

MATERIAL COST

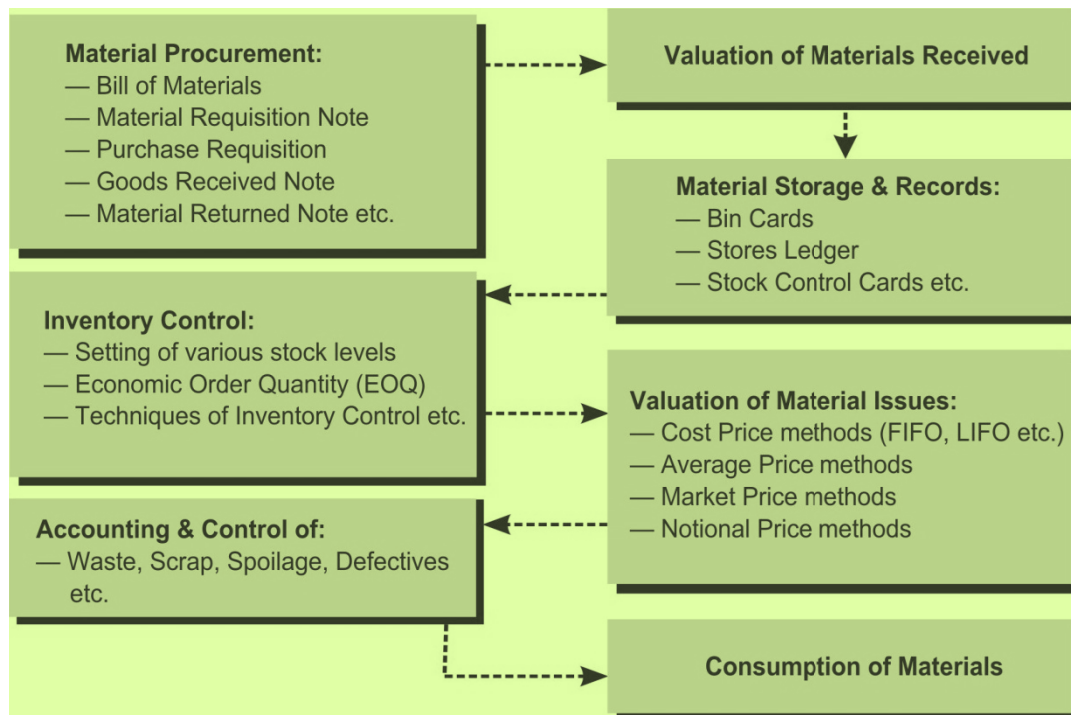


LEARNING OUTCOMES

After studying this chapter, you would be able to-

- ❑ State the meaning, need and importance of materials,
- ❑ Discuss the procedures and documentations involved in procuring, storing and issuing material.
- ❑ Discuss the various inventory control techniques and determination of various stock levels.
- ❑ Compute Economic Order Quantity (EOQ) and apply the EOQ to determine the optimum order quantity.
- ❑ Discuss the various methods of inventory accounting and Prepare stock ledger/ account.
- ❑ Identify and explain normal and abnormal loss and its accounting treatment.

CHAPTER OVERVIEW



2.1 INTRODUCTION

We have acquired a basic knowledge about the concepts, objectives, advantages, methods and elements of cost. We shall now study each element of cost separately beginning with material cost. The general meaning of material is **all commodities/ physical objects used to make the final product**. It may be direct or indirect.

- Direct Materials:* Materials, cost of which can be directly attributable to the end product for which it is being used, in an economically feasible way.
- Indirect Materials:* Those materials which are not directly attributable to a particular final product.

Direct Materials constitute a significant part for manufacturing and production of goods. Being an input and a significant cost element, it requires adequate management attention. Cost control starts from here, and for this purpose it is necessary that the principle of **3Es (Economy, Efficiency and Effectiveness)** i.e.

economy in procurement, efficiency in handling and processing the material and effectiveness in producing desired output as per the standard, is also applied for this cost element. *Importance of proper recording and control of material are as follows:*

(a) Quality of final product: The quality of output depends on the quality of inputs.

(b) Price of the final product: Material constitutes a significant part of any product and the cost of final product is directly related with cost of materials used to produce the product.

(c) Production continuity: The production firms need to ensure that production process runs smoothly and should not be paused for the want of materials. In order to avoid production interruptions, an adequate level of stock of materials should be maintained.

(d) Cost of Stock holding and stock-out: An entity has to incur stock holding costs in the form of interest and/or opportunity cost for the fund used, stock handling losses like evaporation, obsolescence etc. Under-stocking causes in loss of revenue due to stock-out and breach of commitment.

(e) Wastage and other losses: While handling and processing of materials, some wastage and loss arise. Based on the nature of material and process, these are classified as normal and abnormal for efficient utilisation and control.

(f) Regular information about resources: Regular and updated information on availability and utilisation of materials are necessary for the entity for timely and informed decision making.

2.2 MATERIAL CONTROL

In the previous chapter, we have discussed the term Cost Control, which means all activities and control mechanism which are necessary to keep the cost in adherence to the set standards. Material, being one of the total cost elements, are also required to be controlled so that the overall cost control objective can be fulfilled.

2.2.1 Objectives of System of Material Control

The objectives of a system of material control are as following:

(i) Minimising interruption in production process: Material Control system ensures that no activity, particularly production, suffers from interruption for want of materials and stores. It should be noted that this requires constant availability of

every item that may be needed in production process, howsoever, small its cost may be.

(ii) *Optimisation of Material Cost:* The overall material costs includes price, ordering costs and holding costs. Since all the materials and stores are acquired at the lowest possible price considering the required quality and other relevant factors like reliability in respect of delivery, etc., holding cost too needs to be minimized.

(iii) *Reduction in Wastages:* Material Control System has an objective of avoidance of unnecessary losses and wastages that may arise from deterioration in quality due to defective or long storage or from obsolescence. It may be noted that losses and wastages in the process of manufacture are a concern of the production department.

(iv) *Adequate Information:* The system of material control maintains proper records to ensure that reliable information is available for all items of materials and stores. This not only helps in detecting losses and pilferages but also facilitates proper production planning.

(v) *Completion of order in time:* Proper material management is very necessary for fulfilling orders of the firm. This adds to the goodwill of the firm.

2.2.2 Requirements of Material Control

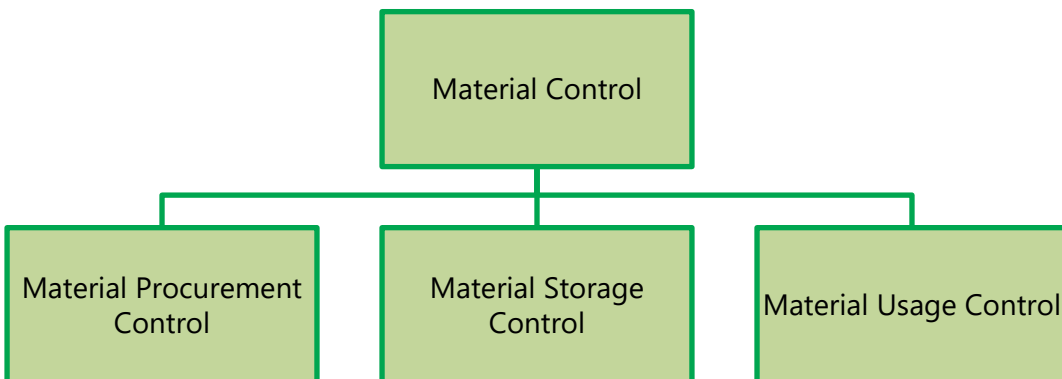
Material control requirements can be summarised as follows:

1. Proper co-ordination of all departments involved viz., finance, purchasing, receiving, inspection, storage, accounting and payment.
2. Determining purchase procedure to see that purchases are made, after making suitable enquiries, at the most favourable terms to the firm.
3. Use of standard forms for placing the order, noting receipt of goods, authorising issue of the materials etc.
4. Preparation of budgets concerning materials, supplies and equipment to ensure economy in purchasing and use of materials.
5. Operation of a system of internal check so that all transactions involving materials, supplies and equipment purchases are properly approved and automatically checked.
6. Storage of all materials and supplies in a well designated location with proper safeguards.

7. Operation of a system of perpetual inventory together with continuous stock checking so that it is possible to determine, at any time, the amount and the value of each kind of material in stock.
8. *Operation of a system of stores control* and issue so that there will be delivery of materials upon requisition to departments in the right amount at the time they are needed.
9. *Development of system of controlling accounts and subsidiary records* which exhibit summary and detailed material costs at the stage of material receipt and consumption.
10. *Regular reports* of materials purchased issue from stock, inventory balances, obsolete stock, goods returned to vendors, and spoiled or defective units are required.

2.2.3 Elements of Material Control

Material control is a systematic control over the procurement, storage and usage of material so as to maintain an even flow of material.



Material control involves efficient functioning of the following operations:

- Purchasing of materials
- Receiving of materials
- Inspection of materials
- Storage of materials
- Issuing materials

- Maintenance of inventory records
- Stock audit



2.3 MATERIALS PROCUREMENT PROCEDURE

Material procurement procedure can be understood with help of the following diagram. Documents required and the departments who initiate these documents are shown sequentially.

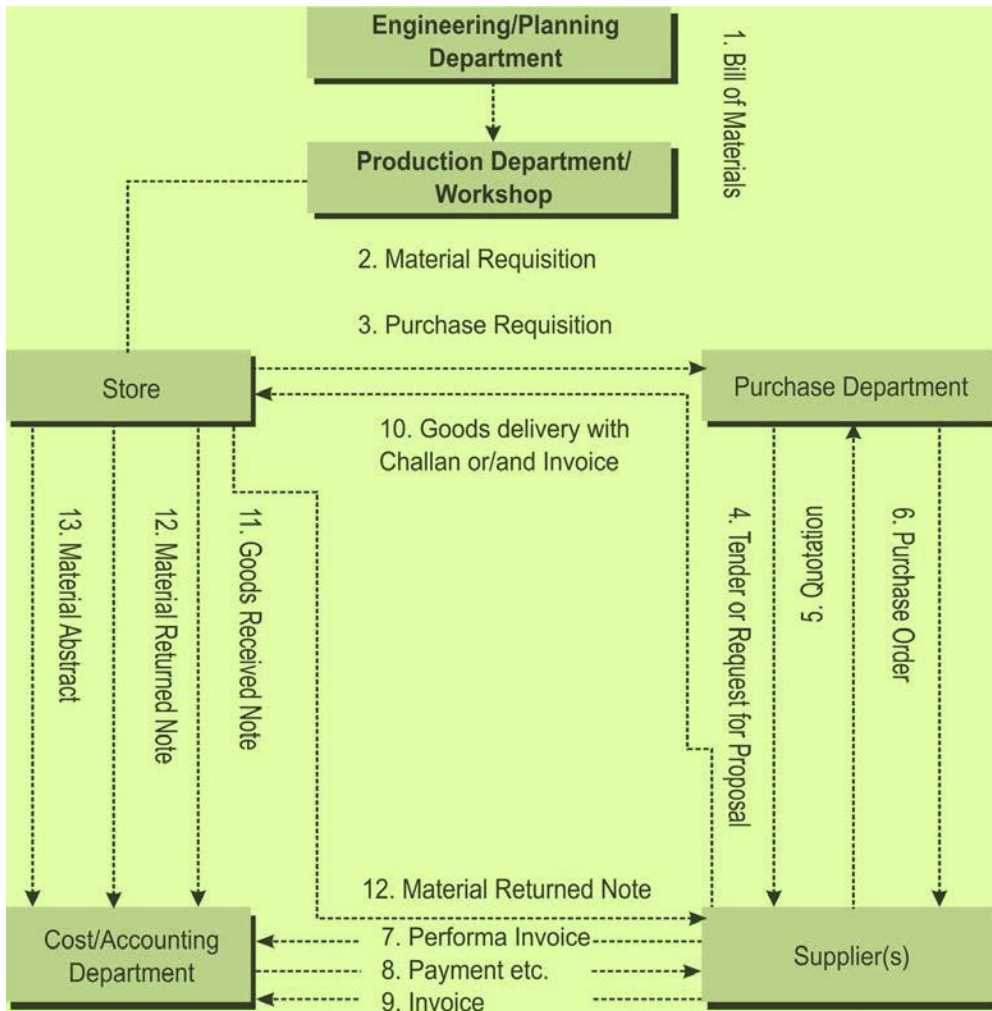


Diagram: Material Procurement Procedure

[The name of the departments and documents shown in the diagram are for illustrative purpose only]

2.3.1 Bill of Materials

It is also known as **Materials Specification List** or Materials List. It is a **detailed list specifying the standard quantities and qualities of materials and components required for producing a product or carrying out of any job**. The materials specification list is prepared by the product development team commonly known as engineering or planning department in a standard form. This is shared with other concerned departments like Marketing, Production, Store, and Cost/Accounting department.

Format and content of a Bill of Materials vary on the basis of industrial peculiarities, management information system (MIS) and accounting system in place.

Uses of Bill of Material

Marketing (Purchase) Dept.	Production Dept.	Stores Dept.	Cost/ Accounting Dept.
Materials are procured (purchased) on the basis of specifications mentioned in it.	Production is planned according to the nature, volume of the materials required to be used. Accordingly, material requisition lists are prepared.	It is used as a reference document while issuing materials to the requisitioning department.	It is used to estimate cost and profit. Any purchase, issue and usage are compared/verified against this document.

2.3.2 Material Requisition Note

It is also known as material requisition slip . It is a **voucher of authority used to get materials issued from store**. Generally, it is prepared by the production department and materials are withdrawn on the basis of material requisition list or bill of materials. If no material list has been prepared, it is desirable that the task of the preparation of material requisition notes be left to the planning department or by the department requires the materials. The note is shared with Store and Cost/Accounting department.

Format of a Material requisition note may vary on the basis of industrial peculiarities, management information system (MIS) and accounting system in place.

Difference between Bill of Materials and Material Requisition Note:

Bill of Materials	Material Requisition Note
1. It is the document prepared by the engineering or planning dept.	1. It is prepared by the production or other consuming department.
2. It is a complete schedule of component parts and raw materials required for a particular job or work order.	2. It is a document asking Store-keeper to issue materials to the consuming department.
3. It often serves the purpose of a material requisition as it shows the complete schedule of materials required for a particular job i.e. it can replace material requisition.	3. It cannot replace a bill of materials.
4. It can be used for the purpose of quotations.	4. It is useful in arriving historical cost only.
5. It helps in keeping a quantitative control on materials drawn through material requisition.	5. It shows the material actually drawn from stores.

2.3.3 Purchase Requisition

This is a document which authorises the purchase department to order for the materials specified in the note. Since the materials purchased will be used by the production departments, there should be constant co-ordination between the purchase and production departments. A purchase requisition is a **form used for making a formal request to the purchasing department to purchase materials**. This form is usually filled up by the store keeper for regular materials and by the departmental head for special materials (not stocked as regular items).

At the beginning a complete list of materials and stores required should be drawn up, which should be reviewed periodically for any addition or deletion. On the basis of **standing order**, once an item is included in the standard list, it becomes the duty of the purchase department to arrange for fresh supplies before existing stocks are exhausted. Any change in the consumption pattern should be informed to the purchase department for necessary action from their end.

For control over buying of regular store materials, Inventory control system is to determine stock levels to be maintained and the number of quantities to be

ordered. In respect of special materials, required for a special order or purpose, it is desirable that the concerned technical department should prepare materials specifications list specifying the quantity, size and order for the materials.

Purchase requisition note may either be originated by the stores department in connection with regular materials or by the production planning or other technical departments in respect of special materials.

Format of a purchase requisition note may vary on the basis of industrial peculiarities, management information system (MIS) and accounting system in place.

2.3.4 Inviting Quotation/Request for Proposal (RFP)

After receipt of duly authorised purchase requisition from the store department or other departments, role of purchase department comes into play. If a concern can afford or the size of the concern is big enough, there should be a separate purchase department for all purchases to be made on behalf of all other departments. Such a department is bound to become expert in the various matters to be attended to, for examples— units of materials to be purchased and licences to be obtained, transport, sources of supply, probable price etc.

Materials purchase department in a business house is confronted with the following issues:

- (i) What to purchase?
- (ii) When to purchase?
- (iii) How much to purchase?
- (iv) From where to purchase.
- (v) At what price to purchase.

To overcome these questions, purchase department make an enquiry into the market for the required material. The process of gathering information about the rate, quantity, technology, services and support etc., purchase department sends RFP to the selected vendors in case if purchase policy allows this practice. Some organizations follow the open and transparent purchase policy and invite quotations from the interested vendors. This process is called **Tender Notification or Invitation of Tender**.

2.3.5 Selection of Quotation/ Proposal

After invitation of tender from the vendors, interested vendors who are fulfilling all the criteria mentioned in the tender notice send their price quotations/ proposals to the purchase department. On the receipt of quotations, a comparative statement is prepared. For selecting material suppliers, the factors which the purchase department keeps in its mind are—*price, quantity, quality offered, time of delivery, mode of transportation, terms of payment, reputation of supplier* etc. In addition to the above listed factors purchase manager obtains other necessary information for final selection of material suppliers.

