Cost Accounting (2)

Collections

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بسم الله الرحمن الرحيم

ذَلِكَ فَضْلُ اللَّه يُؤْتِيهِ مَن يَشَاء وَاللَّهُ ذُو الْفَضْلِ العظيم

صدق الله العظيم

(الجمعة، آية 4)

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Chapter (1)

Multiple Products Costing

The distinguishing feature of the joint and by products production is that the products are not identifiable as different products until a specific point in the production process is reached. Before this point, joint costs are incurred on the production of all products emerging from the joint production process. It is therefore not possible to trace joint costs to individual products. A classic example of joint products is the meat packing industry, where various cuts of meat such as slices of lamb of beef, bacon, and other parts of the body of a lamb or beef are joint products that are processed from one original carcass. The cost of obtaining the carcass is a joint cost that must be allocated to the various cuts of meat. Another example of joint products is the production of gasoline, where the derivation of gasoline inevitably results in the production of various joint products such as gasoline, fuel oil, kerosene and paraffin.

To meet internal and external profit measurement and inventory valuation requirement it is necessary to assign all product- related costs (including joint costs) to products so that costs can be allocated to inventories and cost of goods sold. The assignment of joint costs to products, however, is of little use for decision-making. We shall by distinguishing between joint products and by products. This will be followed by an examination of the different methods that can be used to allocate joint costs to products for inventory valuation. We shall then go on to discuss which costs are relevant for decision making.

Allocating joint costs

Before a manager is able to allocate joint costs, he/she must first look at the context for doing so. Joint costs must be allocated to individual products or services for several purposes, including the following:

For both external and internal reporting needs, we calculate inventoriable costs and the cost of goods sold. Recall from our study of cost theories that absorption costing is required for financial accounting and tax reporting. This necessitates the allocation of joint manufacturing or processing costs to products for calculating ending inventory values. In addition, many firms use internal accounting data based on joint cost allocations to analyze the profitability of their various departments and evaluate the performance of departments' managers.

Reimbursing companies that have some, but not all, of their products or services reimbursed under cost-plus contracts with, say, a government agency. For example, the joint costs incurred when multiple organs are removed from a single donor must be allocated to various organ centers in order to determine reimbursement rates for transplants into Medicare patients. In such cases, stringent rules typically specify the way in which joint costs are assigned to the products or services covered by the agreements.

Regulating the rates or prices of one or more of jointly produced products or services. This issue is critical in the extractive and energy industries, in which output prices are regulatory to yield a fixed return on a cost basis that includes

joint-cost allocations. In telecommunications, a firm with significant market power has some products subject to price regulation (e.g. interconnection) and other activities that are unregulated (such as equipment rentals to end users). In this case, joint costs must be allocated to ensure that costs are not transferred from unregulated services to regulated ones.

For any commercial litigation or insurance settlement situation in which the costs of joint products or services are key points.

Why allocate joint costs?

There are many contexts that require the allocation of joint costs to individual products or services examples include:

- Inventory-costing and cost-of-goods-sold computations for external financial statements and reports for income tax authorities.

- Inventory-costing and cost-of-goods-sold computations for internal financial reporting. Such reports are used in division profitability analysis when determining compensation for departments managers.

- Cost reimbursement under contracts when only a portion of a business' products or services is sold or delivered to a single customer (such as a government agency).

- Customer profitability analysis where individual customers purchase varying combinations of joint products or by-products as well as other products of the company.

- Insurance settlement computations when damage claims made by businesses with joint products, main products or by-products are based on cost information.

- Rate regulation when one or more of the jointly produced products or services are subject to price regulation.

Meaning Of Joint Products and By-Products Terms

Consider a single process that yields two or more products (or services) simultaneously. The distillation of coal, for example, gives us coke, gas and other products. The cost of this distillation process would be called a **Joint Cost**. Joint costs are thus the costs of a production process that yields multiple products simultaneously. The stage in the process when one or more products in a joint-cost setting become separately identifiable is called the **Split-Off Point**. An example is the point where coal becomes coke, gas and other products. **Separable Costs** are costs incurred beyond the split-off point that are assignable to one or more individual products. At or beyond the splitoff point, decisions relating to sale or further processing of individual products can be made independently of decisions about other products.

Various terms have arisen in conjunction with production processes. A **Product** is any output that has a positive sales value (or an output that enables an organization to avoid incurring costs). **Joint Products** all have relatively high sales value but are not separately identifiable as individual products until the split-off point. When a single process yielding two or more products yields only one product with a

relatively high sales value, that product is termed a **Main Product**.

A **By-Product** has a low sales value compared with the sales value of the main or joint product(s). **Scrap** has a minimal sales value. The classification of products as main, joint, byproduct or scrap can change over time, especially for products (such as tin) whose market price can increase or decrease by, say, 30% or more in any one year.

Industries abound in which single processes simultaneously yield two or more products. Exhibit 1 presents examples of joint-cost situations in diverse industries. In each example in Exhibit 1, no individual product can be produced without the accompanying products appearing, although sometimes the proportions can be varied. A poultry farm cannot kill a turkey wing; it has to kill a whole turkey, which yields breast, drumsticks, giblets and poultry meal in addition to wings. In this example, the focus is on building up costs of individual products as disassembly occurs.

In some joint-cost settings, the number of outputs produced exceeds the number of products. This situation can occur where an output, produced as an inherent part of the joint production process, is recycled without any value being added by its production. For example, the offshore processing of hydrocarbons to yield oil and gas also yields water as an output, which is recycled back into the sea. Similarly, the processing of mineral ore to yield gold and silver also yields dirt as an output, which is recycled back

into the ground. The water and dirt in these examples typically are not classified as products, but they are outputs. No entries are made in the accounting system to record their processing. The physical quantity of these outputs can be large relative to the physical quantity of outputs that are recorded in the accounting system as products. It is only those outputs that have a positive sales value that are typically labeled products.

Exhibit 1

Industry	Separable products at the spilt off point
Agriculture**:**	
Lamb	Lamb cuts, offal, hides, bones, fat
raw milk	Cream, liquid skim
Turkeys	Breast, wings, drumsticks, giblets, feather, ….
Mining industries	
Coal	Coke, gas, benzol, tar, ammonia
Copper	Copper, silver, lead, zinc
Petroleum	Crude oil, gas, raw liquefied petroleum gas
Salt	Hydrogen, chlorine, caustic soda

Approaches To Allocating Joint Costs

There are two basic approaches to allocating joint costs:

1- Allocate costs using market-based data (for example, revenues). Three methods that can be used in applying this approach are:

A. the sales value at split-off method

B. the estimated Net Realizable Value (NRV) method

C. the constant gross-margin percentage NRV method.

2- Allocate costs using physical measure-based data such as weight or volume.

We have previously emphasized both the cause-and-effect and benefits-received criteria for guiding cost-allocation decisions. In joint-cost settings, it is not feasible to use the cause and-effect criterion to guide individual product-cost allocations. Joint costs, by definition, cannot be the subject of cause-and-effect analysis at the individual product level. The cause-and-effect relationship exists only at the joint process level. The benefits-received criterion leads to a preference for methods under approach 1. Revenues, in general, are a better indicator of benefits received than are physical measures such as weight or volume.

In the simplest situation, the joint products are sold at the split-off point without further processing. We use this case first (Example 1) to illustrate the sales value at split-off method and the physical measures method using volume as the metric. Then we consider situations involving further processing beyond the split-off point (Example 2) to illustrate the estimated NRV method and the constant gross-margin percentage NRV method.

We use the following notation:

To enable comparisons across the methods, we report for each method individual gross margin percentages for individual products.

Example Of:

A. The Sales Value at Split-Off Method

B. The Estimated Net Realizable Value (NRV) Method

C. The Constant Gross-Margin Percentage NRV Method.

D. Allocate Costs Using Physical Measure-Based Data Such as Weight or Volume.

Example(l)

Company A purchases raw milk from individual farms and processes it up to the split-off point, where two products (cream and liquid skim) are obtained. These two products are sold to an independent company, which markets and distributes them to supermarkets and other retail outlets.

• Raw milk processed: 440 liters (440 liters of raw milk yield 400 liters of good product with a 40-litre shrinkage):

	production	sales
Cream	100 liters	80 liters at $2 per liter
Liquid skim	300 liters	120 liters at $1 per liter

• Inventory's:

	Beginning inventory	Ending inventory
Raw milk	0 liters	0 liters
Cream	0 liters	20 liters
Liquid skim	0 liters	180 liters

• Cost of purchasing 440 liters of raw milk and processing it up to the split-off point to yield 100 liters of cream and 300 liters of liquid skim: $400.

How much of the joint costs of $400 should be allocated to the Ending inventory of 20 liters of cream and 180 liters of liquid skim? The joint production costs of $400 cannot be uniquely identified with or traced to either product. Why? Because the products themselves were not separated before the split-off point. The joint-cost-allocation methods we now discuss can be used for costing the inventory of cream and liquid skim as well as determining cost of goods sold.

Sales Value at Split-Off Method

The sales value at split-off method allocates joint costs on the basis of the relative sales value at the split-off point of the total production in the accounting period of each product. In schedule:1, the sales value at split-off of the May 2024 production **is $200 for cream and $300 for liquid skim**. We then assign a weighting to each product, which is a percentage of total sales value. Using this weighting, we allocate the joint costs to the individual products, as shown in schedule:1.

Note that this method uses the sales value of the ***Entire Production*** of the accounting period. The joint costs were incurred on all units produced and not just those sold. Schedule: 2 presents the product-line income statement, using the sales value at split-off method of joint-cost allocation. Use of this method has enabled us to obtain individual product costs and gross margins. Both cream and liquid skim have gross-margin percentages of 20%. The equality of the gross-margin percentages for the two products is a mechanical result reached with the sales value at split-off method when there are no beginning inventories and all products are sold at the split-off point.

Schedule: 1, Allocate the Joint Costs Using Sales Value at Split-Off Method

	Cream	Liquid Skim	Total
1. Sales Value at Split-Off Point: (Cream,100 Liters × $2); (Liquid Skim, 300 Liters × $1)	$200	$300	$500
2. Weighting ($200, $500); ($300, $500)	0.40	0.60	
3. Joint Costs Allocated: (Cream, 0.40 × $400); (Liquid Skim, 0.60 × $400)	$160	$240	$400
4. Joint Production Costs Per Liter: (Cream, $160 ÷ 100 liters); (liquid skim, $240 ÷ 300 liters)	$1.60	$0.80	

Schedule: 2,

Company A Product-Line Income Statement for May 2024:

Joint Costs Allocated Using Sales Value at Split-Off Method

	Cream	Liquid skim	Total
Sales: (cream, 80 liters × $2) ;(liquid skim, 120 liters × $1)	$160	$120	$280
Joint costs: Production costs (cream,0.4×$400) ;(liquid skim, 0.6 × $400)	$160	$240	$400
Deduct Ending Inventory: (cream, 20 liters × $1.60) ;(liquid skim, 180 liters × $0.80)	$32	$144	$176
Cost of goods sold	$128	$96	$224
Gross margin	$32	$24	$56
Gross-margin percentage	20%	20%	20%

The sales value at split-off point method exemplifies the benefits-received criterion of cost allocation. **Costs are allocated to products in proportion to their ability to contribute revenue**. This method is both straightforward and intuitive. The cost-allocation base (sales value at splitoff) is expressed in terms of a common denominator ($) that is systematically recorded in the accounting system and well understood by all parties.

Physical Measure Method

The **Physical Measure Method** allocates joint costs on the basis of their relative proportions at the split-off point, using a common physical measure such as weight or volume of the total production of each product. In Example 1, the $400 joint costs produced 100 liters of cream and 300 liters of

liquid skim. Joint costs using these quantities are allocated as shown in Schedule: 3. Schedule: 4 presents the product-line income statement using this method of joint-cost allocation. The gross-margin percentages are 50% for cream and 0% for liquid skim.

The physical weights used for allocating joint costs may have no relationship to the revenue producing power of the individual products. Using the benefits-received criterion, the physical measure method is less preferred than the sales value at split-off method. Consider a mine that extracts ore containing gold, silver and lead. Use of a common physical measure (tons) would result in almost all the costs being allocated to the product that weighs the most - lead, which has the lowest revenue-producing power. As a second example, if the joint cost of a pig were assigned to its various products on the basis of weight, loin pork chops would have the same cost per kilogram as pigs' trotters, lard, bacon, bones and so forth. In a product-line income statement, the pork products that have a high sales value per kilogram (for example, loin pork chops) would show a fabulous _ profit ', and products that have a low sales value per kilogram (for example, bones) would show consistent losses.

Schedule: 3, Allocate the Joint Costs Using Physical Measure Method.

	Cream	Liquid skim	Total
1. Physical measure of production (liters):	25	75	100
2. Weighting (100 liters ÷400 liters); (300litres÷400 liters)	0.25	0.75	
3. Joint costs allocated: (Cream, 0.25 × $400); (Liquid Skim, 0.75 × $400)	$100	$300	$400
4. Joint production costs per liter: (cream, $100 ÷ 100 liters); (liquid skim, $300 ÷ 300 liters)	$1	$1	

Schedule: 4,

Company A Product-Line Income Statement for May 2024:

Joint Costs Allocated Using Physical Measure Method.

	Cream	Liquid skim	Total
Sales: (cream, 80 liters × $2) ;(liquid skim, 120 liters × $1)	$160	$120	$280
Joint costs: Production costs (cream,0.25×$400) ;(liquidskim,0.75×$400)	$100	$300	$400
Deduct Ending Inventory: (Cream, 20 liters × $1);(liquid skim, 180 liters × $1)	$20	$180	$200
Cost of goods sold	$80	$120	$200
Gross margin	$80	$ 0	$80
Gross-margin percentage	50%	0%	28.6%

Obtaining comparable physical measures for all products is **not always straightforward**. Consider oil and gas joint-cost settings, where oil is a liquid and gas is a vapor. Use of a physical measure, such as barrels, will require technical assistance from chemical engineers on how to convert the

vapor into a measure additive with barrels of oil. Technical personnel outside accounting may be required when using some physical measures in joint-cost-allocation situations.

Example (2)

- Cream -Butter cream: 100 liters of cream are further processed to yield 80 liters of butter cream at additional processing (separable) costs of $280. Butter cream is sold for $6.25 per liter.

- Liquid skim - Condensed milk: 300 liters of liquid skim are further processed to yield 200 liters of condensed milk at additional processing costs of $520. Condensed milk is sold for $5.5 per liter.

Sales during the accounting period were 48 liters of butter cream and 180 liters of condensed milk. Schedule presents an overview of the basic relationships. Inventory information is as follows:

	Beginning inventory	Ending inventory
Raw milk	0 liters	0 liters
Cream	0 liters	0 liters
Liquid skim	0 liters	0 liters
Butter cream	0 liters	32 liters
Condensed milk	0 liters	20 liters

Example 2 will be used to illustrate the estimated net realizable value (NRV) method and the constant gross-margin percentage NRV method.

Estimated Net Realizable Value Method

The **Estimated Net Realizable Value (NRV) Method** allocates joint costs on the basis of the relative ***Estimated Net Realizable Value*** (expected final sales value in the ordinary course of business minus the expected separable costs of production and marketing of the total production of the period). Joint costs would be allocated as shown in Schedule: 5.

Schedule: 6 presents the product-line income statement using the estimated NRV method. The gross-margin percentages are 22.0% for butter cream and 26.4% for condensed milk. Estimating the net realizable value of each product at the split-off point requires information about the subsequent processing steps to be taken (and their expected separable costs). (The estimated NRV method is clear-cut when there is only one split-off point. When there are multiple split-off points, however, additional allocations may be required if processes subsequent to the initial split-off point remerge with each other to create a second joint-cost situation.) In some plants, such as in petrochemicals, there may be many possible subsequent steps. Companies may frequently change further processing to exploit fluctuations in the separable costs of each processing stage or in the selling prices of individual products. Under the estimated NRV method, each such change would affect the joint-cost-allocation percentages. (In practice, a set of standard subsequent steps is assumed at the start of the accounting period when using the estimated NRV method.).

Schedule: 5, Allocate the Joint Costs Using Estimated Net Realizable Value (NRV) Method.

	Butter cream	Condensed milk	Total
1. Expected final sales value of production: (butter cream, 80 liters × $6.25) (condensed milk, 200 liters × $5.5)	$500	$1100	$1600
2. Deduct expected separable costs to complete and sell	280	520	800
3. Estimated NRV at Split-Off Point	$220	$580	$800
4. Weighting ($220 ÷ $800); ($580 ÷ $800)	0.275	0.725	
5. Joint costs allocated: (Butter Cream, 0.275 × $400) (Condensed Milk, 0.725 × $400)	$110	$290	$400
6. Production costs per liter: [butter cream ($110 + $280) ÷ 80 liters condensed milk ($290 + $520) ÷200 liters]	$4.875	$4.05	

The sales value at split-off method is less complex than the estimated NRV method as it does not require knowledge of the subsequent steps in processing. However, it is not always feasible to use the sales value at split-off method. Why? Because there may not be any market prices at the split-off point for one or more individual products. Market prices may not first appear until after processing beyond the split-off point has occurred.

Schedule: 6

Company A Product-Line Income Statement for May 2024: Joint Costs Allocated Using the Estimated Net Realizable Value (NRV) Method.

	Butter cream	Condensed milk	Total
Sales (butter cream, 48 liters × $6.25). (condensed milk, 180 liters × $5.5)	$300	$990	$1290
Cost of goods sold: Joint costs: (butter cream, 0.275 × $400); (condensed milk, 0.725 × $400)	$110	$290	$400
Separable processing costs:	$280	$520	$800
Cost of goods available for sale	$390	$810	$1200
Deduct Ending inventory (butter cream, 32 liters × $4.875) (condensed milk, 20 liters × $4.05)	$156	$81	$237
Cost of goods sold:	$234	$729	$963
Gross margin	$66	$261	$327
Gross-margin percentage	22.0%	26.4%	25.3%

Constant Gross-Margin Percentage NRV Method

The **Constant Gross-Margin Percentage NRV Method** allocates joint costs in such a way that the overall gross-margin percentage is identical for all the individual products. This method entails three steps:

1. Calculate the overall gross-margin percentage.

2. Use the overall gross-margin percentage and deduct the gross margin from the final sales values to obtain the total costs that each product should bear.

3. Deduct the expected separable costs from the total costs to obtain the joint-cost allocation.

Schedule: 7

Company A for May 2024: joint costs allocate using Constant Gross-Margin Percentage (NRV) Method. Schedule: 7 presents these three steps for allocating the $400 joint costs between butter cream and condensed milk. To determine the joint-cost allocation,

	Butter Cream	Condensed Milk	Total
Step 1: 1. Expected final sales value of production: (80 liters × $6.25) =$500 (200 liters × $5.5)=$1100			$1600
Deduct joint and separable costs ($400 + $280 + $520)			$1200
Gross margin			$400
Gross-margin percentage ($400 ÷ $1600)			25%
Step 2: Expected final sales value of production (butter cream, 80 liters × $6.25; (condensed milk, 200 liters × $5.5)	$500	$1100	$1600
Deduct gross margin, using overall gross-margin percentage (25%)	$125	$275	$400
Cost of goods sold	$375	$825	$1200
Step 3: Deduct separable costs to complete and sell	$280	$520	$800
Joint costs allocated	$95	$305	$400

Schedule: 7 uses the expected final sales value of the *total production* of the period ($1600) and *not* the actual sales of the period. The joint costs allocated to each product need not always be positive under this method. Some products may receive negative allocations of joint costs to bring their gross-margin percentages up to the overall company average. The overall gross-margin percentage is 25%. A product-line income statement for the constant gross-margin percentage NRV method is presented in Schedule: 8.

The tenuous assumption underlying the constant gross-margin percentage NRV method is that all the products have the same ratio of cost to sales value. A constant ratio of cost to sales value across products is rarely seen in companies that produce multiple products but have no joint costs. The main advantage of this method, however, is that it is easy to implement.

Schedule: 8

Company A Product-Line Income Statement for May 2024: Joint Costs Allocated Using Constant Gross-Margin Percentage (NRV) Method.

	Butter Cream	Condensed Milk	Total
Sales: (butter cream, 48 liters × $6.25) (condensed milk, 180 liters × $5.5)	$300	$990	$1290
Cost of goods sold: Joint costs (from Schedule: 7) Separable costs to complete and sell	 $95.0 280.0	 305.0 520.0	 400.0 800.0
Cost of goods available for sale	375	825	1200
Deduct Ending inventory: (butter cream,32 liters × $4.6875*) (condensed milk,20 liters × $4.125†	150	82.5	232.5
Cost of goods sold	225.0	742.5	967.5
Gross margin	$75.0	$247.	$322.5
Gross-margin percentage	25%	25%	25%
* 375 ÷80 liters = $4.6875. † 825 ÷200 liters = $4.125.			

Comparison Of Methods

Which method of allocating joint costs should be chosen? Because the costs are joint in nature, managers cannot use the cause-and-effect criterion in making this choice. Managers cannot be sure what causes what cost when examining joint costs. The benefits-received criterion leads to a preference for the sales value at split-off point method (or other related revenue or market-based methods). Additional benefits of this method include:

1. No anticipation of subsequent management decisions. The sales value at split-off method does not presuppose an exact number of subsequent steps undertaken for further processing.

2. Availability of a meaningful common denominator to calculate the weighing factors. The denominator of the sales value at split-off method is a meaningful one. In contrast, the physical measure method may lack a meaningful common denominator for all the separable products (for example, when some products are liquids and other products are solids).

3. Simplicity. The sales value at split-off method is simple. In contrast, the estimated NRV method can be very complex in operations with multiple products and multiple split-off points.

The total sales value at split-off is unaffected by any change in the production process after the split-off point.

The purpose of the joint-cost allocation is important. Consider rate regulation. Market-based measures are difficult to use in this context. It is circular to use selling prices as a basis for setting prices (rates) and at the same time use selling prices to allocate the costs on which prices (rates) are based. Physical measures represent one joint-cost-allocation approach available in rate regulation.

Choosing An Allocation Method

Which method of allocating joint costs should be used? When selling-price data exist at the splitoff, the sales value at splitoff method is preferred, even if further processing is done. The following are reasons why:

1. Measure of benefits received. The sales value at splitoff is the best measure of the benefits received by joint products

relative to all other methods of allocating joint costs. It is a meaningful basis for allocating joint costs because generating revenues is the reason why a company incurs joint costs in the first place. It is also sometimes possible to vary the physical mix of final output and thereby produce more or less market value by incurring more or less joint costs. In such cases, there is a clear causal link between total cost and total output value, thereby further validating the use of the sales value at splitoff method.

2. Independent of further processing decisions. The sales value at splitoff method does not require information on the processing steps after the splitoff, if there are any. In contrast, the NRV and constant gross-margin percentage NRV methods require information on (a) the specific sequence of further processing decisions, (b) the separable costs of further processing, and (c) the point at which individual products will be sold.

3. Common allocation basis. As with other market-based approaches, the sales value at splitoff method provides a common basis for allocating joint costs to products, namely revenue. In contrast, the physical measure at splitoff method may lack an easily identifiable common basis for cost allocation.

4. Simplicity. The sales value at splitoff method is simple. In contrast, the NRV and constant gross-margin percentage NRV methods can be complex for

operations with multiple products and multiple splitoff points. This complexity increases when managers make frequent changes to the sequence of post-splitoff processing decisions or to the point at which individual products are sold.

