INVENTORY MANAGEMENT

By : Kuldeep Uttam
Production and Industrial Engineer

Outline

- Elements of Inventory Management
- Inventory and Supply Chain Management
- Inventory Control Systems
- Economic Order Quantity Models
- Reorder Point
- Classification of Inventories: ABC, VED

What is inventory?

A physical resource that a firm holds in stock with the intent of selling it or transforming it into a more valuable state.

Purpose of inventory management

- How many units to order?
- when to order? discount

Types of Inventories

- Raw materials
- Purchased parts and supplies
- Finished Goods
- Work-in-process (partially completed products)
- Items being transported
- Tools and equipment

Nature of Inventories

Raw Materials – Basic inputs that are converted into finished product through the manufacturing process

Work-in-progress – Semi-manufactured products need some more works before they become finished goods for sale

Finished Goods – Completely manufactured products ready for sale

Supplies – Office and plant materials not directly enter production but are necessary for production process and do not involve significant investment.

Inventory and Supply Chain Management

Bullwhip effect

- demand information is distorted as it moves away from the end-use customer(forecast)
- higher safety stock inventories are stored to compensate

Seasonal or cyclical demand

Sale of umbrella , dominos sale in weekend

Inventory provides independence from vendors

Take advantage of price discounts

Inventory provides independence between stages and avoids work stoppages

WIP inventories

Two Forms of Demand

Dependent

(not used by customer directly)

- Demand for items used to produce final products
- Tires stored at a plant are an example of a dependent demand item

Independent

- Demand for items used by external customers
- Cars, computers, and houses are examples of independent demand inventory

Inventory and Quality Management

Customers usually perceive quality service as availability of goods when they want them

Inventory must be sufficient to provide high-quality customer service

Inventory Costs

Carrying cost

- cost of holding an item in inventory

Ordering cost

- cost of replenishing inventory

Shortage cost

- temporary or permanent loss of sales when demand cannot be met

Inventory Control Systems

Continuous system (fixed-order-quantity)	• constant amount ordered when inventory declines to predetermined level
Periodic system (fixed-time-period)	• order placed for variable amount after fixed passage of time

Economic Order Quantity (EOQ) Models

EOQ

- We want to determine the optimal number of units to order so that we minimize the total cost associated with the purchase, delivery and storage of the product.