2.3.6 Preparation and Execution of Purchase Orders

Having decided on the best quotation that should be accepted, the purchase manager or concerned officer proceeds to issue the formal purchase order. It is a written request to the supplier to supply specified materials at specified rates and within a specified period. Generally, copies of purchase order are given to Store or order indenting department, receiving department and cost accounting department. A copy of the purchase order with relevant purchase requisitions, is held in the file of the department to facilitate the follow-up of the delivery and also for approval of the invoice for payment.

2.3.7 Receipt and Inspection of Materials

After execution of purchase order and advance payment (if terms of quotation so specify), necessary arrangement is made to receive the delivery of materials. After receipt of materials along with relevant documents or/ and invoice, receiving department (store dept.) arrange to inspect the materials for its conformity with purchase order. After satisfactory inspection, materials are received and **Goods Received Note** is issued. If some materials are not found in good condition or are not in conformity with the purchase order are returned back to the vendor along with a Material Returned Note.

2.3.7.1 Goods Received Note

If everything is in order and the supply is considered suitable for acceptance, the Receiving department prepares a Receiving Report or **Material Inward Note** or Goods Received Note. Generally, it is prepared in quadruplicate, the copies being distributed to purchase department, store or order indenting department, receiving department and accounting department.

2.3.7.2 Material Returned Note

Sometimes materials have to be returned to suppliers after these have been received in the factory. Such returns may occur before or after the preparation of the receiving report. If the return takes place before the preparation of the receiving report, such material obviously would not be included in the report and hence not shown in the stores ledgers. In that case, no adjustment in the account books would be necessary. But if the material is returned after its entry in the receiving report, a suitable document must be drawn up in support of the issue so as to exclude from the Stores of Material Account the value of the materials returned back. This document usually takes the form of a *Material Returned Note* or *Material outward return note*.

2.3.8 Checking and Passing of Bills for Payment:

The invoice received from the supplier is sent to the accounts section to check authenticity and mathematical accuracy. The quantity and price are also checked with reference to goods received note and the purchase order respectively. The accounts section after checking its accuracy finally certifies and passes the invoice for payment.



2.4 VALUATION OF MATERIAL RECEIPTS

After the procurement of materials from the supplier actual material cost is calculated. **Ascertainment of cost of material purchased is called valuation of materials receipts.** Cost of material includes cost of purchase net of trade discounts, rebates, duty draw-back, input credit availed, etc. and other costs incurred in bringing the inventories to their present location and condition. Invoice of material purchased from the market sometime contain items such as trade discount, quantity discount, freight, duty, insurance, cost of containers, taxes, cash discount etc.

Treatment of items associated with purchase of materials is tabulated as below

Sl No.	Items	Treatment
Discounts and Subsidy		
(i)	Trade Discount	Trade discount is deducted from the purchase price if it is not shown as deduction in the invoice.
(ii)	Quantity Discount	Like trade discount quantity discount is also shown as deduction from the invoice. It is deducted from

		the purchase price if not shown as deduction.
(iii)	Cash Discount	Cash discount is not deducted from the purchase price. It is treated as interest and finance charges. It is ignored.
(iv)	Subsidy/ Grant/ Incentives	Any subsidy/ grant/ incentive received from the Government or from other sources deducted from the cost of purchase.
Duties and Taxes		
(v)	Road Tax/ Toll Tax	Road tax/ Toll tax, if paid by the buyer, is included with the cost of purchase.
(vi)	Integrated Goods and Service Tax (IGST)	Integrated Goods and Service Tax (IGST) is paid on inter-state supply of goods and provision of services and collected from the buyers. It is excluded from the cost of purchase if credit for the same is available. Unless mentioned specifically it should not form part of cost of purchase.
(vii)	State Goods and Service Tax (SGST)	State Goods and Service Tax (SGST) is paid on intra-state supply and collected from the buyers. It is excluded from the cost of purchase if credit for the same is available. Unless mentioned specifically it should not form part of cost of purchase.
(viii)	Central Goods and Service Tax (CGST)	Central Goods and Service Tax (CGST) is paid on manufacture and supply of goods and collected from the buyer. It is excluded from the cost of purchase if the input credit is available for the same. Unless mentioned specifically CGST is not added with the cost of purchase.
(ix)	Basic Custom Duty	Basic Custom duty is paid on import of goods from outside India. It is added with the purchase cost.
Penalty and Charges		
(x)	Demurrage	Demurrage is a penalty imposed by the transporter for delay in uploading or offloading of materials. It is an abnormal cost and not included with cost of purchase
(xi)	Detention charges/ Fine	Detention charges/ fines imposed for non-compliance of rule or law by any statutory authority.

		It is an abnormal cost and not included with cost of purchase
(xii)	Penalty	Penalty of any type is not included with the cost of purchase
Other expenditures		
(xiii)	Insurance charges	Insurance charges are paid for protecting goods during transit. It is added with the cost of purchase.
(xiv)	Commission or brokerage paid.	Commission or brokerage paid is added with the cost of purchase.
(xv)	Freight inwards	It is added with the cost of purchase as it is directly attributable to procurement of material.
(xvi)	Cost of containers	<p>Treatment of cost of containers are as follows:</p> <ul style="list-style-type: none"> • Non-returnable containers: The cost of containers is added with the cost of purchase of materials. • Returnable Containers: If the containers are returned and their costs are refunded, then cost of containers should not be considered in the cost of purchase. • If the amount of refund on returning the container is less than the amount paid, then, only the short fall is added with the cost of purchase.
(xvii)	Shortage	<p>Shortage in materials are treated as follows:</p> <p>Shortage due to normal reasons: Good units absorb the cost of shortage due to normal reasons. Losses due to breaking of bulk, evaporation, or due to any unavoidable conditions etc. are the reasons of normal loss.</p> <p>Shortage due to abnormal reasons: Shortage arises due to abnormal reasons such as material mishandling, pilferage, or due to any avoidable reasons are not absorbed by the good units. Losses due to abnormal reasons are debited to costing profit and loss account.</p>

ILLUSTRATION 1

An invoice in respect of a consignment of chemicals A and B provides the following information:

	(₹)
Chemical A: 10,000 kgs. at ₹ 10 per kg.	1,00,000
Chemical B: 8,000 kgs. at ₹ 13 per kg.	1,04,000
Basic custom duty @ 10% (Credit is not allowed)	20,400
Railway freight	<u>3,840</u>
Total cost	<u>2,28,240</u>

A shortage of 500 kgs. in chemical A and 320 kgs. in chemical B is noticed due to normal breakages. You are required to COMPUTE the rate per kg. of each chemical, assuming a provision of 2% for further deterioration.

SOLUTION**Working:****Computation of effective quantity of each chemical available for use**

	Chemical A (kg.)	Chemical B (kg.)
Quantity purchased	10,000	8,000
Less: Shortage due to normal breakages	500	320
	9,500	7,680
Less: Provision for deterioration 2%	190	153.6
Quantity available	9,310	7,526.4

Statement showing the computation of rate per kg. of each chemical

	Chemical A (₹)	Chemical B (₹)
Purchase price 10,000@ ₹10 per kg, 8,000@₹13 per kg	1,00,000	1,04,000
Add: Basic Custom Duty @10%	10,000	10,400
Add: Railway freight (in the ratio of quantity purchased i.e., 5:4)	2,133	1,707
Total cost (A)	1,12,133	1,16,107
Effective Quantity (see working) (B)	9,310 kg.	7,526.4 kg.
Rate per kg. (A ÷ B)	12.04	15.43

ILLUSTRATION 2

At WHAT price per unit would Part No. A 32 be entered in the Stores Ledger, if the following invoice was received from a supplier:

Invoice	(₹)
200 units Part No. A 32 @ ₹5	1,000.00
Less: 20% discount	(200.00)
	800.00
Add: IGST @ 12%	96.00
	896.00
Add: Packing charges (5 non-returnable boxes)	50.00
	946.00

- (i) A 2 per cent cash discount will be given if payment is made in 30 days.
- (ii) Documents substantiating payment of IGST are enclosed for claiming Input credit.

SOLUTION**Computation of cost per unit**

	(₹)
Net purchase Price	800.00
Add: Packing charges (5 non-returnable boxes)	50.00
	850.00
No. of units purchased	200 units
Cost per unit	4.25

Note: (i) Cash discount is treated as interest and finance charges, hence, it is not considered for valuation of material.

(ii) Input credit is available for IGST paid; hence it will not be added to purchase cost.

**2.5 MATERIAL STORAGE & RECORDS**

Proper storing of materials is of primary importance. It is not enough only to purchase material of the required quality. If the purchased material subsequently deteriorates in quality because of bad storage, the loss is even more than what

might arise from purchase of bad quality of materials. Apart from preservation of quality, the store-keeper also ensures safe custody of the material. It should be the function of store-keeper that the right quantity of materials always should be available in stock.

2.5.1 Duties of Store Keeper

These can be briefly set out as follows:

- (i) General control over store:** Store keeper should keep control over all activities in Stores department. He should check the quantities as mentioned in Goods received note and with the purchased materials forwarded by the receiving department and to arrange for the storage in appropriate places.
- (ii) Safe custody of materials:** Store keeper should ensure that all the materials are stored in a safe condition and environment required to preserve the quality of the materials.
- (iii) Maintaining records:** Store keeper should maintain proper record of quantity received, issued, balance in hand and transferred to/ from other stores.
- (iv) Initiate purchase requisition:** Store keeper should initiate purchase requisitions for the replacement of stock of all regular stores items whenever the stock level of any item of store approaches the re-order level fixed.
- (v) Maintaining adequate level of stock:** Store keeper should maintain adequate level of stock at all time. He/ she should take all the necessary action so that production could not be interrupted due to lack of stock. Further he/ she should take immediate action for stoppage of further purchasing when the stock level approaches the maximum limit. He also needs to reserve a particular material for a specific job when so required.
- (vi) Issue of materials:** Store keeper should issue materials only against the material requisition slip approved by the appropriate authority. He/ she should also refer to bill of materials while issuing materials to requisitioning department.
- (vii) Stock verification and reconciliation:** Store keeper should verify the book balances with the actual physical stock at frequent intervals by way of internal control and check the any irregular or abnormal issues, pilferage, etc.

2.5.2 Store Records

The record of stores may be maintained in three forms:

- **Bin Cards**

➤ **Stock Control Cards**

➤ **Store Ledger**

Bin Cards: It is a **quantitative** record of inventory which shows the quantity of inventory available in a particular bin. Bin refers to a box/ container/ space where materials are kept. Card is placed with each of the bin (space) to record the details of material like receipt, issue and return. It is maintained by store department.

Stock Control Cards: It is also a **quantitative** record of inventory maintained by stores department for every item of material. In other words, it is a record which shows the overall inventory position in store. Recording includes receipt, issue, return, in hand and order given.

Advantages and Disadvantages of Bin Cards

Advantages:

- (i) There would be fewer chances of mistakes being made as entries are made at the same time as goods received or issued by the person actually handling the materials.
- (ii) Control over stock can be more effective, as comparison of the actual quantity in hand at any time with the book balance is possible.
- (iii) Identification of the different items of materials is facilitated by reference to the Bin Card, the bin or storage receptacle.

Disadvantages

- (i) Store records are dispersed over a wide area.
- (ii) The cards are liable to be smeared with dirt and grease because of proximity to material and also because of handling materials.
- (iii) People handling materials are not ordinarily suitable for the clerical work involved in writing Bin Cards.

Advantages and Disadvantages of Stock Control Cards

Advantages:

- (i) Records are kept in a more compact manner so that reference to them is facilitated.
- (ii) Records can be kept in a neat and clean way by men solely engaged in clerical work so that a division of workers between record keeping and actual material handling is possible.

- (iii) As the records are at one place, it is possible to get an overall idea of the stock position without the necessity of going round the stores.

Disadvantages:

- (i) On the spot comparison of the physical stock of an item with its book balance is not facilitated.
- (ii) Physical identification of materials in stock may not be as easy as in the case of bin cards, as the Stock Control Cards are housed in cabinets or trays.

Stores Ledger: A Stores Ledger is maintained to record **both quantity and cost of materials received, issued and those in stock**. It is a subsidiary ledger to the main cost ledger ;it is maintained by the Cost/ Accounts Department. The source documents for posting the ledger are Goods received notes, Materials requisition notes etc.

The first two forms are records of quantities received, issued and those in balance, but in the third record i.e. store ledger, value of receipts, issues and closing balance is also maintained. Usually, records of quantities i.e. *Bin cards and Store Control Cards are kept by the store keeper in store department while record of both quantity and value is maintained by cost accounting department.*

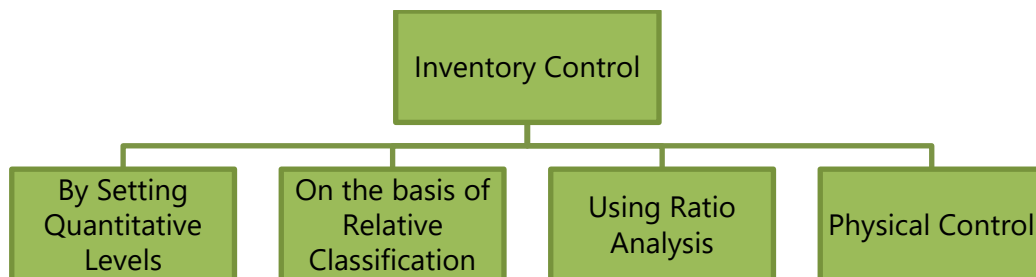
Difference between Bin Card & Stores Ledger

Bin Card	Stores Ledger
It is maintained by the storekeeper in the store.	It is maintained in cost accounting department.
It contains only quantitative details of material received, issued and returned to stores.	It contains information both in quantity and value.
Entries are made when transaction takes place.	It is always posted after the transaction.
Each transaction is individually posted.	Transactions may be summarized and then posted.
Inter-department transfers do not appear in Bin Card.	Material transfers from one job to another job are recorded for costing purposes.

2.6 INVENTORY CONTROL

The Chartered Institute of Management Accountants (CIMA) defines Inventory Control as *"The function of ensuring that sufficient goods are retained in stock to meet all requirements without carrying unnecessarily large stocks."*

The objective of inventory control is to make a balance between sufficient stock and over-stock. The stock maintained should be sufficient to meet the production requirements so that uninterrupted production flow can be maintained. Insufficient stock not only pause the production but also cause a loss of revenue and goodwill. On the other hand, inventory requires some funds for purchase, storage, maintenance of materials with a risk of obsolescence, pilferage etc. The main objective of inventory control is to maintain a **trade-off between stock-out and over-stocking**. The management may employ various methods of inventory control to have a balance. Management may adopt the following basis for inventory control:



2.6.1 Inventory Control- By Setting Quantitative Levels

Re-order Stock Level	•When to Order
Re-order Quantity/ EOQ	•How Much to Order
Maximum Stock Level	•Upto How much to stock
Minimum Stock Level	•Atleast How much to stock
Average Stock Level	•Stock normally kept
Danger Stock Level	•Kept for emergency requirement
Buffer Stock	•To meet sudden demand

(i) Re-order Stock Level (ROL): *This level lies between minimum and the maximum levels* in such a way that before the material ordered is received into the stores, there is sufficient quantity in hand to cover both normal and abnormal consumption situations. In other words, it is the level at which fresh order should be placed for replenishment of stock.

It is calculated as:

$$\text{ROL} = \text{Maximum Consumption} \times \text{Maximum Re-order Period}$$

Maximum Consumption = The maximum rate of material consumption in production activity

Maximum Re-order period = The maximum time to get order from supplier to the stores

This can also be calculated alternatively as below:

$$\text{ROL} = \text{Minimum Stock Level} + (\text{Average Rate of Consumption} \times \text{Average Re-order period})$$

Minimum Stock Level = Minimum Stock level that must be maintained all the time.

Average Rate of Consumption = Average rate of material consumption in production activity. It is also known as normal consumption/ usage

Average Re-order period = Average time to get an order from supplier to the stores. It is also known as normal period.

(Re-order period is also known as Lead time)

(ii) Re-Order Quantity: Re-order quantity is the quantity of materials for which purchase requisition is made by the store department. While setting the quantity to be re-ordered, consideration is given to the maintenance of minimum level of stock, re-order level, minimum delivery time and the most important the cost. Hence, **the quantity should be where, the total of carrying cost and ordering cost is at minimum.** For this purpose, an economic order quantity should be calculated.

Economic Order Quantity (EOQ): The size of an order for which total of ordering and carrying cost are minimum.

Ordering Cost: Ordering costs are the costs which are associated with the purchase or order of materials such as *cost to invite quotations, documentation works like preparation of purchase orders*, employee cost directly attributable to the procurement of material, transportation and inspection cost etc.

Carrying Cost: Carrying costs are the costs for *holding/ carrying of inventories in store* such as the cost of fund invested in inventories, cost of storage, insurance cost, obsolescence etc.

