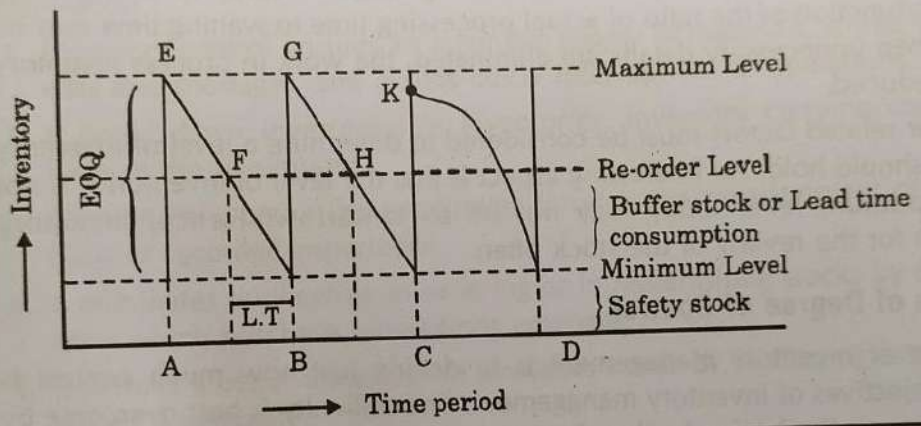
the arrival of supplies and the issues cross minimum (safety) level. Similarly at D, stock is touched due to heavy consumption of material.

Exhibit 23.1 : Operation of Fixed Order Quantity System



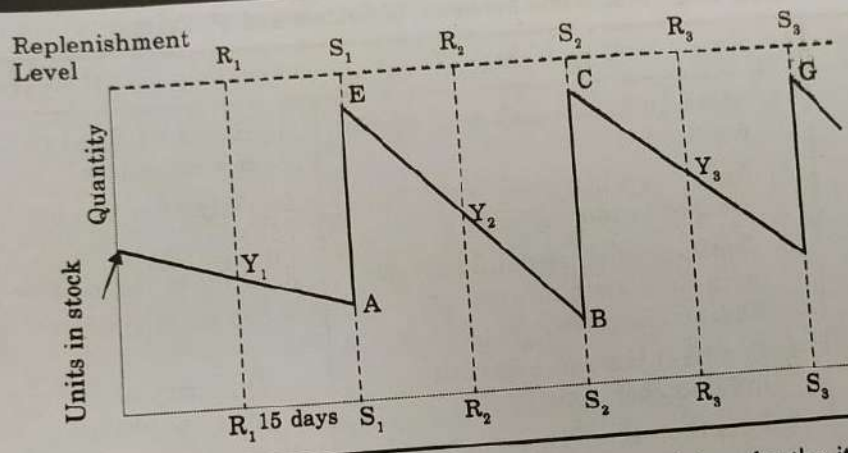
Advantages of 'Q' System

The fixed order quantity system has certain advantages. The major advantages claimed are that:

1. Each material can be procured in the most economical quantity.

review system.

Exhibit 23.2 : Periodic Review System



Suppose we fix review period for an item as two months and the lead time for the item at 15 days. Then the order would be placed every two months, *i.e.*, at ordinate of R_1, R_2, R_3 etc., and the supplies would be received at ordinates S_1, S_2, S_3, etc., (15 days after R_1, R_2, R_3 etc.).

At R_1 let us assume that the stock available to be Y_1, then this stock together with the quantity ordered at R_1 (supplies received at S_1) should be sufficient to last till the next supplies are received at S_1 *i.e.*, to last a total period of 2½ months (review + lead time).

In addition, some buffer stock would also be necessary to take care of any increased consumption or increase in lead time.

Advantages of 'P' System

tems help to attractive ounts from upplier.

This system has some distinct advantages.

1. The ordering and inventory costs are low. The ordering cost is considerably reduced though follow-up work for each delivery may be necessary.
2. The suppliers will also offer attractive discounts as sales are guaranteed.
3. The system works well for materials which exhibit an irregular or seasonal usage and whose purchases must be planned in advance on the basis of sales estimates.

Disadvantages of 'P' System

The system has certain limitations also.

1. It compels a periodic review of all items; this in itself makes the system somewhat inefficient. Because of differences in usage rates, supplies may not have to be ordered until the succeeding review. Conversely, the usage of some items during the period may have increased to the point where they should have been ordered before the current review date. Consequently, this system must be augmented with a minimum balance figure which signals the need for an early reorder in the case of a sharp usage increase.
2. Equally important, the system demands the establishment of rather inflexible order quantities in the interest of administrative efficiency. Theoretically, there exists an optimum economic order quantity for each item, depending upon its price structure, its rate of usage and attendant internal costs. However, because all items must fit reasonably well into a limited number of ordering cycles under this system, actual order quantities may deviate substantially from the optimum.

odic review em tends to he purchasing k around the iew dates.

3. The periodic review system tends to peak the purchasing work around the review dates. For the mathematical approach to the design of 'Q' System and 'P' System, refer to Annexure-D.