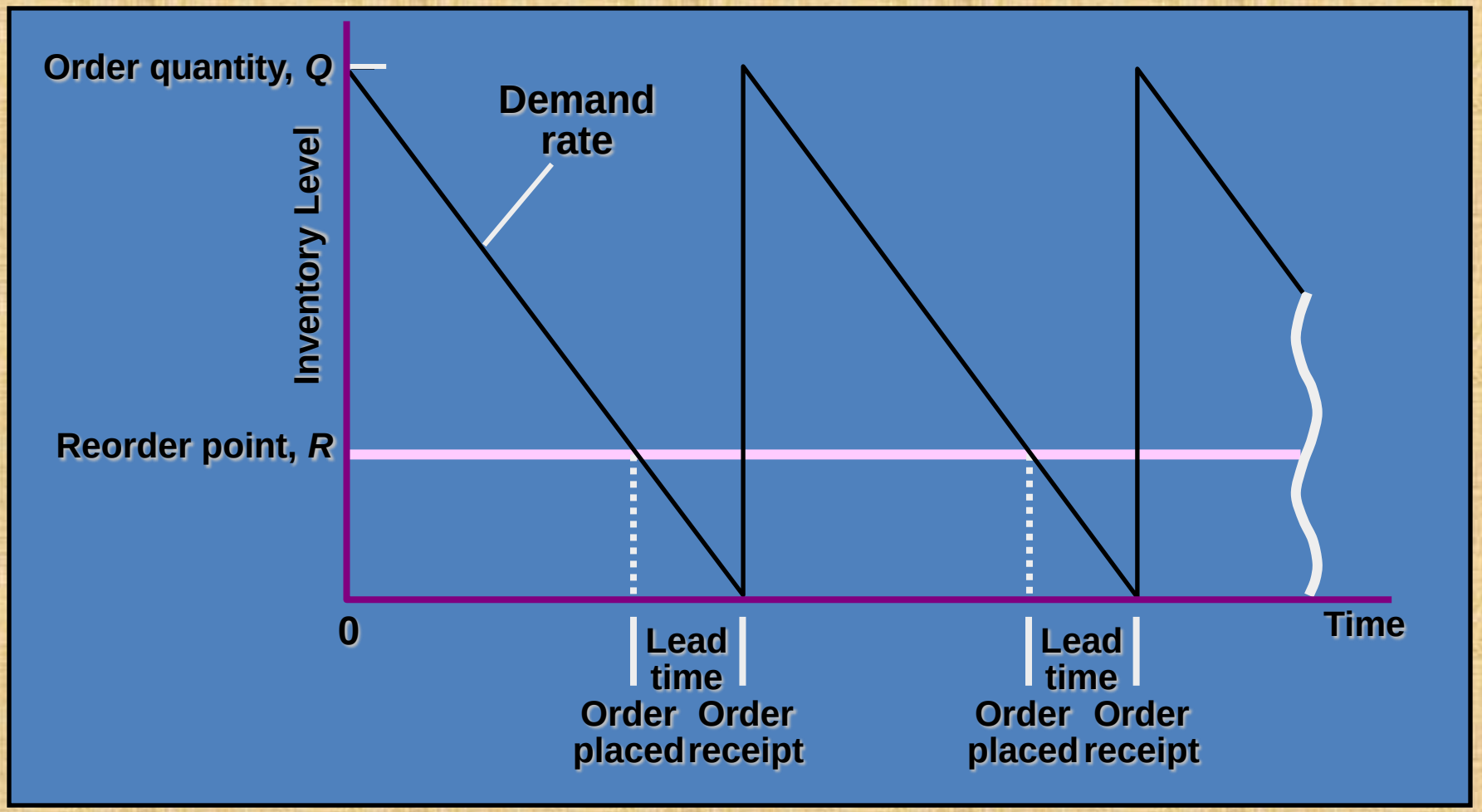
Basic EOQ model

Production quantity model

Assumptions of Basic EOQ Model

- Demand is known, constant, and independent
- Lead time is known and constant
- Order quantity received is instantaneous and complete
- No shortage is allowed