The Economic Order Quantity (EOQ) is calculated as below:

$$EOQ = \sqrt{\frac{2 \times \text{Annual Requirement (A)} \times \text{Cost per order (O)}}{\text{Carrying Cost per unit per annum (C)}}$$

Annual Requirement (A)- It represents demand for raw material or Input for a year.

Cost per Order (O) - It represents cost of placing an order for purchase.

Carrying Cost (C) – It represents cost of carrying average inventory on annual basis.

Assumptions underlying E.O.Q.: The calculation of economic order of material to be purchased is subject to the following assumptions:

- (i) Ordering cost per order and carrying cost per unit per annum are known and they are fixed.
- (ii) Anticipated usage of material in units is known.
- (iii) Cost per unit of the material is constant and is known as well.
- (iv) The quantity of material ordered is received immediately *i.e.* the lead time is zero.

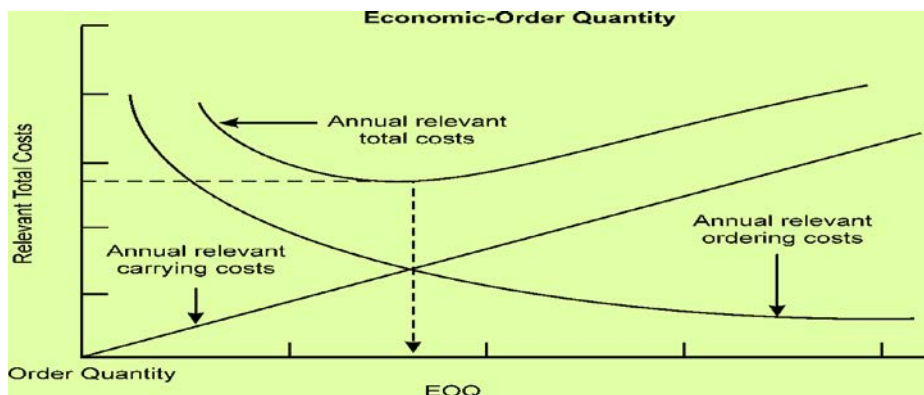


ILLUSTRATION 3

CALCULATE the Economic Order Quantity from the following information. Also state the number of orders to be placed in a year.

Consumption of materials per annum	:	10,000 kg.
Order placing cost per order	:	₹ 50
Cost per kg. of raw materials	:	₹ 2
Storage costs	:	8% on average inventory

SOLUTION

$$\text{EOQ} = \sqrt{\frac{2 \times A \times O}{C}}$$

A = Units consumed during year = 10,000

O = Ordering cost per order = 50

C = Inventory carrying cost per unit per annum. = 8% of ₹ 2

$$\text{EOQ} = \sqrt{\frac{2 \times 10,000 \times 50}{\frac{2 \times 8}{100}}} = \sqrt{\frac{2 \times 10,000 \times 50 \times 25}{4}} = \mathbf{2,500 \text{ kg}}$$

$$\begin{aligned} \text{No. of orders to be placed in a year} &= \frac{\text{Total consumption of materials per annum}}{\text{EOQ}} \\ &= \frac{10,000 \text{ kg.}}{2,500 \text{ kg.}} = \mathbf{4 \text{ Orders per year}} \end{aligned}$$

ILLUSTRATION 4

(i) *COMPUTE E.O.Q. and the total variable cost for the following:*

Annual Demand	=	5,000 units
Unit price	=	₹ 20.00
Order cost	=	₹ 16.00
Storage rate	=	2% per annum
Interest rate	=	12% per annum
Obsolescence rate	=	6% per annum

- (ii) DETERMINE the total cost that would result for the items if a new price of ₹ 12.80 is used.

SOLUTION

(i) Carrying cost (C) = Storage rate = 2%
 Interest Rate = 12%
 Obsolescence Rate = 6%
 Total = 20% per annum
 $C = 20\% \text{ of ₹ } 20 = ₹ 4 \text{ per unit per annum.}$

$$\text{E.O.Q} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 5000 \times 16}{4}} = \sqrt{40,000} = 200 \text{ units}$$

Total cost:

Purchase price of 5,000 units @ ₹ 20.00 per unit = ₹ 1,00,000

Ordering cost = $\frac{5000}{200} = 25 \text{ orders @ ₹ } 16 = ₹ 400$

Carrying cost of average Inventory = $\frac{200}{2} = 100 \text{ units @ ₹ } 4 = ₹ 400$

Total cost = ₹ 1,00,800

- (ii) If the new price of ₹ 12.80 is used:

$C = 20\% \text{ of } 12.80 = ₹ 2.56 \text{ per unit per annum.}$

$$\text{E.O.Q.} = \sqrt{\frac{2 \times 5,000 \times 16}{2.56}} = 250 \text{ units}$$

Total cost:

Purchase price of 5,000 units @ ₹ 12.80 per unit = ₹ 64,000

Ordering cost = $\frac{5,000}{250} = 20 \text{ orders @ ₹ } 16 = ₹ 320$

Carrying cost (of average inventory) = $\frac{250}{2} = 125 \text{ units @ ₹ } 2.56 = ₹ 320$

Total variable cost = ₹ 64,640

(iii) Minimum Stock Level: It is lowest level of material stock, which must be *maintained in hand at all times*, so that there is no stoppage of production due to non-availability of inventory.

It is calculated as below:

$$\text{Minimum Stock Level} = \text{Re-order Stock Level} - (\text{Average Consumption Rate} \times \text{Average Re-order Period})$$

(iv) Maximum Stock Level: It is *the highest level of quantity for any material which can be held in stock at any time*. Any quantity beyond this level cause extra amount of expenditure due to engagement of fund, cost of storage, obsolescence etc.

It can be calculated as below:

$$\text{Maximum Stock Level} = \text{Re-order Level} + \text{Re-order Quantity} - (\text{Minimum Consumption Rate} \times \text{Minimum Re-order Period})$$

Here, Re-order Quantity may be EOQ

(v) Average Inventory Level: This is the quantity of material that is normally held in stock over a period. *It is also known as normal stock level*.

It can be calculated as below:

$$\text{Average Stock Level} = \text{Minimum Stock Level} + 1/2 \text{ Re-order Quantity}$$

Alternatively, it can be calculated as below:

$$\text{Average Stock Level} = \frac{\text{Maximum Stock Level} + \text{Minimum Stock Level}}{2}$$

(vi) Danger level: It is the level at which normal issues of the raw material inventory are stopped and emergency issues are only made.

It can be calculated as below:

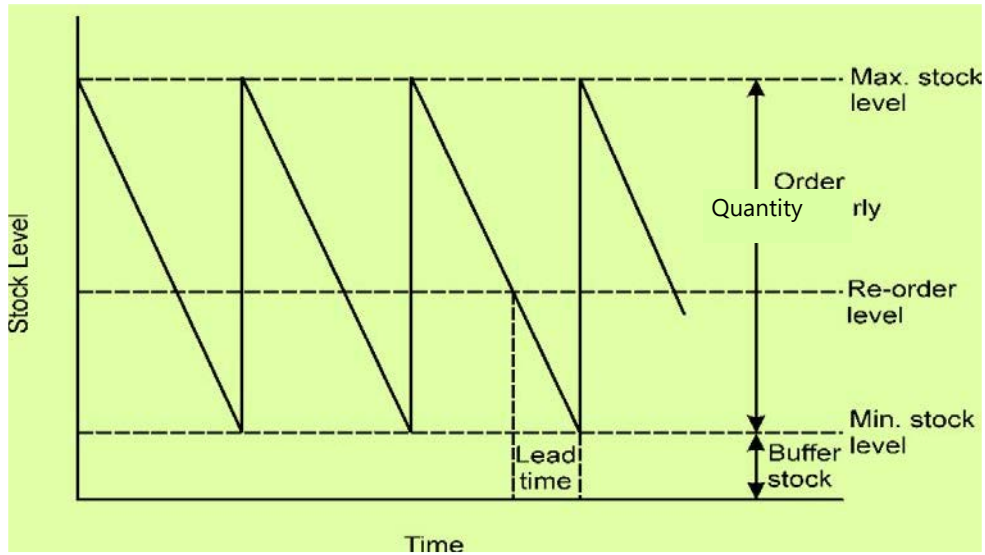
$$\text{Danger Level} = \text{Average Consumption} \times \text{Lead time for emergency purchase}$$

*Some time minimum consumption is also used.

(vii) Buffer Stock: Some quantity of stock may be kept for **contingency** to be used in case of sudden order, such stock is known as buffer stock.

All the above stock levels can be understood with the help of the following diagram:

Stock Control Chart



When the materials are purchased the level keeps rising. It may reach maximum level if the rate of issuance is less. As the materials are consumed, the stock level starts declining. At re-order level, reorder quantity is ordered and fresh supplies are normally received when stocks reach minimum level. The time interval between re-order level, when the fresh order is placed, and the time of actual receipt of materials is known as lead time.

ILLUSTRATION 5

Two components, A and B are used as follows:

Normal usage	50 per week each
Maximum usage	75 per week each
Minimum usage	25 per week each
Re-order quantity	A: 300; B: 500
Re-order period	A: 4 to 6 weeks
	B: 2 to 4 weeks

CALCULATE for each component (a) Re-ordering level, (b) Minimum level, (c) Maximum level, (d) Average stock level.

SOLUTION**(a) Re-ordering level:**

Maximum usage per week × Maximum delivery period.

Re-ordering level for component A = 75 units × 6 weeks = **450 units**

Re-ordering level for component B = 75 units × 4 weeks = **300 units**

(b) Minimum level:

Re-order level – (Normal usage × Average period)

Minimum level for component A = 450 units – (50 units × 5 weeks) = 200 units

Minimum level for component B = 300 units – (50 units × 3 weeks) = 150 units

(c) Maximum level:

Re-order level + Re-order quantity – (Min. usage × Minimum period)

Maximum level for component A = (450 units + 300 units) – (25 units × 4 weeks)
= 650 units

Maximum level for component B = (300 units + 500 units) – (25 units × 2 weeks)
= 750 units

(d) Average stock level:

$\frac{1}{2}$ (Minimum + Maximum) stock level

Average stock level for component A = $\frac{1}{2}$ (200 units + 650 units) = 425 units.

Average stock level for component B = $\frac{1}{2}$ (150 units + 750 units) = 450 units.

ILLUSTRATION 6

From the details given below, CALCULATE:

(i) *Re-ordering level*

(ii) *Maximum level*

(iii) *Minimum level*

(iv) *Danger level.*

Re-ordering quantity is to be calculated on the basis of following information:

Cost of placing a purchase order is ₹ 20

Number of units to be purchased during the year is 5,000

Purchase price per unit inclusive of transportation cost is ₹ 50

Annual cost of storage per units is ₹ 5.

Details of lead time : Average- 10 days, Maximum- 15 days, Minimum- 5 days.

For emergency purchases- 4 days.

Rate of consumption : Average: 15 units per day,

Maximum: 20 units per day.

SOLUTION

Basic Data:

A	(Number of units to be purchased annually)	=	5,000 units
O	(Ordering cost per order)	=	₹ 20
C	(Annual cost of storage per unit)	=	₹ 5
	Purchase price per unit inclusive of transportation cost	=	₹ 50.

Computations:

- (i) **Re-ordering level** = Maximum usage per period × Maximum lead time
(ROL) = 20 units per day × 15 days = **300 units**
- (ii) **Maximum level** = ROL + ROQ – [Min. rate of consumption × Min.
(Refer to working notes 1 and 2) lead time]
= 300 units + 200 units – [10 units per day × 5 days]
= **450 units**
- (iii) **Minimum level** = ROL – Average rate of consumption × Average re-order-period
= 300 units – (15 units per day × 10 days) = **150 units**
- (iv) **Danger level** = Average consumption × Lead time for emergency purchases
= 15 units per day × 4 days = **60 units**

Working Notes:

1. Minimum rate of consumption per day

$$\text{Av. rate of consumption} = \frac{\text{Minimum rate of consumption} + \text{Maximum rate of consumption}}{2}$$

$$15 \text{ units per day} = \frac{X \text{ units/day} + 20 \text{ units per day}}{2} \quad \text{or} \quad X = 10 \text{ units per day.}$$

2. Re-order Quantity (ROQ) or Economic Order Quantity (EOQ) =

$$\sqrt{\frac{2 \times 5,000 \text{ units} \times ₹ 20}{5}} = 200 \text{ units}$$

2.6.2 Inventory Stock- Out

Stock out is said to be occurred **when an inventory item could not be supplied due to insufficient stock in the store**. The stock- out situation costs to the entity not only in financial terms but in non-financial terms also. Due to stock out an entity not only loses overheads costs and profit but reputation (goodwill) also due to non-fulfilment of commitment. Though it may not be a monetary loss in short term but in long term it could be a reason for financial loss.

While deciding on the level of inventory, a trade-off between the stock out cost and carrying cost is made so that overall inventory cost can be minimized.

ILLUSTRATION 7

M/s Tyrotubes trades in four wheeler tyres and tubes. It stocks sufficient quantity of tyres of almost every vehicle. In year end 2019-20, the report of sales manager revealed that M/s Tyrotubes experienced stock-out of tyres.

The stock-out data is as follows:

Stock-out of Tyres	No. of times of Stock Out
100	2
80	5
50	10
20	20
10	30
0	33

M/s Tyrotubes loses ₹ 150 per unit due to stock-out and spends ₹ 50 per unit on carrying of inventory.

DETERMINE optimum safest stock level.

SOLUTION

Computation of Stock-out and Inventory carrying cost

Safety Stock Level (units) (1)	Stock-out (units) (2)	Probability (3)	Stock-out cost (₹) (4) = (2) x ₹ 150	Expected stock-out cost (₹) (5) = (3)x(4)	Inventory carrying cost (₹) (6) = (1)x₹ 50	Total cost (₹) (7) = (5) + (6)
100	0	0.00	0	0	5,000	5,000
80	20	0.02	3,000	60	4,000	4,060
50	50	0.02	7,500	150		
	30	0.05	4,500	225		
			12,000	375	2,500	2,875
20	80	0.02	12,000	240		
	60	0.05	9,000	450		
	30	0.10	4,500	450		
			25,500	1,140	1,000	2,140
10	90	0.02	13,500	270		
	70	0.05	10,500	525		
	40	0.10	6,000	600		
	10	0.20	1,500	300		
			31,500	1,695	500	2,195
0	100	0.02	15,000	300		2,700
	80	0.05	12,000	600		
	50	0.10	7,500	750		
	20	0.20	3,000	600		
	10	0.30	1,500	450		
			39,000	2,700	0	2,700

At safety stock level of 20 units, total cost is least i.e. ₹ 2,140.

Working Note:**Computation of Probability of Stock-out**

Stock-out (units)	100	80	50	20	10	0	Total
Nos. of times	2	5	10	20	30	33	100
Probability	0.02	0.05	0.10	0.20	0.30	0.33	1.00

Explanation:

Stock-out means the demand of an item that could not be fulfilled because of insufficient stock level.

Safety stock is the level of stock of any item which is maintained in excess of lead time consumption. It is kept as cushion against any unexpected demand for that item.

Safety stock level	Impact
100 units	Any unexpected demand up-to 100 units can be met.
80 units	Stock out will only arise if unexpected demand will be for 100 units. In this case 20 units will remain unsatisfied. The probability of any unexpected demand for 100 units is 0.02.
50 units	Any unexpected demand beyond 50 units will be remain unsatisfied. If unexpected demand for 100 units arises (probability is 0.02) 50 units will be unsatisfied. Similarly, if unexpected demand for 80 units arises (probability is 0.05), 30 units will be unsatisfied.
20 units	Any unexpected demand beyond 20 units will be remain unsatisfied. If unexpected demand for 100 units arises (probability is 0.02), 80 units will remain unsatisfied. If unexpected demand for 80 units arises (probability is 0.05), 60 units will remain unsatisfied. Similarly, when unexpected demand for 50 units arises (probability is 0.10), 30 units will remain unsatisfied.
10 units	Any unexpected demand beyond 10 units will be remain unsatisfied. If unexpected demand for 100 units arises (probability is 0.02), 90 units will remain unsatisfied. If

	unexpected demand for 80 units arises (probability is 0.05), 70 units will remain unsatisfied. If unexpected demand for 50 units arises (probability is 0.10), 40 units will remain unsatisfied. Similarly, when unexpected demand for 20 units arises (probability is 0.20), 10 units will remain unsatisfied.
0 unit	When no safety stock level is maintained, any unexpected demand cannot be satisfied. If unexpected demand for 100 units arises (probability is 0.02), 100 units will remain unsatisfied. If unexpected demand for 80 units arises (probability is 0.05), 80 units will remain unsatisfied. If unexpected demand for 50 units arises (probability is 0.10), 50 units will remain unsatisfied. If unexpected demand for 20 units arises (probability is 0.20), 20 units will remain unsatisfied. Similarly, unexpected demand for 10 units (probability is 0.30), 10 units will remain unsatisfied.

