer spends supervising each product's machine setup as a percentage of the amount of time spent supervising all product setups (the **resource driver**).

And not only is the engineer required. Production supervisors are also required to supervise machine setup, and they spend 40% of their time doing that (the **resource driver** again).

All of the costs of machine setup are collected in a "machine setups" cost pool. Setup time spent on each product as a percentage of setup time spent on all products is the **activity driver**. The total costs in the pool are allocated to the different products being produced based on what percentage of total setup time is used for each product.

Example #2: A service firm. Bank tellers process all kinds of transactions. The transactions relate to many different banking services that the bank offers. Transactions processed are the **cost driver**. How should the tellers' time, the teller machines used by the tellers, the supplies used by the tellers and the space occupied by the tellers be allocated among the various services offered by the bank (checking accounts, savings accounts, and so forth) in order to determine which services are most profitable?

The bank would do time and motion studies to determine the average time that it takes tellers to process each type of transaction (checking account transactions, savings account transactions, and so forth). Then, information on how many of each type of transactions processed by tellers is captured. The average time for each type of transaction is multiplied by the number of transactions processed. The percentage of teller time spent on each type of transaction as a percentage of the amount of teller time spent on all types of transactions is the **activity driver**.

If the tellers spend 90% of their time performing teller transactions and 10% of their time doing something else like answering telephones, then that 90% is the **resource driver** for the tellers' salaries. 90% of the tellers' salaries will be put into the "tellers" cost pool along with 100% of the costs of their teller machines, their supplies, and the square footage occupied by their teller stations. Then the percentage of tellers' time spent on each type of transaction in relation to their total time spent on all teller transactions (the **activity driver**) is used to allocate the teller costs in the cost pool proportionately among the bank's various services.

In ABC, the cost driver for a cost pool can be anything at all that causes indirect or overhead costs to arise, as long as those costs can be allocated to individual products or services (or organizational units, if management wishes) in some meaningful way.

Life-Cycle Costing

Life-cycle costing is a type of costing that is useful only for internal decision-making. It cannot be used for external financial reporting because it does not conform to GAAP.

In life-cycle costing a company does not determine the production cost in the short-term sense of the production of one unit. Rather, the company takes a much longer view to the cost of production and attempts to allocate all of the research and development, marketing, development, after-sale service and support costs and any other **cost that is associated with this product during its life cycle**. The life cycle of the product may be called its **value chain**.

This longer-term view is of particular importance when the product has significant research and development (R&D) costs associated with it (or other nonproduction costs such as after sale service and support costs). For the product to be profitable over its life, these costs also need to be covered by the sales price. If the company fails to take into account the large costs of R&D, it runs the risk of the sales price covering the costs of the actual production of that particular unit, but not the costs of R&D, marketing, after-sales and other costs.

The process of a company looking at all of the costs hopefully enables it to determine the ultimate value of developing a better product. In addition to R&D costs there are also after-sale costs such as warranties and repair work and product support expense. It may be that a larger investment in the design or development of the product will be recovered through smaller after-sale costs. Or alternatively, the company may realize that additional design costs will not provide sufficient benefit later to make the additional investment in design and development feasible.

Note: Life-cycle costing is different from other costing methods because it treats pre-production and after-sale costs as part of the product costs, whereas other methods treat these costs as period expenses that are expensed as incurred. Therefore, under other methods, these pre-production and after-sale costs are not directly taken into account when determining the profitability of a product or product line.

All of the costs in the life cycle of the company can be broken down into three categories. These three categories and the types of costs that are included in them are:

Upstream Costs (before production)

- Research and Development
- Design – prototyping (the first model), testing, engineering, quality development

Manufacturing Costs

- Purchasing
- Direct and indirect manufacturing costs (labor, materials and overhead)

Downstream Costs (after production)

- Marketing and distribution
- Services and warranties

Under GAAP financial reporting, the R&D and design costs are expensed as they are incurred. However, for internal decision-making purposes, it is important that the company treat these as product costs that will need to be recovered.

Life-cycle costing plays a role in strategic planning and decision-making about products. After making the life-cycle cost calculations, the company can make an assessment as to whether or not the product should be manufactured. If they believe that they will not be able to charge the required price for the product, then it should not be produced.

Also, by looking at all of the costs that are going to be incurred in the process of developing, producing and selling the product, the company can identify any non-value-adding costs, which can then be reduced or eliminated without reducing the value of the product to the customer.

Joint Products and Byproducts

Joint products occur when one production process leads to the production of two or more finished products. These products are not identical, but they share the same production process up to what is called the **splitoff point**. This is the point at which the two products stop sharing the same process and become different, identifiable products.

An example of joint products would be the processing of pineapple. As a pineapple goes through processing at the factory it becomes juice and pineapple slices that will be canned. These are two products that arise from the same process and as such the joint costs of processing the pineapple need to be allocated to the juice and to the slices.

The main issue with joint products is how to account for the **joint costs** (those costs incurred prior to the splitoff point) and how to allocate these costs to the different products. Accurate allocation is needed primarily for financial reporting purposes and pricing decisions. We need to accurately determine the inventory cost of each unit of each joint product so that the balance sheet will be accurate. And since the inventory cost of each unit becomes its cost of goods sold when it is sold, we need to know the amount of cost to be expensed to COGS for each unit sold.