Inventory Order Cycle



EOQ Cost Model

C_o - cost of placing order

C_c - annual per-unit carrying cost

D - annual demand

Q - order quantity

$$\text{Annual ordering cost} = \frac{C_o D}{Q}$$

$$\text{Annual carrying cost} = \frac{C_c Q}{2}$$

$$\text{Total cost} = \frac{C_o D}{Q} + \frac{C_c Q}{2}$$

EOQ Cost Model

Deriving Q_{opt}

$$TC = \frac{C_o D}{Q} + \frac{C_c Q}{2}$$

$$\frac{\partial TC}{\partial Q} = -\frac{C_o D}{Q^2} + \frac{C_c}{2}$$

$$0 = -\frac{C_0 D}{Q^2} + \frac{C_c}{2}$$

$$Q_{opt} = \sqrt{\frac{2C_o D}{C_c}}$$

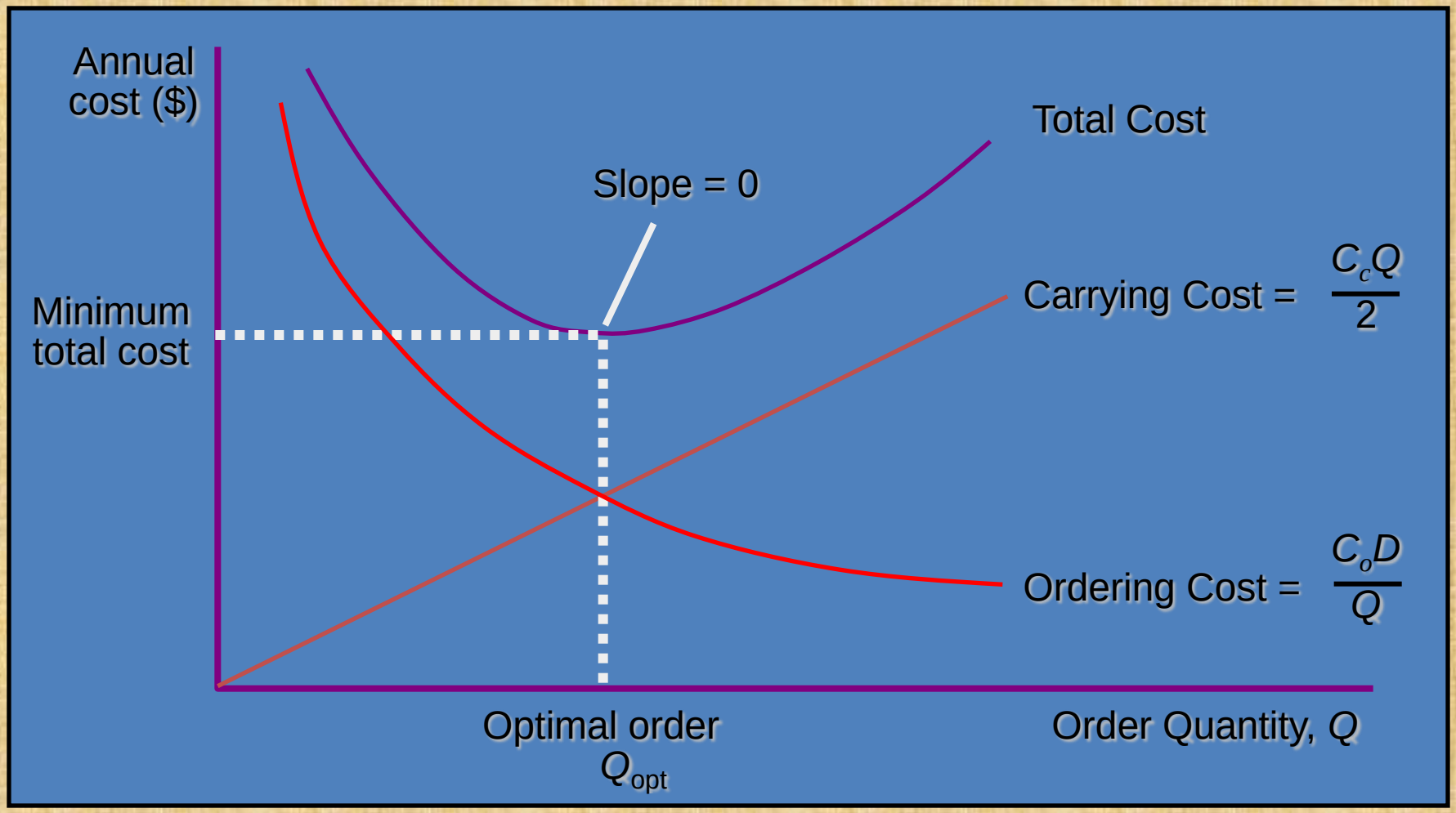
Proving equality of costs at optimal point

$$\frac{C_o D}{Q} = \frac{C_c Q}{2}$$

$$Q^2 = \frac{2C_o D}{C_c}$$

$$Q_{opt} = \sqrt{\frac{2C_o D}{C_c}}$$

EOQ Cost Model (cont.)



Production Quantity Model

An inventory system in which an order is received gradually, as inventory is simultaneously being depleted

Also known as non-instantaneous receipt model
Now replenishment not at once

Assumption

- *Q* is received all at once is relaxed
- *p* - daily rate at which an order is received over time, or *production rate*
- *d* - daily rate at which inventory is demanded

Production Quantity Model (cont.)