2.6.3 Just in Time (JIT) Inventory Management

JIT is a system of inventory management with an approach to have a **zero inventories in stores**. According to this approach material should *only be purchased when it is actually required for production*.

JIT is based on two principles

- (i) Produce goods only when it is required and
- (ii) the products should be delivered to customers at the time only when they want.

It is also known as 'Demand pull' or 'Pull through' system of production. In this system, production process actually starts after the order for the products is received. Based on the demand, production process starts and the requirement for raw materials is sent to the purchase department for purchase. This can be understood with the help of the following diagram:



2.6.4 Inventory Control- On the basis of Relative Classification

ABC Analysis	• On the basis of value and frequency of inventory
Fast, Slow and Non Moving (FSN)	• On the basis of inventory turnover
Vital, Essential and Desirable (VED)	• On the basis of importance of inventory
High, Medium and Low (HML)	• On the basis of price of an item of inventory

(1) ABC Analysis: This system exercises discriminating control over different items of inventory on the basis of the investment involved. Usually the items are classified into three categories according to their relative importance, namely, their value and frequency of replenishment during a period.

(i) 'A' Category: *This category of items consists of only a small percentage i.e., about 10% of the total items handled by the stores but require heavy investment about 70% of inventory value, because of their **high prices or heavy requirement** or both. Items under this category can be controlled effectively by using a regular system which ensures neither over-stocking nor shortage of materials for production. Such a system plans its total material requirements by making budgets. The stocks of materials are controlled by fixing certain levels like maximum level, minimum level and re-order level.*

(ii) 'B' Category: *This category of items is relatively less important; they may be 20% of the total items of material handled by stores. The percentage of investment required is about 20% of the total investment in inventories. In the case of these items, as the sum involved is **moderate**, the same degree of control as applied in 'A' category of items is not warranted. The orders for the items, belonging to this category may be placed after reviewing their situation periodically.*

(iii) 'C' Category: *This category of items does not require much investment; it may be about 10% of total inventory value but they are nearly 70% of the total items handled by store. For these category of items, there is no need of exercising constant control. Orders for items in this group may be placed either after six months or once in a year, after ascertaining consumption requirements. In this case the objective is to economies on ordering and handling costs.*

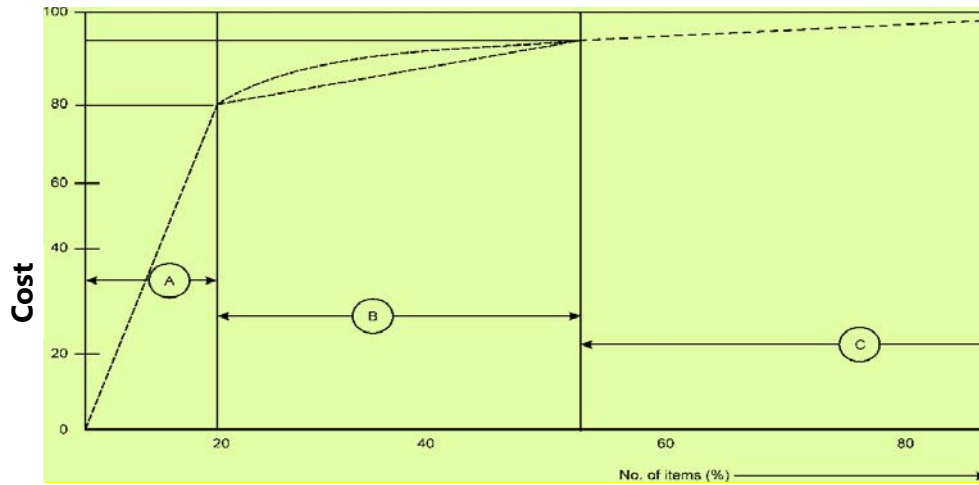


ILLUSTRATION 8

From the following details, DRAW a plan of ABC selective control:

Item	Units	Unit cost (₹)
1	7,000	5.00
2	24,000	3.00
3	1,500	10.00
4	600	22.00
5	38,000	1.50
6	40,000	0.50
7	60,000	0.20
8	3,000	3.50
9	300	8.00
10	29,000	0.40
11	11,500	7.10
12	4,100	6.20

SOLUTION**Statement of Total Cost and Ranking**

Item	Units	% of Total units	Unit cost (₹)	Total cost (₹)	% of Total cost	Ranking
1	7,000	3.1963	5.00	35,000	9.8378	4
2	24,000	10.9589	3.00	72,000	20.2378	2
3	1,500	0.6849	10.00	15,000	4.2162	7
4	600	0.2740	22.00	13,200	3.7103	8
5	38,000	17.3516	1.50	57,000	16.0216	3
6	40,000	18.2648	0.50	20,000	5.6216	6
7	60,000	27.3973	0.20	12,000	3.3730	9
8	3,000	1.3699	3.50	10,500	2.9513	11
9	300	0.1370	8.00	2,400	0.6746	12
10	29,000	13.2420	0.40	11,600	3.2605	10
11	11,500	5.2512	7.10	81,650	22.9502	1
12	4,100	1.8721	6.20	25,420	7.1451	5
	2,19,000	100		3,55,770	100	

Basis for selective control (Assumed)

₹ 50,000 & above -- 'A' items

₹ 15,000 to 50000 -- 'B' items

Below ₹ 15,000 -- 'C' items

On this basis, a plan of A B C selective control is given below:

Ranking	Item Nos.	% of Total units	Cost (₹)	% of Total Cost	Category
1	11	5.2512	81,650	22.9502	
2	2	10.9589	72,000	20.2378	
3	5	17.3516	57,000	16.0216	
Total	3	33.5617	2,10,650	59.2096	A
4	1	3.1963	35,000	9.8378	
5	12	1.8721	25,420	7.1451	
6	6	18.2648	20,000	5.6216	

7	3	0.6849	15,000	4.2162	
Total	4	24.0181	95,420	26.8207	B
8	4	0.2740	13,200	3.7103	
9	7	27.3973	12,000	3.3730	
10	10	13.2420	11,600	3.2605	
11	8	1.3699	10,500	2.9513	
12	9	0.1370	2,400	0.6746	
Total	5	42.4202	49,700	13.9697	C
Grand Total	12	100	3,55,770	100	

(1) **Advantages of ABC analysis:** The advantages of ABC analysis are the following:

- (i) *Continuity in production:* It ensures that, without there being any danger of interruption of production for want of materials or stores, minimum investment will be made in inventories of stocks of materials or stocks to be carried.
- (ii) *Lower cost:* The cost of placing orders, receiving goods and maintaining stocks is minimised specially if the system is coupled with the determination of proper economic order quantities.
- (iii) *Less attention required:* Management time is saved since attention need to be paid only to some of the items rather than all the items, as would be the case if the ABC system was not in operation.
- (iv) *Systematic working:* With the introduction of the ABC system, much of the work connected with purchases can be systematized on a routine basis, to be handled by subordinate staff.

ILLUSTRATION 9

A factory uses 4,000 varieties of inventory. In terms of inventory holding and inventory usage, the following information is compiled:

No. of varieties of inventory	%	% value of inventory holding (average)	% of inventory usage (in end-product)
3,875	96.875	20	5
110	2.750	30	10

15	0.375	50	85
4,000	100.00	100	100

CLASSIFY the items of inventory as per ABC analysis with reasons.

SOLUTION

Classification of the items of inventory as per ABC analysis

1. 15 number of varieties of inventory items should be classified as 'A' category items because of the following reasons:
 - (i) Constitute 0.375% of total number of varieties of inventory handled by stores of factory, which is minimum as per given classification in the table.
 - (ii) 50% of total use value of inventory holding (average), which is maximum, according to the given table.
 - (iii) Highest in consumption, about 85% of inventory usage (in end-product).
2. 110 number of varieties of inventory items should be classified as 'B' category items because of the following reasons:
 - (i) Constitute 2.750% of the total number of varieties of inventory items handled by stores of factory.
 - (ii) Requires moderate investment of about 30% of total use value of inventory holding (average).
 - (iii) Moderate in consumption, about 10% of inventory usage (in end-product).
3. 3,875 number of varieties of inventory items should be classified as 'C' category items because of the following reasons:
 - (i) Constitute 96.875% of total varieties of inventory items handled by stores of factory.
 - (ii) Requires about 20% of total use value of inventory holding (average).
 - (iii) Minimum inventory consumption, i.e. about 5% of inventory usage (in end-product).

(2) Fast Moving, Slow Moving and Non Moving (FSN) Inventory: It is also known as FNS (Fast, Normal and Slow moving) classification of inventory analysis.

Under this system, inventories are controlled by classifying them **on the basis of frequency of usage**. The classification of items into these three categories depends on the nature and managerial discretion. A threshold range on the basis of inventory turnover is decided and classified accordingly.

(i) Fast Moving- This category of items are placed nearer to store issue point and the stock is reviewed frequently for making of fresh orders.

(ii) Slow Moving- This category of items are stored little far and stock is reviewed periodically for any obsolescence. and may be shifted to Non-moving category.

(iii) Non Moving- This category of items are kept for disposal. This category of items is reported to the management and an appropriate provision for loss may be created.

Some of the reasons for slow moving and non-moving inventories are stated below:

- (i) Failure of production management to communicate the updated requirement to the stores management
- (ii) Technological upgradation in terms of new machine requiring new kind of material or existing material becoming obsolete.
- (iii) Lack of periodic review of inventories.

By careful observation, timely identification and adoption of inventory management techniques such as maintenance of minimum level or just in time approach, one can manage slow moving and non-moving inventories. We may calculate inventory turnover ratio and present the reports of comparison of actual and standards with variations, if any to the management.

(3) Vital, Essential and Desirable (VED): Under this system of inventory analysis, inventories are classified **on the basis of its criticality for the production function and final product**. Generally, this classification is done for spare parts which are used for production.

(i) Vital- Items are classified as vital when its unavailability can interrupt the production process and cause a production loss. Items under this category are strictly controlled by setting re-order level.

(ii) Essential- Items under this category are essential but not vital. The unavailability may cause sub standardisation and loss of efficiency in production process. Items under this category are reviewed periodically and get the second priority.

(iii) Desirable- Items under this category are optional in nature, unavailability does not cause any production or efficiency loss.

For instance, in hospital administration, stock of medicines and essential chemicals are categorized as VED or FSN inventory. In case of life saving, rare and critical drugs, they are being categorized as vital inventory. They are the ones whose unavailability can interrupt smooth service. Those inventories which are optional or substitutes, not leading to loss in efficiency would be categorized as desirable inventories. FNS categorization helps the store keepers in hospitals to keep a check on medicines whose expiry date is close and needs to be disposed off at the earliest. The quantity of slow moving drugs are maintained accordingly.

(4) High Cost, Medium Cost, Low Cost (HML) Inventory: Under this system, inventory is classified **on the basis of the cost of an individual item**, unlike ABC analysis where inventories are classified on the basis of overall value of inventory. A range of cost is used to classify the inventory items into the three categories. High Cost inventories are given more priority for control, whereas Medium cost and Low cost items are comparatively given lesser priority.

2.6.5 Using Ratio Analysis

(i) Input- Output Ratio: Inventory control can also be exercised by the use of input- output ratio analysis. **Input- output ratio is the ratio of the quantity of input of material to production and the standard material content of the actual output.**

This type of ratio analysis enables comparison of actual consumption and standard consumption, thus indicating whether the usage of material is favourable or adverse.

(ii) Inventory Turnover Ratio: Computation of inventory turnover ratios for different items of material and comparison of the turnover rates provides a useful guidance for measuring inventory performance. *High inventory turnover ratio indicates that the material in the question is a fast moving one. A low turnover ratio indicates over-investment and locking up of the working capital in inventories.* Inventory turnover ratio may be calculated by using the following formulae: -

$$\text{Inventory Turnover Ratio} = \frac{\text{Cost of materials consumed during the period}}{\text{Cost of average stock held during the period}}$$

$$\text{Average stock} = 1/2 (\text{opening stock} + \text{closing stock})$$

$$\text{Average no. of days of Inventory holding} = \frac{365 \text{ days} / 12 \text{ months}}{\text{Inventory Turnover Ratio}}$$

By comparing the number of days in the case of two different materials, it is possible to know which is fast moving and which is slow moving. On this basis, attempt should be made to reduce the amount of capital locked up, and prevent over-stocking of the slow moving items.

ILLUSTRATION 10

The following data are available in respect of material X for the year ended 31st March, 2020.

	(₹)
Opening stock	90,000
Purchases during the year	2,70,000
Closing stock	1,10,000

CALCULATE:

- (i) Inventory turnover ratio, and
- (ii) The number of days for which the average inventory is held.

SOLUTION

Inventory turnover ratio

$$\begin{aligned} \text{(Refer to working note)} &= \frac{\text{Cost of stock of raw material consumed}}{\text{Average stock of raw material}} \\ &= \frac{₹2,50,000}{₹1,00,000} = 2.5 \end{aligned}$$

Average number of days for which the average inventory is held

$$\begin{aligned} &= \frac{365}{\text{Inventory turnover ratio}} = \frac{365 \text{ days}}{2.5} \\ &= \mathbf{146 \text{ days}} \end{aligned}$$

Working Note:

	(₹)
Opening stock of raw material	90,000

Add: Material purchases during the year	2,70,000
Less: Closing stock of raw material	<u>1,10,000</u>
Cost of stock of raw material consumed	<u>2,50,000</u>

ILLUSTRATION 11

From the following data for the year ended 31st March, 2020, CALCULATE the inventory turnover ratio of the two items and put forward your comments on them.

	Material A (₹)	Material B (₹)
Opening stock 1.04.2019	10,000	9,000
Purchase during the year	52,000	27,000
Closing stock 31.03.2020	6,000	11,000

SOLUTION

First of all, it is necessary to find out the material consumed:

Cost of materials consumed	Material A (₹)	Material B (₹)
Opening stock	10,000	9,000
Add: Purchases	<u>52,000</u>	<u>27,000</u>
	62,000	36,000
Less: Closing stock	<u>6,000</u>	<u>11,000</u>
Materials consumed	<u>56,000</u>	<u>25,000</u>
Average inventory: (Opening Stock + Closing Stock) ÷ 2	8,000	10,000
Inventory Turnover ratio: (Consumption ÷ Average inventory)	7 times	2.5 times
Inventory Turnover (Number of Days in a year/IT ratio)	52 days	146 days

Comments: Material A is moving faster than Material B.

2.6.6 Physical Control

- (i) **Two Bin System:** Under this system, each bin is divided into two parts –
- (I) smaller part to stock the quantity equal to the minimum stock or even the re-ordering level, and

(II) the other part to keep the remaining quantity.

Issues are made out of the larger part; but as soon as it becomes necessary to use quantity out of the smaller part of the bin, fresh order is placed. "Two Bin System" is supplemental to the record of respective quantities on the bin card and the stores ledger card.

(ii) Establishment of system of budgets: To control investment in the inventories, it is necessary to know in advance about the inventories requirement during a specific period (usually a year). The exact quantity of various types of inventories and the time when they would be required can be known by studying carefully production plans and production schedules. Based on this, inventories requirement budget can be prepared. Such a budget will discourage the unnecessary investment in inventories.

(iii) Perpetual inventory records and continuous stock verification: Perpetual inventory represents a system of records maintained by the stores department. **It, in fact, comprises of: (i) Bin Cards, and (ii) Stores Ledger.**

The success of perpetual inventory depends upon the following:

- (a) The Stores Ledgers showing quantities and amount of each item.
- (b) Stock Control cards (or Bin Cards).
- (c) Reconciling the quantity balances shown by (a) & (b) above.
- (d) Checking the physical balances of a number of items every day systematically and by rotation.
- (e) Explaining promptly the causes of discrepancies, if any, between physical balances and the book figures.
- (f) Making corrective entries wherever required after step (e) and
- (g) Removing the causes of the discrepancies referred to in step (e)

Advantages of perpetual inventory: The main advantages of perpetual inventory are as follows:

- (1) Physical stocks can be counted and book balances adjusted as and when desired without waiting for the entire stock-taking to be done.
- (2) Quick compilation of Profit and Loss Account (for interim period) due to prompt availability of stock figures.

- (3) Discrepancies are easily located and thus corrective action can be promptly taken to avoid their recurrence.
- (4) A systematic review of the perpetual inventory reveals the existence of surplus, dormant, obsolete and slow-moving materials, so that remedial measures may be taken in time.
- (5) Fixation of the various stock levels and checking of actual balances in hand with these levels assist the store keeper in maintaining stocks within limits and in initiating purchase requisitions for correct quantity at the appropriate time.

(iv) Continuous Stock Verification: The checking of physical inventory is an essential feature of every sound system of material control. The system of continuous stock-taking consists of **physical verification of items of inventory**. The stock verification may be done by internal audit department but are independent of the store and production staff. Stock verification is done at appropriate interval of time without prior notice. The element of surprise is essential for effective control of the system.

Disadvantages of Annual/ Periodic Stock Taking: Annual stock-taking, however, has certain inherent shortcomings which tend to detract from the usefulness of such physical verification. For instance, since all the items have to be covered in a given number of days, either the production department has to be shut down during those days to enable thorough checking of stock or else the verification must be of limited character.