Joint costs may include direct materials, direct labor and overhead. Costs incurred after the splitoff point are **separable costs** and they are allocated to each product as they are incurred by that product.

Byproducts are the low-value products that occur naturally in the process of producing higher value products. They are, in a sense, accidental results of the production process.

Methods of Allocating Costs to Joint Products

There are a number of different allocation measures to use, but all of these different methods use some sort of ratio between the two or more products to allocate the joint costs. This is largely a mathematical exercise, but you need to remember how the different allocation bases are calculated. The different methods and how to calculate the bases follow.

1. Relative Sales Value at Splitoff Method (or Gross Market Value Method)

Joint costs are allocated on the basis of the sales values of each product at the splitoff point, relative to the total sales value of all the joint products.

This method can also be called the **Sales Value at Splitoff** method or, more simply, just the **Sales Value** method.

The formula to allocate the costs between or among the products is as follows, for each of the joint products:

$$\frac{\text{Sales Value of Product X}}{\text{Total Sales Value of all Joint Products}} \times \text{Joint Costs} = \text{Amount allocated to the individual Joint Product}$$

This method can be used **only if all of the joint products can be sold at the splitoff point** (i.e., with no further processing). Management may decide it would be more profitable to the company to process some of the joint products further; but the Sales Value at Splitoff method can still be used to allocate joint costs up to the splitoff point, as long as sales prices at the splitoff point do exist for all of the joint products.

Example of the Relative Sales Value at Splitoff method:

Cafe Industries manufactures two kinds of coffee percolators: an electric model and a stovetop model. Part of the manufacturing process is the production of the coffee basket assembly, which includes a basket and a spreader. The 8-cup electric model and the 8-cup stovetop model use the same basket assembly, though the pump stems are different. The basket assembly is also sold separately as a replacement part for both percolators at a price of \$10.00. Separate prices for the basket assemblies that go on to be incorporated into the two percolators do not exist, since they become integral parts of the percolators. However, the whole production run could be sold as replacement baskets, since a market does exist for them at that stage of production.

One batch consists of 500 basket assemblies, of which 300 are destined to become part of electric percolators, 150 are destined to become part of stovetop percolators, and 50 are sold separately as replacement parts. The joint costs of one batch total \$2,500, or \$5.00 per unit.

Using the Sales Value at Splitoff method, how much of the joint cost is allocated to electric percolators, how much to stovetop percolators, and how much to the replacement parts?

The sales value of the electric percolator basket assemblies is $300 \times \$10.00$, or \$3,000. The sales value of the stovetop percolator basket assemblies is $150 \times \$10.00$, or \$1,500. The sales value of the replacement baskets is $50 \times \$10.00$, or \$500. The total sales value of all 500 basket assemblies is therefore $\$3,000 + \$1,500 + \$500$, or \$5,000.

The portion of the joint cost allocated to the electric percolators is $\$3,000 \div \$5,000 \times \$2,500$, or \$1,500.

The portion of the joint cost allocated to the stovetop percolators is $\$1,500 \div \$5,000 \times \$2,500$, or \$750.

The portion of the joint cost allocated to the replacement basket assemblies is $\$500 \div \$5,000 \times \$2,500$, or \$250.

We can confirm that the full \$2,500 of joint cost has been allocated, because $\$1,500 + \$750 + \$250 = \$2,500$.

2. Estimated Net Realizable Value (NRV) Method

This method can be used if one or more of the joint products **must** be processed beyond the splitoff point in order to be sold. It may also be used under certain circumstances if one or more of the joint products **may** be processed beyond the splitoff point in order to increase its value above the selling price at the splitoff point.

This method is essentially the same as the Relative Sales Value method, and the allocation is done in the same way, except an **estimated Net Realizable Value** (NRV) is used for the product or products that must be or will be processed further.

The estimated NRV for a product to be processed further is calculated as:

$$\begin{aligned} & \text{Sales price of items produced that will be sold in the future} \\ - & \text{Separable costs that are incurred after the splitoff point} \\ = & \text{Estimated Net Realizable Value} \end{aligned}$$

Note: If **one (or more) of the joint products is not processed further** but is sold at the splitoff point, instead of using NRV for those products, the company will simply use the Sales Value(s) at the splitoff point for the product(s) that can be sold at the splitoff point, while using the NRV(s) for the product(s) that must be processed further to be marketable.

The estimated NRV method would generally be used instead of the Relative Sales Value at Splitoff Point method **only when a market price at the splitoff point is not available** for one or more of the joint products, for example because a product is not marketable at the splitoff point. If a market price at the splitoff point is available because the product **can** be sold at that point, **that price is used instead of the NRV, even if the product will be processed further.**

If a sales value at splitoff is not available for one or more of the joint products, it is acceptable to use within the same allocation the net realizable value(s) of the product(s) that must be processed further in order to be sellable while using the sales value(s) at splitoff for the product(s) that can be sold at the splitoff point. For instance, you may have one product that **cannot** be sold at the splitoff point and must be processed further (thus there is no sales value at splitoff available for it), while the other product **can** be sold at the splitoff point. In a case such as this, the NRV of the product that must be processed further is its **estimated NRV** (sales price after further processing less cost to process further), while the NRV of the product that can be sold at the splitoff point is its **sales value at the splitoff point.**

Note: The Net Realizable Value method is generally used in preference to the Relative Sales Value at Splitoff method **only** when selling prices for one or more products at splitoff **do not exist.** However, sometimes when sales prices at the splitoff **do** exist for all of the joint products but one or more products **can** be processed further, an exam problem will say to use the Net Realizable Value method to allocate the joint costs. If the problem says to use the Net Realizable Value method, use the net realizable value(s) for the product(s) that can be processed further even though sales prices at splitoff do exist, **but only if the cost to process further is less than the additional revenue to be gained from the further processing.**

If the problem does **not** say to use the Net Realizable Value method and sales values at the splitoff exist for all products, then use the **sales values** of all of the joint products for the allocation, even if one or more of the products can be or will be processed further.