When the selling prices of all products at the splitoff point are unavailable, the NRV method is the best alternative. It attempts to approximate the sales values at splitoff by subtracting from final selling prices the separable costs incurred after the splitoff point. The NRV method assumes that all the markup (the profit margin) is attributable to the joint process and none of the markup is attributable to the separable costs. This is unrealistic if, for example, a firm uses a special patented technology in its separable process or innovative marketing that enables it to generate significant profits. Despite this limitation, the NRV method is commonly used when selling prices at splitoff are not available as it provides a better measure of the benefits received than either the constant gross-margin percentage NRV method or the physical measure method.

The constant gross-margin percentage NRV method treats the joint products as though they comprise a single product. This method calculates the aggregate gross-margin percentage, applies this percentage to each product, and views the residual after separable costs are accounted for as the amount of joint costs assigned to each product. Consequently, unlike the NRV method, the benefits received by each of the joint products at the splitoff point don’t have

to be measured. Also, the constant gross-margin percentage method recognizes that the profit margin is not just attributable to the joint process but is also derived from the costs incurred after splitoff. The drawback of the method is that it assumes that the profit margin is identical across products; that is, all products are assumed to have the same ratio of cost to sales value. Recall from our discussion of activity-based costing (ABC) in this book that such a situation is uncommon when companies offer a diverse set of products.

Although there are difficulties in using the physical-measure method—such as lack of congruence with the benefits-received criterion—there are instances when it may be preferred. In settings where end prices are volatile or the process after splitoff is long or uncertain, the presence of a comparable physical measure at splitoff would favor use of the method. This is true, for instance, in the chemical and oil refining industries. The physical-measure method is also useful when joint cost allocations are used as the basis for setting market prices, as in rate regulation. It avoids the circular reasoning of using selling prices to allocate the costs on which prices (rates) are based.

No Allocation of Joint Costs

All of the preceding methods of allocating joint costs to individual products are subject to criticism. As a result, some companies refrain from joint-cost allocation entirely. Instead, they carry all inventories at estimated NRV. Income on each product is recognized when production is completed.

Industries that use variations of this approach include meat packing, canning and mining. Accountants ordinarily criticize carrying inventories at estimated NRV. Why? Because income is recognized *before* sales are made. Partly in response to this criticism, some companies using this no-allocation approach carry their inventories at estimated NRV minus a normal profit margin.

Schedule: 9 presents the product-line income statement with no allocation of joint costs for Example.2. The separable costs are assigned first, which highlights for managers the cause and-effect relationship between individual products and the costs incurred on them. The joint costs are not allocated to butter cream and condensed milk as individual products.

Schedule: 9

	Butter Cream	**Condensed Milk**	**Total**
Produced and sold: (butter cream, 48 liters × $6.25) (condensed milk, 180 liters × $5.5)	300	990	1290
Produced but not sold: (butter cream, 32 liters × $6.25) (condensed milk, 20 liters × $5.5)	200	110	310
Total sales value of production -Separable costs	$500 $280	$1100 $520	$1600 $800
Contribution to joint costs and operating profit	$220	$580	800
Joint costs			400
Gross margin			$400
Gross-margin percentage			25%

Irrelevance Of Joint Costs for Decision Making

No technique for allocating joint-product costs should guide management decisions regarding whether a product should be sold at the split-off point or processed beyond split-off When a product is an inevitable result of a joint process, the decision to process further should not be influenced either by the size of the total joint costs or by the portion of the joint costs allocated to particular products. Ultimately, all joint-cost allocations to products are, to a degree, arbitrary.

Sell Or Process Further

The decision to incur additional costs beyond split-off should be based on the incremental operating profit attainable beyond the split-off point. Example 2 assumed that it was profitable for both cream and liquid skim to be further processed into butter cream and condensed milk, respectively.

The incremental analysis for these decisions to process further is as follows:

Further Processing Cream into Butter Cream:	
Incremental revenue ($500 - $200)	$300
Incremental processing costs	$280
Incremental operating profit	$20

Further Processing Liquid Skim into Condensed Milk:	
Incremental revenue ($1100 - $300)	$800
Incremental processing costs	$520
Incremental operating profit	$280

Assume The Same Situation as In Example 1 Except That Both Cream and Liquid Skim Can Be Processed Further:

Example (3)

A-Parfums jointly processes a special chemical material that yields two perfumes: 50 ml of C and 150 ml of N. The sales values per milliliter at split-off are $6 for C and $4 for N.

The joint costs incurred up to the split-off point are $880. The manager has the option of further processing 150 ml of N to yield 100 ml of P. The total additional costs of converting N into P would be $160 and the selling price per milliliter of P would be $8.

The amount of joint costs incurred up to split-off ($400) - and how it is allocated - is irrelevant in deciding whether to process further cream or liquid skim. Why? Because the joint costs of $400 are the same whether or not further processing is done.

Many manufacturing companies constantly face the decision of whether to process further a joint product. Meat products may be sold as cut or may be smoked, cured, frozen, canned, and so forth. Petroleum refiners are perpetually trying to adjust to the most profitable product mix. The refining process necessitates separating all products from crude oil, even though only two or three may have high revenue potential. The refiner must decide what combination of processes to use to get the most profitable mix of crude oil, gas, butane, ethane, propane and the like.

In designing reports for managers' decisions of this nature, the accountant must concentrate on incremental costs rather than on how historical joint costs are to be allocated among various products. The only relevant items are incremental revenue and incremental costs. This next example illustrates the importance of the incremental-cost viewpoint.

The correct approach in deciding whether to further process N into P is to compare the incremental revenue with the incremental costs, if all other factors such as invested capital and the time period are held constant:

Incremental revenue of P (100 × $8) -(150 × $4)	$200
Incremental costs of P, further processing	$160
Incremental operating profit from converting N into P	$40

The following is a total income computation of each alternative. The revenues reported for each product are C (50 ml at $6 per ml = $300), N (150 ml at $4 per ml = $600) and P (100 ml at $8 per ml = $800).

	Alternative 1: Sell C and N	Alternative 2: Sell C and P	Difference
Total revenues	($300 + $600) $900	($300 + $800) $1100	$200
Total processing costs	$880	($880 + $160) $1040	$160
Operating profit	$20	$60	$40

As we can see from our example, it is profitable to extend processing and to incur additional costs on a joint product as long as the incremental revenue exceeds incremental costs.

Conventional methods of joint-cost allocation may mislead managers who rely on unit-cost data to guide their sell-or-further-process decisions. For example, the physical measure method (milliliters in our example) would allocate the $880 joint costs as follows:

Product	Milliliters produced	Weighting	Allocation of joint costs
C	50	50/200 = 0.25	0.25 x $880 = $220
N	150	150/200 = 0.75	0.75 x $880 = $660
	200		$880

The resulting product-line income statement for the alternative of selling C and P would erroneously imply that the company would suffer a loss by selling P:

	C	P
Revenues	$300	$800
Costs: Joint costs allocated Separable costs	 $220 ---------	 $660 $160
Cost of goods sold	$220	$820
Operating profit	$80	$(20)

Accounting For By-Products

Processes that yield joint products often also yield what are frequently referred to as byproducts - products that have relatively low sales value compared with the sales value of the main or joint product(s). We now discuss accounting for by-products. To simplify the discussion, consider a two-product example consisting of a main product and a by-product.

Example (4)

Company A processes meat. One of its departments cuts beef shanks and generates two products:

-shank meat (the main product) - sold for $60 per pack

-shank bone (the by-product) - sold for $4 per pack.

Both products are sold at the split-off point without further processing, as Exhibit: shows. Data (number of packs) for this department in July 2018 are as follows:

	Production	Sales	Beg. inventory	Ending inventory
shank meat	500	400	0	100
shank Bone	100	30	0	70

Total manufacturing costs of these products were $25,000.

Accounting methods for by-products address two major questions:

1. When are by-products first recognized in the general ledger? The two basic choices are (a) at the time of production, or (b) at the time of sale.

2. Where do by-product revenues appear in the income statement?

The two basic choices are (a) as a cost reduction of the main or joint product(s), or (b) as a separate item of revenue or other income.

Combining these two questions and choices gives four possible ways of accounting for byproducts:

Four Ways Account for By-Product.

By-product accounting method	**When by-products are recognized in the general ledger**	**When by-product revenue appears in the income statement**	**When by product inventory appears in the balance sheet**
A	Production	Reduction of the cost	By-product inventory reported at (unrealized) selling prices
B	Production	Revenue or other income item	
C	sale	Reduction of the cost	By-product inventory not recognized
D	sale	Revenue or other income item	

Schedule 10, presents the income statement figures and inventory figures that Company A would report under each method. Methods A and B recognize the by-product inventory at the time of production. Note, however, that by-

products inventories are reported on the balance sheet at selling prices rather than at a cost amount. One variation of methods A and B is to report by-products inventories' at selling price minus a _normal profit margin. This variation avoids including unrealized gains as an offset to cost of goods sold in the period of production. One version of method A deducts the estimated NRV of the by-product(s) from the joint costs before the remainder is allocated to individual joint products. Another version of method A deducts the estimated NRV of the by-product(s) from the total production costs (joint costs plus separable costs).

Schedule: 10, Company A Income Statement For July 2024.

	By-Product Accounting Method			
	A	B	C	D
When By-Products Are Recognized in General Ledger	At Production-	At Production-	At Sale-	At Sale-
Where By-Product Revenues Appear in Income Statements	Reduction of cost	Revenue item	Reduction of cost	Revenue item
Revenues:				
Main product: Shank meat (400 × $60)	$24000	$24000	$24000	$24000
By-product: Shank Bone (30 × $4)	-----	$120	----	$120
Total revenue	$24000	$24120	$24000	$24120
Cost of goods sold:				
Total manufacturing costs	$25000	$25000	$25000	$25000
Deduct by-product net revenue (30 × $4)	$120	----	$120	----
Net Manufacturing Costs	$24880	$25000	$24880	$25000
Deduct main product inventory*	$4976	$5000	$4976	$5000
Deduct by-product inventory (70 × $4)	$280	$280	----	-----
Total Cost of Goods Sold	$19624	$19720	$19904	$20000
Gross margin	$4376	$4400	$4096	$4120

Gross-Margin Percentage	18.23%	18.24%	17.07%	17.08%
Inventoriable costs (End of Period)				
Main product: shank meat	$4976	$5000	$4976	$5000
By-product: Shank Meat **	$280	$280	0	0
* net manufacturing costs/500 ×100 . **Shown at selling prices.				

Methods C and D are rationalized in practice primarily on grounds of the relative insignificance of by-products. By-products are sometimes viewed as incidental. Methods C and D permit managers to manage reported earnings by timing when they sell by-products. Managers may inventory by-products so that they have flexibility to give revenue a boost when this favorable for them.

Company A uses method B in its accounting system. This method highlights how each saleable product contributes to its total revenues. Over time, the revenues contributed by individual products can vary. Method B enables managers to track these changing contributions easily.

In general:

1. A joint cost is the cost of a single process that yields multiple products. The split-off point is the juncture in the process when the products become separately identifiable.

2. Joint products have relatively high sales value and are not separately identifiable as individual products until the split-off point. A by-product has a low sales value compared with the sales value of a joint product. Individual products can change from being a byproduct or a joint product when their market prices move sizably in one direction.

3. The purposes for allocating joint costs to products include inventory costing for external financial reporting, internal financial reporting, cost reimbursement under contracts, customer profitability analysis, insurance settlements and rate regulation.

4. The accounting methods available for allocating joint costs include using market selling price (either sales value at split-off or estimated net realizable value) or using a physical measure. Choosing not to allocate is also an option.

5. The benefits-received criterion leads to a preference for revenue or market-based methods such as the sales value at split-off point method. Additional pros of this method include not anticipating subsequent management decisions on further processing, using a meaningful common denominator and being simple.

6. By-product accounting is an area where there is much inconsistency in practice and where some methods used are justified on the basis of expediency rather than theoretical soundness. By-products can be recognized at production or at the point of sale. By-product revenues can appear as a separate revenue item or an offset to other costs.

Example Of Joint Product Costing:

1- Sales Value at Splitoff Method.

Sugar Cane Company processes sugar cane into three products. During May, the joint costs of processing were $240,000. Production and sales value information for the month were as follows:

Product	Units Produced	Sales Value at Splitoff Point	Separable costs
Sugar	6,000	$80,000	$24,000
Sugar Syrup	4,000	$70,000	$64,000
Fructose Syrup	2,000	$50,000	$32,000

Required:

Determine the amount of joint cost allocated to each product if the sales value at splitoff method is used.

Solution

Product	Units Produ	Sales Value	Percent	Joint Cost	Allocated
Sugar	6,000	$80,000	40%	$240,000	$96,000
Sugar Syrup	4,000	$70,000	35%	$240,000	$84,000
Fructose Syrup	2,000	$50,000	25%	$240,000	$60,000
Total		$200,000	100%		$240,000

2- Constant Gross-Margin Percentage NRV Method.

Calamata Corporation processes a single material into three separate products A, B, and C. During September, the joint costs of processing were $300,000. Production and sales value information for the month were as follows:

Product	Units Produced	Sales Value per Unit	Separable costs
A	10,000	$25	$125,000
B	15,000	$30	$250,000
C	12,500	$24	$125,000

Required:

Determine the amount of joint cost allocated to each product if the constant gross-margin percentage NRV method is used.

Solution

The gross margin percentage is 20% ($1,000,000-$800,000)/$1,000,000

Product	Sales Value	Less Gross Margin	Total Production Costs	Less Separable Costs	Joint Costs Allocated
A	$250,000	$50,000	$200,000	$125,000	$75,000
B	$450,000	$90,000	$360,000	$250,000	$110,000
C	$300,000	$60,000	$240,000	$125,000	$115,000
Total	$1,000,000	$200,000	$800,000	$500,000	$300,000

3- Sales Value at Splitoff Method Is Used for Product Costing.

Oregon Lumber processes timber into four products. During January, the joint costs of processing were $280,000. There was no inventory at the beginning of the month. Production and sales value information for the month is as follows:

		Sales Value at	
Product	Units Produced (Board feet)	Splitoff Point	Ending Inventory
A	6,000,000	$0.30 per board foot	500,000 bdft.
B	3,000,000	$0.40 per board foot	250,000 bdft.
C	2,000,000	$0.45 per board foot	100,000 bdft.
D	1,000,000	$0.10 per board foot	50,000 bdft.

Required:

Determine the value of ending inventory if the sales value at splitoff method is used for product costing. Round to 3 decimal places when necessary.

Product	(Board feet)	Sales Value	Percent	Joint Cost	Allocated
A	6,000,000	$1,800,000	45%	$280,000	$126,000
B	3,000,000	$1,200,000	30%	$280,000	$84,000
C	2,000,000	$900,000	22.5%	$280,000	$63,000
D	1,000,000	$100,000	2.5%	$280,000	$7,000
Totals		$4,000,000	100%		$280,000

Solution.

Product	Fraction of Production in Inventory	Allocated	Inventory value
A	500,000/6,000,000 ×	$126,000 =	$10,500
B	250,000/3,000,000 ×	84,000 =	$7,000
C	100,000/2,000,000 ×	63,000 =	$3,150
D	50,000/1,000,000 ×	7,000 =	$350
Totals			$21,000

4- Joint Cost Allocated to Each Product If the Physical-Measure Method.

Z Chemical, Inc., processes pine rosin into three products: turpentine, paint thinner, and spot remover. During May, the joint costs of processing were $240,000. Production and sales value information for the month is as follows:

Product	Units Produced	Sales Value at Splitoff Point
Turpentine	6,000 liters	$60,000
Paint thinner	6,000 liters	$50,000
Spot remover	3,000 liters	$25,000

Required:

Determine the amount of joint cost allocated to each product if the physical-measure method is used.

Solution.

Product	Units Produced	Percentage	Joint Costs	Allocated
Turpentine	6,000 liters	40% x	$240,000 =	$96,000
Paint thinner	6,000 liters	40% x	$240,000 =	$96,000
Spot remover	3,000 liters	20% x	$240,000 =	$48,000
Total	15,000 liters	100%		$240,000

5- Joint Cost Allocated to Each Product If Net-Realizable Value (NRV) Method Is Used.

Red Sauce Canning Company processes tomatoes into ketchup, tomato juice, and canned tomatoes. During the summer of 2024, the joint costs of processing the tomatoes were $420,000. There was no beginning or ending inventories for the summer. Production and sales value information for the summer is as follows:

Product	Units Produced Cases	Sales Value at Splitoff Point	Separable Costs	Selling Price
ketchup	100,000	$6 per case	$3.00 per case	$28 per case
Juice	150,000	$8 per case	$5.00 per case	$25 per case
Canned	200,000	$5 per case	$2.50 per case	$10 per case

Required:

Determine the amount allocated to each product if the estimated net realizable value method is used, and compute the cost per case for each product.

Solution.

Product	Expected Sales Value	Separable Costs	Net Realizable	Percentage
ketchup	$2,800,000	$300,000	$2,500,000	35.71%
Juice	$3,750,000	$750,000	$3,000,000	42.86%
Canned	$2,000,000	$500,000	$1,500,000	21.43%
Totals			$7,000,000	100%

Product	Percentage	Joint Costs	Allocated	Separable Costs	Product Costs
Catchup	35.71%	$420,000 =	$149,982 +	$300,000 =	$449,982
Juice	42.86%	$420,000 =	$180,012 +	$750,000 =	$930,012
Canned	21.43%	$420,000 =	$90,006 +	$500,000 =	$590,006

Catchup cost per case $449,982/100,000 = $4.50
Juice cost per case $930,012/150,000 = $6.20
Canned cost per case $590,006/200,000 = $2.95

Example of Joint Product Costing:

Example (6)

Northern Company processes 100 gallons of raw materials into 75 gallons of product GS-50 and 25 gallons of GS-80. GS-50 is further processed into 50 gallons of product GS-505 at a cost of $5,000, and GS-80 is processed into 50 gallons of product GS-805 at a cost of $2,000. **Required:** Allocate the joint product costs and then compute the cost per unit using each of the following methods: (1) physical measure, (2) sales value at split-off, and (3) net realizable value.

Solution.

(1) The Physical Measure Method If we use a physical measure method, the joint cost of $20,000 is allocated as shown in **Schedule 1**.

The production costs per gallon for both products are the same:

Product GS-50: $15,000 ÷ 75 = $200

Product GS-80: $5,000 ÷ 25 = $200

(2) The Sales Value at Split-Off Method If Northern Company could sell the GS-50 and GS-80 at the split-off point, then the $20,000 joint cost should be allocated among the products as shown in **Schedule 2.**

Note that whether or not any of the gallons are sold at the split-off point is irrelevant, as the allocation is based on units produced. The production costs per gallon for both products are calculated as follows:

Product GS-50: $18,750 ÷ 75 = $250

Product GS-80: $1,250 ÷ 25 = $50

(3) The Net Realizable Value Method The net realizable values of GS-50 and GS-80 are $20,000 and $5,000, respectively, as shown in **Schedule 3**. The allocated costs are $16,000 to GS-50 and $4,000 to GS-80.

The costs per gallon for products GS-505 and GS-805 are calculated as follows:

Product GS-505: ($16,000 + $5,000) ÷ 50 = $420 Product GS-805: ($4,000 + $2,000) ÷ 50 = $120

Schedule 1.

Physical Measure Method

Product	Physical Measure	Proportion	Allocation of Joint Cost
GS-50	75 gallons	75%	$20,000 × 75% = $15,000
GS-80	25 gallons	25%	$20,000 × 25% = $5,000
	100 gallons	100%	$20,000

Schedule 2.

Sales Value at Split-Off Method

Product	Units	Price	Sales Value	Proportion	Allocation of Joint Cost
GS-50	75	$300	$22,500	93.75%	$20,000 × 93.75% = $18,750
GS-80	25	$60	$1,500	6.25%	$20,000 × 6.25% = $ 1,250
Total			$24,000	100%	$20,000

Schedule 3.

Net Realizable Value Method

Product	Units	Price	Sales Value	Separable Processing	Net Realizable Value	Proportion	Allocation of Joint Cost
GS-505	50	$500	$25,000	$5,000	**$20,000**	93.75%	$20,000 × 80% = 16000
GS-805	50	$140	$7,000	$2,000	**$5,000**	6.25%	$20,000 × 20% = $4000
Total			$32,000	$7,000	$25,000	100%	$20,000

Example (7)

Western, Corp., produces two products, cigars and chewing tobacco, from a joint process involving the processing of tobacco leaves. Joint costs are $60,000 for this process, and yield 2,000 pounds of cigars and 4,000 pounds of chewing tobacco. Cigars sell for $80 per pound, and chewing tobacco sells for $20 per pound. Cigars require $80,000 in separable costs, while chewing tobacco requires $50,000 in separable costs. Chewing tobacco can be processed further (for $30,000 in additional separable costs) into a mint-flavored premium chewing tobacco that would sell for $30 per pound.

Required:

1. Should Western process chewing tobacco into premium chewing tobacco?

2. What is the maximum amount that joint costs can increase before (a) it would not be better to process chewing tobacco further into premium chewing tobacco, and (b) it would be better to cease processing tobacco leaves to produce cigars and premium chewing tobacco?

Solution

1.

Incremental Revenue, $10 × 4,000	$40,000
Incremental Cost	$30,000
Incremental Profit	$10,000

Therefore, Western should process further.

2. a. The joint costs can increase by any amount, since they are sunk and irrelevant. Western should always choose to process further.

B.

Total Revenue, $160,000 + $120,000	$280,000
Total Costs:	
Separable costs: $80,000 + $50,000 + $30,000	$160,000
Joint costs	$60,000
Net Profit	$60,000

Therefore, joint costs can increase by $60,000 before it is better to not be in the business of processing tobacco leaves.

Example (8)

Sanders Pharmaceutical Company purchases a material that is then processed to yield three chemicals: anarol, estyl, and betryl. In June, Sanders purchased 10,000 gallons of the material at a cost of $250,000, and the company incurred joint conversion costs of $70,000. June sales and production information are as follows:

	Gallons Produced	Price at Split-Off	Further Processing Cost per Gallon	Eventual Sales Price
Anarol	2,000	$55	-	-
Estyl	3,000	$40	-	-
Betryl	5,000	$30	$5	$60

Anarol and estyl are sold to other pharmaceutical companies at the split-off point. Betryl can be sold at the split-off point or processed further and packaged for sale as an asthma medication.

Required:

1. Allocate the joint costs to the three products using the physical units method, the sales-value at split-off method, the net realizable value method, and the constant gross margin percentage method.

2. Suppose that half of June' production of estyl could be purified and mixed with all of the anarol to produce a veterinary grade anesthetic. All further processing costs amount to $35,000. The selling price for the veterinary grade anarol is $112 per gallon. Should Sanders further process the estyl into the anarol anesthetic?

Solution.

1. Total joint cost to be allocated $250,000 + $70,000 = $320,000

Physical Units Method:

	Gallons Produced	Percent of Gallons Produced	Joint Cost	Joint Cost Allocation
Anarol	2,000	(2,000/10,000) = 20%	$320,000	$64,000
Estyl	3,000	(3,000/10,000) = 30%	$320,000	$96,000
Betryl	5,000	(5,000/10,000) = 50%	$320,000	$160,000
Total	10,000			$320,000

Sales-Value at SplitOff Method:

	Gallons Produced	Price at Split-Off	Revenue at Split-Off	Percent of Revenue	Joint Cost	Joint Cost Allocation
Anarol	2,000	$55	$110,000	28.94%	$320,000	$92,630
Estyl	3,000	$40	$120,000	31.579%	$320,000	$101,053
Betryl	5,000	$30	$150,000	39.474%	$320,000	$126,317
Total	10,000		$380,000			$320,000

Net Realizable Value Method:

Step 1: Determine hypothetical sales revenue.