On the contrary, continuous stock taking is holding more advantages. Some of them are discussed below:

Advantages of continuous stock-taking:

1. Closure of normal functioning is not necessary.
2. Stock discrepancies are likely to be brought to the notice and corrected much earlier than under the annual stock-taking system.
3. The system generally has a sobering influence on the stores staff because of the element of surprise present therein.
4. The movement of stores items can be watched more closely by the stores auditor so that chances of obsolescence buying are reduced.
5. Final Accounts can be ready quickly. Interim accounts are possible quite conveniently.



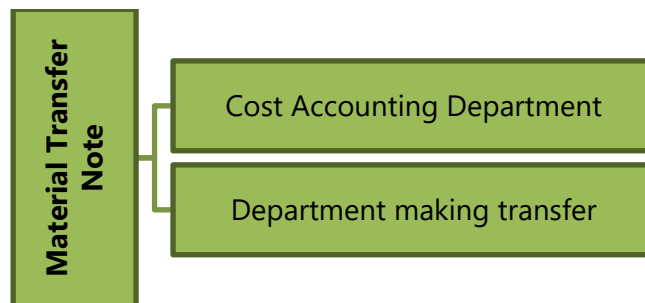
2.7 MATERIAL ISSUE PROCEDURE

Issue of material must not be made except under properly authorised requisition slip. Usually, it is the foreman of a department who has the authority to draw materials from the store. Issue of material must be made on the basis of first in first out, that is, out of the earliest lot in hand. If care is not exercised in this regard, quality of earliest lot of material may deteriorate for having been kept for a long period.

(i) Issue against Material Requisition Note: It is the **voucher of the authority as regards to the issue of materials** for use in the factory or in any of its departments. After receipt of material requisition slip, store keeper ensures that requisition is properly authorized and requisitioned quantity is within the quantity specified in bill of materials. After satisfied with the documents, store keeper issue materials and keeps one copy of the MRN to maintain the necessary records.

(ii) Transfer of Material: The **surplus material arising on a job** or other units of production may sometime be unsuitable for transfer to store because of its bulk, heavy weight, brittleness or some other reason. It may, however, be possible to find some alternative use for such materials by transferring them to some other job instead of returning them to the store.

It must be stressed that generally transfer of material from one job to another is irregular, if not improper; in so far, it is not conducive to correct allocation and control of material, cost of jobs or other units of production. It is only in the circumstances envisaged above, that such direct transfer should be made. At the time of material transfer, a material transfer note should be made in duplicate. The disposition of the copies of this note being are as follows:



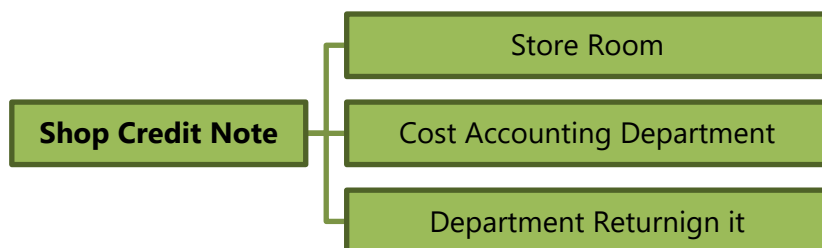
No copy is required for the store, as no entry in the stores records would be called for. The Cost Accounting Department would use its copy for the purpose of making the necessary entries in the cost ledger accounts for the jobs affected.

Format of a material requisition note may vary on the basis of industrial peculiarities, management information system (MIS) and accounting system in place.

(iii) Return of Material: Sometimes, it is not possible before hand to make any precise estimate of the material requirements or units of production. Besides, at times, due to some technical issues or other difficulties, it is not practicable to measure the exact quantity of material required by a department. In either case, material may have to be issued from stores in bulk, often in excess of the actual quantity required. Where such a condition exists, it is of the utmost importance from the point of view of materials control that **any surplus material left over on the completion of a job should be promptly hand over to the storekeeper for safe and proper custody.**

Unless this is done, the surplus material may be misappropriated or misapplied to some purpose, other than that for which it was intended. The material cost of the job against which the excess material was originally drawn in that case, would be overstated, unless the job is given credit for the surplus arising thereon.

The surplus material, when it is returned to the storeroom, should be accompanied by a document known as a **Shop Credit Note or alternatively as a Stores Debit Note.** This document should be made out; by the department returning the surplus material and it should be in triplicate to be used as follows:



Format of a shop credit note may vary on the basis of industrial peculiarities, management information system (MIS) and accounting system in place.



2.8 VALUATION OF MATERIAL ISSUES

Materials issued from stores should be priced at the value at which they are carried in stock. But there can be a situation where the material may have been purchased at different times and at different prices with varying discounts, taxes etc. Because of this the problem arises as to how the material issues to production are to be valued. There are several methods for tackling this situation. The cost accountant

should select the proper method based on following factors:

1. The frequency of purchases, price fluctuations and its range.
2. The frequency of issue of materials, relative quantity etc.
3. Nature of cost accounting system.
4. The nature of business and the type of production process.
5. Management policy relating to the valuation of closing stock.

Several methods of pricing material issues have been evolved in an attempt to satisfactorily answer the problem. These methods may be grouped and explained as follows:

2.8.1 Cost Price Methods

(i) Specific Price Method: This method is useful, especially when **materials are purchased for a specific job or work order**, as such materials are **issued** subsequently to that specific job or work order **at the price at which they were purchased**.

To use this method, it is necessary to store each lot of material separately and maintain its separate account.

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> The cost of materials issued for production purposes to specific jobs represent actual and correct costs. 	<ul style="list-style-type: none"> This method is difficult to operate, specially when purchases and issues are numerous.
<ul style="list-style-type: none"> This method is best suited for non-standard and specific products. 	

(ii) First-in First-out (FIFO) method: It is a **method of pricing the issues of materials, in the order in which they are purchased**. In other words, the materials are issued in the order in which they arrive in the store or the items longest in stock are issued first. Thus each issue of material only recovers the purchase price which does not reflect the current market price.

This method is considered **suitable in times of falling price** because the material cost charged to production will be high while the replacement cost of materials will be low. But, in the case of rising prices, if this method is adopted, the charge to production will be low as compared to the replacement cost of materials.

Consequently, it would be difficult to purchase the same volume of material (as in the current period) in future without having additional capital resources.

Advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> It is simple to understand and easy to operate. 	<ul style="list-style-type: none"> If the prices fluctuate frequently, this method may lead to clerical error.
<ul style="list-style-type: none"> Material cost charged to production represents actual cost with which the cost of production should have been charged. 	<ul style="list-style-type: none"> Since each issue of material to production is related to a specific purchase price, the costs charged to the same job are likely to show a variation from period to period.
<ul style="list-style-type: none"> In the case of falling prices, the use of this method gives better results. 	<ul style="list-style-type: none"> In the case of rising prices, the real profits of the concern being low, while the profits in the books will appear high. This may lead to inability of the firm to meet the materials purchase demand at the current market price.
<ul style="list-style-type: none"> Closing stock of material will be represented very closely at current market price. 	

The application of FIFO method is illustrated below:

Material Received and Issued

Lot No.	Date	Quantity Kg.	Lot No.	Rate (₹)	Amount (₹)
1.	July 3	600		1.00	600.00
2.	July 13	800		1.20	960.00
3.	July 23	600		0.90	540.00
4.	August 5	400		1.10	440.00
5.	August 6	1200		0.80	960.00
	July 8		400 Kgs. out of (1)	1.00	400.00
	July 12		200 Kgs. out of (1)	1.00	200.00
	July 22		600 Kgs. out of (2)	1.20	720.00
	July 25		200 Kgs. out of (2)	1.20	240.00

			200 Kgs. out of (3)	0.90	180.00
	August 8		400 Kgs. out of (3)	0.90	360.00
			400 Kgs. out of (4)	1.10	440.00
			200 Kgs. out of (5)	0.80	160.00

The stock in hand after 8th August will be 1,000 kgs. This will be out of lot number (5) and its value will be ₹ 800, i.e., @ ₹ 0.80 per kg.

(iii) Last-in-First-out (LIFO) method: It is a method of pricing the issues of materials on the basis of assumption that the **items of the last batch (lot) purchased are the first to be issued**. Therefore, under this method the prices of the last batch (lot) are used for pricing the issues, until it is exhausted, and so on. If however, the quantity of issue is more than the quantity of the latest lot, then earlier (lot) and its price will also be taken into consideration.

During inflationary period or period of rising prices, the use of LIFO would help to ensure that the cost of production determined on the above basis is approximately the current one. This method is also useful specially when there is a feeling that due to the use of FIFO or average methods, the profits shown and tax paid are too high.

Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> The cost of materials issued will be either nearer to and or will reflect the current market price. Thus, the cost of goods produced will be related to the trend of the market price of materials. Such a trend in price of materials enables the matching of cost of production with current sales revenues. 	<ul style="list-style-type: none"> Calculation under LIFO system becomes complicated and cumbersome when frequent purchases are made at highly fluctuating rates.
<ul style="list-style-type: none"> The use of the method during the period of rising prices does not reflect undue high profit in the income statement as it was under the first-in-first-out or average method. In fact, the profit shown here is relatively lower because the cost of production takes 	<ul style="list-style-type: none"> Costs of different similar batches of production carried on at the same time may differ a great deal.

into account the rising trend of material prices.	
<ul style="list-style-type: none"> In the case of falling prices profit tends to rise due to lower material cost, yet the finished products appear to be more competitive and are at market price. 	<ul style="list-style-type: none"> In time of falling prices, there will be need for writing off stock value considerably to stick to the principle of stock valuation, i.e., the cost or the market price whichever is lower.
<ul style="list-style-type: none"> Over a period, the use of LIFO helps to iron out the fluctuations in profits. 	<ul style="list-style-type: none"> This method of valuation of material is not acceptable to the income tax authorities.
<ul style="list-style-type: none"> In the period of inflation LIFO will tend to show the correct profit and thus avoid paying undue taxes to some extent. 	

It may be noted that Last in First out (LIFO) is not permitted under Accounting Standard (AS)-2: Valuation of Inventories and Ind AS- 2: Inventories. However, for the purpose of academic knowledge LIFO method is included in this Study Material

ILLUSTRATION 12

The following transactions in respect of material Y occurred during the six months ended 30th June, 2020:

Month	Purchase (units)	Price per unit (₹)	Issued Units
January	200	25	Nil
February	300	24	250
March	425	26	300
April	475	23	550
May	500	25	800
June	600	20	400

Required:

- (a) *The Chief Accountant argues that the value of closing stock remains the same no matter which method of pricing of material issues is used. Do you agree? Why or why not? EXPLAIN. Detailed stores ledgers are not required.*
- (b) *STATE when and why would you recommend the LIFO method of pricing material issues?*

SOLUTION

(a) Total number of units purchased = 2,500

Total number of units issued = 2,300

The closing stock at the end of six months' period *i.e.*, on 30th June, 2020 will be 200 units

Upto the end of May 2020, total purchases coincide with the total issues *i.e.*, 1,900 units. It means that at the end of May 2020, there was no closing stock. In the month of June 2020, 600 units were purchased out of which 400 units were issued. Since there was only one purchase and one issue in the month of June, 2020 and there was no opening stock on 1st June 2020, the Closing Stock of 200 units is to be valued at ₹ 20 per unit.

In the view of this, the argument of the Chief Accountant appears to be correct. Where there is only one purchase and one issue in a month with no opening stock, the method of pricing of material issues becomes irrelevant. Therefore, in the given case one should agree with the argument of the Chief Accountant that the value of closing stock remains the **same** no matter which method of pricing the issue is used.

It may, however, be noted that the argument of Chief Accountant would not stand if one finds the value of the Closing Stock at the end of each month.

(b) LIFO method has an edge over FIFO or any other method of pricing material issues due to the following advantages:

- (i) The cost of the materials issued will be either nearer or will reflect the current market price. Thus, the cost of goods produced will be related to the trend of the market price of materials. Such a trend in price of materials enables the matching of cost of production with current sales revenues.
- (ii) The use of the method during the period of rising prices does not reflect undue high profit in the income statement, as it was under the first-in-first-

out or average method. In fact, the profit shown here is relatively lower because the cost of production takes into account the rising trend of material prices.

- (iii) In the case of falling prices, profit tends to rise due to lower material cost, yet the finished products appear to be more competitive and are at market price.
- (iv) During the period of inflation, LIFO will tend to show the correct profit and thus, avoid paying undue taxes to some extent.

ILLUSTRATION 13

The following information is provided by Sunrise Industries for the fortnight of April, 2020:

Material Exe:

Stock on 1-4-2020 100 units at ₹ 5 per unit.

Purchases

5-4-2020, 300 units at ₹ 6

8-4-2020, 500 units at ₹ 7

12-4-2020, 600 units at ₹ 8

Issues

6-4-2020, 250 units

10-4-2020, 400 units

14-4-2020, 500 units

Required:

- (A) *CALCULATE using FIFO and LIFO methods of pricing issues:*
 - (a) *the value of materials consumed during the period*
 - (b) *the value of stock of materials on 15-4-2020.*
- (B) *EXPLAIN why the figures in (a) and (b) in part A of this question are different under the two methods of pricing of material issues used. You need not draw up the Stores Ledgers.*

SOLUTION

- (A)** (a) Value of Material Exe consumed during the period
1-4-2020 to 15-4-2020 by using FIFO method.

Date	Description Units	Qty. (Units)	Rate (₹)	Amount (₹)
1-4-2020	Opening balance	100	5	500
5-4-2020	Purchased	300	6	1,800
6-4-2020	Issued	100	5	} 1,400
		150	6	
8-4-2020	Purchased	500	7	3,500
10-4-2020	Issued	150	6	} 2,650
		250	7	
12-4-2020	Purchased	600	8	4,800
14-4-2020	Issued	250	7	} 3,750
		250	8	
15-4-2020	Balance	350	8	2,800

Total value of material Exe consumed during the period under FIFO method comes to (₹ 1,400 + ₹ 2,650 + ₹ 3,750) ₹ 7,800 and balance on 15-4-2020 is of ₹ 2,800.

Value of material Exe consumed during the period 01-4-2020 to 15-4-2020 by using LIFO method

Date	Description	Qty. (Units)	Rate (₹)	Amount (₹)
1-4-2020	Opening balance	100	5	500
5-4-2020	Purchased	300	6	1,800
6-4-2020	Issued	250	6	1,500
8-4-2020	Purchased	500	7	3,500
10-4-2020	Issued	400	7	2,800
12-4-2020	Purchased	600	8	4,800
14-4-2020	Issued	500	8	4,000
15-4-2020	Balance	350	—	2,300*

Total value of material Exe issued under LIFO method comes to (₹ 1,500 + ₹ 2,800 + ₹ 4,000) ₹ 8,300.

*The balance 350 units on 15-4-2020 of ₹ 2,300, relates to opening balance on 1-4-2020 and purchases made on 5-4-2020, 8-4-2020 and 12-4-2020. (100 units @ ₹ 5, 50 units @ ₹ 6, 100 units @ ₹ 7 and 100 units @ ₹ 8).

(b) As shown in (a) above, the value of stock of materials on 15-4-2020:

Under FIFO method ₹ 2,800

Under LIFO method ₹ 2,300

(B) Total value of material Exe issued to production under FIFO and LIFO methods comes to ₹ 7,800 and ₹ 8,300 respectively. The value of closing stock of material Exe on 15-4-2020 under FIFO and LIFO methods comes to ₹ 2,800 and ₹ 2,300 respectively.

The reasons for the difference of ₹ 500 (₹ 8,300 – ₹ 7,800) as shown by the following table in the value of material Exe, issued to production under FIFO and LIFO is as follows:

Date	Quantity Issued	Value	Total	Value	Total
		FIFO		LIFO	
	(Units)	(₹)	(₹)	(₹)	(₹)
6 - 4-2020	250	1,400		1,500	
10-4-2020	400	2,650		2,800	
14-4-2020	500	3,750	7,800	4,000	8,300

1. On 6-4-2020, 250 units were issued to production. Under FIFO their value comes to ₹ 1,400 (100 units × ₹ 5 + 150 units × ₹ 6) and under LIFO ₹ 1,500 (250 × ₹ 6). Hence, ₹ 100 more was charged to production under LIFO.
2. On 10-4-2020, 400 units were issued to production. Under FIFO their value comes to ₹ 2,650 (150 × ₹ 6 + 250 × ₹ 7) and under LIFO ₹ 2,800 (400 × ₹ 7). Hence, ₹ 150 more was charged to production under LIFO.
3. On 14-4-2020, 500 units were issued to production. Under FIFO their value comes to ₹ 3,750 (250 × ₹ 7 + 250 × ₹ 8) and under LIFO ₹ 4,000 (500 × ₹ 8). Hence, ₹ 250 more was charged to production under LIFO.

Thus the total excess amount charged to production under LIFO comes to ₹ 500.