Table 23.2 : Distinction between 'Q' System and 'P' System

oint of Difference	Q System	P System
Initiation of order.	1. Stock on hand reaches to reorder point	1. Based on fixed review period and not stock level
Period of order.	2. Any time when stock level reaches to reorder point.	2. Only after the predetermined period.
Record keeping.	3. Continuously (perpetual system) each time a withdrawal or addition is made.	3. Only at the review period.
Order quantity.	4. Constant the same quantity ordered each time.	4. Quantity of order varies each time order is placed.
Size of inventory.	5. Less than the 'P' system.	5. Larger than the Q system.
Time to maintain.	6. Higher due to perpetual record keeping.	6. Less time due to only at the review period.

...ered for order qty. (Q_1) of 3,000 nos. = 5% of unit price

New price after discount, $P_1 = 25 \times 0.95 = \text{Rs. } 23.75$

Total cost of materials plus cost on materials $TC_{(Discount)} = DP_1 + \frac{D}{Q_1} S + \frac{Q_1}{2} C_1 \cdot i$

$$= 18,000 \times 23.75 + \frac{18,000}{3,000} \times 250 + \frac{3,000}{2} \times 23.75 \times 0.25$$

$$= 4,27,500 + 1,500 + 8,906.25$$

$TC_{(Discount)} = \text{Rs. } 4,37,906.25$

(iii) Decision rule :

If TC (Discount) $\leq$ TC (EOQ) $\rightarrow$ Accept discount

If TC(Discount) $>$ TC(EOQ) $\rightarrow$ Reject discount offer

5% discount offer on unit price for ordering 3,000 nos. per order is acceptable.

Since $TC_{(Discount)}$ (i.e., 4,37,906.25) is less than TC_{EOQ} (i.e., 4,57,500).

3. *The ABC Fun novelty company buys 80,000 shipping container per year. Price of each container is Rs. 0.40. Cost of purchase Rs. 80 per order, cost of holding one container per year Re. 0.10. Bank rate of interest 15% including a charge for taxes and insurance. Find*

(i) the economic order quality and time between orders based on 220 working days per year.

(ii) the minimum variable cost per year.

(iii) if the company had been following a policy of quarterly ordering, what would have been the increase in the variable cost?

Solution :

Annual demand (D) = 80,000 units

Unit price (C) = Re. 0.40

Ordering cost per order (S) = Rs. 80

Holding cost per item per year = Re. 0.10

Bank rate of interest including charge for taxes and insurance = 15% of unit price

$$= \frac{15}{100} \times 0.40 = \text{Re. } 0.06$$

$$\left.\begin{matrix}\text{Inventory carrying cost}\\ \text{per item per year}\end{matrix}\right\} C_c = 0.10 + 0.06 = \text{Re. } 0.16$$

Calculation of EOQ :

$$\text{(i) EOQ} = \sqrt{\frac{2DS}{C \cdot i}} = \sqrt{\frac{2 \times 80{,}000 \times 80}{0.16}} = 8944.27 = 9{,}000 \text{ nos.}$$

Calculating of time between orders based on 220 working days per year:

$$\left.\begin{matrix}\text{Time between order}\\ \text{(in days)}\end{matrix}\right\} = \frac{\text{No. of working days per year}}{\text{No. of orders per year (N)}}$$

$$\left.\begin{matrix}\text{No. of orders per}\\ \text{year (N)}\end{matrix}\right\} = \frac{\text{Annual demand (D)}}{\text{EOQ (Q)}}$$

$$N = \frac{D}{Q} = \frac{80{,}000}{9{,}000} = 8.88 = 9 \text{ orders}$$

$$\text{Time between order} = \frac{220}{9} = 24.44 \text{ days} = 24 \text{ days}$$

(ii) Calculation of minimum variable cost per year :

Variable cost comprises ordering cost per year and inventory carrying cost per year and this would be minimum when the order qty. equals economic order qty. (*i.e.*, EOQ).

$$\left.\begin{matrix}\text{Minimum variable}\\ \text{cost per year}\end{matrix}\right\} = \text{Ordering cost per year} + \text{Inventory carrying cost per year}$$

$$= \left(\begin{matrix}\text{No. of}\\ \text{orders}\end{matrix} \times \begin{matrix}\text{Ordering}\\ \text{cost per order}\end{matrix}\right) + \left(\begin{matrix}\text{Average}\\ \text{inventory}\\ \text{units}\end{matrix} \times \begin{matrix}\text{Inventory}\\ \text{carrying cost /}\\ \text{unit / year}\end{matrix}\right)$$

$$= (9 \times 80) + \left(\frac{9{,}000}{2}\right) \times 0.16 = 720 + 720 = \text{Rs. } 1{,}440$$

(iii) Policy of quarterly ordering (ordering once in 3 months)

$$\text{No. of orders per year} = \frac{12}{3} = 4$$

$$\text{Order Qty. per order} = \frac{80{,}000}{4} = 20{,}000 \text{ units}$$

$$\text{Ordering cost per year} = 4 \times 80 = \text{Rs. } 320$$

$$\text{Inventory carrying cost per year} = \frac{20{,}000}{2} \times 0.16 = \text{Rs. } 1600$$

$$\text{Total variable cost per year} = 320 + 1{,}600 = \text{Rs. } 1920$$

$$\left.\begin{matrix}\text{Increase in the variable cost as}\\ \text{compared with that of EOQ ordering}\end{matrix}\right\} = 1{,}920 - 1{,}440 = \text{Rs. } 480$$

4. *Determine safety stock, reserve stock and buffer stock for the data given below :*

Normal usage = 100 per week

Lead time = 4 to 6 weeks