Note: The joint costs of production are not relevant costs in the decision to process further or sell immediately. This is because they are sunk costs. In order to determine if a product should be processed further, the company should compare the **incremental revenues** (the increase in the sales price that results from further processing) with the **incremental cost** (the increase in costs related to the additional processing).

Costs that are incurred by each of the products **after** the splitoff point are simply allocated directly to those products.

Example of the Net Realizable Value method:

Simpli Chili Company produces three flavors of its chili in a joint process: mild, original and extra spicy. 500,000 gallons of unspiced chili are produced per batch, and then varying amounts and types of spices are added to produce the mild, original and extra spicy flavors. The three types of chili are packaged in 16-ounce cans. The total joint cost of the unspiced chili is \$1,850,000.

One batch results in 500,000 gallons of unspiced chili. The unspiced chili is, of course, not marketable at that point. It needs spices.

After the spices have been added, Simpli has 800,000 cans of mild chili, 2,000,000 cans of original chili, and 1,200,000 cans of extra spicy chili. The cost per can of adding the spices and blending them into the unspiced chili are as follows:

Mild	0.065
Original	0.075
Extra spicy	0.080

The mild chili sells for \$0.98 per can. The original chili sells for \$1.05 per can. The extra spicy chili sells for \$1.09 per can.

Using the Net Realizable Value method of allocating the joint costs, how much of the joint costs will be allocated to each type of chili?

<u>Product</u>	<u># Cans</u>	<u>Price/Can</u>	<u>Extended Sales Value</u>	<u>Cost to Process Further</u>	<u>NRV</u>	<u>Percentage of Total NRV</u>
Mild	800,000	0.98	\$ 784,000	\$ 52,000	\$ 732,000	18.8%
Original	2,000,000	1.05	2,100,000	150,000	1,950,000	50.1%
Extra spicy	<u>1,200,000</u>	1.09	1,308,000	96,000	<u>1,212,000</u>	31.1%
Total	4,000,000				\$3,894,000	

The joint cost of \$1,850,000 will be allocated as follows:

Mild	$\$1,850,000 \times 0.188 =$	\$ 347,800
Original	$\$1,850,000 \times 0.501 =$	926,850
Extra Spicy	$\$1,850,000 \times 0.311 =$	<u>575,350</u>
Total allocated		<u>\$1,850,000</u>

3. Physical Measure and Average Cost Methods

These two methods are essentially the same. In the **Physical Measure** method, the joint cost allocation is done based on the weight, volume, or other physical measure of the joint products, such as pounds, tons, or gallons. In the **Average Cost** method, the joint cost allocation is done based on the physical units of output. In both methods, joint costs are allocated proportionately among the joint products, so that each product is allocated the same amount of joint cost per unit of measure, whether that unit is a unit of physical measure or a unit of output.

Physical Measure Method

Joint cost allocation may be done based on the **weight, volume or other physical measure** of the joint products. In this method, joint costs are allocated based on some common unit of measurement of output at the splitoff point, such as pounds, tons, gallons, or board feet (for lumber). This method may also be called the **Quantitative Unit** method.

The total joint cost up to the splitoff point is prorated between or among the joint products based on the physical measure being used. It stands to reason that it must be possible to measure all of the joint products

in the same unit of measurement. If all of the output that results from a joint process cannot be measured in the same terms, this method cannot be used.

Example of the Physical Measure method:

We will use the Simpli Chili Company example again. The company produces three flavors of its chili in a joint process: mild, original, and extra spicy. 500,000 gallons of unspiced chili are produced per batch, and then varying amounts and types of spices are added to produce the mild, original and extra spicy flavors.

However, in this example we will say that each of the three types of chili is packaged in a choice of can sizes: 12-ounce, 16-ounce and 20-ounce cans. 100,000 gallons are used to produce the mild chili, 250,000 gallons are used for the original chili, and 150,000 gallons are used for the extra spicy chili. The total joint cost of the unspiced chili (including direct materials, direct labor and overhead) is \$1,850,000. The joint cost is allocated as follows:

Product	Physical Measure	Proportion	Allocation of Joint Cost	Cost Per Gallon
Mild	100,000 gal.	0.20	\$1,850,000 × 0.20 = \$ 370,000	\$3.70
Original	250,000 gal.	0.50	\$1,850,000 × 0.50 = 925,000	\$3.70
Extra spicy	<u>150,000</u> gal.	0.30	\$1,850,000 × 0.30 = <u>555,000</u>	\$3.70
Total	500,000 gal.		\$1,850,000	

Average Cost Method

This method may also be called the **Physical Unit** method. It is used when the joint costs are to be allocated on the basis of **physical units of output** in completed form. It is basically the same as the Physical Measure method, but because physical units of completed product are used, it is called by the name **Average Cost**, or sometimes **Average Unit Cost** method.