	Eventual Price	Further Processing Cost per Gallon	Hypothetical Sales Price	Gallons	Hypothetical Revenue
Anarol	$55	-	$55	2,000	$110,000
Estyl	$40	-	$40	3,000	$120,000
Betryl	$60	$5	$55	5,000	$275,000
Total					$505,000

Step 2: Allocate joint cost as a proportion of hypothetical sales revenue.

	Hypothetical Sales Revenue	Percent	Joint Cost	Joint Cost Allocation
Anarol	$110,000	21.782%	$320,00	$69,702
Estyl	$120,000	23.762%	$320,00	$76,039
Betryl	$275,000	54.456%	$320,00	$174,259
Total	$505,000			$320,000

Constant Gross Margin Percentage Method:

	Dollars	*Percent*
Revenue [($55 × 2,000) + ($40 × 3,000) + ($60 × 5,000)]	$530,000	100.00%
Costs [$320,000 + ($5 × 5,000)]	$345,000	65.09%
Gross margin	$185,000	34.91%

	Anarol	Estyl	Betryl
Eventual Market Value	$110,000	$120,000	$300,000
Less: Gross Margin At 34.91%	$38,401	$41,892	$104,730
Cost Of Goods Sold	$71,599	$78,108	$195,270
Less: Separable Costs	-	-	$(25,000)
Joint Cost Allocation	$71,599	$78,108	$170,270

Note: $71,599 + $78,108 + $170,270 = $319,977; there is a rounding error of $23.

2. Joint costs are irrelevant to this decision. Instead, further processing costs and the opportunity cost of lost revenue on the estyl diverted to anarol purification must be considered.

Added Revenue ($112 - $55) × (2,000)	$114,000
Less: Further Processing Of Anarol Mixture	$(35,000)
Less: Lost Revenue On Estyl (1,500 × $40)	$(60,000)
Increased Operating Income	$19,000

Example (9)

Iden Company makes two products from a common input. Joint processing costs up to the split-off point total $64,800 a year. The company allocates these costs to the joint products on the basis of their total sales values at the split-off point.

Each product may be sold at the split-off point or processed further. Data concerning these products appear below:

	Product X	***Product Y***	***Total***
Allocated Joint Processing Costs	$32,400	$32,400	$64,800
Sales Value at Split-Off Point	$36,000	$36,000	$72,000
Costs Of Further Processing	$20,300	$14,300	$34,600
Sales Value After Further Processing	$55,400	$53,000	$108,400

Required:

a. What is the net monetary advantage (disadvantage) of processing Product X beyond the split-off point?

b. What is the net monetary advantage (disadvantage) of processing Product Y beyond the split-off point?

Solution. a. & b.

	Product X	*Product Y*
Sales value after further processing	$55,400	$53,000
Costs of further processing	$20,300	$14,300
Benefit of further processing	$35,100	$38,700
Less: Sales value at split-off point	$36,000	$36,000
Net advantage (disadvantage)	$(900)	$2,700

Example (10)

Benjamin Company produces products C, J, and R from a joint production process. Each product may be sold at the split-off point or processed further. Joint production costs of $95,000 per year are allocated to the products based on the

relative number of units produced. Data for Benjamin's operations for last year follow:

			Additional sales values and costs if processed further	
Product	*Units Produced*	*Sales values at split-off*	*Sales values*	*Added costs*[*]
C	6,000	$75,000	$100,000	$20,000
J	9,000	$70,000	$115,000	$36,000
R	4,000	$46,500	$55,000	$10,000

[*]All variable and traceable to the products involved.

Required:

Which products should be processed beyond the split-off point?

	*Product **C***	*Product **J***	*Product **R***
Sales value after further processing	$100,000	$115,000	$55,000
Sales value after split-off	$75,000	$70,000	$46,500
Added sales value from processing	$25,000	$45,000	$8,500
Added processing costs	$20,000	$36,000	$10,000
Net gain (loss) from further processing	$5,000	$9,000	$(1,500)

Products C and J should be processed beyond the split-off point. Product R should be sold at split-off Joint production costs are not relevant to the decision to sell at splitoff or to process further.

Accounting Joint Products, Making A Journal Entry:

The assignment of costs in proportion to the relative sales value of each product is most commonly used and is the only method that will be illustrated here. This method assumes a direct relationship between selling prices and joint costs. It

follows the logic that the greatest share of joint cost should be assigned to the product that has the highest sales value.

To illustrate, assume that Clean It, Inc., produces two liquid products from one process. In the manufacturing process, various materials are mixed in a huge vat and allowed to settle, so that a light liquid rises to the top and a heavier liquid settle to the bottom of the vat. The products, Gloss and Glow, are drawn off separately and piped directly into tank cars for shipment. The joint processing costs of materials, labor, and overhead total $200,000, producing 30,000 gallons of Gloss and 20,000 gallons of Glow.

Gloss sells for $10 a gallon and Glow for $25 a gallon. Using the relative sales value method, we would allocate the joint costs of $200,000 as follows:

Product	Gallons Produced	Selling Price/ Gallon	Total Sales Value	Percent of Sales Value	Assignment of Joint Costs
Gloss	30,000	$10.00	$300,000	37.5%	$75,000
Glow	20,000	$25.00	$500,000	62.5%	$125,000
Total	50,000		$800,000	100.0%	$200,000

The amounts in the final column of the above table were determined as follows:

- Gloss: $200; 000 x 0.375 = $75,000
- Glow: $200; 000 x 0.625 = $125,000

Some companies further refine this method by subtracting each product' estimated selling expenses from its sales value to determine the net realizable value of the product. If a product is to be processed further after the point of

separation, costs should not be assigned on the basis of ultimate sales value because the additional processing adds value to the product. In a case such as this, an adjusted sales value is used that takes into consideration the cost of the processing after split-off.

Assume that Clean It‘s market researchers determine that Glow would have a better market if it were sold in powder form in individual packages. (Two gallons of liquid are needed for one pound of powder.) After studying this proposition, the company decides to pipe Glow into ovens to dehydrate it. The resulting powder is divided into one-pound packages that will sell for $80 each.

During the month of October, when the new process began, the joint costs of materials, labor, and factory overhead in the Mixing and Settling Department were again $200,000, and 30,000 gallons of Gloss were transferred to tank cars. In the Baking Department, costs totaled $100,000 for baking and packaging the 20,000 gallons of Glow received from Mixing and Settling, and 10,000 one-pound packages were produced.

The assignment of joint costs of $200,000 in Mixing and Settling, using the adjusted sales value method, follows:

Units Produced	Unit Selling Price	Sales Value	Less Cost After split Off	Sales Value At Split-Off	Percent Of Sales Value	Assignment Of Joint Costs
Gloss-30,000 gal	$10	$300,000	-0-	$300,000	30%	$60,000
Glow-10,000 lb.*	$80	$800,000	$100,000	$700,000	70%	$140,000
Total		$1,100,000	$100,000	$1,000,000	100.0%	$200,000

*****20,000 gallons of liquid is further processed into 10,000 lb. of powder.

The following journal entries illustrate the allocated cost of Gloss being transferred to a finished goods inventory account and the assigned cost of Glow being transferred to a work in process account to which the additional costs of processing after split-off are charged as follows:

Work in Process-Baking Finished Goods (Gloss Work in Process—Mixing and Settling Allocation of split-off costs to the two products	140000 60000	 200000
Work in Process-Baking Materials, Wages Payable, Applied Factory Overhead Processing costs after split-off charged to Glow.	100000	 100000
Finished Goods (Glow) Work in Process-Baking Completed cost of Glow ($140,000+$100,000 charged to finished goods	240000	 240000

Accounting For By-Products

In accounting for by-products, the common practice is to make no allocation of the processing costs up to the split-off point. Costs incurred up to that point are chargeable to the main products. If no further processing is required to make the by-products marketable, they may be accounted for by debiting an inventory account, By-Products, and crediting Work in Process for the estimated sales value of the by-products recovered. Under this procedure, the estimated sales

value of the by-products reduces the cost of the main products that is accumulated in the work in process account.

The reduction in costs, due to the by-product, is shown in the inventory costs section of the cost of production summary. If the by-products are sold for more or less than the estimated sales value, the difference may be credited or debited to Gain and Loss on Sales of By-Products. The journal entries to reflect the above, with amounts assumed, are as follows:

By-Product Inventory Work in Process to reduce cost of main products by estimated by-product sales value.	$200	 $200
Accounts Receivable Gain or Loss on Sale of By-Product By-Product Inventory to record the sale of by-product at a gain.	$300	 $100 $200

Example

Crispy, Inc., is a producer of potato chips. A single production process at Crispy, Inc., yields potato chips as the main product, as well as a byproduct that can be sold as a snack. Both products are fully processed by the splitoff point, and there are no separable costs. For September 2024, the cost of operations is $520,000. Production and sales data are as follows:

	Production (in pounds)	Sales (in pounds)	Selling Price per pound
Potato Chips	46,000	34,960	$26
Byproduct	8,200	5,000	$5

There were no beginning inventories on September 1, 2024.

Required:

1. What is the gross margin for Crispy, Inc., under the production method and the sales method of byproduct accounting?

2. What are the inventory costs reported in the balance sheet on September 30, 2024, for the main product and byproduct under the two methods of byproduct accounting in requirement 1?

3. Prepare the journal entries to record the byproduct activities under (a) the production method and (b) the sales method. Briefly discuss the effects on the financial statements.

Solution

1.

	Production Method	Sales Method
Revenues:		
Main product (potato chips)	$908,960[a]	$908,690
Byproduct (snack)	-0-	$25,000[d]
Total revenues	$909,960	$933,960
Cost of goods sold:		
Total manufacturing costs	$520,000	$520,000
Deduct value of byproduct production	$41,000**b**	-0-
Net manufacturing costs	$479,000	$520,000
Deduct main product inventory	$114,960**c**	$124,800[e]
Cost of goods sold	$364,040	$395,200
Gross margin	$544,920	$538,760

[a] 34,960 × $26
[b] 8,200 × $5
[c] Inventory = 46,000 – 34,960 = 11,040 lbs...; (11,040/46,000) × $479,000 = $114,960
[d] 5,000 × $5
[e] (11,040/46,000) × $520,000 = $124,800

2.

	Production Method	Sales Method
Main Product (potato chips)	$114,960	$124,800
Byproduct (snack)	$16,000	0

3.

a. Byproduct—Production Method Journal Entries; -

i) At time of production:	Debit	Credit
Work-in-process Inventory	$520,000	
Accounts Payable		$520,000
For Byproduct:		
Finished Goods Inv – Byproduct	$41,000	
Work-in-process Inventory		$41,000
For Joint Product:		
Finished Goods Inv – Potato Chips	$479,000	
Work-in-process Inventory		$479,000
ii) At time of sale:		
For Byproduct:		
Cash or A/R	$25,000	
Finished Goods Inv – Byproduct		$25,000
For Joint Product:		
Cash or A/R	$908,960	
Sales Revenue – Potato Chips		$908,960
Cost of Goods sold – Potato Chips	$364,040	
Finished Goods Inv – Potato Chips		$364,040

b. Byproduct—Sales Method Journal Entries

i) At time of production:		
Work-in-process Inventory Accounts Payable, etc.	$520,000	 $520,000
For Byproduct: No Entry	-	-
For Joint Product: Finished Goods Inv – Potato Chips Work-in-process Inventory	$520,000	 $520,000
ii) At time of sale:		
For Byproduct: Cash or A/R Sales Revenue – Byproduct	$25,000	 $25,000
For Joint Product: Cash or A/R Sales Revenue – Potato Chips	$908,960	 $908,960
Cost of Goods sold – Potato Chips Finished Goods Inv – Potato Chips	$395,200	 $395,200

Questions:

1- Lexington Lumber Co. processes rough timber to obtain three grades of finished lumber, A, B, and C. The company allocates costs to the joint products on the basis of market value. During the month of May, Lexington incurred total production costs of $300,000 in producing the following:

Grade	Thousand Board Feet	Selling Price per 1,000 Board Feet
A	200	$200
B	300	$100
C	500	$150

Required:

Make the journal entry to transfer the finished lumber to separate inventory accounts for each product.

2- Boone Oil Company transports crude oil to its refinery where it is processed into main products gasoline, kerosene, and diesel fuel, and by-product base oil. The base oil is sold at the split-off point for $500,000 of annual revenue, and the joint processing costs to get the crude oil to split off are $5,000,000. Additional information includes:

Product	*Barrels Produced*	*Cost After Split-Off*	*Selling Price Per Barrel*
Gasoline	500,000	$2,000,000	$25
Kerosene	100,000	$500,000	$30
Diesel fuel	250,000	$1,000,000	$20

Required:

Determine the allocation of joint costs, using the adjusted sales value method. (Hint: Reduce the amount of the joint costs to be allocated by the amount of the by-product revenue.)

3-The Carolina Company prepares lumber for companies who manufacture furniture. The main product is finished lumber with a byproduct of wood shavings. The byproduct is sold to plywood manufacturers. For July, the manufacturing process incurred $332,000 in total costs. Eighty thousand board feet of lumber were produced and sold along with 6,800 pounds of shavings. The finished lumber sold for $6.00 per board foot and the shavings sold for $0.60 a pound. There was no beginning or ending inventories.

Required:

Prepare an income statement showing the byproduct (1) as a cost reduction during production, and (2) as a revenue item when sold.

4- Jim Davis Company processes Sheep meat into three products, chops, bacon and sausage. Production and selling price data follow:

Products	Quantity	Salling value
Chops	100,000 lbs...	$5.00/ lb.
Bacon	210,000 lbs...	$4.00/ lb.
Sausage	410,000 lbs...	$2.00/ lb.

Bacon was processed with steam, sliced and packaged after the split-off point. The cost incurred for these processes was $100,000. Sausage was ground and formed into patties after the split-off This process cost $60,000.

Required:

If joint processing costs were $1,500,000, calculate the total cost of each product using the adjusted sales value method.

5- Keith Company manufactures Products A, B, and C from a joint process. Additional information is as follows:

	Product			
	A	B	C	*Total*
Units produced	8,000	4,000	2,000	14,000
Joint costs	$90,000	?	?	$150,000
Sales value at split	?	?	$30,000	$240,000

Assuming that joint costs are allocated using the relative sales value at split-off approach, what was the sales value at split off for Product A?

6- Nate Company manufactures Products A and B from a joint process that also yields a byproduct, X.

Nate Company accounts for the revenue from its by-product sales as a deduction from the cost of its main products. Additional information is as follows:

	Product			
	A	B	X	*Total*
Units produced	15,000	9,000	6,000	30,000
Joint costs	?	?	?	$180,000
Sales value at split	$420,000	$140,000	$20,000	$580,000

Required:

(1) Assuming that joint product costs are allocated using the relative sales value at split-off approach, what was the joint cost allocated to Products A and B?

(2)Prepare the journal entry to transfer the finished products to separate inventory accounts.

(3)Assuming the sales value of X is stable, prepare the journal entries to:

(a)place the by-product in inventory

(b)record the sale of 3,000 units for $10,500 on account.

7-Alphabet Manufacturing Co. makes one main product, X, and a by-product, Z, which splits off from the main product when the work is three-fourths completed. Product Z is sold without further processing and without being placed in inventory. During June, $1,200 is realized from the sale of the by-product. Make the entries to record the recovery and sale of the byproduct, on account, on the assumption that the recovery is treated as one of the following:

a. A reduction in the cost of the main product.

b. other income.

8- Orlando Metals manufactures tin. During the process, a byproduct— scrap metal—is obtained and placed in inventory. The estimated sales value of the scrap metal produced during the month of April is $2,000. Assume that the value of the by-product is treated as a reduction in production cost.Make the journal entry for April to record the following:

a. Placing of the scrap metal in inventory.

b. Sale of one-half of the scrap metal for $850, on account.

Chapter (2)

Job Order Costing

A job order cost system is the most suitable where the products manufactured differ in materials and conversion requirements, each product is made according to a customer's specifications and the price quoted is closely tied to estimated cost. The cost incurred in manufacturing a particular job must therefore be matched to the goods produced. Examples of types of companies which might use job order costing are printing, shipbuilding, aircraft, construction, and engineering firms.

Under a job order cost system, the three basic elements of cost-direct materials, direct labor, and factory overhead- are accumulated according to assigned job numbers. The unit cost for each job is obtained by dividing the total units for the job into the job's total cost. A cost sheet is used to summarize the applicable job costs. Selling and administrative expenses,

which are based on a percentage of manufacturing cost, are listed on the cost sheet to arrive at total cost.

In order for a job order cost system to function properly, it must be possible to identify each job physically and segregate its related costs. Direct material requisitions and direct labor costs carry the particular job number; factory overhead is usually applied to individual jobs based on a predetermined factory overhead application rate. The profit or loss can be determined for each job and the unit cost computed for purposes of inventory costing. Schedules are prepared to accumulate the information for the required journal entries.

Following is an illustration of the flow of costs through a job order cost system together with the required journal entries and necessary source documents. Fork company is a small furniture manufacturing company specializing in custom

made office furniture. All orders are made to specifications indicated by customers, and costs are accumulated according to jobs. On June 2020 maple company placed order with fork company for a large custom-made conference table with matching wood chairs and wall units at a total price of 12000. Maple company wants shipment on or before July 10,2020.

The maple company order, designated job 85, will be followed through the manufacturing process and the accumulation of production costs. The following information relates to job 85:

1-purchase of materials. On july3, 2020, the purchasing department received $11000 of materials, as indicated below. Material purchases are on account and payment is made at a later date. (Not all the materials will be used for job85)

20 sheets mahogany wood(at $ 500 a sheet)	$10000
100gallons stain (at $ 5 /gallon)	500
10 cases of glue(at $ 20 /case)	300
5cases of nails(at $ 40 /case)	200
total	$11000

2-issuance of materials. On july3, 2020, the production department requisitioned the following materials and began work on job 85:

Direct material for job 85:		
(5 sheet at $ 500 each)		2500
Indirect materials for job 85:		
Stain(10gallons at $ 5)	50	
Glue (1 case at $ 20)	20	
Nails (1 case at $ 40)	40	110
Total materials cost		$ 2610

3-labor cost the production department incurred the following payroll costs for the week ended july7, 2020:

Direct labor for job 73	300
Direct labor for job 85	300
Indirect labor	1000
Total labor cost	$ 4800

4-actual factory overhead. The production department incurred other factory overhead costs (in addition to indirect materials and indirect labor) amounting to $ 2000 for the week ended july7, 2020. Actual factory overhead is not charged directly to jobs; instead a predetermined factory overhead application rate is used.

5-applied factory overhead. Factory overhead was applied at a rate of 75% of direct labor cost for job 85.

6-completion of job. Job 85 was completed on July 7, 2020, and transferred to the finished goods storeroom.

7-sale of job. Job 85 was picked up by Maple Company on July 10, 2020, payment is to be made in 20 days.

The following journal entries and reports are for the week ended july7, 2020, when production of job 85 was started and completed.

Purchase of materials

Raw materials and supplies used in production are ordered by the purchasing department. These materials are kept in a materials storeroom under the control of a clerk and are issued only when a properly approved requisition is presented.

Entry 1 records the purchase of materials (assuming a perpetual inventory system is used):

Materials inventory		11000
	Accounts payable	11000

Issuance of materials

The next step in the manufacturing process is to obtain the needed raw materials from the materials storeroom. There is one source document for the issuance of materials in a job order cost system- a materials requisition.

Any issuance of materials by the materials clerk must substantiated by a materials requisition approved by the production manager or the department supervisor. Each requisition from shows the job order number, the department number, and the quantities and description of materials requested. the materials clerk enters the unit cost and total cost on the requisition from.

On a regular basis, perhaps weekly, materials requisitions are sorted by job number and the totals recorded on a cost summary sheet.

When direct materials are put into production, a journal entry is made to record the addition of materials to work in process inventory. When indirect materials are requisitioned, they are generally charged to a departmental factory overhead control account. Indirect materials costs are included in the factory overhead application rate, as it is often impractical to trace these materials to each job. Entry 2 records the requisition of direct and indirect materials for job 85:

Work in process inventory-job 85	2500	
Factory overhead control-production department	110	
Materials inventory		2610

Each work in process inventory account is supported by a subsidiary ledger.

Labor cost

There are two source documents for labor in a job order cost system- a time card and a labor job ticket. Time (or clock) cards are inserted in a time clock by employees each day when they arrive, go to and return from lunch, take breaks, and leave work for the day. This procedure mechanically shows a record of total hours worked each day by each employee and thus provides a reliable source for the computation and recording of payroll. Labor job tickets are prepared daily by each employee indicating the job worked on and the number of hours worked. the wage rate of the employee is inserted by payroll department. The sum of labor cost and hours incurred on various jobs (labor tickets) should be equal to the total labor cost and total labor hours for the period(time cards).

The following information is available concerning job 85 for the week ended July 7, 2020:

1- Ten employees worked 40 hours each entirely on job 85. Their pay rate was $ 8 per hour (10x40 hours x 8 per hour= $ 3200 of direct labor for job 85).

2- Two employees (x and y) worked 40hours each; 20hours each on job85 and 20 hours each on job73. Their pay rate is $ 7.50 per hour (2 x 20x 7.5= $ 300 of direct labor for job 85 and $ 300 of direct labor for job73).

3- The salaries for supervisors and maintenance personnel in the production department amounted to $ 1000.

Time accumulated for employees working directly on production (direct labor) is charged to each job. Time accumulated for workers who cannot be identified directly

with a particular job is indirect labor and is charged to factory overhead control.

At periodic intervals, time cards are summarized to record the payroll, and labor job tickets are summarized to be charged to work in process inventory or factory overhead control. Time card and job ticket hours should be reconciled. The total payroll is computed from the time cards as follows:

10 employees (400 hours x **$** 8)	3200
2 employees (80 hours x **$** 7.5)	600
Supervisors and maintenance	1000
Total payroll	**$** 4800

Entry 3 records the labor cost (based on labor job tickets) as follows:

Work in process inventory- job 73	300	
Work in process inventory-job85	3500	
Factory overhead control- production department	1000	
Payroll payable		4800

Factory overhead

The third element to be included in determining the total cost in a job order cost system is factory overhead. There is one source document for the computation of factory overhead costs in a job order cost system- a departmental factory overhead cost sheet, which each department maintains. This is a subsidiary ledger of the factory overhead control account. Reconciliation of the control and subsidiary ledgers should be performed at regular intervals.

Entry 4 records the factory overhead costs (except indirect materials, which recorded in Entry 2, and indirect labor, which was recorded in Entry 3)

Factory overhead control-production department	2000	
Accumulated depreciation- machinery		220
Accumulated depreciation- factory		290
Utilities payable		490
Miscellaneous payables		1000

Entry 4 records the balance of the expenses incurred by the production department. In this example, factory overhead costs are accumulated by production departments. It should be noted, however, that factory overhead costs may be recorded for the factory in total and then distributed to production departments for ultimate distribution to jobs.