The reasons for the difference of ₹ 500 (₹ 2,800 – ₹ 2,300) in the value of 350 units of Closing Stock of material Exe under FIFO and LIFO are as follows:

1. In the case of FIFO, all the 350 units of the closing stock belongs to the purchase of material made on 12-4-2020, whereas under LIFO these units were from opening balance and purchases made on 5-4-2020, 8-4-2020 and 12-4-2020.
2. Due to different purchase price paid by the concern on different days of purchase, the value of closing stock differed under FIFO and LIFO. Under FIFO 350 units of closing stock were valued @ ₹ 8 p.u. Whereas under LIFO first 100 units were valued @ ₹ 5 p.u., next 50 units @ ₹ 6 p.u., next 100 units @ ₹ 7 p.u. and last 100 units @ ₹ 8 p.u.

Thus, under FIFO, the value of closing stock increased by ₹ 500.

(iv) Base Stock Method: Minimum quantity of stock under this method is **always held at a fixed price as reserve in the stock, to meet the state of emergency**, if it arises. This minimum stock is known as base stock and is valued at a price at which the first lot of materials is received and remains unaffected by subsequent price fluctuations.

This method of valuing inventory is different from other methods of valuing issues, as the base stock of materials are valued at the original cost, whereas, materials other than the base are valued using other methods like FIFO, LIFO etc. This method is not an independent method as it uses FIFO or LIFO.

Advantages and disadvantages of this method depend upon the use of the other method viz., FIFO or LIFO.

2.8.2 Average Price Methods

(i) **Simple Average Price Method:** Under this method, materials issued are valued at average price, which is calculated by dividing the total of rates at which different lot of materials are purchased by total number of lots. In this method quantity purchased in each lot is ignored. However, the price of stock of that lot which is completely sold out is not considered for taking average price.

Example - 1: During the month of April, a company has made five purchases as follows:

1st April, 200 units @ ₹10 each;

5th April, 150 units @ ₹12 each;

14th April, 210 units @ ₹12 each;

21st April, 50 units @ ₹15 each and

28th April, 140 units @ ₹ 11 each.

The issue price under Simple Average Price Method would be calculated as below:

$$\frac{₹10 + ₹12 + ₹12 + ₹15 + ₹11}{5 \text{ lots}} = ₹ 12 \text{ each}$$

This method is suitable when the materials are received in uniform lots of similar quantity, and prices do not fluctuate considerably.

Advantages and Disadvantages:

Advantages	Disadvantages
<ul style="list-style-type: none"> This method is simple to use for an entity which orders materials in a lot of standard quantity, as only price per lot is taken to calculate average price 	<ul style="list-style-type: none"> This method does not provide right stock valuation when standard quantity for purchase in a lot is not specified.
<ul style="list-style-type: none"> In a stable price environment, this method gives a price which approximates to the current market price. 	<ul style="list-style-type: none"> When price of materials fluctuates and the entity chooses to customise the order quantity, the price under this method may differ substantially from the current market price.

(ii) Weighted Average Price Method: Unlike Simple Average Price method, this method gives due weightage to quantities also. Under this method, issue price is calculated by dividing sum of products of price and quantity by total number quantities.

Example - 2: During the month of April, a company has made five purchases as follows:

1st April, 200 units @ ₹10 each;

5th April, 150 units @ ₹12 each;

14th April, 210 units @ ₹12 each;

21st April, 50 units @ ₹15 each and

28th April, 140 units @ ₹ 11 each.

The issue price under Weightage Average Price Method would be calculated as below:

$$\frac{\{(\text{₹}10 \times 200 \text{ units}) + (\text{₹}12 \times 150 \text{ units}) + (\text{₹}12 \times 210 \text{ units}) + (\text{₹}15 \times 50 \text{ units}) + (\text{₹}11 \times 140 \text{ units})\}}{(200 + 150 + 210 + 50 + 140) \text{ units}}$$

$$= \frac{\text{₹}8,610}{750 \text{ units}} = \text{₹}11.48 \text{ each}$$

This method is useful in case when quantity purchased under each lot is different and price fluctuates frequently.

Advantages and Disadvantages:

Advantages	Disadvantages
<ul style="list-style-type: none"> It smoothens the price fluctuations, if at all it is there, due to material purchases. 	<ul style="list-style-type: none"> Material cost does not represent actual cost price and therefore, a different profit or loss will arise out of such a pricing method.
<ul style="list-style-type: none"> Issue prices need not be calculated for each issue unless new lot of materials is received. 	<ul style="list-style-type: none"> It may be difficult to compute, since every time lot is received, it would require re-computation of issue prices.

2.8.3 Market Price Methods

(i) Replacement Price Method: Replacement price is defined as **the price at which it is possible to purchase an item, identical to that which is being replaced or revalued.** Under this method, materials issued are valued at the replacement cost of the items. This method pre-supposes the determination of the replacement cost of materials at the time of each issue; viz., the cost at which identical materials could be currently purchased. The **product cost under this method is at current market price**, which is the main objective of the replacement price method.

This method is useful to determine true cost of production and to value material issues in periods of rising prices, because the cost of material considered in cost of production would be able to replace the materials at the increased price.

(ii) Realisable Price Method: Realisable price means a **price at which the material to be issued can be sold in the market.** This price may be more or may be less than the cost price at which it was originally purchased. Like replacement price method, the stores ledger would show profit or loss in this method too.

2.8.4 Notional Price Methods

(i) Standard Price Method: Under this method, **materials are priced at some predetermined rate or standard price** irrespective of the actual purchase cost of the materials. Standard cost is usually fixed after taking into consideration the following factors:

- (i) Current prices,
- (ii) Anticipated market trends, and
- (iii) Discount available and transport charges etc.

Standard prices are fixed for each material and the requisitions are priced at the standard price. This method is useful for controlling material cost and determining the efficiency of purchase department. In the case of highly fluctuating prices of materials, it is difficult to fix their standard cost on long-term basis.

Advantages	Disadvantages
<ul style="list-style-type: none"> The use of the standard price method simplifies the task of valuing issues of materials. 	<ul style="list-style-type: none"> The use of standard price does not reflect the market price and thus results in a different or incorrect profit or loss.
<ul style="list-style-type: none"> It facilitates the control of material cost and the task of judging the efficiency of purchase department. 	<ul style="list-style-type: none"> The fixation of standard price becomes difficult when prices fluctuate frequently
<ul style="list-style-type: none"> It reduces the clerical work. 	

(ii) Inflated Price Method: In case material suffers loss in weight due to natural or climatic factors, e.g., evaporation, the issue price of the material is inflated to cover up the losses.

(iii) Re-use Price Method: When materials are rejected and returned to the stores or a processed material is put to some other use, other than for the purpose it is meant, then such materials are priced at a rate quite different from the price paid for them originally. There is no final procedure for valuing use of material.



2.9 VALUATION OF RETURNS & SHORTAGES

2.9.1 Valuation of Materials Returned to the Vendor

Generally, materials are checked for quality, before dispatching to the store; and if any issues arise such as not meeting the quality requirements or any specification or are considered unfit for production due to any reason, due notice is made and materials are returned to the vendor. However, even if any substandard quality is noticed, before or after reaching the store, such materials can also be returned to the vendor.

The price of the materials to be returned to the vendor should include its invoice price plus freight, receiving and handling charges etc. *Strictly speaking, the materials returned to the vendor should be returned at the stores ledger price and not at invoice price.* But in practice, only invoice price is considered and the gap between the invoice price and stores ledger price is charged as overhead. In stores ledger, the defective or sub-standard materials are shown in the issue column at the rate shown in the ledger, and the difference between issue price and invoice cost is debited to an inventory adjustment account.

2.9.2 Valuation of Materials Returned to Stores

When materials requisitioned for a specific job or work-in progress are found to be in excess of the requirement or are unsuitable for the purpose, they are returned to the stores. There are two ways of treating such returns.

- (1) Such returns are entered in the receipt column at the price at which they were originally issued, and the materials are kept in suspense account, to be issued at the same price, against the next requisition.
- (2) Include the materials in stock, as if they were fresh purchases at the original issue price.

2.9.3 Valuation of Shortages during Physical Verification

Materials found short during physical verification should be entered in the issue column and valued at the rate as per the method adopted, i.e., FIFO or any other.

ILLUSTRATION 14:

Arnav Electronics manufactures electronic home appliances. It follows weighted average Cost method for inventory valuation. Following are the data of component X:

Date	Particulars	Units	Rate per unit (₹)
15-12-19	Purchase Order- 008	10,000	9,930
30-12-19	Purchase Order- 009	10,000	9,780
01-01-20	Opening stock	3,500	9,810
05-01-20	GRN*-008 (against the Purchase Order- 008)	10,000	-
05-01-20	MRN**-003 (against the Purchase Order- 008)	500	-
06-01-20	Material Requisition-011	3,000	-
07-01-20	Purchase Order- 010	10,000	9,750
10-01-20	Material Requisition-012	4,500	-
12-01-20	GRN-009 (against the Purchase Order- 009)	10,000	-
13-01-20	MRN-004 (against the Purchase Order- 009)	400	-
15-01-20	Material Requisition-013	2,200	-
24-01-20	Material Requisition-014	1,500	-
25-01-20	GRN-010 (against the Purchase Order- 010)	10,000	-
28-01-20	Material Requisition-015	4,000	-
31-01-20	Material Requisition-016	3,200	-

*GRN- Goods Received Note; **MRN- Material Returned Note

Based on the above data, you are required to CALCULATE:

- (i) Re-order level
- (ii) Maximum stock level
- (iii) Minimum stock level
- (iv) PREPARE Store Ledger for the period January 2020 and DETERMINE the value of stock as on 31-01-2020.
- (v) Value of components used during the month of January, 2020.
- (vi) Inventory turnover ratio.

SOLUTION

1. Workings:

Consumption is calculated on the basis of material requisitions:

Maximum component usage = 4,500 units (Material requisition on 10-01-20)

Minimum component usage = 1,500 units (Material requisition on 24-01-20)

Lead time is calculated from purchase order date to material received date

Maximum lead time = 21 days (15-12-2019 to 05-01-2020)

Minimum lead time = 14 days (30-12-2019 to 13-01-2020)
2. Reorder quantity (observed) = 10,000 units

Date	Material Requisition number	Units
06-01-2020	11	3,000
10-01-2020	12	4,500 (Maximum)
15-01-2020	13	2,200
24-01-2020	14	1,500 (Minimum)
28-01-2020	15	4,000
31-01-2020	16	3,200

Calculations:

(i) Re-order level

= Maximum usage × Maximum lead time

= 4,500 units × 21 days = 94,500 units

(ii) Maximum stock level

= Re-order level + Re-order Quantity – (Min. Usage × Min. lead time)

= 94,500 units + 10,000 units – (1,500 units × 14 days)

= 1,04,500 units – 21,000 units = 83,500 units

(iii) Minimum stock level

= Re-order level – (Avg. consumption × Avg. lead time)

= 94,500 units – (3,000 units × 17.5 days)

= 94,500 units – 52,500 units

= 42,000 units

(iv) Store Ledger for the month of January 2020: (Weighted Average Method)

Date	Receipts				Issue				Balance		
	GRN/ MRN	Units	Rate	Amt. (‘000)	MRN / MR	Units	Rate	Amt. (‘000)	Units	Rate	Amt. (‘000)
01-01-20	-	-	-	-	-	-	-	-	3,500	9,810	34,335
05-01-20	008	10,000	9,930	99,300	003	500	9,930	4,965	13,000	9,898	1,28,670
06-01-20	-	-	-	-	011	3,000	9,898	29,694	10,000	9,898	98,980
10-01-20	-	-	-	-	012	4,500	9,898	44,541	5,500	9,898	54,439
12-01-20	009	10,000	9,780	97,800	004	400	9,780	3,912	15,100	9,823	1,48,327
15-01-20	-	-	-	-	013	2,200	9,823	21,611	12,900	9,823	1,26,716
24-01-20	-	-	-	-	014	1,500	9,823	14,734	11,400	9,823	1,11,982
25-01-20	010	10,000	9,750	97,500	-	-	-	-	21,400	9,789	2,09,482
28-01-20	-	-	-	-	015	4,000	9,789	39,156	17,400	9,789	1,70,326
31-01-20	-	-	-	-	016	3,200	9,789	31,325	14,200	9,789	1,39,001

[Note: Decimal figures may be rounded-off to the nearest rupee value wherever required)

Value of 14,200 units of stock as on 31-01-2020 (‘000) = ₹1,39,001

(v) Value of components used during the month of January 2020:

Sum of material requisitions 011 to 016 (‘000)

= ₹ 29,694 + ₹ 44,541 + ₹ 21,611 + ₹ 14,734 + ₹ 39,156 + ₹ 31,325

= ₹ 1,81,061

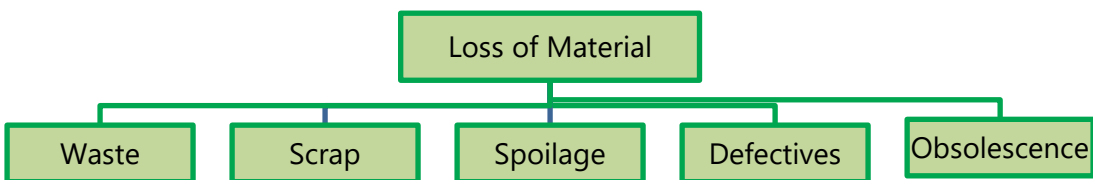
(vi) Inventory Turnover Ratio

$$= \frac{\text{Value of materials used}}{\text{Average stock value}} = \frac{1,81,061}{(1,39,001 + 34,335) / 2} = \frac{1,81,061}{86,668} = 2.09$$



2.10 TREATMENT OF NORMAL AND ABNORMAL LOSS OF MATERIALS

Loss of materials during handling, storage, process may occur any of the following forms:



(i) **Waste:** The portion of raw material which is lost during storage or production and discarded. The waste may or may not have any value.

Treatment of Waste

Normal- Cost of normal waste is absorbed by good production units.

Abnormal- The cost of abnormal loss is transferred to Costing Profit and loss account.

(ii) **Scrap:** The materials which are discarded and disposed-off without further treatment. Generally, scrap has either no value or insignificant value. Sometimes, it may be reintroduced into the process as raw material.

Treatment of Scrap

Normal- The cost of scrap is borne by good units and income arises on account of realisable value is deducted from the cost.

Abnormal- The scrap account should be charged with full cost. The credit is given to the job or process concerned. The profit or loss in the scrap account, on realisation, will be transferred to the Costing Profit and Loss Account.

(iii) **Spoilage:** It is the term used for materials which are badly damaged in manufacturing operations, and they cannot be rectified economically and hence taken out of the process to be disposed off in some manner without further processing.

Treatment of Spoilage

Normal- Normal spoilage (i.e., which is inherent in the operation) costs are included in costs, either by charging the loss due to spoilage to the production

order or by charging it to the production overhead so that it is spread over all the products.

Any value realised from spoilage is credited to production order or production overhead account, as the case may be.

Abnormal- The cost of abnormal spoilage (i.e., arising out of causes not inherent in manufacturing process) is charged to the Costing Profit and Loss Account. When spoiled work is the result of rigid specification, the cost of spoiled work is absorbed by good production while the cost of disposal is charged to production overhead.

(iv) Defectives: It signifies those units or portions of production which do not meet the quality standards. Defectives arise due to sub-standard materials, bad-supervision, bad-planning, poor workmanship, inadequate-equipment and careless inspection.

The defectives which can be re-made as per the quality standard by using additional materials are known as reworks. Reworks include repairs, reconditioning and refurbishing.

Defectives which cannot be brought up to the quality standards are known as rejects. The rejects may either be disposed- off or re-cycled for production process.

Treatment of Defectives:

Normal- An amount equal to the cost less realisable value on sale of defectives are charged to material cost of good production.

Abnormal- Material Cost of abnormal defectives are not included in material cost but treated as loss after giving credit to the realisable value of such defectives. The material cost of abnormal loss is transferred to costing profit and loss account.

Reclamation of loss from defective units

In the case of articles that have been spoiled, it is necessary to take steps to reclaim as much of the loss as possible. For this purpose:

- (i) All defective units should be sent to a place fixed for the purpose;
- (ii) These should be dismantled;
- (iii) Goods and serviceable parts should be separated and taken back into the stock;
- (iv) Parts which can be made serviceable by further work should be separated and sent to the workshop for the purpose and taken into stock after the defects have been removed; and

- (v) Parts which cannot be made serviceable should be collected in one place for being melted or sold off.

Printed forms should be used to record quantities for all purposes aforementioned.

Difference between Waste and Scrap

Waste	Scrap
1. It is connected with raw material or inputs to the production process.	1. It is the loss connected with the output
2. Waste of materials may be visible or invisible.	2. Scraps are generally identifiable and has physical substance.
3. Generally waste has no recoverable value.	3. Scraps are termed as by-products and has small recoverable value.