The total joint cost is divided by the total number of units of all of the joint products produced to calculate the average cost per unit. Then that average cost per unit is multiplied by the number of units of each product produced to find the amount of cost to be allocated to each product.

Example of the Average Cost/Physical Unit Method:

In our Simpli Chili example, now we will go back to packaging all three flavors of chili in 16-ounce cans only. Since the size of the cans is all the same, we can now use units of output for the allocation, with the can as the unit of output. The 500,000 gallons of output have now become 4,000,000 16-ounce cans. The average cost per can is the total cost of \$1,850,000 divided by 4,000,000, or \$0.4625 per can.

Now, the output and the allocations from the joint process are as follows:

Product	Units of Output	× Avg. Cost/Unit	Allocation of Joint Cost
Mild	800,000 cans	\$0.4625	\$ 370,000
Original	2,000,000 cans	\$0.4625	925,000
Extra spicy	<u>1,200,000</u> cans	\$0.4625	<u>555,000</u>
Total	4,000,000 cans		\$1,850,000

Note that the allocation of the cost by product using the Average Cost/Physical Unit method is exactly the same as it was using the Physical Measure method.

Accounting for Byproducts

As we said, byproducts are the low-value products that occur naturally in the process of producing higher value products. They are, in a sense, accidental results of the production process. The main issue for accounting for byproducts relates to the treatment of the associated costs and revenues.

There are two methods of accounting for byproducts that you need to be familiar with.

The Production Method: Inventory the Byproduct Costs

(Byproduct Recognized at Production)

In the Production Method, the costs that are allocated to the byproducts are inventoried, and the sales revenue received from the sale of the byproduct is treated as a **reduction of the costs of production of the main product**.

Byproducts are inventoried in a separate inventory account at their estimated net realizable value. Inventoried costs allocated to the main product or joint products are reduced by the NRV allocated to the byproduct. When the byproduct is sold, the company recognizes no revenue or cost of goods sold but simply debits cash or accounts receivable and credits Byproduct Inventory.

And when the main product or joint products are sold, the COGS for the main product or joint products is lower because their inventory cost has been decreased by the NRV of the byproduct.

The reason it is done this way is because the NRV of the byproduct was used to determine its cost in inventory. Therefore, its cost will be the same as the revenue received for it, and there will be no gross profit on the sale. There would be no reason to record the sale of the byproduct by increasing revenue and COGS by the same amount, since the transactions would have no effect on net income. So the journal entry is simply the debit to cash or accounts receivable and the credit to byproduct inventory.

Note: Only the **sales proceeds from what can actually be sold** are used to reduce the costs of production of the main product(s). If some of the byproduct cannot be sold, the amount that cannot be sold is not included in the amount debited to inventory for the byproduct, nor is it included in the reduction of costs of the main product(s).

The Sales Method: Revenue from the Byproduct

(Byproduct Recognized at Time of Sale)

In the Sales Method, the byproduct costs are not put into inventory separately from the main product or joint products. Instead, all of the costs of production are allocated to the main product or joint products in inventory. When the main product or joint products are sold, their COGS will be higher than it would have been under the Production Method. Since the byproduct is not put into inventory at all, when it is sold the sale is recorded the way service revenue would be recorded, with no associated COGS. So the company debits cash or accounts receivable and credits revenue for the amount of the sale.

Which Method is Better?

Both methods are acceptable. The Production Method, where the byproduct is inventoried at the time of production is conceptually correct because it is consistent with the matching principle. Byproduct inventory is recognized as an asset in the accounting period in which it is produced, and it reduces the inventory cost assigned to the main product or joint products.

However, the Sales Method, where the byproduct is recognized at the time of sale, is simpler and is used more frequently in practice if the dollar amounts of the byproduct(s) are immaterial. There is a disadvantage to the sales method, though. The sales method makes it possible for managers to time when they sell the byproduct(s) and thus permits them to manage their earnings. A manager could store the byproducts for a

period of time and sell them to increase revenues and profits during a time when sales and/or profits from the main product or joint products are low.

Note: A question on the Exam will outline the treatment of the costs or revenue associated with the byproduct and you just need to follow the math that is required. **If the question states that the company inventories the byproduct, this means that it treats the revenue as a reduction of the costs of production;** this is the first method above.

Variable and Absorption Costing

Variable and absorption costing are two different methods of inventory costing. Under both variable and absorption costing, all **variable** manufacturing costs (both direct and indirect) are inventoriable costs. The only two differences between the two methods are in:

- 1) Their treatment of fixed manufacturing overhead
- 2) The income statement presentation of the different costs

Note: All other costs except for fixed factory overheads are treated in the same manner under both of these methods, but they may be reported in a slightly different manner on the income statement.

Absorption costing is required by US GAAP for external financial reporting and by the US taxing authorities for tax reporting. (Job-order costing, process costing and in some cases activity-based costing can all be used with absorption costing for external purposes.) Variable costing can be used internally for decision-making but it cannot be used for external financial reporting or for tax reporting.

We will first look at the difference in the treatment of fixed factory overheads under each of these two methods, and then we will look at the income statement presentation under each method.

Fixed Factory Overheads Under Absorption Costing

Under absorption costing fixed factory overhead costs are **allocated to the units produced during the period** according to a predetermined rate. The predetermined fixed overhead allocation rate is

$$\frac{\text{Budgeted Dollar Amount of Manufacturing Overhead}}{\text{Budgeted Activity Level}}$$

Fixed manufacturing overhead is therefore a **product cost** under absorption costing.