The distribution of factory overhead to jobs is based on a predetermined factory overhead application rate. Factory overhead application rates are expressed in terms of direct labor hours, direct labor dollars, direct materials dollars, machine hours, or some other reasonable basis. When factory overhead is not accumulated on a factory wide level for distribution to several departments, each department will generally have a different rate. Department A's rate may be $ 2.30 per direct labor hour. In addition, each department may use separate bases to determine the rate of application. For

example, factory overhead may be based on direct labor hours in department A and on machine hours in department B, application rates vary because of the differences in activity and functions of individual production departments.

To clarify, the production department applies factory overhead at a rate of 75% of direct labor cost. Total direct labor cost for job 85 amounted to $ 3500, factory overhead applied would therefore be $ 2625 (75% of $ 3500). Assume that any under- or overapplied factory overhead is not adjusted until the end of the period.

Entry 5 records the application of factory overhead to job 85:

Work in process inventory- job5	2625
Factory overhead applied- production department	

Job order cost sheet

A job order cost sheet summarizes the amount of direct materials, direct labor, and applied factory overhead for each job processed. Direct materials and direct labor cost information is obtained from material requisitions and labor summaries, and is posted to job order cost sheet daily or weekly. Factory overhead is usually applied at the end of the job, as are selling and administrative expenses.

Job order cost sheets are designed to provide information needed by management and therefore will vary according to management's desires or needs. For example, some forms include selling and administrative expenses and selling price so that estimated profit can be readily determined for each job. Other forms provide only basic factory cost data-direct materials, direct labor, and factory overhead. Forms will also

vary depending upon whether a firm is departmentalized or not.

Cost Sheet *

Direct materials consumed	xxx
Direct labor	xxx
Direct expenses	xxx
Prime Cost	xxx
Factory overhead (say, …. of the prime cost)	xxx
Factory Cost / Works Cost	xxx
Add: Opening stock of W.I.P.	xxx
Less: Closing stock of W.I.P.	xxx
Works Cost of Finished Goods	xxx
Administrative overhead (say …. of works cost)	xxx
Cost of Production	xxx
Add: Opening stock of finished goods	xxx
Less: Closing stock of finished goods	xxx
Cost of Goods Sold	xxx
Selling and Distribution overhead (say …per unit sold)	xxx
Cost of Sales	xxx
Profit	xxx
Sales	xxx

* The cost of each job is recorded in a summary sheet called a Job Order Cost Sheet or simply a Cost Sheet. This cost sheet is designed to collect the cost of materials, labor and production overhead consumed in completing the job. There is no standard format for Cost Sheet. Cost Sheet differs in form, contents and arrangement. It is designed according to the need of the organization.

Entry 6 transfers completed goods out of the work in process inventory account and into the finished goods

inventory account for job 85(direct materials $ 2500 +direct labor $ 3500 + factory overhead $ 2625).

Finished goods inventory	8625	
Work in process inventory		8625

Entry 7 records the delivery of job 85 to Maple Company:

Account receivable	12000	
Cost of goods sold	8625	
Finished goods inventory		8625
Sales		12000

Spoiled units, defective units, scrap materials, and waste materials in a job order cost system

The term spoiled units, defective units, scrap material and waste material are not synonymous, for this discussion, the following definitions will apply:

Spoiled units. Units that do not meet production standards and are either sold for their salvage value or discarded. When spoiled units are discovered, they are taken out of production and no further work is performed on them. For example, if a batch of bread is left in the oven too long and burns, it cannot be corrected.

Defective units. Units that do not meet production standards and must be processed further in order to be salable as good units or as irregulars. For example, if a television set does not produce any sound, it can be reworked to correct the problem and sold as good unit.

Scrap material. Raw materials left over from the production process, that cannot be put back into production for the same purpose but may be sold but may be usable for a different purpose or production process or which may be sold to outsiders for a nominal amount. Scrap material such as

shavings, filing, and sawdust is similar to a by-product that results from the production of a main product in a joint manufacturing process and has a small sales value in comparison with the main product.

Waste materials. The part of raw material left over after production that has no further use or resale value. A cost of disposal may be incurred for waste materials.

Accounting for spoiled units

A system of accounting for spoilage should be developed for all cost accounting system. This system should provide management with the information necessary to determine the nature and cause of spoiled units.

Spoilage is an important consideration in any production – related planning and control decision. Management must determine the most efficient production process that will

keep spoilage to minimum. Spoilage is typically divided into normal and abnormal spoilage.

Normal spoilage that results despite efficient production methods is called normal spoilage. Normal spoilage costs are considered to be an unavoidable cost of producing good units and are therefore treated as a product cost. For example, the cost of operating a production process that will yield a perfect product 100% of the time may outweigh the benefits. It may be more economical (by employing cheaper and less sophisticated equipment and workers) to accept, for example, a 5% spoilage rate than to plan for perfection. If management developed a production process where a 5% spoilage rate is considered acceptable, then it is expected that an efficient production process would result in no more than 5% normal spoilage. The cost of producing the good units would therefore also include the unavoidable cost of producing the

number of spoiled units that are considered normal for the production process.

Normal spoilage costs have commonly been accounted for by either of the following two methods:

1- allocated (applied) to all jobs. In method 1, an estimate of the cost of net normal spoilage (normal spoilage cost less any estimated salvage value) is made and included in the factory overhead application rate to be applied to all jobs. When normal spoilage develops, the total cost of the spoiled units is removed from the work in process inventory because it has already been accounted for the work in work in process inventory as part of applied factory overhead.

The following entry would be made:

Spoiled units inventory (salvage value of spoiled units)	x	
Factory overhead control	x	
Work in process inventory- job A		x

2-allocated (applied) to specific jobs. In method 2, normal spoilage is ignored in the computation of the factory overhead application rate to be applied to jobs. When normal spoiled units develop from a specific job, only the salvage value is removed from work in process inventory, leaving in the unsalvageable costs (thus increasing only the unit cost of the jobs where spoilage resulted). The following entry would be made:

Spoiled units inventory (40 x $ 10)	400	
Work in process inventory –job B		400

Method 1 (normal spoilage applied to all jobs) is appropriate when management considers spoilage inherent in their general production process and therefore expected to result from all jobs. Method 2 (normal spoilage applied to specific

job) is appropriate when management expects spoilage to develop only on special jobs that may require, for example, more stringent specifications.

For example, assume 40 units were spoiled on job B. the spoilage was considered normal. Spoilage costs were $ 50 per unit with an estimated salvage value of $ 10 per unit. The following entry would be made to account for the normal spoilage if normal spoilage is applied to all jobs:

Spoiled units inventory (40 x $ 10)	400	
Factory overhead control (40 x $ 40)	1600	
Work in process inventory- job		20000

If the company's policy is to allocate normal spoilage to specific jobs, the following entry would be made:

Spoiled units inventory (40 x $ 10)	400	
Work in process inventory-job B		400

Abnormal spoilage. Spoilage in excess of what is considered normal for a particular production process is called abnormal spoilage. Abnormal spoilage is considered to be controllable by line or production personnel and is usually the result of inefficient operations. Although normal spoilage is acceptable and expected in most production activities and is usually considered a part of production costs, abnormal spoilage is not anticipated and thus is usually not considered a part of the cost of production. Instead, the total cost of the abnormal spoiled units should be removed from the work in process inventory account and any salvage value should be recorded in a spoiled units inventory account, with the difference between the total cost of abnormal spoilage and the salvage value being charged to a loss from abnormal spoilage account. This account would appear on the income statement as a period cost. The entry to remove abnormal

spoilage from the work in process inventory account appears as follows:

Spoiled units inventory (salvage value of spoiled units)	X	
Loss from abnormal spoilage (total cost of spoiled units less salvage value)	X	
Work in process inventory- job A		X

The unit cost of the good units is not affected by this technique. For example, assume that 5000 units are put into production for job 106 at a cost of $ 20000 the work in process inventory account for job 106 would have a debit balance of $ 20000.

The unit cost on job 106 would be $ 4 (20000/5000). If 20 units are found to be spoiled with a salvage value of $ 0.5 each and no spoilage was anticipated for job 106, the 20 units are deemed to be abnormal spoilage. The total cost of these units must be removed from the work in process inventory account as follows:

Spoiled units inventory (20*50)	10	
Loss from abnormal spoilage ((20*4)-(20*0.5))	70	
Work in process inventory- job A (20*4)		80

The work in process inventory account for job would now appear as follow:

Work in process inventory- job106			
	20000		80
Balance	19920		

The unit cost for job 106 is still $ 4 {$ 19920 /4980(5000 good units- 20 abnormal spoiled units)}.

The following is an example of a situation involving both normal and abnormal spoilage: assume that 10000 units were put into production for job 9 and the total cost of production was $ 300000 normal spoilage for the job is estimated to be 50 units.at the completion of production only 9910 units were good (90 units were spoiled, with a salvage value of $ 5 each). Therefore, normal spoilage was 50 units and abnormal

spoilage was 40(90-50) units. The following entries would be made, assuming that normal spoilage is allocated to specific jobs:

Normal spoilage (50 units) to remove salvage value:

Spoiled units inventory (50*$ 5)	250	
Work in process inventory- job 9		250

Abnormal spoilage (40 units) to remove total cost of spoiled units:

Spoiled units inventory (40*$ 5)	200	
Loss from abnormal spoilage (40*30=1200-(40*$ 5))	1000	
Work in process inventory- job 9		1200

The unit cost before the adjustment for spoilage was $ 30 ($ 30000 / 10000 units). After the above entries are posted, the

work in process inventory account would have a balance of $ 298550, shown as follows:

Work in process inventory- job9			
Cost put into production	300000	Normal spoilage	250
		abnormal spoilage	1200
		Balance	298550
	300000		300000

The unit cost for job 9 is computed as follow :(298550/ 9910) =$ 30.126 per unit

Note: the unit cost computed for abnormal spoilage using $ 30 which is the unit cost before the adjustment for normal spoilage. Manufacturing firms can compute the unit cost for abnormal spoilage either before or after the adjustment for normal spoilage because the difference between the two methods is usually insignificant. For example, if the unit cost for abnormal spoilage is computed after the adjustment for normal spoilage, the unit cost used to remove abnormal spoilage from work in process inventory would be $ 30.13 ($ 300000 -$ 250)/ 9950. Thus, abnormal spoilage would equal $

1005 (40 * $ 30.13 = $ 1205– $ 200). The method chosen by accompany should be consistently applied.

Accounting for defective units

The difference between spoiled units and defective units is that defective units are reworked to put them into condition to be sold with good units or to be sold as irregulars, whereas spoiled units are sold (at salvage value) without additional work being performed on them. As with spoiled units, defective units are classified as either normal or abnormal.

Normal defective units. The number of defective units in any particular production process that can be expected despite efficient operations are called normal defective units. Normal defective rework costs have commonly been accounted for by either of the following methods:

1- allocated(applied) to all jobs. An estimate of the normal rework cost is made and included in the factory overhead application rate to be applied to all jobs. When normal rework costs are necessary, factory overhead control is charged because rework costs have already been charged to work in process inventory as part of applied factory overhead. The following entry would be made:

Factory overhead	x	
Materials inventory		x
Payroll payable		x
Factory overhead applied		x

Note that the preceding entry although commonly used in practice, is unusual in that factory overhead control account is debited and the factory overhead applied account is credited for the estimated portion of factory overhead rework costs. During the year, the work in process inventory account is debited and the factory overhead applied account is again

credited for the same estimated portion of factory overhead rework costs. Thus, the factory overhead applied account is credited twice for the factory overhead portion of rework costs. The factory overhead control account is also debited again when the factory overhead rework costs are incurred. The final result is that both the factory overhead applied account and the factory overhead control account are charged twice for the same rework costs. Since both accounts are closed against each other at the end of the year, the double counting of the rework portion of factory overhead is eliminated.

For example, assume that the normal portion of factory overhead expected to be incurred during the period, for rework costs is $ 200 the predetermined factory overhead application rate is increased to account for this because rework costs are to be allocated to all jobs. On the

assumption that the actual additional factory overhead rework cost is $ 200 (resulting from increased use of electricity), the following summary entries would be made:

A- defective units are reworked:

Factory overhead control	200	
Factory overhead applied		200

B-factory overhead is applied to work in process inventory during the period (only the additional amount for factory overhead rework cost is shown):

Work in process inventory (various jobs)	200	
Factory overhead applied		200

C-the electricity cost for reworking defective units is recorded:

Factory overhead control	200	
Accounts payable		200

The posting of these entries would result in the following account balances:

Factory overhead control ($ 200 entry 1+ $ 200 entry 2) $ 400 debit.

Factory overhead applied ($ 200 entry1+ $ 200 entry 2) $ 400 credit.

Work in process inventory ($ 200 entry 1) $ 200 debit.

D-yearend closing entry:

Factory overhead applied	400	
Factory overhead control		400

The end of these entries is that total work in process inventory is increased by $ 200, which cancels the factory overhead portion of rework costs.

2-allocated (applied) to specific jobs.in method2, rework costs are ignored in the computation of factory overhead application rate to be applied to specific jobs. When rework costs are necessary, work in process inventory for the specific job is charged. The following entry would be made:

Work in process inventory-job A	x	
Materials inventory		x
Payroll payable		x
Factory overhead applied		x

For example, assume that 20 units were found to be defective on job22 and had to be reworked. The cost of reworking the defective units is as follows:

Direct material	$ 1000
Direct labor	400
Factory overhead applied(50% of labor dollars)	200

The following entry would be made to account for the normal rework costs if normal rework costs are allocated to

Factory overhead control	1600	
Materials inventory		1000
Payroll payable		400
Factory overhead applied		200

If the company's policy is to allocate normal rework costs to specific jobs, the entry would be:

Work in process inventory-job 22	1600	
Materials inventory		1000
Payroll payable		400
Factory overhead applied		200

Abnormal defective units. The number of defective units that exceed what is considered to be normal for an efficient productive operation are called abnormal defective units. The total cost of reworking abnormal defective units should be charged to a loss from abnormal defective units account instead of the work in process inventory account because it is

the result of inefficient operations and should not become

Loss from abnormal defective units	1600	
Materials inventory		1000
Payroll payable		400
Factory overhead applied		200

part of the product cost. The cost of reworking abnormal

defective units should be shown on the income statement as a period cost. In our previous example (job 22), if no defective units are anticipated, the 20 defective units would be considered abnormal and the following entry would be made:

As an example of the situation involving both normal and abnormal defective units, assume that 40000 units are placed into production for job32. Normal defective units for this job are estimated to be 400; actual defective units were 1000. The total cost to rework the 1000 defective units was as follows:

Direct materials	$ 500
Direct labor	1000
Factory overhead applied(50% of direct labor dollars)	500
total	$ 2000

Unit cost of reworking is computed as follows:

= total rework costs/total units reworked

=2000 $ /1000=$ 2 rework cost per defective unit

Direct materials	500/1000=0.5per unit
Direct labor	1000/1000=1 per unit
Factory overhead	500/1000=0.5 per unit
	$ 2 per unit

The following journal entries would be made, assuming that normal rework costs are applied to specific jobs:

Normal defective units (400 units):

Work in process inventory-job 32(400* $ 2)	800	
Materials inventory (400*$ 0.5)		200
Payroll payable (400*$ 1)		400
Factory overhead applied (400*$ 0.5)		200

Abnormal defective units (600 units):

Loss from abnormal defective units (600*$ 2)	1200	
Materials inventory (600*$ 0.5)		300
Payroll payable (600*$ 1)		600
Factory overhead applied (600*$ 0.5)		300

Accounting for scrap material

A cost accounting system should provide a method of costing and control for scrap as it does for spoilage and defective units. When the amount of scrap produced exceeds the norm, it could be an indication of inefficiency. A predetermined rate for scrap should be prepared as a guide for comparison with the actual scrap that results. If large variances occur, management should find the reason and correct the problem.

Scrap materials have commonly been accounted for in either of the following two ways:

1-allocated (applied) to all jobs.an estimate of the proceeds from the sale of scrap is considered in the computation of the factory overhead application rate. The entry to record the sale of scrap would reduce factory overhead control. For example, scrap from job 402 was sold for $ 100 and had been

considered in computing the factory overhead application rate. The following entry is made to record the sale:

Cash	100	
Factory overhead control		100

This method is simple and acceptable when scrap does not result from any particular job and is common to the whole production process.

2- allocated (applied)to specific jobs. In method 2, the estimated proceeds from the sale of scrap are not considered in the computation of the factory overhead application rate. The entry to record the sale of scrap would reduce the work in process inventory of specific job in which the scrap originated.

If this were the case, the $ 100 of scrap from job 402 would be recorded as follows:

Cash	100	
Work in process inventory- job 402		100

No entry is normally made on the books when scrap is returned to the materials inventory, only a memorandum as to the type and quantity returned. Only when the dollar amount of scrap is material and there is a significant time lag before it can be sold is an inventory value assigned to the scrap.

Accounting for waste material

The cost of disposing of waste materials may be allocated either to all jobs (included in the factory overhead application rate) or to specific jobs (not included in the factory overhead application rate). The entry would be made as follow:

Waste allocated to all jobs:

Factory overhead control	x	
Accounts payable		x

Waste allocated (applied) to specific jobs:

Work in process inventory – job A	x	
Accounts payable		x

Waste exceeding a normal level (based on past experience or engineering specifications) indicates inefficiencies somewhere in the production process and signals management to take corrective action.

Although the cost of disposing of waste materials is usually slight when compared to the total cost of production, in some manufacturing and service operations it may involve significant expenditures, for example, a chemical manufacturer may have toxic waste which requires special packaging before disposal and thus result in an expensive disposal operation. Another example would be the cost of disposing of radioactive waste materials from a nuclear power plant. The cost of disposing of most types of waste is expected to increase significantly in the near future as

existing garbage dumps fill up and more elaborate and expensive forms of disposal must be developed.

questions:

(1) Z Electronics Ltd. produces a standard product and provides you the following information for the year

Ending 31st March, 2017:	$
Raw materials:	
Opening stock	10,000
Purchases	85,000
Closing stock	4,000
Direct wages	20,000
Other direct expenses	10,000
Factory overheads	10% of direct labor
Office overheads	10% of works cost
Selling expenses	$ 2 per unit sold
Finished goods:	
Opening stock	1,000 units ($ 16,000)
Produced during the year	10,000 units
Closing stock	2,000 units

Prepare cost sheet for the year ending 31st March, 2017. Also ascertain the selling price per unit so as to yield a profit of 25% on cost of sales.

(2)From the following information, prepare cost sheet and find out the amount of profit :

Raw materials purchased	24000
Direct labor	6,000
Works overhead	14,000
Stock on 1st January, 2020 :	
Raw materials	4,000
Finished goods (800 quintals)	3,200
Work–in–Process :	960
1st January, 2020	3,200
31st January, 2020	1,600
Office and administrative overheads	60,000
Sales (finished goods)	

Advertising, discount allowed and selling cost is $ 0.40 per quintal. During the month, 12,800 quintals of the commodity were produced.

(3)A company manufactures to customer order and operates a job costing system. Job X-3 remained incomplete at the end of April with the following production costs incurred :

Prime Costs :	$ 4,360
Overheads :	$ 2,890

The company worked on two jobs in May, Prime Cost incurred were :

	Job X–3 ($)	Job X–4 ($)
Direct materials issued from stores	1,660	8,240
Direct materials returned to stores	Nil	(470)
Direct materials transferred between two jobs	(180)	180
Direct labor	720	3,690

Direct labor is paid at a rate of $ 9.00 per hour. Production overheads are absorbed at a rate of $ 17.50 per direct labor hour. 10% of the total production cost of each job is added in order to recover general administration costs. Job X-3 was completed in May and the customer paid the agreed sum of $ 13,400.

You are required to :

(i) Prepare a Profit Statement for Job X-3

(ii) Calculate the value of work-in-process for Job X-4 at the end of May.

(4)ARB Ltd. furnished the following information for the year 2019–20:

Stock of raw materials on 1.4.2019	1,00,000
Stock of finished goods on 1.4.2019 (500 tonnes)	8,00,000
Freight paid	2,00,000
Prime cost	44,50,000
Stock of raw materials on 31.3.2020	3,00,000 ?
Stock of finished goods on 31.3.2020 (750 tonnes)	
Direct labor :	
60 skilled labor @ $50 per day for 250 days	
200 unskilled labors @ $ 30 per day for 250 days	
Indirect wages	40,000
Factory rent, rates and power	30,000
Salary of Managing Director	50,000
Office rent and taxes	1,00,000
Donation	30,000
Advertisement	4,50,000
Income tax	60,000
Depreciation on plant and machinery	35,000
Selling overhead	5,00,000
Packing and distribution expenses	85,990
Fuel	65,000

Other information :

(a) During the year 2019-20, 2,250 tonnes of finished goods were sold.

(b) The company valued the closing stock of finished goods under FIFO basis.

(c) The company maintains profit @ 20% on sales.

On the basis of above-mentioned data, you are required to prepare a detailed cost sheet for the year 2019-20.

(5) From the following information, prepare a Statement of Cost for the year 2020:

	$
Opening Stock :	
Raw materials	18,000
Finished goods	5,000
Closing Stock :	
Raw materials	10,000
Finished goods	6,000
Purchase of raw materials	90,000
Indirect wages (factory)	5,000
Direct wages	18,000
Power & Fuel	12,000
Office Salary	14,000
Sundry Office Expenses	9,000
Salesman's Salaries	6,000

(6)Prepare a Cost Sheet from the following particulars :

	$
Opening stock on 1.1.2013 :	
Raw materials	1,00,00
Work-in-process	30,000
Finished goods	2,500
Closing stock on 31.12.2013 :	
Raw materials	90,000
Work-in-process	25,000
Finished goods	7,500
Purchase of raw mateirals during the year	2,50,00
Directwages	75,000
Manufacturing overheads	50,000
Administrative overheads	8,000
Selling and distribution overheads	2,000
Sales	4,20,00

(7)the S. Loppy manufacturing company produces items made to order and uses a job order cost system to record and distribute costs. The following information applies to job 86 for 30000 units:

Cost of normal spoilage(500units)(assume normal spoilage was ignored in the computation of the factory overhead application rate)	$20000
Cost of abnormal spoilage(10units)	$4000
Salvage value of spoiled units	$10per unit

(8) The S. Loppy Manufacturing Company produces items made to order and uses a job order cost system to record and distribute costs. The following information applies to job 86 for 30000 units:

Cost of normal spoilage (500 units) (assume normal spoilage was ignored in the computation of the factory overhead application rate)	$20000
Cos abnormal spoilage (100 units)	$4000
Salvage value of spoiled units	$10 per unit
Cost of reworking defective units (required only labor, assume normal rework costs were ignored in the computation of the factory overhead application rate)	$5 per unit
Normal defective units	140
Abnormal defective units	20
Cash received from sale of scrap materials (assume scrap was ignored the computation of the overhead application rate)	$ 300
Cost disposing of waste materials (assume the cost of disposing of waste was included in the factory overhead application rate)	$40

Required: Write the journal entries necessary to record the above information.

(9) Wellgoes Company put 1331 units into production for job 3. Spoilage costs were %40 per unit. Only 1300 good units are produced and the rest are spoiled, with a salvage value of $6 each. Spoilage of 20 units was anticipated.

Required: Write the journal entries necessary to record the above information, assuming that the normal spoilage costs were:

.a Allocated to all jobs (included in the factory overhead application rate).