p = production rate $\qquad$ d = demand rate

$$\text{Maximum inventory level} = Q - \frac{Q}{p}d$$

$$= Q\left(1 - \frac{d}{p}\right)$$

$$\text{Average inventory level} = \frac{Q}{2}\left(1 - \frac{d}{p}\right)$$

$$TC = \frac{C_o D}{Q} + \frac{C_c Q}{2}\left(1 - \frac{d}{p}\right)$$

$$Q_{opt} = \sqrt{\frac{2C_o D}{C_c\left(1 - \frac{d}{p}\right)}}$$

Quantity Discounts

Price per unit decreases as order quantity increases

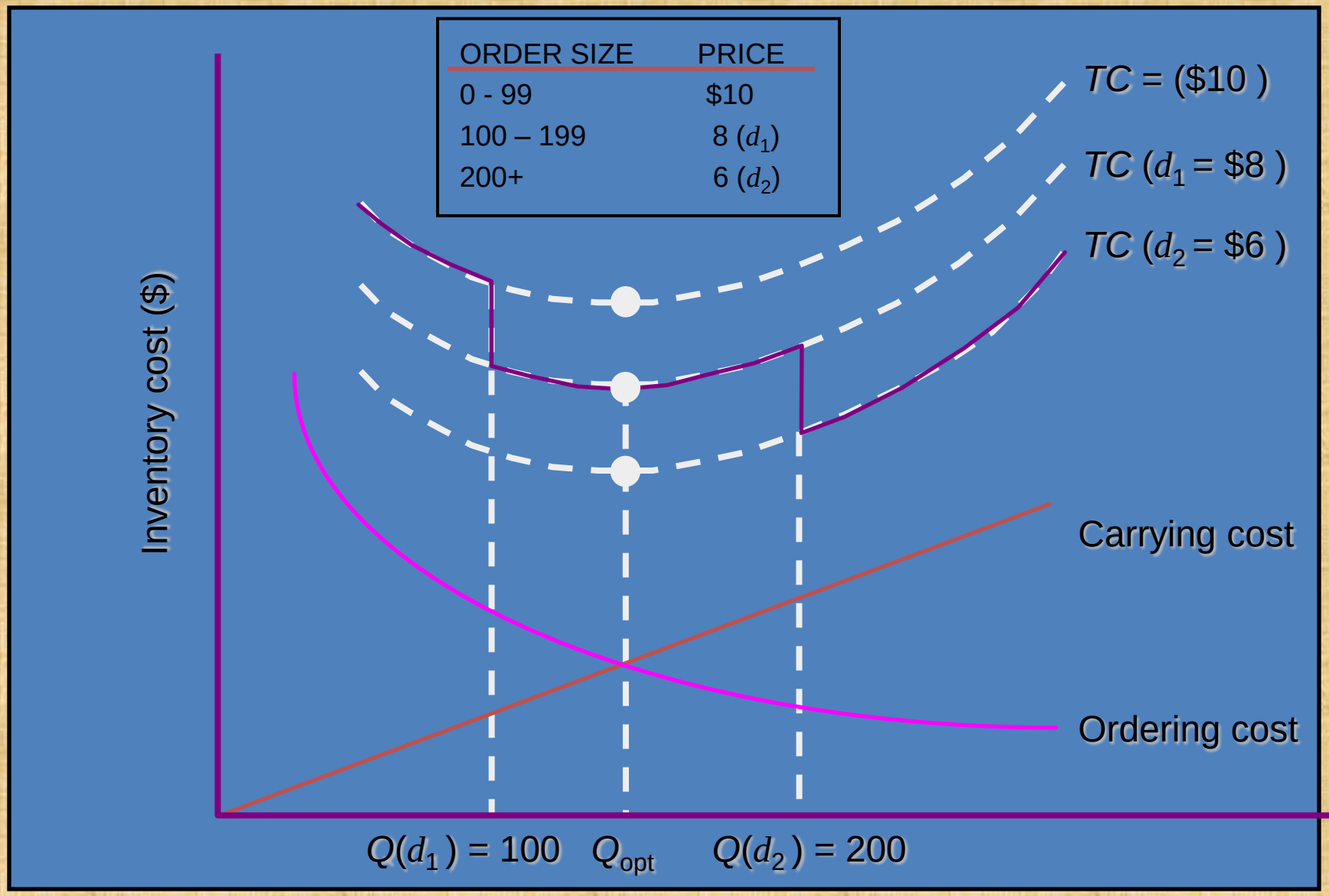
$$TC = \frac{C_o D}{Q} + \frac{C_c Q}{2} + PD$$

where

P = per unit price of the item

D = annual demand

Quantity Discount Model (cont.)