Fixed factory overheads are allocated to the units produced as if they were variable costs, even though they are not variable costs.

Under the absorption costing method, the profit of a company is influenced by the difference between the level of production and the level of sales. When the level of production is higher than the level of sales, some of the fixed manufacturing overhead costs from this period are included on the balance sheet as inventory at the year-end. As a result, these costs that are in inventory are **not included** on the income statement as an expense. We will look at this in more detail on the following page.

Fixed Factory Overheads Under Variable Costing

Under variable costing (also called **direct costing**), fixed factory overheads are a **period cost** that are expensed in the period when they are incurred. This means that no matter what the level of sales, all of the fixed factory overheads will be expensed in the period when incurred.

Variable costing is not GAAP. For external reporting purposes, **GAAP requires the use of absorption costing** for fixed manufacturing cost allocation, and therefore variable costing cannot be used for external financial reporting. However, many accountants feel that variable costing is a better tool to use for internal analysis, and therefore variable costing is often used internally.

Note: It is important to remember that the only difference in the profit between these two methods relates to the treatment of **fixed factory overheads**. Under absorption costing, fixed factory overhead costs are included, or absorbed, into the product cost. Under variable costing, they are excluded from the product cost and treated as a period cost, because they are not variable costs.

Effects of Changing Inventory Levels

Because fixed factory overheads are treated differently in these two methods, it is most certain that these two methods (variable and absorption) will result in different amounts of net income or net loss for the **same period of time**.

Note: In addition to producing different amounts of profit, these two methods will always produce different values for ending inventory because they include different costs in each unit of inventory. Ending inventory under absorption costing will be higher because each unit of inventory will include some fixed factory overhead costs while under variable costing fixed factory overhead costs are not included in inventory.

Only when **production and sales are equal** in a period (meaning no change takes place in inventory levels and everything that was produced was sold) will there not be a difference between the incomes reported under these two methods. This is because all of the fixed factory overheads were expensed as period costs under the variable method, and all of the fixed factory overheads were “sold” and included in cost of goods sold under the absorption method.

Whenever inventory changes during a period of time, the two methods will give different levels of net income.

Production Greater than Sales (Inventory Increases)

If production is greater than sales, the **net income calculated under the absorption method is greater** because some of the fixed factory overheads were inventoried under this method. Under absorption costing fixed factory overheads are allocated to each unit. When a unit that was produced but not sold during the period goes to the balance sheet as inventory, it takes some of the fixed factory overheads with it. This temporarily puts that amount of fixed factory overhead on the balance sheet. When the unit is sold the next period that amount of fixed factory overhead will go to the income statement as cost of goods sold.

Under variable costing, all of the fixed factory overheads for the period are on the income statement.

Sales Greater than Production (Inventory Decreases)

If production is lower than sales, the **variable method will result in a greater net income** because the only fixed factory overheads included as an expense in this period were those that were incurred during the year. Because sales were greater than production, some of the products that were produced in previous years were sold in the current period. This means that under the absorption method, some of the fixed factory overhead costs that had been inventoried in previous years will now be expensed in the current period.

Note: You should recognize that over a long period of time, the total income presented under both methods will be essentially the same. In the long term these two methods do not differ in total income, because in the long term the company will not produce more than it can sell and therefore sales will equal production. Rather, the difference between them will appear in the allocation of income to the different periods within that longer time period.

The following table summarizes the effect of changing inventory levels (production compared to sales) under the two methods:

Production & Sales	Profit
Production = Sales	→ Absorption = Variable
Production > Sales	→ Absorption > Variable
Production < Sales	→ Absorption < Variable

Note: Ending inventory under absorption costing will **always be higher** than ending inventory under variable costing, because there are more costs in each unit under absorption costing, and the number of units in ending inventory are the same under both methods. There will always be some **fixed** costs in ending inventory under absorption costing that will not be in ending inventory under variable costing.

Income Statement Presentation

As mentioned earlier, there is also a difference in the presentation of the Income Statement with these two methods.

The Income Statement under Absorption Costing

Under absorption costing we calculate a **gross profit** by subtracting **all variable and fixed manufacturing costs for goods sold** (this being COGS) from revenue. All variable and fixed nonproduction costs are then subtracted from the gross profit to calculate net income.

The income statement under absorption costing is as follows:

	Sales revenue
–	<u>Cost of goods sold</u> – variable and fixed manufacturing costs of items sold
=	Gross profit
–	Variable non manufacturing costs (expensed)
–	<u>Fixed nonmanufacturing costs (expensed)</u>
=	<u>Operating Income</u>

The Income Statement under Variable (Direct) Costing

Under variable costing we calculate a **manufacturing contribution margin** by subtracting all **variable manufacturing costs for goods that were sold** from revenue. From this manufacturing contribution margin, we subtract nonmanufacturing variable costs to arrive at the **contribution margin**. All fixed costs (manufacturing and non-manufacturing) are then subtracted from the contribution margin to calculate net income.