.b Allocated to specific jobs (not included in the factory overhead application rate).

(10) Cosmo Company placed 16500 units into production for job 16. Normal defective units for this job are estimated to be 100 units. The actual defective units were 250. The total cost to rework the defective units is as follows:

Direct materials	$300
Direct labor	450
Applied factory overhead (30% of direct labor)	135
Total	$885

Required: Write the journal entries necessary to record the above information, assuming that normal rework costs were:

.a Allocated to all jobs (included in the factory overhead application rate).

.b Allocated to specific jobs (not included in the factory overhead application rate).

(11) Register, Inc., had both defective units and scrap materials from job 186. There were 70 defective units, 20 of which were abnormal. The scrap material was sold for $ 125 and were not considered in the computation of the factory overhead application rate.

Required:

.a Prepare journal entries for the normal and abnormal defective units, assuming the following rework costs:

Direct materials	$105
Direct labor	70
Factory overhead	35
Total	$210

Normal rework costs allocated to all jobs (included in the factory overhead application rate).

.b Prepare journal entries for the sale of the scrap materials.

(12) The Dapper Dan Company makes jackets and uses a job order cost system to record and distribute costs. The following information relates to job 22, which is the production of 1000 jackets at a total cost $15000. Normal

spoilage is estimated to be 25 jackets. Abnormal spoilage consisted of 4 jackets.

Normal defective units for this job are estimated to be 11 jackets. Actual defective units were 16. At completion of production only 955 jackets were good before defective units were reworked. The salvage value of the spoiled goods is $3 per jacket. The total cost to rework the defective units was as follows:

Direct materials	$50
Direct labor	40
Applied factory overhead	10
Total	$100

Cash received from the sale of scrap materials was $150. A special inventory account for scrap is not maintained. The cost of disposing of waste materials was $25. The factory

overhead application rate does not include a provision for normal spoiled units, normal defective units, scrap, and waste.

Required: Prepare journal entries to record the above information. (Assume that the unit cost for abnormal spoilage is computed before the adjustment for normal spoilage).

(13) The Hungry Frozen Food Company maintains a job order cost system. For the month of June it had the following information: Work in process inventory on June 1 was $12500; raw materials purchased amounted to $15000; materials requisitioned were $11000 of which $3000 was indirect. Payroll for the month was $36000, $12000 of which was indirect. The actual factory overhead was $42000. Factory overhead is applied at %85 of direct labor cost. Jobs with a total cost of $52000 were completed during June. Jobs

costing $76000 were sold at a markup of 30% of cost. Assume a perpetual inventory system.

Required:

.a Prepare the entries for the above transactions.

.b Compute the amount in the work-in-process inventory on June 30.

(14) Ajax Assembling Company is manufacturing 500 radios for Sonar Sound Supply via job 821. The radios were ordered on April 11, 2020, and work was commenced 3 days later. They were completed and delivered on April 18, 2020. There were not specifications for the job, and radios were to be standard size.

Ajax accumulated the following costs in connection with job 821:

Materials received on requisition 492:

500 enclosure at $.10 each

500 transistors at $.50 each.

2500 circuits at $.25 each

1000 dials at $.40 each

2000 wires at $.05 each

For the purposes of this job, the dials and wires are considered to be indirect materials.

For the duration of job 821, three permanent employees worked a total of 180 hours at a rate of $9.25 per hour. Any hours in excess of 40 per worker are overtime and are to be paid at 1½ times the normal hourly rate.(Assume that overtime is charged to jobs as incurred).

In addition, five employees worked 20 hours each on job 821, at an hourly rate of $5.85.

Salaries for supervisors and repair personnel amounted to $550 for the job.

Factory overhead is applied on the basis of $1.25 per direct labor hour.

The radios were sold for $15 each, and selling and administrative expenses were 2% of total sales. The company uses a perpetual cost accumulation system.

Required:

.a Journalize the above transactions.

.b Prepare a job order cost sheet for job 821.

.c Prepare journal entries to transfer goods from work-in-process inventory to finished goods inventory, and to record the sale and delivery of the merchandise.

(15) Shamrock, Inc., entered into the following transactions during May of 2021:

1 Purchased materials on account for $56000. Assume no beginning inventories.

2 Job 67 requisitioned direct materials of $32000 and supplies of $6000.

3 Job 67 incurred labor costs of $4400 for direct labor and $1200 for supervision.

4 Factory rent of $2000 was accrued but not paid. Factory depreciation was $800 on the building and $1750 on the equipment.

5 Factory overhead was applied at a rate of 75% of direct labor dollars.

6 Goods costing $30000 were transferred to finished goods inventory and then sold on account for $40000

Required: Journalize the above transactions and post them to T accounts.

(16) Steinwin Corporation produces high-quality pianos. Work is completed in one department, Production. The following transactions occurred relative to job 491:

1 Purchased for cash and received on June 14, 2021, when they were immediately requisitioned for job 491:

50 lb of oak at $12 per pound

600 lb of ivory at $6.50 per pound

100 ft of string at $2.60 per foot

2 Accounted for the following labor costs on June 18, 2021: 100 hours of direct labor, 60% of which was paid $7.75 per hour. The remaining hours were paid at $6.35 per hour. Supervision costs

amounted to $895.

3 Utility costs for the job were $605. Depreciation on factory machinery was $715. Miscellaneous factory expenses totaled $545. Depreciation of office equipment$500

4 Factory overhead is applied on the basis of %110 of direct labor cost

5 On June 21, 2021, as a result of a breakdown in the Production department, three pianos were considered to be defective. Normal rework costs amounted to $640 for direct materials and $1175 for direct labor. In addition, 10% of the ivory was wasted. It cost $230 in cash to remove the materials from the factory. Normal rework costs and waste disposal were not included in the factory overhead application rate.

6 At the completion of the job, the units were transferred to finished goods inventory. The following week, they were sold for $12000. Fifty percent of the sales price was paid in cash, the rest by a 30-day note.

Required: Prepare journal entries reflecting the above transactions.

Chapter (3)

Process costing

3/1 introduction

In addition to the products that are produced according to the customer's request, and according to a prior contract between the customer and the producer, which are covered by the cost systems of short and long-term contracts, there are other products that are produced for the market according to the continuous production system.

There are many different industries, whose activity is based on the production of one main product with specific standard or typical specifications, on the basis of which the product is marketed. Such as the mining industries, the chemical and pharmaceutical industries, the detergent industry, the cement industry, the sugar industry, the candy industry, the paper industry and others. These industries are characterized by the homogeneity of the product units in their final form, as is the case for a piece of soap in the soap industry, or a ton of

aluminum in the aluminum industry. Therefore, all production processes are the same for each unit of production. In such activities, the manufacturing of the product passes through successive production stages, each stage of which carries out a distinct set of industrial processes that contribute to the formation of the product in the required quality, so that it becomes fit for its purpose only after the completion of the last production stage. Of course, the number of production stages varies according to the nature of each product and its intended purpose.

The process cost is characterized by many features that reflect its impact on the adopted costing system in terms of the favorable treatment of the issues and problems that these features give rise, and perhaps the most prominent of these characteristics are the following:

1-The independence of the production stages:

We mentioned above that each production stage carries out a set of industrial processes that distinguish it from other stages, and this distinction extends to include the method of production and the technical and technological methods used. as well as the quality of raw materials, the quantity and quality of labor, the quantity and quality of machines, equipment, and other necessary services, and etc.

According to this distinction in the production method and production requirements in the stage, each stage is considered as if it were a stand-alone factory, with its different inputs from the production requirements, as well as its outputs from the units of the product, and the outputs that benefit in full from the production processes in the stage are considered complete units for this stage only and move to the next stage, and so on until the last stage in which the product

is wholly completed to reach its final form required at the level of the industry as a whole. This requires the need for a costing system to be in charge of accumulating and aggregating costs at the level of each stage separately.

2- stage outputs are non-homogeneous

It is rare for the production phase to start with the processing of a certain number of units, and then end with the completion of this number in full without leaving units in operation that have not yet been completed at the end of the period. In most cases, the production stage begins with a certain amount of units, some of them are completed and fulfilled all the prescribed industrial operations and become complete at the level of the stage and transferred to the next stage or to the finished production inventories in preparation for its sale, Others of this quantity reach a certain level of completion, but it is not completed yet at the end of the

accounting period, so it remains in processing at the stage until it is completed during the next period. In addition to the above some units may be spoiled or lost during processing after they have reached a certain level and their processing stops after that.

Hence, we find that the outputs of the stage may include several types of units that differ among themselves in terms of the extent to which they benefit from the operations scheduled for the stage. The complete units at the stage level got their full share of the operations. As for the other units, whether they are scheduled to complete the processing in the following period, or those whose processing was stopped at a certain level due to damage, these units have not yet benefited from all the operations that were scheduled for them with the different level of completion. Therefore, the unit share of the stage costs will vary according to the

different types of production outputs and according to the level of completion reached by each of them. Undoubtedly, this imposes burden on the costing system used. The costing system in this case must accurately determine the cost of each type of output separately, for specifying accountability.

3- Changing the amount of production during processing in the stage

It often happens in the process costing that the volume of production is exposed to an increase or decrease during operations as a result of natural reasons related to the nature of the industrial operations that are carried out on it. For example, a certain department may start with a specified number of units to perform operations on them, and then after a certain period of time or operation, during which those units have reached a determined level of completion. Another material or materials are added, and this addition leads to an

increase in the number of units than what the department originally started with.

On the contrary, adding a certain material during operation, or carrying out an additional industrial process, may lead to a reduction or decrease in the number of units that the department begins with. As is the case when adding some materials that work to extract, purify, or cohesive product particles, or what happens from evaporation and volatilization of some quantities as a result of heating operations in the case of liquids. In such cases, the unit's share of costs before the increase or decrease will, of course, differ from it after the increase or decrease, and the costing system used should trace the units during processing to determine the exact unit cost.

4- Reprocessing

It often happens that some units get damaged after they have reached a certain completion level, whether due to permissible / natural reasons or for other reasons that are not permitted. In such cases, it may be decided to repair these units because it is not possible to sell them in their condition, and this is done by reprocessing them, either at the same department in which the damage occurred, or by returning them to an earlier department or departments. The costing system must accurately determine the cost of these units before reprocessing them, then the cost of reprocessing and how to account for them.

3-2 Accounting for costs of production in process costing

It is known that the costs of production in any cost system are divided into three types: Direct materials - direct labor and factory overhead.

The process costing system uses well-known control accounts to accumulate the production cost elements from materials, wages and other indirect costs.

A separate work in process inventory account is opened for each department, which debited by the costs of production incurred on the department, and credited by the costs of completed units, units still in process at the end of the period, the abnormal damaged or spoiled production, if any.

It is worth noting that the abnormal damaged or spoiled production is considered an element of the department's output, but the department is not charged by its cost or burden. Therefore, it appears on the credit side of the department's work in process inventory account and then closed in the profit and loss account. In the following, we present the accounting treatment of the costs of production

that are charged to the debit side of the work in process inventory account

First: Accounting for the materials

The incurring of materials for the different departments is according to “material requisition form” As long as the materials are incurred on a specific production process or department, the procedures for charging the department with the materials incurred on them are mostly used in the first department and less used in the following departments.

In some companies, special inventories are allocated for each department in which the materials used by the department are stored from time to time. This procedure facilitates the process of inventorying materials and it is sufficient to determine the quantity of materials used in production by monitoring the inventory at the beginning of the period and the quantities received during the period; by determining the

ending inventory, it is possible to know the quantity of materials used by the department during the period.

One of the unique characteristics of the process costing is that the large size of the cost unit (which is the department or cost center) makes the distinction between direct materials and indirect materials unnecessary. All materials incurred for this department are considered direct at that department, which also facilitates the accounting procedures for the materials.

The materials used by departments are recorded by debiting the department work in process inventory account and crediting the materials inventory account. Of course, one entry can be made for the materials issued from the inventories during the period (usually weekly or monthly) as follows:

By sundries Work in process inventory dep 1 Work in process inventory dep 2 Work in process inventory dep 3 To material inventory Materials used by departments for the month of

Second: Accounting for labor:

As long as each production department or production stage is the cost unit on which the costs are accumulated, the use of time cards to record the time that workers took in production is sufficient instead of using the "job card" as is the case of the job order costing system.

It is also noted that the distinction between direct and indirect labor is unnecessary. Labor costs are charged as follows: -

By sundries Work in process inventory dep 1 Work in process inventory dep 2 Work in process inventory dep 3 To payroll payable the allocation of total wages for the month of……..

Third: Accounting for indirect costs (factory overhead)

It is possible to charge the production departments with indirect industrial costs on the basis of predetermined application rates , but if the nature of production leads to the

continuation of the cost flow in a continuous and orderly manner from one period to another , So that there are few causes - or almost no causes - that lead to differences between the amount of indirect costs charged to production and the actual indirect costs, so the actual application rates can be used, But if the level of production changes from one period to another (as if the production were for seasonal factors), it is preferable, of course, to use the predetermined application rates, So that there is no significant difference in the cost of production from one period to another, in a way that it is not possible to compare the unit cost in different periods.

It is noted in this system that some companies differentiate in the books between variable and fixed factory overhead. For the fixed factory overhead, it charged to the departments on the basis of predetermined application rates (based on the

normal production capacity). If there is a difference between the actual fixed factory overhead and applied fixed factory overhead, this difference shall be considered the responsibility of the management and closed directly to the profit and loss account.

And if the companies follow the policy of charging actual factory overhead costs, then after collecting the actual factory overhead costs and assigning it to the production departments, the following entry is made:

By sundries Work in process inventory dep 1 Work in process inventory dep 2 Work in process inventory dep 3 To factory overhead control Allocation of factory overhead costs for the month of ... on production departments

But if the firm uses the predetermined application rates, the entry will be:

By sundries Work in process inventory dep 1 Work in process inventory dep 2 Work in process inventory dep 3 To applied factory overhead Charging the production departments with factory overhead costs on the basis of the predetermine application rates

As a result of the accounting treatment of cost elements as previously, these elements appear in the debit side of the departments work in process inventory account as follows:

Work in process dep 1 account

To material inventory	xx		
To payroll payable	xx		
Ty applied factory overhead	xx		
	xx		xx

It is worth mentioning in this regard that the elements of labor and factory overhead costs are often combined together in one element called conversion costs, in order to facilitate

the accounting workload, especially if the factory overhead costs are charged on the basis of direct labor.

3- Determining the costs of the production elements in the department:

Here we mean by production elements in the department, the outputs of the department at the end of the processing period that is being reported. These outputs include

-Complete units transferred out to a next department or finished goods inventory.

-Units still in process at the end of the period that remain in the department to complete their processing in the next period.

- Spoiled, missing, defective, or rejected units.

The completion levels of these units have varying percentage, and therefore, the share of each unit of the

production costs differs in the department. As it is not correct in light of the heterogeneity of the outputs in the department to calculate the unit cost by dividing the total production costs incurred in the department by the total output units therein.

There is a necessity for determining the unit cost of each product cost element separately and reporting on it periodically at the end of period. Therefore, the process costing system defines procedures for measuring and determining the cost of production elements as follows:

First: an accurate calculation of the production quantity in units

This is done for each department separately from the daily or weekly reports and others prepared by those responsible for production in each department. This includes determining the quantity, type and completion level of the units that have

been started processing in the department during the period. Whether the units are incomplete units remaining from the previous period, or new units received or other inputs.

It also includes determining the quantity, type, and completion level of the units that have processed at the same department during the same period, whether the units that have been fully completed or that are still in process (incomplete units) for the next period or the units that have been damaged or lost during processing and their causes and other outputs.

A report is prepared as a result of this counting, called" production quantities schedule" takes the following form:

production quantities schedule	
Units to account for(inputs) Beginning units in process (%) Units received from preceding department or Units started in process Units……..	 xx xx xx
total	xxx
Units accounted for (outputs) Units transferred to the next department Ending units in process (%) Units…..	 xx xx xx
total	xx

The careful examination must result in the equality of the total of the inputs with the total of the outputs.

Second: calculating the equivalent production

As is clear from the previous step, the outputs of the department include several types of units, and these units are not homogeneous in terms of their completion level, and therefore the unit share for each type from production costs differ.

Therefore, it is necessary to homogenize the output units by converting the incomplete units into their equivalent complete units, so that the unit cost for finished units can be determined. This is done by relying on the completion level of the incomplete units determined by the technicians specialized in production. Equivalent production equals total units completed plus incomplete units restated in terms of completed units.

Assuming that one of the departments produced during period 1000 units, of which 800 units are fully completed and the rest is still in processing at the end of the period with 50% completion level.

In this case, the equivalent production for this department is as follows

Output units	Equivalent units
800compeleted	
unitsx100%=	800
200units still in process	
x50%=	100
	900units

The above means that the outputs of the department of all types, which are 1,000 units, are equivalent to only 900 complete units. It also means that the processing efforts in the department, if it were limited to 900 units only, it would finish their processing and there will be no units still in process. , and most importantly, it means that the costs that the incurred in processing 1,000 units in the department are sufficient to complete only 900 units in full.

We must point out here, and as will be explained in detail later, that it is not constant that the completion level of the

incomplete units be the same for all product costs elements as is the previous simplified assumption.

For example, the units still in process at the end of the period may have fully benefited from the materials element at the beginning of process, but they benefited from the conversion costs (labor + factory overhead) by only 50%. Therefore, it is necessary to restate the incomplete units for each product cost element.

This is expressed in the form of a report called the equivalent production schedule, in which the outputs of the department are restated as they appeared in the aforementioned production quantity schedule. to compute the equivalent production, an analysis must be made of the completion level of work in process inventory it must be subdivided into direct materials, direct labor and factory overhead in order to

determine the completion level of each component. This schedule takes the following form:

Description/items	No. of units	Direct materials		Direct labor		Factory overhead	
		Stage of completion	Equivalent units	Stage of completion	Equivalent units	Stage of completion	Equivalent units
-Units completed and transferred out	xx						
-Ending units in process	xx						
-Spoiled units	xx						
-Units…..	xx						
Total Equivalent units							

Third: Determining the total production cost and the unit cost of the product for the department:

What we presented in first and second is a necessary prelude so that the product unit cost and the cost of the production outputs at the department can be determined in a proper and accurate manner. This is done in two steps.

The first step: It is concerned with determining the unit cost of the product in detail for each cost of production elements. This is done by dividing each element of the costs by the number of its equivalent production units, as previously specified in the Equivalent Production schedule. By summing up the unit share of all the cost components, we arrive at the unit cost of the product.

The second step: It is concerned with determining the cost of production types (outputs) in each department separately. This is done by multiplying the complete total unit cost (as defined in the previous step) by the number of units of each type of the outputs, taking into account the equivalent production for the incomplete units. This procedure is expressed in the form of a report called the costs of production costs report and takes the following form:

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: costs added by the department				
Direct material	XX		XXX	XX
Direct labor	XX		XXX	XX
Factory overhead	XX		XXX	XX
Total costs			XX	XX
Second: costs of production outputs				
-Transferred to the next dep. Or finished goods inventory	XX		XX	XX
-Ending work in process				
Materials	XX	XX		XX
Labor	XX	XX		XX
Factory overhead	XX	XX	XX	XX
-units……				
Total costs			XXX	

It is clear that the cost of production report consists of two parts, in the first part, accumulating the elements of product costs incurred by the department, and by dividing each of them by the equivalent production units, the unit cost for each of these elements is determined, and this corresponds to the first step previously referred to.

In the second part of the report, the cost of the production outputs for the department is determined using the unit cost that was calculated in the first part, with respect to each type of outputs separately. This corresponds to the second step previously mentioned. Note that the total of the costs in the two parts must be equal.

Fourth: Preparing the work in process inventory account for the department

With the end of the previous procedure, as we presented in the third item, the costing system has determined the cost of each type of production outputs in the department whether the cost of the complete units at the level of the department or the remaining units (units still in process) and so on.

These items represent the credit side of the work in process inventory account, which appears in full as follows:

Work in process dep. 1 account

To beg. Work in process	xx	By finished good inventory	XX
To costs from preceding department (transferred in costs)	xx	By transferred out costs	XX
To material inventory		By abnormal spoiled units	XX
To payroll payable	xx	By ending work in process	XX
To applied factory overhead	xx		
	XX		XX

Example 1

Production is carried out in one of the factories in two departments, and the first department started with the manufacture of 12000 units of product "N" during January.

Raw materials were issued to the department from the storeroom at $ 36000. The direct labor at this department during the month amounted to $ 37,500, and the factory overhead incurred equal $ 25,000. During the month, 9000 units were completed and transferred to the second department, 3000 units still in process, with a completion

level of 33.33% from conversion costs, but it received 100% with respect to materials.

In the second department, direct labor was $ 24,000, and factory overhead were $ 16,000, and 7,000 units were completed and sent to finished goods inventory, and 2,000 units remained in process, with an estimated completion level of 50%.

Required

1- Prepare quantity schedule and costs of Production report for each of the two departments for the month of January.

2- Prepare the journal entries for the month of January.

3- Prepare the work in process inventory account for each of the two departments for the month of January.

First: department 1

production quantities schedule

for January

Inputs: Units started in process	 12000
total	12000
Outputs: Units transferred to the next department Ending units in process (1/3)	 9000 3000
total	12000

Equivalent production schedule

Description/items	No. of units	Direct materials		Direct labor		Factory overhead	
		Stage of completion	Equivalent units	Stage of completion	Equivalent units	Stage of completion	Equivalent units
-Units completed and transferred out	9000	100%	9000	100%	9000	100%	9000
-Ending units in process	3000	100%	3000	33.33%	1000	33.33%	1000
Total Equivalent units			12000		10000		10000

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: costs added by the department				
Direct material	12000		36000	3.00
Direct labor	10000		37500	3.750
Factory overhead	10000		25000	2.500
Total costs to account for			98500	9.250
Second: costs of production outputs				
-Transferred to the next dep. Or finished goods inventory	9000		83250	9.250
-Ending work in process				
Materials	3000	9000		3.000
Labor	1000	3750		3.750
Factory overhead	1000	2500	15250	2.500
Total costs accounted for			98500	

Second: department 2

production quantities schedule

for January

Inputs:	
Units received from department 1	9000
total	9000
Outputs:	
Units transferred to finished goods inventory	7000
Ending units in process (50%)	2000
total	9000

Equivalent production schedule

Description/items	No. of units	Transferred in costs		Direct labor		Factory overhead	
		Stage of completion	Equivalent units	Stage of completion	Equivalent units	Stage of completion	Equivalent units
-Units completed and transferred out	7000	100%	7000	100%	7000	100%	7000
-Ending units in process	2000	100%	2000	50%	1000	50%	1000
Total Equivalent units			9000		8000		8000

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
-Costs from preceding department transferred in	9000		83250	9.250
- costs added by the department				
Direct labor	8000		24000	3.000
Factory overhead	8000		16000	2.000
Total costs to account for			123250	14.250
- costs of production outputs				
-Transferred to finished goods inventory	7000		99750	14.250
-Ending work in process				
Costs from preceding department	2000	18500		9.250
Labor	1000	3000		3.000
Factory overhead	1000	2000		2.000
			23500	
Total costs accounted for			123250	

2-journal entries

By work in process inventory dep.1	36000	
To material inventory		36000
By sundries		
Work in process inventory dep.1	37500	
Work in process inventory dep.2	24000	
To payroll payable		61500
By sundries		
Work in process inventory dep.1	25000	
Work in process inventory dep.2	16000	
To applied factory overhead		41000
By Work in process inventory dep.2	83250	
To Work in process inventory dep.1		83250
By finished goods inventory a/c	99750	
To Work in process inventory dep.2		99750

3- Work in process inventory account

Work in process inventory dep. 1 a/c

		By work in process inventory dep.2	83250
To material inventory	36000		
To payroll payable	37500	By ending work in process	15250
To applied factory overhead	25000		
	98500		98500

Work in process inventory account dep. 2 a/c

To costs from preceding department (transferred in costs)	83250	By finished good inventory	99750
To payroll payable	24000	By ending work in process	23500
To applied factory overhead	16000		
	123250		123250

-Notes on the solution of the previous example:

1- The units of production that still in process have been restated on the basis of the completion levels to the equivalent of completed units in the equivalent report.