Reorder Point

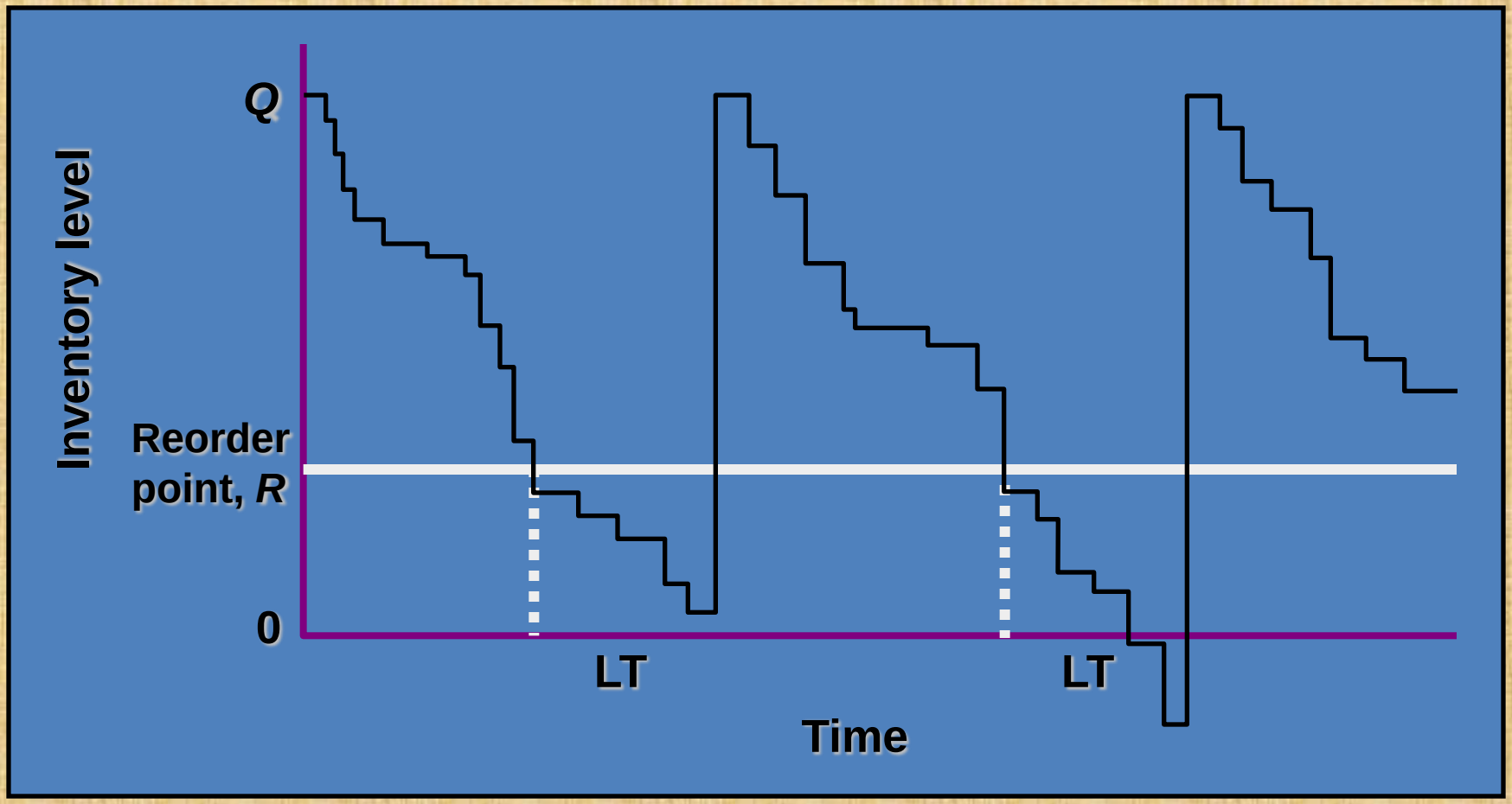
Level of inventory at which a new order is placed