Difference between Scrap and Defectives

Scrap	Defectives
1. It is the loss connected with the output	1. This type of loss is connected with the output as well as the input .
2. Scraps are not intended but cannot be eliminated due to the nature of material or process itself.	2. Defectives also are not intended but can be eliminated through a proper control system.
3. Generally scraps are not used or rectified.	3. Defectives can be used after rectification.
4. Scraps have insignificant recoverable value.	4. Defectives are sold at a lower value from that of the good one.

Distinction between Spoilage and Defectives: The difference between spoilage and defectives is that while spoilage cannot be repaired or reconditioned, defectives can be rectified and transferred, either back to the standard production or to the seconds.

The problem of accounting for defective work is in relation to the costs of rectification or rework.

(v) Obsolescence: Obsolescence is defined as "the loss in the intrinsic value of an asset due to its supersession". In simple words, obsolescence refers to the loss in the value of an asset due to technological advancements.

Treatment: Materials may become obsolete under any of the following circumstances:

- (i) where it is a spare part or a component of a machinery that is used in manufacturing and is now obsolete;
- (ii) where it is used in the manufacturing of a product which has now become obsolete;
- (iii) where the material itself is replaced by another material due to either improved quality or fall in price.

In all the three cases, the value of the obsolete material held in stock is a total loss and immediate steps should be taken to dispose it off at the best available price. The loss arising out of obsolete materials is an abnormal loss and it does not form part of the cost of manufacture.



2.11 CONSUMPTION OF MATERIALS

Any product that is manufactured in a firm entails consumption of resources like material, labour etc. The management for planning and control must know the cost of using these resources in manufacturing process. The consumption of materials takes place when it is used in the manufacturing of the product.

It is important to note that the amount of materials consumed in a period by a cost object need not be equal to the amount of material available with the concern. For example, during any period, the total of raw material stock available for use in production may not be equal to the amount of materials actually consumed and assigned to the cost object of the production. The difference between the material available and material consumed represents the surplus stock or stock of material at the end of the period.

2.11.1 Identification of Materials

For the identification of consumption of materials with products of cost centres the followings points should be noted:

1. It is required that the concern should follow **coding system** for all materials, so that each material is identified by unique code number.
2. It is required that **each product of a cost centre should be given a unique code number** so that the direct material issued for production of particular product of a cost centre can be collected against the code number of that product.

However, it may not be possible to allocate all materials directly to individual product of a cost centre e.g. maintenance materials, inspection and testing materials etc. The consumption of these materials are collected for cost centre and then charged to individual product by adopting suitable overhead absorption rate of cost centre.

$$\text{Overhead absorption rate of cost centre} = \frac{\text{Cost for cost centre}}{\text{Base relating to cost centre}} \\ (\text{e.g. labour hrs. or machine hrs.})$$

3. Each issue of materials should be recorded. One way of doing this is to use a material requisition note. This note shows the details of materials issued for the product of cost centre or the cost centre which is to be charged with cost of materials.
4. A material return note is required for recording the excess materials returned to the store. This note is required to ensure that original product of cost centre is credited with the cost of material which was not used and that the stock records are updated.
5. A material transfer note is required for recording the transfer of materials from one product of cost centre to other or from one cost centre to other cost centre.
6. The cost of materials issued would be determined according to stock valuation method used.

2.11.2 Monitoring Consumption of Materials

For monitoring consumption of materials, a storekeeper should periodically analyse the various material requisitions, material return notes and material transfer notes. Based on this analysis, a **material abstracts or material issue analysis sheet is prepared**, which shows at a glance the value of material consumed in manufacturing each product. This statement is also useful for ascertaining the cost of material issued for each product.

Format of Material Abstract

Week Ending.....

Material requisition or Transfer Note or Returned Note No.	Amount (₹)	Product Nos.						Total for Product	Overheads (Indirect Material charged)
		101	102	103	104	105	106		
		(₹)	(₹)	(₹)	(₹)	(₹)	(₹)		(₹)
	—	—	—	—	—	—	—	—	—
Total									

The material abstract statement serves a useful purpose. It, in fact, shows the amount of material to be debited to various products & overheads. The total amount of stores debited to various products & overheads should be the same as the total value of stores issued in any period.

2.11.3. Basis for consumption entries in Financial Accounts

Every manufacturing organisation assigns material costs to the products for two purposes.

Firstly, for external financial accounting requirements, in order to allocate the material costs incurred during the period between cost of goods produced and inventories; **secondly to provide useful information for managerial decision making** requirements. In order to meet external financial accounting requirements, it may not be necessary to accurately trace material costs to individual products.

Some products costs may be overstated and others may be understated. But this may not matter for financial accounting purposes, as long as total of individual materials costs transactions are recorded i.e., transactions between cost centre within the firm are recorded in a manner that facilitates analysis of costs for assigning them to cost units.

The consumption entries in financial accounts are made on the basis of total cost of purchases of materials after adjustment for opening and closing stock of materials.

Following equation is applicable here:

Consumption of Materials = Opening Stock of material + Purchases – Closing Stock of materials

The stock of materials is taken at cost or net realisable value, whichever is less.

SUMMARY

- ◆ **Material Control:** It is the systematic control over the procurement, storage and usage of materials to maintain even flow of materials and avoiding at the same time excessive investment in inventories.
- ◆ **Material Requisition Note:** Document used to authorize and record the issue of materials from store.
- ◆ **Purchase Requisition Note:** Document is prepared by the storekeeper to initiate the process of purchases.
- ◆ **Purchase Order:** It is a written request to the supplier to supply certain specified materials at specified rates and within a specified period.
- ◆ **Goods Received Note:** This document is prepared by receiving department which unpacks the goods received and verify the quantities and other details.
- ◆ **Material Transfer Note:** This document is prepared when the material is transferred from one department to another.
- ◆ **Material Return Note:** It is a document given with the goods being returned from factory back to the stores.
- ◆ **Bin Card:** A prime entry record of the quantity of stocks, kept on in/out/balance, held in designated storage areas.
- ◆ **Stores Ledger:** A ledger containing a separate account for each item of material and component stocked in store giving details of the receipts, issues and balance both in terms of quantity and value.
- ◆ **Minimum Level:** It is the minimum quantity, which must be retained in stock
$$ROL - (Avg. \text{ consumption} \times Avg. \text{ Lead time})$$
- ◆ **Maximum Level:** It is the maximum limit up to which stock can be stored at any time
$$ROL + ROQ - (\text{Min consumption} \times \text{Min Lead Time})$$
- ◆ **Re order Level:** It is the level at which new order needs to be placed

Maximum lead time × Maximum Usage

Or

Minimum level + (Average rate of consumption × Average time to obtain fresh supplies).

- ♦ **Average Inventory Level** = Minimum level + $\frac{1}{2}$ Re-order quantity

Or

$$= \frac{\text{Maximum level} + \text{Minimum level}}{2}$$

- ♦ **Danger Level:** The level where normal issue of materials is stopped, and only emergency materials are issued.

Danger level = Average consumption × Lead time for emergency purchases.

- ♦ **Stock-out** = Stock out is said to be occurred when an inventory item could not be supplied due to insufficient stock in the store.

- ♦ **Just-in-time (JIT) Inventory management** = JIT is a system of inventory management with an approach to have a zero inventories in stores. According to this approach material should only be purchased when it is actually required for production.

- ♦ **ABC analysis** :Items are classified into the following categories:

A Category: Quantity less than 10 % but value more than 70 %

B Category: Quantity less than 20 % but value about 20 %

C Category: Quantity about 70 % but value less than 10%

- ♦ **Fast Moving, Slow Moving and Non Moving (FSN) Inventory:** Under this system, inventories are controlled by classifying them on the basis of frequency of usage.
- ♦ **Vital, Essential and Desirable (VED):** Under this system of inventory analysis, inventories are classified on the basis of its criticality for the production function and final product.
- ♦ **High Cost, Medium Cost, Low Cost (HML) Inventory:** Under this system, inventory is classified on the basis of the cost of an individual item, unlike ABC analysis where inventories are classified on the basis of overall value of inventory.
- ♦ **Two bin system:** If one bin items exhausts, new order is placed and in the mean time, quantity from the smaller bin is used or issued.

- ◆ **First-in First-out method:** The materials received first are to be issued first when material requisition is received. Materials left as closing stock will be at the price of the latest purchases.
- ◆ **Last-in First-out method:** The materials purchased last are to be issued first when material requisition is received. Closing stock is valued at the oldest available stock price.
- ◆ **Simple Average Method:** Material Issue Price
$$= \frac{\text{Total of unit price of each purchase}}{\text{Total number of Purchases}}$$
- ◆ **Weighted Average Price Method:** This method gives due weightage to quantities purchased and the purchase price to determine the issue price.
$$\text{Weighted Average Price} = \frac{\text{Total cost of material in stock}}{\text{Total quantity of materials}}$$
- ◆ **Various Material Losses**
 - (a) Wastage: Portion of basic raw material lost in processing, having no recoverable value
 - (b) Scrap: The incidental material residue coming out of certain manufacturing operations, having low recoverable value.
 - (c) Spoilage: Goods damaged beyond rectification, to be sold off without further processing.
- ◆ **Defectives:** Goods which can be rectified and turned out as good units by the application of additional labour or other services.

TEST YOUR KNOWLEDGE

MCQs based Questions

1. Direct material can be classified as
 - (a) Fixed cost
 - (b) Variable cost
 - (c) Semi-variable cost.
 - (d) Prime Cost
2. In most of the industries, the most important element of cost is

- (a) Material
 - (b) Labour
 - (c) Overheads
 - (d) Administration Cost
3. Which of the following is considered to be the normal loss of materials?
- (a) Loss due to accidents
 - (b) Pilferage
 - (c) Loss due to breaking the bulk
 - (d) Loss due to careless handling of materials.
4. In which of following methods of pricing, costs lag behind the current economic values?
- (a) Last-in-first out price
 - (b) First-in-first out price
 - (c) Replacement price
 - (d) Weighted average price
5. Continuous stock taking is a part of
- (a) Annual stock taking
 - (b) Perpetual inventory
 - (c) ABC analysis.
 - (d) Bin Cards
6. In which of the following methods, issues of materials are priced at pre-determined rate?
- (a) Inflated price method
 - (b) Standard price method
 - (c) Replacement price method
 - (d) Market price method.
7. When material prices fluctuate widely, the method of pricing that gives absurd results is

- (a) Simple average price
 - (b) Weighted average price
 - (c) Moving average price
 - (d) Inflated price.
8. When prices fluctuate widely, the method that will smooth out the effect of fluctuations is
- (a) Simple average
 - (b) Weighted average
 - (c) FIFO
 - (d) LIFO
9. Under the FSN system of inventory control, inventory is classified on the basis of:
- (a) Volume of material consumption
 - (d) Frequency of usage of items of inventory
 - (c) Criticality of the item of inventory for production
 - (d) Value of items of inventory
10. Materials are issued to and from one process to another, on the basis of:
- (a) Material Transfer Note
 - (b) Material Requisition Note
 - (c) Bill of Materials
 - (d) Purchase Requisition Note

Theoretical Questions

1. STATE how normal and abnormal loss of material arising during storage are treated in Cost Accounts?
2. DISTINGUISH clearly between Bin cards and Stores Ledger.
3. DISCUSS the accounting treatment of defectives in Cost Accounts.
4. EXPLAIN the concept of "ABC Analysis" as a technique of inventory control.
5. DISTINGUISH between Re-order level and Re-order quantity.

6. EXPLAIN how is slow moving and non-moving item of stores detected and what steps are necessary to reduce such stocks?
7. Write short notes on any three of the following:
 - (i) Danger Level
 - (ii) Just in Time Inventory Management
 - (iii) Maximum stock level and Minimum Stock level
 - (iv) Obsolescence

Practical Problems

1. Anil & Company buys its annual requirement of 36,000 units in 6 instalments. Each unit costs ₹ 1 and the ordering cost is ₹25. The inventory carrying cost is estimated at 20% of unit value. FIND the total annual cost of the existing inventory policy. CALCULATE, how much money can be saved by Economic Order Quantity?
2. A Company manufactures a special product which requires a component 'Alpha'. The following particulars are collected for the year 2020:
 - (i) Annual demand of Alpha 8,000 units
 - (ii) Cost of placing an order ₹ 200 per order
 - (iii) Cost per unit of Alpha ₹ 400
 - (iv) Carrying cost p.a. 20%

The company has been offered a quantity discount of 4 % on the purchase of 'Alpha' provided the order size is 4,000 components at a time.

Required:

- (i) COMPUTE the economic order quantity
- (ii) STATE whether the quantity discount offer can be accepted.
3. The complete Gardener is deciding on the economic order quantity for two brands of lawn fertilizer - Super Grow and Nature's Own. The following information is collected:

	FERTILIZER	
	Super Grow	Nature's Own
Annual demand	2,000 bags	1,280 bags

Relevant ordering cost per purchase order	₹ 1,200	₹ 1,400
Annual relevant carrying cost per bag	₹ 480	₹ 560

Required:

- (i) COMPUTE EOQ for Super Grow and Nature's own.
 - (ii) For the EOQ, WHAT is the sum of the total annual relevant ordering costs and total annual relevant carrying costs for Super Grow and Nature's own?
 - (iii) For the EOQ, COMPUTE the number of deliveries per year for Super Grow and Nature's own.
4. A Company uses three raw materials A, B and C for a particular product for which the following data apply:

Raw Material	Usage per unit of Product (Kgs.)	Re-order quantity (Kgs.)	Price per Kg.	Delivery period (in weeks)			Re-order level (Kgs)	Minimum level (Kgs.)
				Minimum	Average	Maximum		
A	10	10,000	10	1	2	3	8,000	?
B	4	5,000	30	3	4	5	4,750	?
C	6	10,000	15	2	3	4	?	2,000

Weekly production varies from 175 to 225 units, averaging 200 units of the said product. COMPUTE the following quantities:

- (i) Minimum stock of A,
 - (ii) Maximum stock of B,
 - (iii) Re-order level of C,
 - (iv) Average stock level of A.
5. (a) EXE Limited has received an offer of quantity discounts on its order of materials as under:

Price per ton (₹)	Ton (Nos.)
1,200	Less than 500
1,180	500 and less than 1,000

1,160	1,000 and less than 2,000
1,140	2,000 and less than 3,000
1,120	3,000 and above.

The annual requirement for the material is 5,000 tons. The ordering cost per order is ₹ 1,200 and the stock holding cost is estimated at 20% of material cost per annum. You are required to COMPUTE the most economical purchase level.

- (b) WHAT will be your answer to the above question if there are no discounts offered and the price per ton is ₹ 1,500?

6. From the details given below, CALCULATE:

- (i) Re-ordering level
- (ii) Maximum level
- (iii) Minimum level
- (iv) Danger level.

Re-ordering quantity is to be calculated on the basis of following information:

Cost of placing a purchase order is ₹ 4,000

Number of units to be purchased during the year is 5,00,000

Purchase price per unit, inclusive of transportation cost is ₹ 50

Annual cost of storage per unit is ₹ 10.

Details of lead time: Average- 10 days, Maximum- 15 days, Minimum- 5 days,
for emergency purchases- 4 days.

Rate of consumption: Average: 1,500 units per day,
Maximum: 2,000 units per day.

7. G. Ltd. produces a product which has a monthly demand of 4,000 units. The product requires a component X which is purchased at ₹ 20. For every finished product, one unit of component is required. The ordering cost is ₹ 120 per order and the holding cost is 10% p.a.

You are required to CALCULATE:

- (i) Economic order quantity.
- (ii) If the minimum lot size to be supplied is 4,000 units, what is the extra

cost, the company has to incur?

(iii) What is the minimum carrying cost, the company has to incur?

8. 'AT' Ltd. furnishes the following store transactions for September, 2020:

1-9-20	Opening balance	25 units value ₹ 162.50
4-9-20	Issues Req. No. 85	8 units
6-9-20	Receipts from B & Co. GRN No. 26	50 units @ ₹ 5.75 per unit
7-9-20	Issues Req. No. 97	12 units
10-9-20	Return to B & Co.	10 units
12-9-20	Issues Req. No. 108	15 units
13-9-20	Issues Req. No. 110	20 units
15-9-20	Receipts from M & Co. GRN. No. 33	25 units @ ₹ 6.10 per unit
17-9-20	Issues Req. No. 121	10 units
19-9-20	Received replacement from B & Co. GRN No. 38	10 units
20-9-20	Returned from department, material of M & Co. MRR No. 4	5 units
22-9-20	Transfer from Job 182 to Job 187 in the dept. MTR 6	5 units
26-9-20	Issues Req. No. 146	10 units
29-9-20	Transfer from Dept. "A" to Dept. "B" MTR 10	5 units
30-9-20	Shortage in stock taking	2 units

PREPARE the priced stores ledger on FIFO method and STATE how would you treat the shortage in stock taking.

9. The following information is extracted from the Stores Ledger:

Material X

Opening Stock Nil

Purchases:

Jan. 1	100 @ ₹ 1 per unit
Jan. 20	100 @ ₹ 2 per unit

Issues:

Jan. 22	60 for Job W 16
Jan. 23	60 for Job W 17

Complete the receipts and issues valuation by adopting the First-In-First-Out, Last-In-First-Out and the Weighted Average Method. TABULATE the values allocated to Job W 16, Job W 17 and the closing stock under the methods aforesaid and discuss from different points of view which method you would prefer.