2-The cost of production report contains two parts: The first part: shows the total costs of production, and shows the unit cost of each component of the costs. The second part: shows how to distribute the total production costs to the completed units transferred to the next department and the units still in process.

3-The equivalent report for to the department following the first one includes additional item for the cost from

preceding department (transferred in cost), and it also appear in cost of production report.

4- In the previous example, we assumed the following:

A - There is no effect of the material on the number of units produced.

B - The absence of beginning work in process inventory in each of the two departments.

C - The absence of any kind of damage or spoilage in each of the two departments.

3-4 Accounting treatment for the use of the material component

We mentioned above that the completion level of incomplete units is not the same for all cost elements, unless we assume that all cost elements, including direct materials, are incurred evenly through processing. But if this assumption is correct

with regard to conversion costs (labor + factory overhead), the direct materials component may differ. As we also mentioned that in many cases the addition of the material during operation leads to a change in the number of units.

Accordingly, the use of the material in the production raises two basic problems, the first relates to the relationship of that element to the completion level, while the second concerns its relation to the number of units being produced.

In this section, we discuss these two problems and how the process costing system addresses them:

First: the relationship of the material component to the completion level.

In some industries, direct materials may be added at the beginning of the department, thus making the units in processing - whatever the completion level in relation to the

conversion costs - have completion level of 100% for the material component.

In some other industries, materials may be added at the end of the stage, so that the units under processing do not receive any materials as long as they have not yet reached the completion level of 100% in which the materials are added, so its completion level for the materials component is “zero”.

In other industries, materials may be added at a certain completion level, such as 50%, for example. In this case, the benefit of units in process from the materials component is determined as follows:

A- If the completion level of the units in processing at the end of the period has not yet reached the completion level at which the materials are added, the units in process do not receive any materials - that is, the level of their

completion with respect to the materials component is "zero".

B- If the completion level of the units at the end of the period has reached the completion level at which materials are added - or exceeded - then these units received their full share of direct materials, i.e. their completion level for the materials component is (100%)

Example 2:

Production is carried out in one of the factories in two stages, and the following are the production and cost data for January:

items	Department A	Department B
Units:		
Units started in process	25000	
Units received from the preceding department		15000
Units transferred to finished inventory		10000
Ending units in process	10000	5000
Costs:	25000	

materials		
material X is added at the beginning		18750
material Z is added at 70% completion level		7500
Direct labor	10000	3900
Factory overhead applied	10000	3600

If you know that:

1- The completion level of the units still in process is 50% and 60%, for the two departments, respectively.

2- The adding of materials in the second department does not result in an increase in the number of units produced.

Required

1- Prepare quantity schedule and costs of production report for each of the two departments for January.

3- Prepare the work in process inventory account for each of the two departments.

Production quantities schedule dep. A

Inputs: Units started in process	 25000
total	25000
Outputs: Units transferred to the department B Ending units in process (50%)	 15000 10000
total	25000

Equivalent production schedule
Department A

Description/items	No. of units	Direct material		Direct labor		Factory overhead	
		Stage of completion	Equivalent units	Stage of completion	Equivalent units	Stage of completion	Equivalent units
-Units completed and transferred to dep. B	15000	100%	15000	100%	15000	100%	15000
-Ending units in process	10000	100%	10000	50%	5000	50%	5000
Total Equivalent units			25000		20000		20000

cost of production report department A

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: costs added by the department				
Direct material	25000		25000	1.0
Direct labor	20000		10000	0.5
Factory overhead	20000		10000	0.5
Total costs to account for			45000	2.0
Second: costs of production outputs				
-Transferred to the next dep.	15000		30000	2
-Ending work in process	10000	10000		1
Materials	5000	2500		0.5
Labor	5000	2500	15000	0.5
Factory overhead				
Total costs accounted for			45000	

Work in process inventory dep. A a/c

To material inventory	25000	By work in process inventory dep. B	30000
To payroll payable	10000		
To applied factory overhead	10000	By ending work in process	15000
	45000		45000

production quantities schedule

for department B

Inputs:	
Units received from department A	15000
total	15000
Outputs:	
Units transferred to finished goods inventory	10000
Ending units in process (60%)	5000
total	15000

Equivalent production schedule

Department B

Description/items	Transferred in costs	Direct materials		Direct labor	Factory overhead
		X	Z		
-Units completed and transferred to finished goods	10000	10000	10000	10000	10000
-Ending units in process(60%)	5000	5000	----	3000	3000
Total Equivalent units	15000	15000	10000	13000	13000

Cost of production report dep. B

description	Equivalent production	Total costs		Unit cost	
-Costs from preceding department transferred in	15000		30000		2.0
- costs added by the department					
Direct material:	15000	18750		1.25	
X	10000	7500		0.75	2.0
Z			26250		
Direct labor	13000		3900		0.3
Factory overhead	13000		3600		0.2
Total costs to account for			62750		4.5
costs of production outputs:					
-Transferred to finished goods inventory	10000		45000		4.5
-Ending work in process					
Costs from preceding department	5000	10000			2.0
X material	5000	6250			1.25
Labor	3000	900			0.3
Factory overhead	3000	600	17750		0.2
Total costs accounted for			62750		

Work in process inventory account dep. B a/c

To costs from preceding department (transferred in costs)	30000	By finished good inventory	45000
To material inventory(X&Z)	26250		
To payroll payable	3900	By ending work in process	17750
To applied factory overhead	2600		
	62750		62750

Second: The relationship of between materials element and the number of units produced

Production in some industries may start using materials at the beginning of the production process, i.e. materials added at the first department, and the work of the following departments is limited to adding conversion costs. In other industries, the nature of production may require adding new materials at department following the first department, and this result in one of two cases:

- The number of units remains the same without an increase, if the addition was a part to be assembled on the product, or it was a coating material added to the product in the finishing stage. In this case, the addition of new materials results in an increase in the unit cost and not an increase in the number of units produced.

- The addition of materials may result in an increase in the number of units produced. In the chemical industries, for example, a liquid may be added to a particular chemical mixture: The addition of the liquid results in an increase in the units' weight. In this case, an adjustment occurs in the unit cost received from a previous stage, as shown by the following example:

Example 3:

Production in one of the factories goes through two stages, and the following is the data extracted from the factory's books during the month of February for the second stage:

1- The units received from the previous stage are 30,000 units, and the unit cost is 2500.

2- 45,000 units were completed and transferred to finished goods inventory.

3- 15000 units remain in process at the end of the month with 80% completion level.

4- The costs of the stage during the month were as follows

material A added at 10% completion level	45000
material B added at 85% completion level	22500
Direct labor	28500
Factory overhead applied	14250

If you know that adding the material A will result in an increase in the number of units produced to double.

Required

-Prepare the cost of production report.

-Prepare the work in process inventory account.

production quantities schedule

for the department

Inputs:	
Units received from preceding department	30000
The increase resulting from adding A material	30000
total	60000
Outputs:	
Units transferred to finished goods inventory	45000
Ending units in process (60%)	15000
total	60000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials		Direct labor	Factory overhead
		A 10%	B 85%		
-Units completed and transferred to finished goods	45000	45000	45000	45000	45000
-Ending units in process (80%)	15000	15000	---	12000	12000
Total Equivalent units	60000	60000	45000	57000	57000

Cost of production report

description	Equivalent production	Total costs		Unit cost
-Costs from preceding department transferred in	60000		75000	1.250
- costs added by the department				
Direct material:				
A	60000	45000		0.750
B	45000	22500	67500	0.500
Direct labor	57000		28500	0.500
Factory overhead	57000		14250	0.250
Total costs to account for			185250	3.250
costs of production outputs:				
-Transferred to finished goods inventory	45000		146250	3.250
-Ending work in process				
Costs from preceding department	15000	18750		1.250
A material	15000	11250		0.750
Labor	12000	6000		0.500
Factory overhead	12000	3000	39000	0.250
Total costs accounted for			185250	

work in process inventory account a/c

To work in process inventory dp1		By finished good	146250
(transferred in costs)	75000	inventory	
To material inventory(A&B)	675000		
To payroll payable	28500	By ending work in	39000
		process	
To applied factory overhead	14250		
	185250		185250

3-5 Accounting treatment for production in process at the beginning of the period (beg. Work in process)

In the previous sections, we assumed that there were no units in process at the beginning of the accounting period in order to facilitate the presentation of the main lines of the cost flow and accounting for them using the process costing system. In this part, we will discuss how to deal with beginning work in process and its impact on the average unit cost.

The accounting methods for treating the cost of beginning work in process are:

1-Weighted average costing

2-First in, first out costing

The weighted average costing method is based on the assumption that the beginning works in process units completely lose their identity during processing, therefore, its

costs from the previous period (separated to its components of materials, labor, factory overhead and transferred in costs) are merged with the costs added in the department for the current period, treated as if it were a current period cost.

In order to arrive at the weighted average unit cost, the cost of beginning work in process inventory are added to the period's current costs, and this total is divided by equivalent production. Without distinguishing between the units that were in the department at the beginning of the period and the new units that started processing in the department during the current period. Units in process at the beginning of the period are treated as they had been started and completed during the current period, regardless of the completion level of beginning work in process.

Thus, finished units transferred to a later department or transferred to finished goods inventory are evaluated according to one weighted average unit cost.

While the first in first out costing method, it relies on the assumption that the beginning work in process units are independent and separated units, and have independent cost consisting of:

- Its share of the department costs from the previous period, (the balance of the work in process at department in the beginning of the current period).

- Its share of the department costs for the current period, i.e. what these units receive from the added costs in the department until they are completed and transferred to the next department or to the finished goods inventory.

The new units whose production start during the current period, their cost is calculated as completely independent units. When transferring the costs or units to the next department or to the finished goods inventory, it is assumed that the units of the beginning work in process inventory of the period have been completed first and transferred to the next department. In other words, any units that remain in process at the end of the period (provided that they are equal to or less than the number of new units that started processing during the period) are assumed to be of the new units put into production during the period (whose production begins in the current period).

Thus, the unit cost may vary for the production transferred to the next department, according to whether it is from the beginning work in process units or from the new production units that put into production during the current period.

The following example shows how to account for production costs, assuming that there are units in process at the beginning of the period.

Example 4:

The following data is extracted from the cost records in one of the economic units for the second phase during the month of June

Production data:

1- Units in process on the first of June 10,000 units.

2- The department received 76,000 new units during the month from the previous department.

3- 60,000 units were completed, moved to the next department, and 26,000 units still in processing received 100% of materials, 50% form direct labor and factory overhead.

Costs data:

1- Beginning work in process

-Cost from preceding department 0.400 per unit.

-direct material $ 1000.

-direct labor $ 1000.

-factory overhead $ 500.

2- New inputs (units started in process)

-Cost from preceding department 0.400 per unit.

-direct material $ 7600.

-direct labor $ 13600.

-factory overhead $ 6800.

Note that the added raw materials do not lead to an increase in the number of units.

Required:

1-Prepare the cost of production report and work in process inventory account using weighted average costing method.

production quantities schedule

for the department

Inputs:	
Beg. Work in process	10000
Units received from preceding department	76000
total	86000
Outputs:	
Units transferred to next department	60000
Ending units in process (50%)	26000
total	86000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials	Direct labor	Factory overhead
-Units completed and transferred to finished goods	60000	60000	60000	60000
-Ending units in process (50%)	26000	26000	13000	13000
Total Equivalent units	86000	86000	73000	73000

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Costs from preceding department:				
Beg. WIP		4000		
Transferred in during the period	86000	30400	34400	0.400
-costs added by the department				
Direct material:				
Beg. WIP		1000		
Added during the period	86000	7600	8600	0.100
Direct labor:				
Beg. WIP		1000		
Added during the period		13600	14600	0.200
Factory overhead:	73000			
Beg. WIP		500		
Added during the period	73000	6800	7300	0.100
Total costs to account for			64900	0.800
costs of production outputs:				
-Transferred to next dep.	60000		48000	0.800
-Ending work in process:				
Costs from preceding department	26000	10400		0.400
material	26000	2600		0.100
Labor	13000	2600		0.200
Factory overhead	13000	1300	16900	0.100
Total costs accounted for			64900	

Work in process inventory account a/c

To beginning balance	6500	By work in process dep.3	48000
To work in process dep.1 (transferred in costs)	30400		
To material inventory	7600		
To payroll payable	13600	By ending work in process	16900
To applied factory overhead	6800		
	64900		64900

Appling First in first out costing method

It is clear from the solution of the previous example on the basis of the weighted average cost method that this method assumes that all units produced in the department during the period are completely homogeneous units. There is no difference between the existing units at the beginning of the period and the new units that started processing during the period, and that the weighted average unit cost is a fair measure of the unit cost.

As for the first in first out costing method, assumes that the units in process at the beginning of the period have an independent identity, and therefore we must first calculate that part of the period costs that is needed to convert these units into complete units. Then we calculate the cost of the new units that started processing in the department.

This method leads, of course, to use of two different numbers for the unit cost of the units in process at the beginning of the period (after its completion), and the other represents the unit cost of the new units. While the weighted average costing method gives us a single number for the unit cost of department production.

Since the elements of the department costs - in the case of units in process at the beginning of the period - are represented in:

1- The cost of the units in process at the beginning of the period

2- The costs added during the current period

The costs added during the period will be used to complete the incomplete part of the units in process at the beginning of the period and then to process the new units.

Therefore, the department equivalent production is calculated as follows:

-Units completed and transferred:

1-The units in process at the beginning of the period that will receive a share of the added costs to be converted into completed units is calculated by multiplying the number of units by the percent to complete.

2-The units started and completed during the same period treated the same way as weighted average costing method. The equivalent is calculated by multiplying the number of units by the percent of complete

-Ending work in process inventory: ending unit in process multiplied by the percent of completion.

Example 5:

Using the same data in example No. (4) And by assuming that the units in process at the beginning of June, complete for materials, 60% form other costs. Prepare the cost of production report and work in process inventory account using first in first out costing method.

production quantities schedule
for the department

Inputs:	
Beg. Work in process units	10000
Units received from preceding department	76000
total	86000
Outputs:	
Units transferred to next department 60000	
-completed units from beg, WIP	10000
-completed units from new units	50000
Ending units in process (50%)	26000
total	86000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials	Direct labor	Factory overhead
Units completed and transferred out:				
-Beginning units in process			4000	4000
Unit started and completed	50000	50000	50000	50000
Total	50000	50000	54000	54000
Ending units in process (50%)	26000	26000	13000	13000
Total Equivalent units	76000	76000	67000	67000

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Costs from preceding department and prior period:			6500	
-costs added during the period:				
Transferred in cost	76000	30400		0.400
Direct material	76000	7600		0.1000
Direct labor	67000	13600		0.2030
Factory overhead	67000	6800	58400	0.1015
Total costs to account for			64900	0.8045
costs of production outputs:				
Transferred to next dep.:				
From beginning inventory				
-Costs from preceding department and prior period		6500		
-direct labor	4000	810		0.2030
-direct material	4000	406		0.1015
			7716	
From the current production	50000		40225	0.8045
-Ending work in process:				
Costs from preceding department	26000	10400		0.4000
material	26000	2600		0.1000
Labor	13000	2639		0.2030
Factory overhead	13000	1320	16959	0.1015
Total costs accounted for			64900	

Work in process inventory account dep2 a/c

To beginning balance	6500	By work in process dep.3	7716
To work in process dep.1 (transferred in costs)	30400	By work in process dep.3	40225
To material inventory	7600		
To payroll payable	13600	By ending work in process	16959
To applied factory overhead	6800		
	64900		64900

Comparison between weighted average costing method and the first in first out costing method

1-The first in first out costing method treats the units in the beginning of the period as independent, whose total cost, after its completion, differs from the cost of new units that started processing and completed in the department during the same period. Therefore, the unit cost of the units of the beginning of the period after its completion differs from the unit cost of the new units. While the weighted average costing method assumes that there are no differences

between the two types and calculates one weighted average unit cost for the two types.

2- In the weighted average costing method, we are interested in knowing the details of the units in process costs at the beginning of the period according to its components, in order to add the materials, labor and factory overhead of the units in process at the beginning of the period with those the costs of the department. And by dividing the total costs of each component by the equivalent production quantity, we get the unit cost.

As for the first in first out costing method, we are concerned only with the total previous cost of the units at the beginning of the period, and by adding what they have obtained from the cost added during the period that necessary to complete them, we will get an independent cost figure for these units.

3- In the weighted average costing method, we are not interested in knowing the completion level of the units in process at the beginning of the period. They are not treated as distinct and independent units, but rather their identity disappears with the new units, and the opposite is true in the first in first out costing method.

3-6 Accounting treatment for spoiled units

The terms “spoiled units” and “defective” may be used to mean one thing, but in fact they mean two different things. Spoiled production usually means that loss in raw materials that result due to the nature of the production process. It is unavoidable and it is possible to sold for small salvage value or discarded.

An example is the shortage of raw materials resulting from evaporation or shrinkage due to exposure of the raw material to high or low temperatures, as in the manufacture of

medicines, aromatic scents and chemical products, or volatilization or leftover parts of raw materials such as scraps and sawdust in the manufacture of paper, glass and the turning of metals, wood, cotton and leather products.

As for the defective production, it means those units that are damaged during the production process at one of the stages and are rejected by the examiners. Such units usually have a certain salvage value, either represented by what they contain of raw material that can be returned to the inventory and start operating on them again. or represented by what these units can be sold for as a "seconds or irregulars", and in this case, their selling value is - no doubt - less than the sales value of the good products. Examiners may reject some units at one stage because of production damage, and the matter needs to be returned to a previous stage or repaired at the same stage.

In this case, additional costs may be charged that may return the defective units to a good level of production standard.

In view of the economic unit loss caused by spoiled or defective production, there must be sufficient interest to impose adequate control over production to reduce this loss and bring it to a minimum. Specialists in each industry determine a certain percentage of spoilage or defective that is permissible or normal according to the industrial circumstance and the nature of production.

If the spoiled or defective units exceed the permissible percentages, it becomes necessary to study the reasons that led to the occurrence of abnormal spoilage or damage, determine the responsibility for its occurrence, and take corrective actions.

The imposition of production control requires that there be an organized examination of the produced units to discover the

damaged units and the issuance of periodic reports at the appropriate dates so that the specialists can take the necessary measures to correct the abnormal conditions in a timely manner. It is necessary to determine the cause of the damage, and is it a defect in the raw material, or due to the negligence of the competent worker, or a defect in the machinery?

The cost accounting system plays an important role in imposing control over production costs and accounting for damage and loss by designing appropriate reports to determine responsibility, follow-up performance evaluation and correct errors.

Accounting treatment for abnormal spoiled or defective production

Spoiled or defective units that exceed the permissible percentages represent an actual loss resulting from reasons

that could have been avoided. Therefore, it is preferable to appear in the cost accounts in a clear and distinct way to draw the attention of management to them and to the need to address their causes by increasing training or supervising workers or maintaining machines, or reorganization of the production inspection method.

Abnormal spoiled/defective units are treated as part of the stage production, and the cost elements are distributed to them on the basis of their completion level. As the case with the good and complete units and the units in process at the end of the period, whether they have a salvage value or not.

The cost of Abnormal spoiled/defective units is recorded in a separate account that debited by the cost, and work in process inventory account of the department is credit. The loss of Abnormal spoiled/defective units depends on whether these units have a sale or salvage value or not. If the Abnormal

spoiled/defective units have a sale or salvage value, the difference between the cost of production of the damaged one and its selling or salvage value shall be considered a loss to be carried to the profit and loss account. But if the damaged production has no salvage value, its total cost is considered a loss to be carried to the profit and loss account.

Accounting treatment for normal spoiled or defective production:

The accounting treatment for the cost of normal spoiled or defective units aims to determine the actual cost of finished production and production in process, as well as to attempt to impose control over spoiled or defective units.

If there is a certain percentage of spoilage or defect must occur in the normal production circumstance, therefore, the proper accounting treatment requires considering the loss of

these damaged units as part of the good units cost. This is for the following reasons:

1- Good units cannot be completed without this loss, which is part of the production process nature.

2- Normal spoiled or defective units cannot be controlled in their quantity or value and must occur period after period, so it is an element of stage outputs.

The accounting treatment for Normal spoiled or defective units varies according to whether it has a salvage value on one hand, and the completion level at which the inspection is carried out on the other hand, as shown in the following:

First: There is no salvage value for Normal spoiled or defective units

A- It may be the firm's policy to check the units at the end of processing, and this means that the units in process will

not pass through the inspection centers. So, the units in process at the end of the period do not charge with any share of the spoiled or defective units cost in the current period, but this loss is distributed to the completed units and the abnormal spoiled or defective units only, Because the units in process at the end of the period will get their share of the cost of spoiled or defective units in the period in which they are 100% complete.

To determine the production unit cost, we trace the following steps

1- Normal spoiled or defective units are included in the equivalent production schedule, like completed units, units in process, and abnormal spoiled or defective units.

2- The production costs are divided by the equivalent production (including normal spoiled or defective units)

to calculate the total unit cost and the unit cost for each cost component.

3- Calculate the cost of normal spoiled or defective units (the number of normal spoiled or defective units multiplied by the unit cost).

4- The cost of normal spoiled or defective units is redistributed to the completed units and abnormal spoiled or defective units only. This method of dealing with normal spoilage or defect is called (distribution method).

Example 6:

The production passes in one of the factories through two departments. Once the units from the first department reach the second department, new materials are added, resulting in an increase in the number of units by one third.

The following is the data for the second department for the month of January:

- 6000 units in process at the beginning of the period, the cost of which is as follows: transferred in cost $ 10800, direct materials $ 207, direct labor $ 930, factory overhead $ 548.

- 30,000 units received from the first department, the unit cost $ 2,400.

- costs added during the period, Direct materials $ 1863, direct labor $ 8100, indirect expenses $ 4870.

- 5000 units in process at the end of the period, at 40% completion level.

- 1000 spoiled units, of which 600 are within the permissible limits. note that the inspection is carried out at the end of the stage.