$$R = dL$$

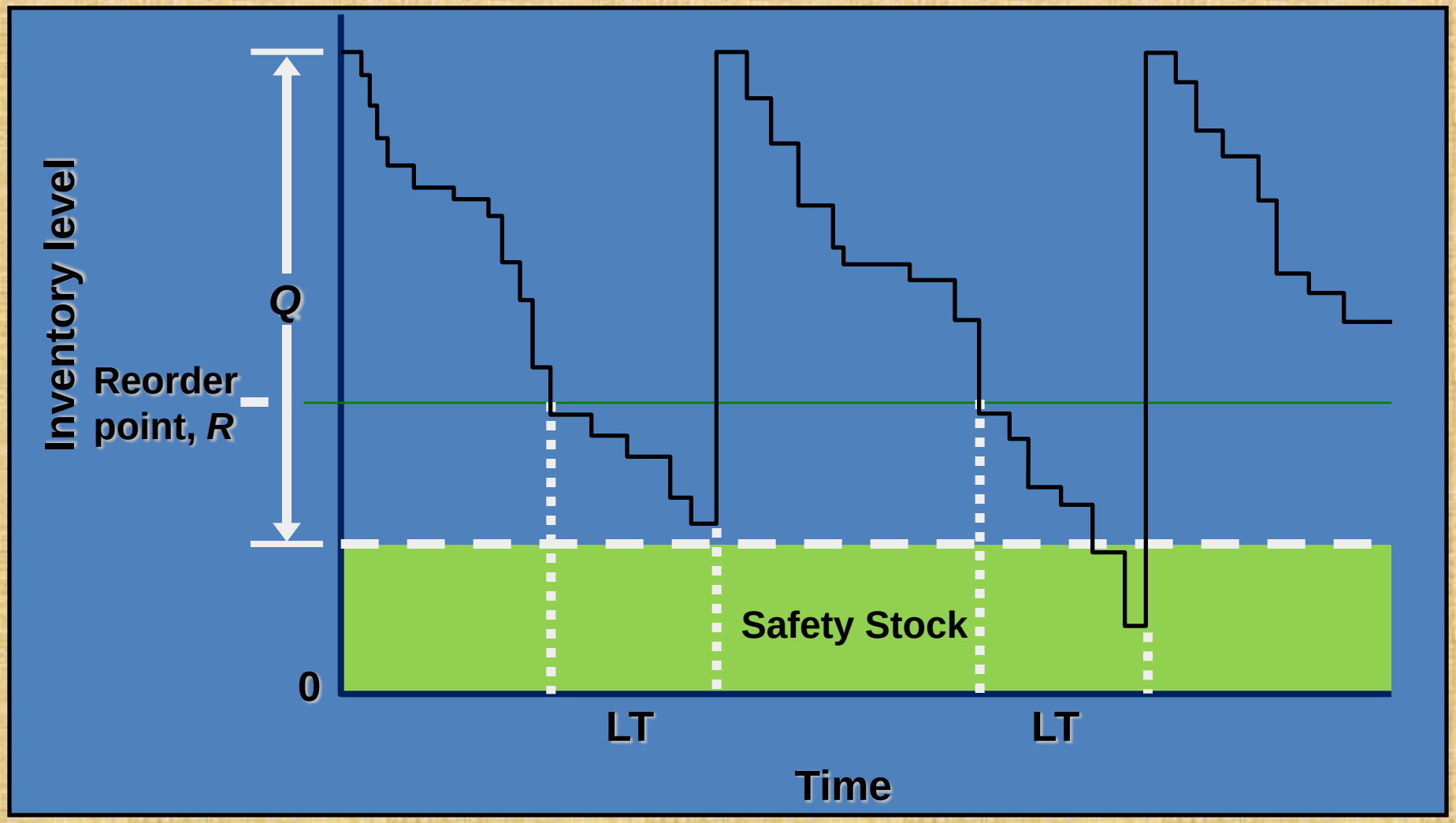
where

- d = demand rate per period
- L = lead time

Variable Demand with a Reorder Point



Reorder Point with a Safety Stock



Classifying Inventory Items

ABC Classification (Pareto Principle)

In any Retail organization there are large numbers of inventories to be maintained. It is not practical to have very stringent inventory control system for each & every item. So with the modus of having an effective Purchase & stores control we implement ABC Inventory

Classification model Known as Always Better Control (ABC) based upon Pareto rule (80/20 rule)

ABC Analysis

Divides inventory into three classes based on Consumption Value

Consumption Value = (Unit price of an item) (No. of units consumed per annum)

- Class A - High Consumption Value
- Class B - Medium Consumption Value
- Class C - Low Consumption Value