ANSWERS/SOLUTIONS

Answers to the MCQs based Questions

1. (b) 2. (a) 3. (c) 4. (b) 5. (b) 6. (b)
 7. (a) 8. (b) 9. (b) 10. (b)

Answers to the Theoretical Questions

- Please refer paragraph 2.10
- Please refer paragraph 2.5
- Please refer paragraph 2.10
- Please refer paragraph 2.6.4
- Please refer paragraph 2.6.1
- Please refer paragraph 2.6.4
- Please refer paragraph 2.6.1, 2.6.3, 2.6.1, 2.10

Answers to the Practical Problems

1. (a) **Total Annual Cost in Existing Inventory Policy**

	(₹)
Ordering cost (6 orders @ ₹ 25)	150
Carrying cost of average inventory $(36,000 \div 6) = 6,000$ units per order	
Average inventory = 3,000 units	

Carrying cost = 20% of ₹1 × 3,000 = 3,000 × 0.20 600

Total cost **A** 750

(b) **Total Annual Cost in E.O.Q**

$$EOQ = \sqrt{\frac{2 \times 36,000 \times 25}{\text{₹}1 \times 20\%}} = 3000 \text{ units}$$

(₹)

No. of orders = 36,000 ÷ 3,000 units = 12 orders

Ordering cost (12 × ₹ 25) = 300

Carrying cost of average inventory (3,000 × 0.20) ÷ 2 = 300

Total Cost **B** 600

Savings due to E.O.Q ₹ (750 – 600) (A – B) 150

Note: As the units purchase cost of ₹ 1 does not change in both the computation, the same has not been considered to arrive at total cost of inventory for the purpose of savings.

2. (i) Calculation of Economic Order Quantity

$$EOQ = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 8,000 \text{ units} \times \text{₹}200}{\text{₹}400 \times 20/100}} = \mathbf{200 \text{ units}}$$

(ii) Evaluation of Profitability of Different Options of Order Quantity

(a) When EOQ is ordered

		(₹)
Purchase Cost	(8,000 units × ₹ 400)	32,00,000
Ordering Cost	[(8,000 units/200 units) × ₹ 200]	8,000
Carrying Cost	(200 units × ₹400 × 1/2 × 20/100)	8,000
Total Cost		32,16,000

(b) When Quantity Discount is accepted

		(₹)
Purchase Cost	(8,000 units × ₹ 384*)	30,72,000
Ordering Cost	[(8,000 units/4000 units) × ₹ 200]	400
Carrying Cost	(4000 units × ₹ 384 × 1/2 × 20/100)	1,53,600
Total Cost		32,26,000

*Unit Cost ₹400

Less Quantity Discount @ 4% = 16

Purchase Cost = 400 - 16 = ₹384

Advise – The total cost of inventory is lower if EOQ is adopted. Hence, the company is advised not to accept the quantity discount.

$$3. \quad EOQ = \sqrt{\frac{2AO}{C}}$$

Where,

A = Annual Demand

O = Ordering cost per order

C = Inventory carrying cost per unit per annum

(i) Calculation of EOQ

Super Grow	Nature's Own
$EOQ = \sqrt{\frac{2 \times 2,000 \times 1,200}{480}}$ $= \sqrt{10,000} \text{ or } 100 \text{ bags}$	$EOQ = \sqrt{\frac{2 \times 1,280 \times 1,400}{560}}$ $= \sqrt{6,400} \text{ or } 80 \text{ bags}$

(ii) Total annual relevant cost = Total annual relevant ordering costs + Total annual relevant carrying cost

	Super Grow	Nature's Own
Number of Orders = Annual Requirement ÷ EOQ	= 2,000/100 = 20 orders	= 1,280/80 = 16 orders
Ordering Cost	20 × 1200 = ₹ 24000	16 × 1400 = ₹ 22,400
Carrying Cost	$\frac{1}{2} \times 100 \times 480 =$ ₹ 24,000	$\frac{1}{2} \times 80 \times 560 =$ ₹ 22,400
Total of Ordering and Carrying Cost	= ₹ 24,000 + ₹ 24,000 = ₹ 48,000	₹ 22,400 + ₹ 22,400 = ₹ 44,800

- (iii) Number of deliveries for Super Grow and Nature's own fertilizer per year = $\frac{\text{Annual demand for fertilizer bags}}{\text{EOQ}}$

Super Grow	Nature's Own
$= \frac{2,000 \text{ bags}}{100 \text{ bags}} = 20 \text{ orders}$	$= \frac{1,280 \text{ bags}}{80 \text{ bags}} = 16 \text{ orders.}$

4. (i) **Minimum stock of A**

Re-order level – (Average rate of consumption × Average time required to obtain fresh delivery)

$$= 8,000 - (200 \times 10 \times 2) = \mathbf{4,000 \text{ kgs.}}$$

(ii) **Maximum stock of B**

Re-order level + Re-order quantity – (Minimum consumption × Minimum delivery period)

$$= 4,750 + 5,000 - (175 \times 4 \times 3)$$

$$= 9,750 - 2,100 = \mathbf{7,650 \text{ kgs.}}$$

(iii) **Re-order level of C**

Maximum delivery period × Maximum usage

$$= 4 \times 225 \times 6 = 5,400 \text{ kgs.}$$

OR

Re-order level of C

= Minimum level of C + [Average rate of consumption × Average time required to obtain fresh delivery]

$$= 2,000 + [(200 \times 6) \times 3] \text{ kgs} = \mathbf{5,600 \text{ kgs.}}$$

(iv) **Average stock level of A**

= Minimum stock level of A + $\frac{1}{2}$ Re-order quantity of A

$$= 4,000 + \frac{1}{2} \times 10,000 = 4,000 + 5,000 = \mathbf{9,000 \text{ kgs}}$$

OR

Average Stock level of A

$$\frac{\text{Minimum stock level of A} + \text{Maximum stock level of A}}{2} \quad (\text{Refer to working note})$$

$$\frac{4,000 + 16,250}{2} = 10,125 \text{ kgs}$$

Working note:

$$\begin{aligned} \text{Maximum stock of A} &= \text{ROL} + \text{ROQ} - (\text{Minimum consumption} \times \text{Minimum re-order period}) \\ &= 8,000 + 10,000 - [(175 \times 10) \times 1] = 16,250 \text{ kgs} \end{aligned}$$

5. (a)

Total annual requirement (A)	Order size (Tonne) (q)	No. of orders A/q	Cost of inventory A × Per tonne cost (₹)	Ordering cost A/q × ₹ 1200 (₹)	Carrying cost p.t. p.a $\frac{1}{2} \times q \times 20\% \text{ of cost p.t. (₹)}$	Total Cost (4+5+6) (₹)
1	2	3	4	5	6	7
5,000 Ton	400	12.5 (13)*	60,00,000 (5,000 × ₹ 1200)	15,600	48,000 (200 × ₹ 240)	60,63,600
	500	10	59,00,000 (5,000 × ₹ 1180)	12,000	59,000 (250 × ₹ 236)	59,71,000
	1,000	5	58,00,000 (5,000 × ₹ 1160)	6,000	1,16,000 (500 × ₹ 232)	59,22,000
	2,000	2.5 (3)*	57,00,000 (5,000 × ₹ 1140)	3,600	2,28,000 (1,000 × ₹ 228)	59,31,600
	3,000	1.666 (2)*	56,00,000 (5,000 × ₹ 1120)	2,400	3,36,000 (1,500 × ₹ 224)	59,38,400

* Since number of orders cannot be in decimals, thus 12.5 orders are taken as 13 orders, 2.5 are taken as 3 order and 1.66 orders are taken as 2 orders.

The above table shows that the total cost of 5,000 units including ordering and carrying cost is minimum (₹ 59,22,000) when the order size is 1,000 units. Hence the most economical purchase level is 1,000 units.

- (b) If there will be no discount offer then the purchase quantity should be equal to EOQ. The EOQ is as follows:

$$EOQ = \sqrt{\frac{2AO}{C}}$$

where A = annual inventory requirement,
O = ordering cost per order and
C = carrying cost per unit per annum.

$$= \sqrt{\frac{2 \times 5,000 \text{ units} \times ₹1,200}{20\% \times ₹1,500}} = 200 \text{ units}$$

6. Basic Data:

A	(Number of units to be purchased annually)	=	5,00,000 units
O	(Ordering cost per order)	=	₹ 4,000
C	(Annual cost of storage per unit)	=	₹ 10
	Purchase price per unit inclusive of transportation cost	=	₹ 50

Computations:

(i) Re-ordering level (ROL)

= Maximum usage per period × Maximum lead time

= 2,000 units per day × 15 days = **30,000 units**

(ii) **Maximum level** = ROL + ROQ – [Min. rate of consumption × Min. lead time] (*Refer to working notes 1 and 2*)

= 30,000 units + 20,000 units – [1,000 units per day × 5 days] = **45,000 units**

(iii) **Minimum level** = ROL – Average rate of consumption × Average re-order-period

= 30,000 units – (1,500 units per day × 10 days) = **15,000 units**

$$\begin{aligned}
 \text{(iv) Danger level} &= \text{Average consumption} \times \text{Lead time for emergency purchases} \\
 &= 1,500 \text{ units per day} \times 4 \text{ days} = \mathbf{6,000 \text{ units}}
 \end{aligned}$$

Working Notes:

1. Minimum rate of consumption per day

$$\text{Av. rate of consumption} = \frac{\text{Minimum rate of consumption} + \text{Maximum rate of consumption}}{2}$$

$$1,500 \text{ units per day} = \frac{X \text{ units/day} + 2,000 \text{ units per day}}{2} \text{ or } X = 1,000 \text{ units per day.}$$

$$2. \text{ Re-order Quantity (ROQ)} = \sqrt{\frac{2 \times 5,00,000 \text{ units} \times 4,000}{10}} = 20,000 \text{ units}$$

7. (a) (i) **Economic order quantity:**

$$A \text{ (Annual requirement or Component 'X')} = 4,000 \text{ units per month} \times 12 \text{ months}$$

$$= 48,000 \text{ units}$$

$$C \text{ (Purchase cost p.u.)} = ₹ 20$$

$$O \text{ (Ordering cost per order)} = ₹ 120$$

$$C_i \text{ (Holding cost)} = 10\% \text{ per annum}$$

$$\text{E.O.Q.} = \sqrt{\frac{2AO}{C_i}} = \sqrt{\frac{2 \times 48,000 \text{ units} \times ₹ 120}{10\% \text{ of } ₹ 20}} = \mathbf{2,400 \text{ units}}$$

(ii) **Extra cost incurred by the company:**

$$A. \text{ Total cost when order size is equal 4,000 units:}$$

$$\text{Total cost} = \text{Total ordering cost} + \text{Total carrying cost}$$

$$= \frac{A}{Q} \times O + \frac{1}{2} Q (C_i)$$

$$= \left(\frac{48,000 \text{ units}}{4,000 \text{ units}} \times ₹120 \right) + \left(\frac{1}{2} \times 4,000 \text{ units} \times 10\% \times ₹20 \right)$$

$$= ₹1,440 + ₹4,000 = ₹5,440$$

B. Total cost when order size is equal EOQ i.e. 2,400 units:

$$\text{Total cost} = \left(\frac{48,000 \text{ units}}{2,400 \text{ units}} \times ₹120 \right) + \left(\frac{1}{2} \times 2,400 \text{ units} \times 10\% \times ₹20 \right)$$

$$= ₹2,400 + ₹2,400 = ₹4,800$$

Extra cost that the company has to incur = (A) – (B) = ₹5,440 – ₹4,800 = **₹640**

(iii) Minimum carrying cost: Carrying cost depends upon the size of the order. It will be minimum on the least order size. (In this part of the question the two order sizes are 2,400 units and 4,000 units. Here 2,400 units is the least of the two order sizes. At this order size carrying cost will be minimum.)

The minimum carrying cost in this case can be computed as under:

$$\text{Minimum carrying cost} = \frac{1}{2} \times 2,400 \text{ units} \times 10\% \times ₹20 = ₹2,400.$$

8. Working Notes:

1. The material received as replacement from vendor is treated as fresh supply.
2. In the absence of any information, the price of the material returned from a user department on 20-9-20 has been taken at the price of the latest issue made on 17-9-20. In FIFO method, physical flow of the material is irrelevant, and issue price is based on first in first out.
3. The issue of material on 26-9-20 is made out of the material received from a user department on 20-9-20.
4. The entries for transfer of materials from one job and department to another on 22-9-20 and 29-9-20 respectively, do not affect the store ledger. However, adjustment entries to calculation of cost of respective jobs and departments are made in cost accounts.
5. The material found short as a result of stock taking has been written off at relevant issue price.

Stores Ledger of AT Ltd. for the month of September, 2020 (FIFO Method)

Date	RECEIPT				ISSUE				BALANCE		
	GRN No MRR No.	Qty. Units	Rate (₹)	Amount (₹)	Requisition No	Qty. Units	Rate (₹)	Amount (₹)	Qty. Units	Rate (₹)	Amount (₹)
1	2	3	4	5	6	7	8	9	10	11	12
1-9-20	—	—	—	—	—	—	—	—	25	6.50	162.50
4-9-20	—	—	—	—	85	8	6.50	52	17	6.50	110.50
6-9-20	26	50	5.75	287.50	—	—	—	—	17 50	6.50 5.75	398.00
7-9-20	—	—	—	—	97	12	6.50	78	5 50	6.50 5.75	320.00
10-9-20	—	—	—	—	Return	10	5.75	57.50	5 40	6.50 5.75	262.50
12-9-20	—	—	—	—	108	5 10	6.50 5.75	90	30	5.75	172.50
13-9-20	—	—	—	—	110	20	5.75	115	10	5.75	57.50
15-9-20	33	25	6.10	152.50	—	—	—	—	10 25	5.75 6.10	210.00
17-9-20	—	—	—	—	121	10	5.75	57.50	25	6.10	152.50

19-9-20	38	10	5.75	57.50	—	—	—	—	25	6.10 } 5.75 }	210.00
20-9-20	4	5	5.75	28.75	—	—	—	—	5 25 10	5.75 } 6.10 } 5.75 }	238.75
26-9-20	—	—	—	—	146	5 5	5.75 } 6.10 }	59.25	20 10	6.10 } 5.75 }	179.50
30-9-20	—	—	—	—	Shortage	2	6.10	12.20	18 10	6.10 } 5.75 }	167.30

9. From the point of view of cost of material charged to each job, it is minimum under FIFO and maximum under LIFO (Refer to Tables). During the period of rising prices, the use of FIFO give rise to high profits and that of LIFO low profits. In the case of weighted average, there is no significant adverse or favourable effect on the cost of material as well as on profits.

From the point of view of valuation of closing stock, it is apparent from the above statement, that it is maximum under FIFO, moderate under weighted average and minimum under LIFO.

It is clear from the tables that the use of weighted average evens out the fluctuations in the prices. Under this method, the cost of materials issued to the jobs and the cost of material in hands reflects greater uniformity than under FIFO and LIFO. Thus, from different points of view, weighted average method is preferred over LIFO and FIFO.

Statement of receipts and issues by adopting First-in-First-Out Method

Date	Particulars	Receipts			Issues			Balance		
		Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)
Jan. 1	Purchase	100	1	100	—	—	—	100	1	100
Jan. 20	Purchase	100	2	200	—	—	—	100	1	100
								100	2	200
Jan. 22	Issue to Job W 16	—	—	—	60	1	60	40	1	40
								100	2	200
Jan. 23	Issue to Job W 17	—	—	—	40	1	40	80	2	160
					20	2	40			

Statement of receipts and issues by adopting Last-In-First-Out method

Date	Particulars	Receipts			Issues			Balance		
		Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)
Jan. 1	Purchase	100	1	100	—	—	—	100	1	100
Jan. 20	Purchase	100	2	200	—	—	—	100	1	100
								100	2	200
Jan. 22	Issue to Job W 16	—	—	—	60	2	120	100	1	100
								40	2	80
Jan. 23	Issue to Job W 17	—	—	—	40	2	80	80	1	80
					20	1	20			

Statement of Receipt and Issues by adopting Weighted Average method

Date	Particulars	Receipts			Issues			Balance		
		Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)	Units No.	Rate (₹)	Value (₹)
Jan. 1	Purchase	100	1	100	—	—	—	100	1	100
Jan. 20	Purchase	100	2	200	—	—	—	200	1.50	300
Jan. 22	Issue to Job W 16	—	—	—	60	1.50	90	140	1.50	210
Jan. 23	Issue to Job W 17	—	—	—	60	1.50	90	80	1.50	120

Statement of Material Values allocated to Job W 16, Job 17 and Closing Stock, under aforesaid methods

	FIFO (₹)	LIFO (₹)	Weighted Average (₹)
Material for Job W 16	60	120	90
Material for Job W 17	80	100	90
Closing Stock	160	80	120
	300	300	300