Required: Preparing a production cost report?

production quantities schedule

for the department

Inputs:	
Beg. Work in process units	6000
Units received from preceding department	30000
Units added to production(30000*1/3)	10000
total	46000
Outputs:	
Units transferred to finished goods inventory	40000
normal spoiled units	600
abnormal spoiled units	400
Ending units in process (40%)	5000
total	46000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials	Direct labor	Factory overhead
-Units completed and transferred to finished goods	40000	40000	40000	40000
-Normal spoiled units	600	600	600	600
-Abnormal spoiled units	400	400	400	400
-Ending units in process (40%)	5000	5000	2000	2000
Total Equivalent units	46000	46000	43000	43000

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Costs from preceding department:				
Beg. WIP		10800		
Transferred in during the period	46000	72000	82800	1.800
-costs added by the department				
Direct material:				
Beg. WIP		207		
Added during the period	46000	1863	2070	0.045
Direct labor:				
Beg. WIP		930		
Added during the period	43000	8100	9030	0.210
Factory overhead:				
Beg. WIP		548		
Added during the period	43000	4870	5418	0.126
Total costs to account for			99318	2.181
costs of production outputs:				
-Transferred to finished goods.				
Completed units				
+ its share of normal spoiled units cost	40000	87240 1296	88536	2.181 0.0324
-abnormal spoiled units cost				
+its share of normal spoiled units cost	400	872 13	885	2.181 0.0324
-Ending work in process:				
Costs from preceding department	5000	9000		1.800
material	5000	325		0.045
Labor	2000	420		0.2100
Factory overhead	2000	252	9897	1.1260
Total costs accounted for			99318	

As will as, if the production inspection process is carried out at a certain level of completion level, and the ending units in process were at completion level less than the completion level at which the inspection is carried out, In dealing with the permissible loss of spoilage, we follow the steps that were followed in the previous case. That is, the normal spoiled/defective units are taken into account when preparing the equivalent production report (it is noted here that they enter the equivalent production report on the basis of their completion level, which is the level of completion at which the inspection is performed)

The abnormal spoiled/defective units are also included in the equivalent production report on the basis of the same level of completion, then the total unit cost and the cost of normal spoiled/defective units is calculated, Then allocate the cost of abnormal spoiled/defective units to

1- Completed units.

2- Abnormal spoiled/defective completed units because they have reached the level of completion at which the inspection is performed.

3- Units in process that have reached the level of completion at which the inspection is performed.

B- But if all units are in process at the level of completion at which the inspection is carried out or exceeded, or if the inspection is carried out at the beginning of the stage or it is carried out gradually, i.e. continuously during process, the calculation of the normal spoiled units in the equivalent production report is neglected. The production of the stage is charged with its costs implicitly by directly inflating the unit cost by its share of normal spoiled/defective units cost. This not only affects the unit's share of the stage's costs, inflating it by the cost of the spoiled/defective units, but rather it

exceeds it to the costs received by the stage from the previous stage. If the loss or damage occurs in a stage following the first stage, the unit share of the received cost will be inflated also, because the number of units that charged with the received cost becomes less and this method is called (the inflation method)

Example 7:

The following data is for the second department of an engineering commodity production during the month of April:

1- Received units: 40,000 units, unit cost $ 3.

2 - 12000 units remain in processing at the end of the month with a 50% completion level.

3- 38,000 units were completed and transferred to the third department.

4- The rest of the units are considered as permissible spoilage and have no salvage value. This spoilage was discovered upon completion of the 40%.

5 – Department costs

Direct material (It is added at the 20% completion level and leads to an increase in the units produced by 50%.	40000
Direct labor	22000
Factory overhead	33000

Required: Prepare cost of production report and work in process inventory account?

production quantities schedule

for the department

Inputs:	
Units received from preceding department	40000
Units added to production (40000*50%)	20000
total	60000
Outputs:	
Units transferred to next department	38000
Ending units in process (50%)	12000
normal spoiled units	10000
total	60000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials	Direct labor	Factory overhead
-Units completed and transferred to next department	38000	38000	38000	38000
-Ending units in process (50%)	12000	12000	6000	6000
Total Equivalent units	50000	50000	44000	44000

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Transferred in cost:	50000		120000	2.4
-costs added by the department				
Direct material:	50000		40000	0.80
Direct labor:	44000		22000	0.50
Factory overhead:	44000		33000	0.75
Total costs to account for			215000	4.45
costs of production outputs:				
-Transferred to finished goods.	38000		169100	4.45
-Ending work in process:				
Costs from preceding department	12000	28800		2.40
material	12000	9600		0.80
Labor	6000	3000		0.50
Factory overhead	6000	4500		0.75
			45900	
Total costs accounted for			215000	

Work in process inventory account a/c

To costs from preceding department (transferred in costs) To material inventory To payroll payable To applied factory overhead	120000 40000 22000 33000	By work in process dep.3 By ending work in process	169100 45900
	215000		215000

Example 8:

The production in the first department of one of the industrial companies is exposed to normal percentage of spoilage equal 2 % of the production, and usually the damage occurs at the beginning of the industrial operations and the following is the data for the department:

Production data:

Sufficient raw materials were used can produce 10,000 units before calculating the spoilage, and 9,000 units were produced and sent to the second department and the rest after

calculating the prescribed percentage of the normal spoilage represented by units in process with a 50% completion level for labor and indirect costs.

Costs data:

- $ 4900 materials, $ 2350 labor, $ 1880 indirect costs.

Required: Preparing a cost of production report and department work in process account?

Equivalent production schedule

Description/items	Direct materials	Direct labor	Factory overhead
Units completed and transferred to next department	90000	9000	9000
Ending units in process (50%)	800	400	400
Total Equivalent units	9800	9400	9400

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements: -costs added during the period: Direct material Direct labor Factory overhead	 9800 9400 9400		 4900 2350 1880	 0.50 0.25 0.20
Total costs to account for			9130	0.95
costs of production outputs: Transferred to next dep.: -Ending work in process: material Labor Factory overhead	 9000 800 400 400	 400 100 80	 8550 580	 0.95 0.50 0.25 0.20
Total costs accounted for			9130	

Work in process inventory account a/c

To material inventory	4900	By work in process	8550
To payroll payable	2350	dep.2	
To applied factory overhead	1880	By ending work in process	580
	9130		9130

Example 9:

If we assume that the second department received from the first department 10,000 units at a total cost of $ 26,125, and

that the production of the second department is summarized as follows:

completed units transferred to the third department	7000
Units in process(100%material and 80% conversion costs)	2000
Spoiled units	1000
The costs of the second department for this period	
Materials(Adding them does not result in an increase in the number of units)	14250
labor	10620
Factory overhead	8850

Additional information:

1- Normal spoilage percentage is 5%

2- The inspection is done continuously during processing

Required: prepare the cost of production report?

production quantities schedule

for the department

Inputs: Units received from the first department	10000
total	10000
Outputs: Units transferred to next department Abnormal spoiled units Normal spoiled units (10000*5%) Ending units in process (80%)	 70000 500 500 2000
total	10000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials	Direct labor	Factory overhead
Units completed and transferred to third dep.:	7000	7000	7000	7000
Normal spoiled units: 50%*	500	500	250	250
Ending units in process (80%):	2000	2000	1600	1600
Total Equivalent units	9500	9500	8850	8850

*We assumed that the level of completion of abnormal spoiled units is 50% (conversion) in the case of the continuous inspection, i.e. evenly through processing, as arithmetic mean for the various continuous inspection points during processing.

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: cost of production elements				
-Transferred in cost	9500		26125	2.750
-costs added by the department				
Direct material	9500		14250	1.500
Direct labor	8850		10620	1.200
Factory overhead	8850		8850	1.000
Total costs to account for			59845	6.450
Second: costs of production outputs				
-Transferred to the next dep.	7000		45150	6.450
-abnormal spoiled units				
Transferred in	500	1375		2.750
Materials	500	750		1.500
Labor	250	300		1.200
Factory overhead	250	250	2675	1.000
-Ending work in process				
Transferred in	2000	5500		2.75
Materials	2000	3000		1.500
Labor	1600	1920		1.200
Factory overhead	1600	1600	12020	1.000
Total costs accounted for			59845	

Example 10:

The second and final stage in one of the factories uses three types of materials. The material A is added at the beginning of the stage and results in an increase in the number of units by one third, material B is added at the 60% completion level. Material C is added at the end of the stage, and the addition of materials B and C do not result in an increase in the number of units.

The following is data of production and costs for the month of August:

1- 5000 units in process at the beginning of the period, 40% completion level, and its total cost is $ 16,520.

2- 30,000 units received from the first stage, the cost per unit $ 2280.

3- 6000 units under operation at the end of the period, half of them reached 70% completion level and the other half reached 30% completion level.

4-Completed units sent to finished goods inventory 35,000 units.

5-Costs for this period

-Materials

Material A 9500 kilo	$ 2 per kilo
Material B 38000Kilo	$ 0.500 per kilo
Material C 0.800 Kilo	$ 0.800 per Kilo

-Conversion costs $ 40700

6-additional information

-Normal spoiled units percentage 5%

- Abnormal spoiled units completion level is 50% in relation to the conversion's costs.

-Inspection is done continuously during the process.

-Units in work in process inventory at beginning of the period were processed without any spoilage.

Required:

Prepare cost of production report and work in process inventory account?

production quantities schedule

Inputs:	
1-Beg. Work in process units	5000
2-Units received from the preceding department	30000
3-units add to production (Increasing in the number of units by adding the material A)	10000
total	45000
Outputs:	
1-Units transferred to finished goods inventory	
Completed From beg work in process units	5000
Completed during the period	30000
2-Ending units in process	
70% complete	3000
30%complete	3000
3-abnormal spoiled units 50%	2000
4-normal spoiled units (continuously)	2000
total	45000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials			Conversion costs
		A	B	C	
Units completed and transferred to finished goods:					
-Beginning units in process (5000units 40%)	---	---	5000	5000	3000
-units started and completed(30000units)	30000	30000	30000	30000	30000
Abnormal spoiled units	2000	2000	---	----	1000
Ending units in process					
-70% complete	3000	3000	3000	---	2100
-30% complete	3000	3000	---	---	900
Total Equivalent units	38000	38000	38000	35000	37000

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	Total	
Costs of production elements:				
Costs from preceding department and prior period:			16520	
-costs added during the period:				
Transferred in cost	38000	68400		1.800
Material A	38000	19000		0.500
Material B	38000	19000		0.500
Material C	35000	28000		0.800
Conversion costs	37000	40700	175100	1.100
Total costs to account for			191620	4.700
costs of production outputs:				
1-Transferred to next dep.:				
From beginning inventory				
-inventory cost			16520	
- Material B	5000	2500		0.500
-Material C	5000	4000		0.800
-Conversion costs	3000	3300		1.100
			9800	
From the current production	30000		141000	4.700
2-Abnormal spoiled units				
Transferred in cost	2000	3600		1.800
Material A	2000	1000		0.500
Conversion costs	1000	1100	5700	1.100
3-Ending work in process:				
-70% complete				
Transferred in cost	3000	5400		1.800
Material A	3000	1500		0.500
Material B	3000	1500		0.500
Conversion costs	2100	2310	10710	1.100
-30% complete				
Transferred in cost	3000	5400		1.800
Material A	3000	1500		0.500
Conversion costs	900	990	7890	1.100
Total costs accounted for			191620	

Work in process inventory account dep. 2 a/c

To beginning balance	15520	By finished goods	
To work in process dep.1	68400	inventory	167320
To material inventory	66000	By spoiled units	5700
Material A 19000		inventory	
Material B 19000		By ending work in process	18600
Material C 28000			
To conversion costs	40700		
	191620		191620

Second: There is a salvage value for normal spoiled or defective units:

In the previous examples, we assumed that the normal spoiled or defective units have no salvage value, and thus their share of the stage costs was charged to the good and abnormal spoiled or defective units. But the damaged units may have a salvage value by selling them at the level they reached or repairing them by reprocessing them at the same stage in which they discovered or in stages prior to the stage

in which they were discovered, and we will discuss below these cases

1- There is a salvage value for the normal spoiled or defective units by selling them

The normal spoiled or defective units may have a salvage value by selling them, and in this case the loss of the spoiled or defective production is the difference between the share of the normal spoiled or defective units in the stage costs and the salvage value (the selling value).

A- If the completion level of the ending units in process or some of it is less than the level reached by the normal spoiled or defective production (the inspection level), then the normal spoiled or defective units are taken into account when preparing the equivalent production schedule (the level of their completion, is the completion level at which the inspection takes place). Then calculate the total unit cost of

the production, and calculate the cost of the normal spoiled or defective units, finally the normal spoiled or defective units loss is distributed over the different production outputs that have reached or exceeded the completion level at which the inspection is performed.

Example 11:

The first department started in one of the industrial companies with the production of 2,500, of which 2,000 units were transferred to the second department, and 100 units considered normal spoilage, and 400 units were still in process, complete with materials and 25% with regard to the conversion costs, and the elements of production costs were as follows:

Materials $ 7500

Labor $ 4300

Factory overhead $ 4300

The selling value of the damaged units is estimated at $ 150, and the inspection is carried out at 50% level of completion.

Required: prepare the cost of production report?

production quantities schedule

for the department

Inputs: Units started in process	 2500
total	2500
Outputs: Units transferred to next department Normal spoiled units (50%) Ending units in process (25%)	 2000 100 400
total	2500

Equivalent production schedule

Description/items	Direct materials	Direct labor	Factory overhead
-Units completed and transferred to next dep.:	2000	2000	2000
-Normal spoiled units (50%)	100	50	50
- Ending units in process	400	100	100
Total Equivalent units	2500	2150	2150

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: costs added by the department				
Direct material	2500	7500		3.00
Direct labor	2150	4300		2.00
Factory overhead	2150	4300		2.00
			16100	
Total costs			16100	7.00
Second: costs of production outputs				
-Transferred to the next dep.	2000	14000		7.00
-Loss of normal spoiled units		350	14350	
-Ending work in process				
Materials	400	1200		3
Labor	100	200		2
Factory overhead	100	200		2
Selling value of normal spoiled units			1600 (150)	
Total costs			16100	

Note:

1- The loss of normal spoiled units has been determined as follows:

First: the cost of normal spoiled units = 100 * 3 + 50 * 2+50*2=$ 500

Second: Loss of normal spoiled units = 500 - 150 = $ 350

Loss from normal spoiled units has been charged to completed units only, because the ending in process units (25%) have not yet reached the level at which the inspection is carried out 50%.

B - If the level of the units in process at the end of the period is the level reached by the normal spoiled units (the inspection level) or exceeded, or the inspection is constantly being performed during the process, then all types of production outputs in the department charged with the

normal spoiled units loss (the share of the spoiled units from the stage costs after deducting its selling value) This is by neglecting the calculation of the normal spoiled units in the equivalent production schedule, while treating the sales value of the normal spoiled units as a reduction from the production cost in the stage (reducing each element of the costs with its share of the selling value of the normal spoiled units), which means at the same time charging the stage production with the loss of the normal spoiled units in an implicit manner (by way of inflation).

The following are taken into consideration: -

1-Since the previous procedure requires lengthy arithmetic operations to calculate the share of each component of costs from the sales value of the normal spoiled units, therefore, cost accountants prefer to treat the selling value of the normal spoiled units as a reduction of the indirect industrial

costs component at the stage in which the damage occurred, i.e. the selling value of normal spoiled units is subtracted from indirect industrial costs only in the first part of the cost of production report.

Example 12:

The third stage in one of the economic units uses two types of direct materials:

- Material A is added at the beginning of the operation in the stage and its addition does not entail any increase in the number of units produced.

- Material B is added at the level of completion of 70% and leads to an increase in the number of units produced by 25%. So if you know that in the period from 1/1 to 31/12/2021:-

1- It was produced 9000 completed units transferred to finished goods inventory (of which 2000 units are in process

at the beginning of the period with a level of 50% completion). 2000 units in process with 50% completion level at the end of the period, 200 spoiled units were gradually discovered during process, and their selling value was estimated at $ 300.

2- The inspectors decided to consider that half of the spoiled units were within the normal percentages.

3- The estimated selling value of the normal spoiled units is treated as a reduction of the indirect manufacturing costs.

4- The total costs of the units in process at the beginning of the period amounted to $ 13,000.

5- Production costs during the period equal the following:

-Transferred in costs from preceding department $ 27300

-Material A cost is $ 18200

-Material B cost is $ 18000

-Direct labor $ 13575

-Factory overhead $ 13725

Required: prepare the cost of production report?

production quantities schedule

Inputs:	
total	11200
Outputs: 1-Units transferred to finished goods inventory Completed From beg work in process units Completed during the period 2-Ending units in process 3- abnormal spoiled units (gradually) 4-normal spoiled units (gradually)	 2000 7000 2000 100 100
total	11200

Equivalent production schedule

Description/items	Transferred in costs	Direct material		Direct labor	Factory overhead
		A	B 70%		
Units completed and transferred to finished goods:					
-Beginning units in process (2000units 50%)	---	---	2000	1000	1000
-units started and completed(7000units)	7000	7000	7000	7000	7000
Abnormal spoiled units	100	100	---	50	50
Ending units in process	2000	2000	---	1000	1000
Total Equivalent units	9100	9100	9000	9050	9050

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	Total	
Costs of production elements:				
Costs from preceding department and prior period:			13000	
-costs added during the period:				
Transferred in cost	9100	27300		3.00
Material A	9100	18200		2.00
Material B	9000	18000		2.00
Direct labor	9050	13575		1.50
Factory overhead	9050	13725		1.50
Selling value for normal spoiled units		(150)		
			90650	
Total costs to account for			103650	10
costs of production outputs:				
1-Transferred to finished goods inventory.:				
From beginning inventory				
-inventory cost		13000		
- Material B	2000	4000		2.0
-direct labor	1000	1500		1.5
-factory overhead	1000	1500		1.5
			20000	
From the current production	7000		70000	10
2-Abnormal spoiled units				
Transferred in cost	100	300		3.0
Material A	100	200		2.0
-direct labor	50	75		1.5
-factory overhead	50	75		1.5
			650	
3-Ending work in process:				
-Transferred in cost	2000	6000		3.0
-Material A	2000	4000		2.0
-direct labor	1000	1500		1.5
-factory overhead	1000	1500		1.5
			13000	
Total costs accounted for			103650	

2-Some may also prefer treating the sales value of the normal spoiled units as a reduction of the cost element of raw materials or any other cost element, according to the importance of this element. In the first part of the report.

Example 13:

The third stage in one of the economic units uses two types of direct materials:

- Material A is added at the beginning of the operation in the stage and its addition does not entail any increase in the number of units produced.

- Material B is added at the level of completion of 70% and leads to an increase in the number of units produced by 25%. So if you know that in the period from 1/1 to 31/12/2021:-

1- It was produced 9000 completed units transferred to finished goods inventory (of which 2000 units are in process at the beginning of the period with a level of 50% completion). 2000 units in process with 50% completion level at the end of the period, 200 spoiled units were gradually discovered during process, and their selling value was estimated at $ 260.

2- The inspectors decided to consider that half of the spoiled units were within the normal percentages.

3- The estimated selling value of the normal spoiled units is treated as a refund for the cost of the material B.

4- The total costs of the units in process at the beginning of the period amounted to $ 13,000.

5- Production costs during the period equal the following:

-Transferred in costs from preceding department $ 27300

-Material A cost is $ 18330

-Material B cost is $ 18000

-Direct labor $ 13575

-Factory overhead $ 13575

Required: prepare the cost of production report?

Equivalent production schedule

Description/items	Transferred in costs	Direct material		Direct labor	Factory overhead
		A	B 70%		
Units completed and transferred to finished goods: -Beginning units in process (2000units 50%)	---	---	2000	1000	1000
-units started and completed(7000units)	7000	7000	7000	7000	7000
Abnormal spoiled units	100	100	---	50	50
Ending units in process	2000	2000	---	1000	1000
Total Equivalent units	9100	9100	9000	9050	9050

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	Total	
Costs of production elements:				
Costs from preceding department and prior period:			13000	
-costs added during the period:				
Transferred in cost	9100	27300		3.00
Material A	9100	18330		2.00
(-)Selling value for normal spoiled units		(130)		
Material B	9000	18000		2.00
Direct labor	9050	13575		1.50
Factory overhead	9050	13575		1.5
			90650	
Total costs to account for			103650	10
costs of production outputs:				
1-Transferred to finished goods inventory.				
From beginning inventory				
-inventory cost		13000		
- Material B	2000	4000		2.0
-direct labor	1000	1500		1.5
-factory overhead	1000	1500		1.5
			20000	
From the current production	7000		70000	10
2-Abnormal spoiled units				
Transferred in cost	100	300		3.0
Material A	100	200		2.0
-direct labor	50	75		1.5
-factory overhead	50	75		1.5
3-Ending work in process:			650	
-Transferred in cost				
-Material A	2000	6000		3.0
-direct labor	2000	4000		2.0
-factory overhead	1000	1500		1.5
	1000	1500	13000	1.5
Total costs accounted for			103620	

3- Also, some may prefer to treat the sales value of the normal spoiled units - especially if it is of little value as secondary or additional revenues that are closed in the profit and loss account created outside the scope of cost accounting. In this case, the normal spoiled costs shall be treated in the same way as the normal spoiled units that have no salvage value.

Example 14:

The third stage in one of the economic units uses two types of direct materials:

- Material M is added at the beginning of the operation in the stage and its addition does not entail any increase in the number of units produced.

- Material N is added at the level of completion of 70% and leads to an increase in the number of units produced by 25%. So if you know that in the period from 1/1 to 31/12/2021:-

1- It was produced 9000 completed units transferred to finished goods inventory (of which 2000 units are in process at the beginning of the period). 2000 units in process with 50% completion level at the end of the period, 200 spoiled units were gradually discovered during process, and their selling value was estimated at $ 300.

2- The inspectors decided to consider that half of the spoiled units were within the normal percentages.

3- The estimated selling value of the normal spoiled units is treated as miscellaneous revenue.

4- The total costs of the units in process at the beginning of the period amounted to $ 13,000.

5- The cost of units in process at the beginning of period equal the following:

-Transferred in costs from the second department $ 6000

-Material M cost $ 4000

-Conversion costs $ 3000

The cost of production during the period was as follows:

-Transferred in costs from the second department $ 27300

-Material M cost is $ 18200

-Material N cost is $ 18000

-Conversion costs $ 27150

Required: prepare the cost of production report?

Equivalent production report

Description/items	Transferred in costs	Direct material		Conversion cost
		M	N 70%	
Units completed and transferred to finished goods:	9000	9000	9000	9000
Abnormal spoiled units	100	100	---	50
Ending units in process	2000	2000	---	1000
Total Equivalent units	11100	11100	9000	10050

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Costs from preceding department:				
Beg. WIP		6000		
Transferred in during the period	11100	27300	33300	3.0
-costs added by the department				
Material M:				
Beg. WIP		4000		
Added during the period	11100	18200	22200	2.0
Material N:				
Beg. WIP		0		
Added during the period	9000	18000	18000	2.0
Conversion cost:				
Beg. WIP		3000		
Added during the period	10050	27150	30150	3.0
Total costs to account for			103650	10
costs of production outputs:				
1-Transferred to finished goods inventory.	9000		90000	10
2-Abnormal spoiled units				
Transferred in cost	100	300		3.0
-Material M	100	200		2.0
-conversion cost	50	150		3.0
			650	
3-Ending work in process:				
-Transferred in cost	2000	6000		3.0
-Material M	2000	4000		2.0
-conversion cost	1000	3000	13000	3.0
Total costs accounted for			103650	

2-there is a salvage value for the spoiled/defective units by reprocessing them in previous stages.