The income statement under variable costing is as follows:

	Sales revenue
–	<u>Variable manufacturing costs of items sold</u>
=	Manufacturing contribution margin
–	<u>Variable nonmanufacturing costs (expensed)</u>
=	Contribution Margin
–	All fixed manufacturing costs (expensed)
–	<u>All fixed nonmanufacturing costs (expensed)</u>
=	<u>Operating Income</u>

Note: This cosmetic difference between the two methods does not change the effect of the treatment of fixed manufacturing overheads under the different methods. But, you need to know that the absorption method determines a **gross profit** and the variable method calculates a **contribution margin**; and the two are different.

This is demonstrated in the example (and the answer to the example) that follows this explanation.

Absorption Costing versus Variable Costing: Benefits and Limitations

While **absorption costing is required for external reporting** (the GAAP financial statements), it is generally thought that **variable costing is better for internal uses**.

Note: In a situation in which there is **no beginning inventory**, or the **LIFO** inventory assumption is used and ending inventory is higher than beginning inventory (i.e., none of the beginning inventory is sold), it is very easy to calculate the difference between the variable and absorption methods using the method following. This method can also be used under other inventory cost flow assumptions if (1) the beginning inventories are valued at the same per-unit fixed manufacturing cost as the current year's planned per-unit fixed manufacturing cost and (2) if under- or over-applied fixed manufacturing overhead is closed out to cost of goods sold only.

Given that the only difference between the absorption and variable methods is the treatment of fixed factory overheads, when the question asks for the **difference in income** between the two methods, if one of the three situations above applies, you simply need to make the following calculation:

	Fixed overhead cost per unit applied to production
×	<u>Number of units of change in inventory</u>
=	<u>Difference in income between the two methods</u>

Remember that this works only if any one of the following applies:

(1) There is no beginning inventory (which is often the case in an Exam question). If there is some beginning inventory, that beginning inventory would have been produced during the previous period, and the fixed manufacturing cost per unit during the previous period is almost certainly different from the fixed manufacturing cost this period. Therefore, a part of the amount of cost expensed for sold units under absorption costing may be the costs from the previous period that were in inventory at the beginning of the period. This is most likely to occur if FIFO is being used, because under FIFO, the first units sold are the earliest units produced. The earliest units produced will be the units that are in inventory at the beginning of the period. But if we limit the use of this formula to situations where there is **no beginning inventory**, we avoid that problem and can be confident that all of the cost of goods sold expensed this period was cost of production that was produced during this period, at this period's cost per unit.

(2) The LIFO inventory assumption is used if ending inventory is higher than beginning inventory. Under LIFO, we assume that the last units produced are the first units sold. Therefore, if the ending inventory is higher than the beginning inventory, we must have sold only units from this year's production. So we know that the cost of the units sold will include only fixed manufacturing costs that are **this year's** costs, and we do not have the problem of having sold units that were manufactured during a previous period and that would have a per unit cost that is different from this year's costs.

(3) Under other inventory cost flow assumptions if the beginning inventories are valued at the same per-unit fixed manufacturing cost as the current year's planned per-unit fixed manufacturing cost and if under- or over-applied fixed manufacturing overhead is closed out to cost of goods sold only. If the cost per unit of the beginning inventory (including fixed manufacturing costs) is exactly the same as the current year's planned cost per unit, we do not have the problem of having sold units with a cost per unit that is different from this year's costs. We may have sold some units that were manufactured in a previous year and some units that were manufactured this year. If the costs during the two years were different, we would have a problem. But since they are not different, we can use the fixed cost per unit in the formula, since it is the same for both years, to calculate the difference in income between the two methods.

Shared Services Cost Allocation

Shared services are administrative services that are provided by a central department to the company's operating units. Shared services are usually services such as human resources, information technology, maintenance, legal, and many accounting services such as payroll processing, invoicing and accounts payable. Usage of the services by the individual departments (cost objects) can be traced in a meaningful way based upon a cost driver that fairly represents their usage of the service.

These shared service, or support, departments incur costs (salaries, rent, utilities and so on). For internal decision-making, the costs of shared service departments need to be allocated to the operating, or production, departments that use their services in order to calculate the full cost of production. The methods of allocating these costs we are about to discuss are different from the activity-based costing method covered previously. These shared service costs are being allocated as a cost pool containing all of each department's costs, and the costs are being allocated to user departments on the basis of a single cost driver, such as hours of service used.

Note: Allocation of shared service costs to products does not change the fact that for external financial reporting purposes, the costs of service departments are period expenses and are expensed as they are incurred. Allocation of shared service costs does not make them product costs. The allocation of service costs to the production departments is strictly an internal function that is used for decision-making, and it is not reflected in the company's external financial statements.

Allocation of shared services is done internally because if a company calculates its cost of production but does not include the costs of its service departments, it will be looking at a cost of production that is less than the actual total cost. As a result of this incorrect calculation, the company's pricing decisions will not be correct, and in a worst-case scenario, the company may sell the product for less than it actually costs to produce it.

Reasons for allocating shared services costs include:

- It provides accurate departmental and product costs for use in making decisions, valuing inventory, and evaluating the efficiency of departments and the profitability of individual products;
- It motivates managers and other employees to make their best effort in their own areas of responsibility to achieve the company's strategic;
- It provides an incentive for managers to make decisions that are consistent with the goals of top management;

- It provides a fair evaluation of the performance of segments and segment managers;
- It justifies costs, such as transfer prices; and
- It can also be used to compute reimbursement when a contract provides for cost reimbursement.

Cost allocations may be done for just one shared service or support department whose costs are allocated to multiple user departments; or they may be done for multiple shared service or support departments whose costs are being allocated both to other service/support departments and to other user departments. But even when costs of shared service departments are allocated to other service departments, ultimately all the shared service costs are allocated only to operating departments.