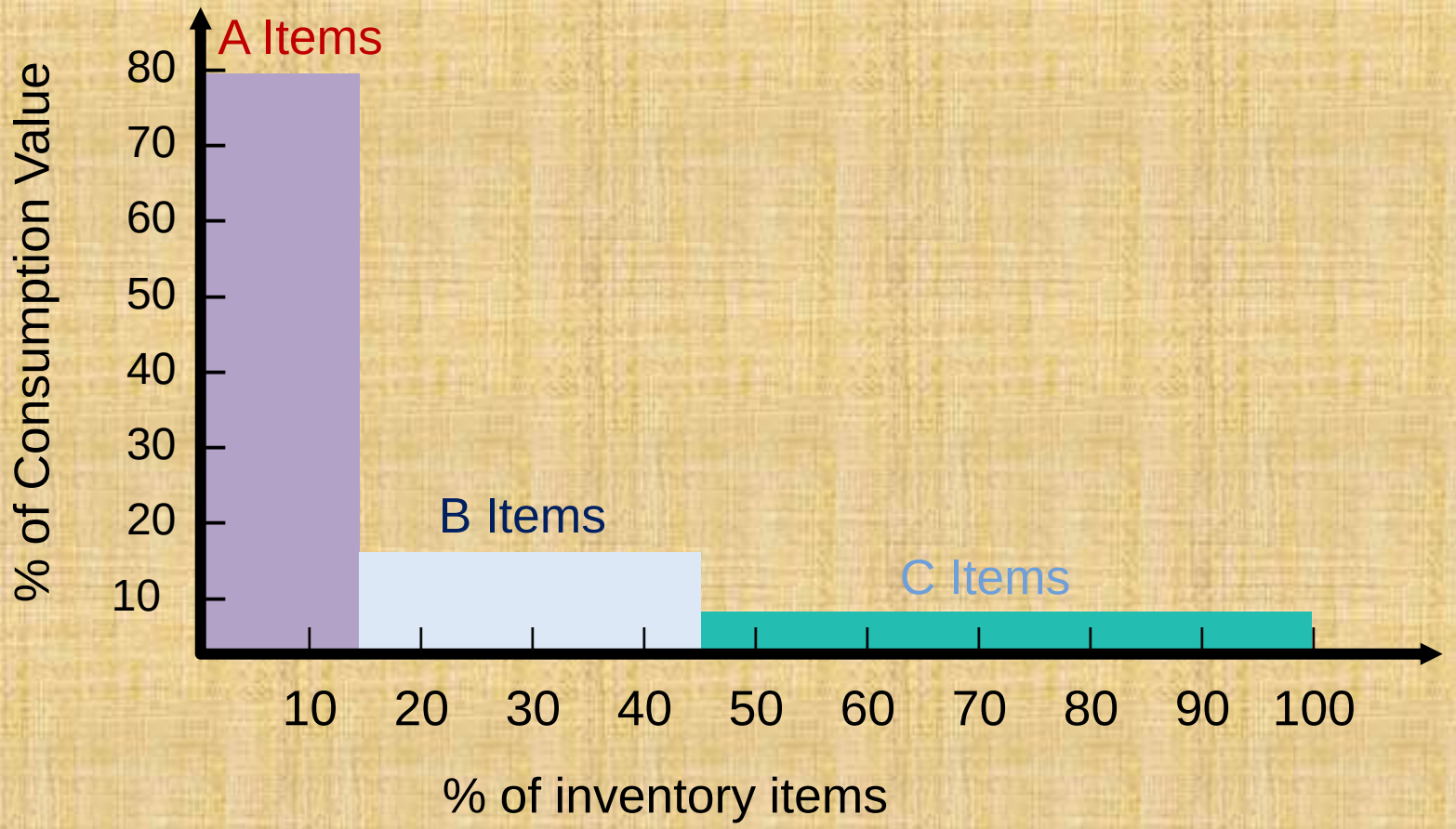
ABC Analysis

Item Stock Number	Percent of Number of Items Stocked	Annual Volume (units)	x	Unit Cost	=	Annual Consumption value	Percent of Annual consumption value		Class
#10286	20%	1,000		$ 90.00		$ 90,000	38.8%	▪72%	A
#11526		500		154.00		77,000	33.2%		A
#12760		1,550		17.00		26,350	11.3%	▪23%	B
#10867	30%	350		42.86		15,001	6.4%		B
#10500		1,000		12.50		12,500	5.4%		B

ABC Analysis

Item Stock Number	Percent of Number of Items Stocked	Annual Volume (units)	x	Unit Cost	=	Annual cons. value	Percent of Annual cons. value		Class
#12572		600		$ 14.17		$ 8,502	3.7%		C
#14075		2,000		.60		1,200	.5%		C
#01036	50%	100		8.50		850	.4%	▪5%	C
#01307		1,200		.42		504	.2%		C
#10572		250		.60		150	.1%		C
		8,550				$232,057	100.0%		

ABC Analysis



Inventory Management Policy

A Items:

very tight control, complete and accurate records, frequent review via EOQ model.

B Items:

less tightly controlled, good records, regular review

C Items:

simplest controls possible, minimal records, large inventories, periodic review and reorder

Some time with the view of doing Lean inventory management

Within ABC category VED (Vital , essential & desirable factor) is introduced with the view of further having effective control of inventory on the basis if its being critical.

V (Vital) is the inventory where neither Substitute nor Variation Gap is allowed .

E (Essential) is the inventory which allows either of the one to be changed

D (Desirable) is the one which can have variation in both of the parameters

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Thank You