-If it is decided to rework the defective units in stages prior to the stage in which it was discovered, then:

A-The salvage value of this defective units is equivalent to what they contain from the materials (doubled at the beginning of the stage) if the rework was at the beginning of the first stage, or what they contain from the materials of the second stage (to be added at the beginning of the stage) in addition to the cost received from the first stage, if the reworking operation at the beginning of the second stage.

In general, the salvage value of the defective units is equivalent to their cost components at the completion level at which it was decided to rework.

B-The loss of the defective units is equal to the difference between their salvage value and their cost at the inspection level at which they were discovered.

C-

1-normal defective units are taken into account when preparing the equivalent production report (at the completion level, which is the completion level of at which the inspection is carried out) if the completion level of ending units in process or part of it is lower than the level of inspection, Then the total unit cost is calculated, calculate the cost of the normal defective units, the salvage value is subtracted from this cost, then the loss of the normal defective units is distributed on the various types of production outputs that have reached or exceeded the same completion level at which the inspection is conducted.

Example 15:

The third department received 850 units at a cost of $ 1.3 per unit, according to the following details:

1- The average unit cost in the first department is $ 1 ($ 0.7 materials, $ 0.2 labors, $ 0.1 factory overhead)

2- The average unit cost in the second department is 0.3($ 0.2 labors, $ 0.1 factory overhead)

700 units were produced and transferred to finished goods inventory, and 100 units remain in process at a completion level of 40%. The rest represents normal defective units and it reworked in earlier departments, as follows:

-20 reworked as raw material in the first department (60% completion level)

-30 units reworked in the second department (60% completion level)

Third department costs:

Materials added at 80% completion level $ 70

Labor $ 154

Factory overhead $ 77

Required: prepare the cost of production report?

production quantities schedule

Inputs:	
1-Units received from the preceding department	850
total	850
Outputs:	
1-Units transferred to finished goods inventory	700
2-Ending units in process	100
3- normal defective units(60%) reworked at the first department	20
4-normal defective units (60%)reworked at the second department	30
total	850

Equivalent production schedule

Description/items	Transferred in costs	Direct material	Direct labor	Factory overhead
-Units completed and transferred to finished goods:	7000	7000	7000	7000
-Ending units in process	100		40	40
- normal defective units(60%) reworked at the first department	20		12	12
- normal defective units (60%) reworked at the second department	30		18	18
Total Equivalent units	850	700	770	770

description	Equivalent production	Total costs		Unit cost
		Sub total	total	
First: cost of production elements				
-Transferred in cost	850		1105	1.300
-costs added by the department				
Direct material	700	70		0.100
Direct labor	770	154		0.200
Factory overhead	770	77		0.100
			301	
Total costs to account for			1406	1.700

Second: costs of production outputs				
-Transferred to the finished goods inventory.	700		1190	1.700
+loss of normal defective units converted to first department			15.6	
+loss of normal defective units converted to second department			14.4 1220	
-Ending work in process				
Transferred in	100	130		1.3
Materials	---	---		0.10
Labor	40	8		0.20
Factory overhead	40	4	142	0.10
Salvage value for defective units:				
Transferred to first dep.			14	
Transferred to second dep.			30	
Total costs accounted for			1406	

Explanatory points:

The loss of defective units has been charged to completed units only, because units in process have not yet reached the level at which the defect happen.

The loss of defective units was calculated as follows:

First: units transferred to the first department:

--The cost of normal defective units transferred to the first dep. = the transferred in cost from the second department + cost of the third department

=20units x 1.300+12units x 0.300 (labor+factory overhead)

=26000+3600=$ 29600

--The salvage value of the defective units transferred to the first department

= The value of materials only = 20 Unit x 0.7=$ 14

--the loss of defective units transferred to first department

=29600-14=$ 15600

Second: units transferred to the second department

--The cost of normal defective units transferred to the second dep. = the transferred in cost from the second department + cost of the third department

=30units x 1.300+18units x 0.300 =39+5.4=$ 44400

--The salvage value of the defective units transferred to the first department

= The value of materials only = 30 Unit x 1=$ 30

--the loss of defective units transferred to first department

=44400-30000=$ 14400

Loss of defective units that have been reworked in the first and second department = 15600 + 14400 = $ 30 and it is charged to the finished units only because the units in process have not reach the level of inspection yet

C-2- normal defective units shall not be taken into account when preparing the equivalent production report, if the completion level of units in process at the end of the period have reached or exceeded the completion level at which the inspection is carried out, or the inspection is taking place gradually (continuously) during the process, provided that the salvage value of the normal defective units is deducted from the cost received from the previous stage in the first part of the current stage cost of production report, and accordingly the resulting average cost is inflated by the normal defective loss only.

Example 16:

Production takes place in one of the factories in three successive stages, and the following is the flow of production and costs in the second stage during the month of October 2021

First, production flow:

-4000 beginning units in process with75% completion level

-20000 units received from the first stage, $ 5 per unit from which $ 1 represent conversion costs

-1500 abnormal defective units received from the third stage to be reworked in the middle of the stage

-2000 normal defective units, half of it was sold at 3.2 per unit and the rest was sent for rework at the beginning of the first stage

-600 units in process at the end of the period with 80% completion level

Second: production costs

-The cost of units at the beginning of the period $ 37000

-salvage cost of units received from the third stage $ 11000

-Material cost during the period $ 78000

-labor cost during the period $ 49600

-Factory overhead cost during the period $ 28000

If you know that:

- Materials are added at 70%completion level, and adding them results in an increase in the number of units by one third.

- Inspection is done at 50%completion level.

Required: prepare the cost of production report and the department work in process inventory account for October 2021?

production quantities schedule

Inputs: 1-Beg. Work in process units 2- Units received from the third department 3- new Units received from the first department 4-units add to production (Increasing in the number of units by adding the materials)	 4000 1500 20000 6500
total	32000
Outputs: 1-Units transferred to third department 2-Ending units in process 4-normal spoiled units	 24000 6000 2000
total	32000

Description/items	Transferred in costs	direct materials	direct labor	Factory overhead
Units completed and transferred to third dep.:				
-From the units of beg. WIP	---	----	1000	1000
-From spoiled units reworked	---	2000	1000	1000
- from new units	18000	18000	18000	18000
Ending units in	6000	6000	4800	4800

process				
Total Equivalent units	24000	26000	24800	24800

Cost of production report

description	Equivalent production	Total costs		Unit cost
		Sub total	Total	
Costs of production elements:				
1-Costs of beginning work in process			37000	
2-salvage cost			11000	
3-costs added during the period:				
Transferred in cost		100000		
(-)salvage cost	24000	(4000)	96000	4.0
Materials	26000		78000	3.0
Direct labor	24800		49600	2.0
Factory overhead		28000		
	24800	(3200)	24800	1.0
Total costs to account for			296400	10.0
costs of production outputs:				
1-Transferred to finished third dep.			37000	
From beginning inventory			3000	
-inventory cost	1000	2000		2.0
-direct labor	1000	1000		1.0
-factory overhead				
From the current production	18000		180000	10
From reworked spoiled units				
salvage cost		11000		
Direct Material	2000	6000		3.0
Direct labor	1000	2000		2.0
Factory overhead	1000	1000	20000	1.0

2-Ending work in process:				
-Transferred in cost	6000	24000		4.0
-direct material	6000	18000		3.0
-direct labor	4800	96000		2.0
-factory overhead	48000	4800	56400	1.0
Total costs accounted for			296400	

3- There is a salvage value for the spoiled units by reworked them at the same stage

Technicians may see that the defective units can be reworked at the same stage in which it was discovered, provided that it is considered as a raw material for this stage. In this case, the resulting loss will be confined to the conversion elements of this stage (labor and factory overhead) In this case, the resulting loss will be confined to the conversion elements of this stage (labor and factory overhead), in addition to the cost of materials added after the reworked point in the stage (if any).

A-If the units in process at the end of the period (all or part) is at a completion level less than the level at which the

inspection is conducted, in this case the permissible defecive units are taken into account when preparing the equivalent production report (at the completion level, which is the level of completion at which the inspection takes place) Also, the abnormal defective units, if any, are included in the calculation of the equivalent production on the basis of the same completion level. Then the total unit cost is calculated, the normal defective unit cost is calculated after that, the salvage value is deducted from it, then the normal defective unit loss is distributed among

-completed units

-The abnormal defective units (if any) because they have reached the completion level at which the inspection is performed

-Part or all of the units in process that have reached the completion level at which the inspection is carried out.

B-But if the level of the units in process at the end of the period is the level reached or exceeded by the defective production (the inspection level), or the inspection is constantly being conducted during operation, then all types of production in the stage charged with the normal defective loss (the share of the defective units from the department costs after deducting its selling the value) This is done by neglecting the normal defective units in the equivalent production report, while treating the salvage value of the normal defective units as a reduction from the production cost in the stage (reducing each element of the costs with its share of the salvage value of the defective), which means at the same time charging the stage production with the loss of the normal defective units in an implicit manner.

Example 17:

The following data is extracted from one of the industrial companies for the third production department for the month of April:

1- Units in process at the beginning of the month 10,000 with a 60% completion level

2- Units received from the second department 40,000 units, unit cost $ 2

3- Completed units 35,000 units, of which 30,000 units were transferred to finished goods inventory, and the rest is still in the department

4- 12000 units in process at the end of the month at 50% completion level

5-The remaining units in the stage are considered defective units and will be reworked at the same department, knowing that the inspection level is 80%.

6-production costs

A-beginning units in process costs

Transferred in cost $ 15000

Labor $ 6000

Factory overhead $ 10100

B- Costs added during the period

Materials add at 75% $ 38000

Labor $ 37400

Factory overhead $ 33300

Required: prepare the cost of production report using weighted average method?

production quantities schedule

for the department

Inputs:	
Beginning units in process	10000
Units received from preceding department	40000
total	50000
Outputs:	
Units transferred to finished goods inventory	30000
Units completed and still on the dep.	5000
Ending units in process (50%)	12000
Normal defective units (80%)	3000
total	50000

Equivalent production schedule

Description/items	Transferred in costs	Direct materials 75%	Direct labor	Factory overhead
-Units completed and transferred to finished goods	30000	30000	30000	30000
- Units completed and still on the dep.	5000	5000	5000	5000
-Ending units in process (50%)	12000	---	6000	6000
- Normal defective units (80%)	3000	3000	2400	2400
Total Equivalent units	50000	38000	43400	43400

Cost of production report

description	Equivalent production	Total costs		Unit cost
Costs of production elements:				
Transferred in costs:				
Beg. WIP		15000		
Transferred in during the period	50000	80000	95000	1.9
-costs added by the department				
Direct material:				
Added during the period	38000		38000	1.0
Direct labor:				
Beg. WIP		6000		
Added during the period	43400	37400	43400	1.0
Factory overhead:				
Beg. WIP		10100		
Added during the period	43400	33300	43400	1.0
Total costs to account for			219800	4.9
costs of production outputs:				
Units completed and transferred to finished goods				
+ its share of normal	30000	147000		
defective units loss		6686	153686	4.9
- Units completed and still on the dep.				
+ its share of normal		24500		
defective units loss	5000	1114	25614	4.9
-Ending work in process:				
Costs from preceding department	12000	22800		1.9
material	---	---		1.0

Labor	6000	6000		1.0
Factory overhead	6000	6000	34800	1.0
-salvage value for normal defective units	3000		5700	1.9
Total costs accounted for			219800	

Explanatory points: It is known that reworking the defective units in the same stage calls for recovering the received cost and the material component as long as the materials are added at the beginning of the stage and the materials here were added at the level of 75%, so it is not considered from the salvage value for the following two reasons

1-The material added at a certain level is a complementary material, not a basic component of the product structure, such as color in the automobile industry, and plating materials in the copper industry.

2- Reworking at the same stage means starting work on the defective units again from zero, and this means that when the

operation progresses and reaches 75%, these units will need complementary materials again.

Therefore, the loss of normal defective units is:

Materials at 75% level=3000 x 1 =3000

Labor and factory overhead=2400 x 2 =4800

7800

It is distributed over the two types of complete units transferred to finished goods inventory and the units completed and still in the department (30000:5000), i.e. in a ratio of 6:1 the share of the completed units transferred to the finished goods inventory will be

=7800 x 6/7= $ 6686

The share of the completed units and the still in the department

=7800 x 1/7 =$ 1114

Example 18:

The second stage received 1000 units with a total cost of $ 1,000 during the month of January

Production data: 850 units converted to the third stage, 100 units in process with 60% completion level, 50 defective units within the permissible limits and discovered at a level of 60%, to be reworked at the same stage

Costs data:

Labor $ 1820

Factory overhead $ 910

Required: prepare the cost of production report and work in process inventory account?

production quantities schedule

for the department

Inputs: Units received from preceding department	 1000
total	1000
Outputs: Units transferred to finished goods inventory Ending units in process (60%) Normal defective units (60%)	 850 100 50
total	1000

Equivalent production schedule

Description/items	Transferred in costs	Direct labor	Factory overhead
-Units completed and transferred to finished goods	850	850	850
-Ending units in process (60%)	100	60	60
- Normal defective units (60%)	50	--	--
Total Equivalent units	1000	910	910

Cost of production report

description	Equivalent production	Total costs		Unit cost
-Costs from preceding department transferred in	1000	1000		1.0
- costs added by the department				
Direct labor	910	1820		2.0
Factory overhead	910	910	3730	1.0
Total costs to account for			3730	4.0
costs of production outputs:				
-Transferred to finished goods inventory	850		3400	4.00
-Ending work in process				
Costs from preceding	100	100		1.0
department	60	120		2.0
Labor	60	60		1.0
Factory overhead			280	
-salvage value for normal defective units	50		50	1.000
Total costs accounted for			3730	

Work in process inventory account a/c

To costs from preceding department (transferred in costs)	1000	By finished good inventory	3400
To payroll payable	1820	By ending work in process	280
To applied factory overhead	910	By salvage value for normal defective units	50
	3730		3730

Exercises:

First: below are the data pertaining to department B:

Units transferred in	55000
Units added to production	5000
Units transferred out	48000
Ending units in process (direct material 100%, conversion costs 70%)	12000
Costs transferred in	$ 24750
Costs added by the department	
Direct materials	7200
Direct labor	21432

Factory overhead	32148

Required: determine the following unit cost

a- Transferred in unit cost

b- Direct materials

c- Direct labor

d-Factory overhead

e- Total unit cost

Second: a factory has two processing department, all direct materials are added in the department 1 at the beginning of the process. Conversion costs are incurred evenly throughout both processes. Data for January are shown below:

	Department 1	Department 2

Unit started in process	75000	
Units transferred to the next department	60000	
Units transferred to the finished goods inventory		55000
Ending units in process	15000 (60%)	50000(80%)
Costs added by the department		
Direct materials	$ 300000	
Direct labor	172000	$ 162250
Factory overhead	86250	81125

No beginning work in process inventory exists.

Required: prepare a cost of production report for both departments.

Third: the company uses the weighted average costing method in its three processing departments. Direct materials are added in department 1 and 2. Direct materials in department 2 consist of erasers which are placed immediately on each unit as it is transferred in

Below is a portion of October's cost of production report for department 2:

Ending units in process

Transferred in cost	8900	2047	0.23
Direct materials 100%	8900	267	0.03
Direct labor 60%	5340	1495.2	0.28

Factory overhead 60%	5340	534	0.1
		4343.2	

During November the following activity occurred in department 2:

Units transferred in	30100
Costs transferred in	$ 8483
Costs incurred:	
Direct material	$ 1683
Direct labor	$ 7994.8
Factory overhead	$ 2021
Units transferred out	$ 29000
Ending work in process inventory	75%

Required: calculate the following unit cost for the month of November:

a- Transferred in unit cost

b- Direct materials

c- Direct labor

d-Factory overhead

e- Total unit cost

Fourth: a factory produces a chemical compound by a unique chemical process which poole has divided into two departments, A and B, for accounting purposes. The process functions are as follows:

The formula for the chemical compound requires 1 pound of chemical X and 1 pound of chemical Y. in the simplest sense, 1 pound of chemical X is processed in department A and transferred for further processing to department B, where 1 pound of chemical Y is added when the process is complete. The finished chemical compound is then

transferred to finished goods inventory. The process is continuous, operating 24 hours a day. Normal spoilage occurs in the department A, five percent of the chemical X is spoiled in the first few seconds of processing.

The company's policy is to treat the cost of spoiled units in production as a separate element of cost in the department in which the spoilage occurs. No spoilage occurs in the department B.

In department A, conversion costs incurred uniformly throughout the process. In department B, conversion costs are allocated equally to each equivalent pound of output.

Poole's unit of measure for work in process and finished goods inventories is pounds.

The following data are available for the month of October.

	Department A	Department B
Work in process, october1	80000lb	10000lb
Completion level of beg. Inventory(one batch per department)	3/4	3/10
Started or transferred in	50000lb	?
Transferred out	46500lb	?
Work in process, october31	?	?
completion level of ending Inventory	1/3	1/5
Total equivalent pounds of direct material added in	---	44500lb

department B

Required:

1-complete the above schedule.

2-prepare equivalent production schedules for department A and department B for October under fifo.

Fifth-you applied for a job as a cost accountant in one of the companies in which production takes place in three stages. And you asked to determine the equivalent production during the month of March 2021 in all of these three stages, noting that:

In the first stage:

1- Produced: 9000 complete units transferred to finished goods inventory (of which 2000 units are in operation at the beginning of the period, with 50%completion level) 2000 units in process at the end of the period with a level

of completion 50%- 200 defective units which decided to be reworked at the beginning of the stage (half of them are normal).

2- Material C is added at the beginning of the operation in the stage, and material Y is added at the completion level 70%.

3- inspection is done throughout the operation.

In the second stage:

1- Produced: 6000 complete units transferred to finished goods inventory (of which 1000 units are in operation at the beginning of the period) -2000 units in process at the end of the period with a level of completion 50%- 200 normal defective units, it is decided to rework them in the first stage on the basis that they represent semi-

manufactured units for the first stage- 100 normal spoiled units, it was decided to sell them at $ 100 per unit.

2- The materials are added at the beginning of the stage, which results in an increase in the number of units produced at a rate of 10%.

3- The inspection is done at the 60% completion level.

In the third stage:

1- Produced: 5000 complete units transferred to finished goods inventory -1000 units in process at the end of the period with a level of completion 60%, not yet reached the level of completion at which the materials are added- 200 spoiled units, at 40% completion level, it was decided to sell them at $ 0.200 per unit.

2- Half of spoiled units are considered within the permissible limits.

3- The sales value of the normal spoilage is treated as secondary revenue.

Sixth-Production is carried out in an industrial company in two phases, and the following is the data on the production flow and costs for the second phase during the month of April:

1- Work in process beginning: 4000 units, total cost is $ 53,654, and the level of completion is as follows:

Transferred in cost 100%

Materials 80%

Conversion costs 40%

2- The second stage received from the first stage 38,000 units at a cost of $ 962,000.

3- The production costs incurred on the second stage during April amounted to:

Materials $ 73,710

Conversion $ 140,600

4-6000 units in process at the end of the period, and their level of completion is as follows

Transferred in cost 100%

Materials 100%

Conversion 60%

5 - 1000 was spoiled at the beginning of stage and was considered within the permissible limits, and the inspectors rejected another 2000 units when checking the completed units.

Required:

Prepare the cost of production report and the work in process account?

Seventh: The following data extracted from the books of an industrial company in the third and final department for the month of March:

Received units 40,000

Completed units 27000

Work in process units ending 10,000

Spoiled units 3000

Department costs:

Materials (added at 75%) $ 3600

Labor $ 17500

Factory overhead $ 10500

If you know:

A- The inspection level is the end of the stage, and the spoiled units have no recoverable value.

B-The addition of materials does not result in an increase in the number of units produced.

C- Transferred in cost one dollar per unit.

D-The normal spoiled rate is 5% of units.

Required

Prepare the cost of production report and the work in process account?

Eighth: the following is the data for the second production department of an industrial company until October:

1- Beginning work in process 8000 units with a completion level of 75%

2-Units received during the period 40,000 units, Unit cost $ 2.

3-Completed units 35000

4- Ending work in process 12000 units with 50% completion level .

5-The remaining units are considered to be normal spoiled discovered at a level of 40% and have no selling or recoverable value.

6- Production costs

-Beginning work in process	$ 23500
Transferred in cost	16000
Material	4000

Labor 2000

Factory overhead 1500

-Costs added during the period

Materials added at 70% $ 32400

Labor $ 35000

Factory overhead $ 45500

Required: prepare the cost of production report using first in first out method?

Ninth- The following data is related to the second production stage of an industrial company for a cost period ending 13/3:

1- Work in process beginning: 8000 units, 75% completion level.

2- The transferred in units 38,000 units at unit cost of $ 2.

3-completed units transferred to finished goods inventory 35000 unit.

4- Ending units in process 12000 unit, 50% completion level.

5- The remaining units are considered as normal defective units and will be reworked at the same stage, and it was discovered at the 50% completion level.

6- The production costs:

A- Beginning work in process cost is $ 39,700, detailed as follows

Transferred in cost	$ 16000
Materials	$ 7500
Labor	$ 6000
Factory overhead	$ 10200

B-period cost

Materials added at 70% $ 10000

Labor $ 35000

Factory overhead $ 39000

Required:

Prepare the cost of production report using weighted average method?

Tenth: The following data extracted from the books of an industrial company in the third and final department for the month of March:

Received units 20,000

Completed units 27000

Ending work in process 60% complete

Department costs:

Materials (added at 50%) $ 3600

Labor $ 17500

Factory overhead $ 10500

If you know:

A- The inspection level is the end of the stage, and the spoiled units have no recoverable value.

B-The addition of materials result in an increase in the number of units produced by half.

C- Transferred in cost one dollar per unit.

Required

Prepare the cost of production report and the work in process account?

Eleventh: a factory produce product “S” in three stages, and here is some information about the third stage for the period from 1/1 to 31/3:

1- The stage uses two types of direct materials:

Material A: added at the level of completion of 10% and its addition does not entail any increase in the number of units produced.

Material B: added at the level of completion of 70%, and leads to an increase in the number of units produced by 25%.

2- Production inspection is carried out continuously during processing.

3- The spoiled units will be sold as irregulars, at a value equal to the costs included at the beginning of the stage.

4- Produced:

9000 completed units transferred to finished goods inventory (of which 2000 units are in process at the beginning of the period with a 50% completion level). 2000 ending units in process, with a level of completion of 40%

100 spoiled units as a result of the negligence of workers in the production

100 spoiled units as a result of the nature of production operations

5- The total costs of the beginning units in process $ 13,000.

6 - The unit production costs during the period were as follows:

Cost received from the second stage (equity between the first and second stages) $ 3

Material A $ 2

Material B $ 2

Conversion cost $ 3

Required: prepare the cost of production report?

Twelfth: The third phase received 850 units at a cost of 13EGP per unit, according to the following details:

1- The average unit cost in the first department is 10 EGP (4.7 EGP materials, 3.3 EGP labors, 2 EGP factory overhead)

2- The average unit cost in the second department is 3(2EGP labors, 1 EGP factory overhead)

700 units were produced and transferred to finished goods inventory, and 100 units remain in process at a completion level of 40%.20 normal defective units discovered gradually through processing and it was decided to reprocessed as raw material in the first department 30 abnormal defective units discovered gradually through processing and it was decided to reprocessed in the second department.

current costs:

Materials added at 80% completion level $ 700

Labor	$ 1510
Factory overhead	$ 755

Required: prepare the cost of production report?

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