Allocating Costs of *Multiple Service or Support Departments*

Special cost allocation problems arise when there are several shared service departments within an organization and the shared service departments provide support not only to the production departments but to the other shared service departments as well. The factor that complicates the process is service departments using the services of other service departments. For example, people in the maintenance department use the services of the IT department and eat in the cafeteria.

There are two different methods of allocating costs of multiple shared service departments in a situation like the one above. Both methods are simply mathematical allocations, much like the way manufacturing overhead is allocated to the products. The different methods of multiple shared service cost allocation treat these reciprocal services differently.

The two methods of allocation are:

- 1) The direct method
- 2) The step (or step-down) method

We will look at each of these in turn.

Note: In a question, you should treat the service departments as shared service departments even if you feel that they should be treated in a different manner. This may be the case with accounting, for example. In some companies accounting (or other departments) may be expensed and not allocated, but in a question, if accounting is given as a service department, you should treat it as such.

1) The Direct Method

Under the direct method the reciprocal services that are provided by the different shared service departments to each other are ignored. The company will simply allocate all of the shared service departments' costs directly to the production departments. The allocation is made on a basis that is reasonable and hopefully equitable to the production departments. For example, the costs of a subsidized employee cafeteria should be allocated to the production departments based on the number of employees, while the maintenance department's costs may be allocated based on the number of maintenance hours used by each production department.

When calculating the usage ratios for the different production departments, we **count only the usage made of the shared service departments by the production departments**. We do not count the usage made of shared service departments that takes place in the other service departments, because service departments will not be allocated any costs from other service departments.

This is the simplest and most common method and a very short example follows (the calculations of the allocations are not shown).

	Maintenance	Cafeteria	Production 1	Production 2	Production 3
Departmental Costs	100	120	300	400	800
Allocation of Maintenance Costs	(100)		20	30	50
Allocation of Cafeteria Costs		(120)	30	30	60
TOTAL COSTS	0	0	350	460	910

2) The Step-Down or Sequential Method

The step-down method is also called the step method or **the sequential method**. In the step-down method we attempt to recognize the services that the shared service departments provide to each other, but we only make one allocation of the costs of each service department. After a particular service department has had its costs allocated, it will not receive any costs from other service departments. This leads to a stair step-like diagram of cost allocations as below. All costs ultimately end up allocated to the production departments.

In order to use the step-down method, there must be an order in which we allocate the costs of the service departments. **This order can be any order management chooses.** A popular method is to determine the order according to the percentage of each department’s services that are provided to other shared service departments, but that is not the only way it can be done. If, for example, the department that provides the highest percentage of its services to other shared service departments is allocated first, then the department that provides the next highest percentage of its services to other shared service departments comes next, and so forth.

The first shared service department’s costs will be allocated to the other shared service departments and the production departments. The second shared service department’s costs (which now include its share of the first shared service department’s costs) will be allocated to the other shared service departments (but not to the first shared service department that has already been allocated) and the production departments. Once a shared service department’s costs have been allocated, no costs will be allocated to it from other shared service departments.

The problem on the Exam will give the allocation order to use if it is not obvious.

Following is an example of the step-down method.

	Maintenance	Cafeteria	Production 1	Production 2	Production 3
Departmental Costs	100	120	300	400	800
Allocation of Maintenance Costs	(100)	10	16	28	46
Allocation of Cafeteria Costs		(130)	36	32	62
TOTAL COSTS	0	0	352	460	908

You will notice that this is a little bit different from the example for the direct method. Again, we did not show the allocation calculations. The step-down method gives a slightly different result from the direct method,

even though the Production Departments used the same amounts of services of the two shared service departments.

Note: In the step-down method, the costs allocated from the cafeteria include its own incurred costs (120), plus the cafeteria's portion of the maintenance costs that were allocated to it from maintenance (10). When this allocation of the maintenance department is made, we will use the number of hours that the cafeteria utilized the services of the maintenance department. However, when the cafeteria costs (including the cafeteria's share of the maintenance costs) are allocated, we do not consider the number of people in the maintenance department or their usage of the cafeteria.

Comprehensive Example of the Two Methods of Shared Service Cost Allocation

Example: We will use the following information about Cubs Co. to demonstrate the different methods of allocating service costs. Cubs Co. has two shared service departments (A and B) and three production departments (X, Y and Z). Shared Service Department A will allocate its overhead based on direct labor hours and Shared Service Department B will allocate its overhead based on machine hours. The following information is in respect to the service and production departments:

	<u>Dept. A</u>	<u>Dept. B</u>	<u>Dept. X</u>	<u>Dept. Y</u>	<u>Dept. Z</u>	Total
Overhead	\$100,000	\$50,000	\$200,000	\$300,000	\$250,000	\$900,000
Labor Hours	--	1,000	2,000	4,000	3,000	10,000
Machine Hours	2,000	--	2,000	2,000	2,000	8,000

Direct Method

Under the direct method each shared service department will allocate costs only to the production departments. For Department A, the production departments used a total of 9,000 (2,000 + 4,000 + 3,000) labor hours, so each department will be allocated \$11.11111 ($\$100,000 \div 9,000$) for each direct labor hour used. Department B provided 6,000 (2,000 + 2,000 + 2,000) machine hours of service to the production departments, so they will allocate \$8.33333 ($\$50,000 \div 6,000$) per machine hour to the production departments. We ignore the services that were provided to the other service departments in this calculation. The numbers that are ignored are shaded.

	<u>Dept. A</u>	<u>Dept. B</u>	<u>Dept. X</u>	<u>Dept. Y</u>	<u>Dept. Z</u>	Total
Overhead	\$100,000	\$50,000	\$200,000	\$300,000	\$250,000	\$900,000
Labor Hours	--	1,000	2,000	4,000	3,000	10,000
Machine Hours	2,000	--	2,000	2,000	2,000	8,000

Now we can determine how much of the costs of the shared service departments will be allocated to each department. First, we will allocate costs of Department A. Of the total 9,000 direct labor hours used in the allocation, Department X used 2,000 labor hours, Department Y used 4,000 labor hours, and Department Z used 3,000 labor hours. Department X is allocated $\$11.11111 \times 2,000$ hours = \$22,222.22 of costs from Department A. Department Y is allocated $\$11.11111 \times 4,000$ hours = \$44,444.45 (adjusted for rounding difference), and Department Z is allocated $\$11.11111 \times 3,000$ hours = \$33,333.33.

Department B's costs are allocated next. Of the total 6,000 machine hours used in the allocation, Departments X, Y and Z each used 2,000 machine hours. Therefore, each production department will be allocated $\$8.33333$ per hour $\times 2,000$ hours = \$16,666.66. (Two of the amounts will be adjusted for rounding differences.)

Below are the total overhead costs for each department after the allocation:

	<u>Dept. A</u>	<u>Dept. B</u>	<u>Dept. X</u>	<u>Dept. Y</u>	<u>Dept. Z</u>
Own Overhead	\$100,000.00	\$50,000.00	\$200,000.00	\$300,000.00	\$250,000.00
Allocated from A	(100,000.00)	0.00	22,222.22	44,444.45	33,333.33
Allocated from B	0.00	(50,000.00)	16,666.67	16,666.66	16,666.67
Total OH	\$ 0.00	\$ 0.00	\$238,888.89	\$361,111.11	\$300,000.00

Step-Down Method

Under the step-down method we must determine which shared service department’s costs will be allocated first. We can calculate that 25% of the service provided by Department B was to Department A. Since only 10% of Department A’s service was to Department B, we will allocate Department B’s costs first. Department B’s cost of \$50,000 is allocated on the basis of machine hours used by all the other departments. In total 8,000 machine hours were used, so the Department B’s cost per machine hour is \$6.25.

Department B’s costs will be allocated among all the other departments, including Department A, based on machine hours used by each. Department A will receive $\$6.25 \times 2,000$ hours, or \$12,500. This \$12,500 will be added to the \$100,000 of A’s own overhead, giving a total \$112,500 cost for Department A. This \$112,500 cost for Department A will then be allocated only to the production departments based on the direct labor hours used by each. The allocation of Department A’s costs is done the same way as in the direct method, except that there are now more costs to allocate from Department A because some allocated costs of Department B are included in Department A’s costs.

First, we allocate Department B’s costs: As mentioned previously, Department A will be allocated \$12,500 of Department B’s costs. Since Departments X, Y and Z each also used 2,000 machine hours, each of those departments will also be allocated \$12,500 from Department B ($\$6.25 \times 2,000$ machine hours).

Next, we will allocate the costs of Department A. The total costs to be allocated for Department A are Department A’s own overhead of \$100,000 plus the \$12,500 allocated overhead from Department B, for a total to allocate of \$112,500. That \$112,500 is allocated based on direct labor hours, excluding the direct labor hours used by Department B. Therefore, a total of 9,000 direct labor hours (2,000 + 4,000 + 3,000) are used in allocating Department A’s total overhead of \$112,500. $\$112,500 \div 9,000 = \12.50 per direct labor hour. Department X will be allocated $\$12.50 \times 2,000 = \$25,000$, Department Y will be allocated $\$12.50 \times 4,000 = \$50,000$, and Department Z will be allocated $\$12.50 \times 3,000 = \$37,500$.

It is important to remember in the step-down method that the hours that the second shared service department provides to the first are ignored when allocating the second shared service department’s costs. The ignored numbers are shaded below:

	<u>Dept. A</u>	<u>Dept. B</u>	<u>Dept. X</u>	<u>Dept. Y</u>	<u>Dept. Z</u>	Total
Overhead	\$100,000	\$50,000	\$200,000	\$300,000	\$250,000	\$900,000
Labor Hours	--	1,000	2,000	4,000	3,000	10,000
Machine Hours	2,000	--	2,000	2,000	2,000	8,000

Below are the total overhead costs for each department after the allocation:

	<u>Dept. A</u>	<u>Dept. B</u>	<u>Dept. X</u>	<u>Dept. Y</u>	<u>Dept. Z</u>
Own Overhead	\$100,000.00	\$50,000.00	\$200,000.00	\$300,000.00	\$250,000.00
Allocated from A	(112,500.00)	0.00	25,000.00	50,000.00	37,500.00
Allocated from B	<u>12,500.00</u>	<u>(50,000.00)</u>	<u>12,500.00</u>	<u>12,500.00</u>	<u>12,500.00</u>
Total OH	\$ 0.00	\$ 0.00	\$237,500.00	\$362,500.00	\$300,000.00