Material Costing

- Calculation of cost related to Input required for production.
- Objective is to reduce material cost.

1. Input & output:

Input material
Raw material
(Plastic)
↓
Material Costing

machine

Output
Product
Finished Goods
(Pen)
↓
COST SHEET

Rs.
100

2. Cost related to material:

Purchase Cost	Ordering / Procurement Cost	Carrying / Holding storage Cost
Amount paid to supplier	• Loading & unloading • Transportation cost • Inspection cost etc.	• storage Rent • Insurance • Interest etc.

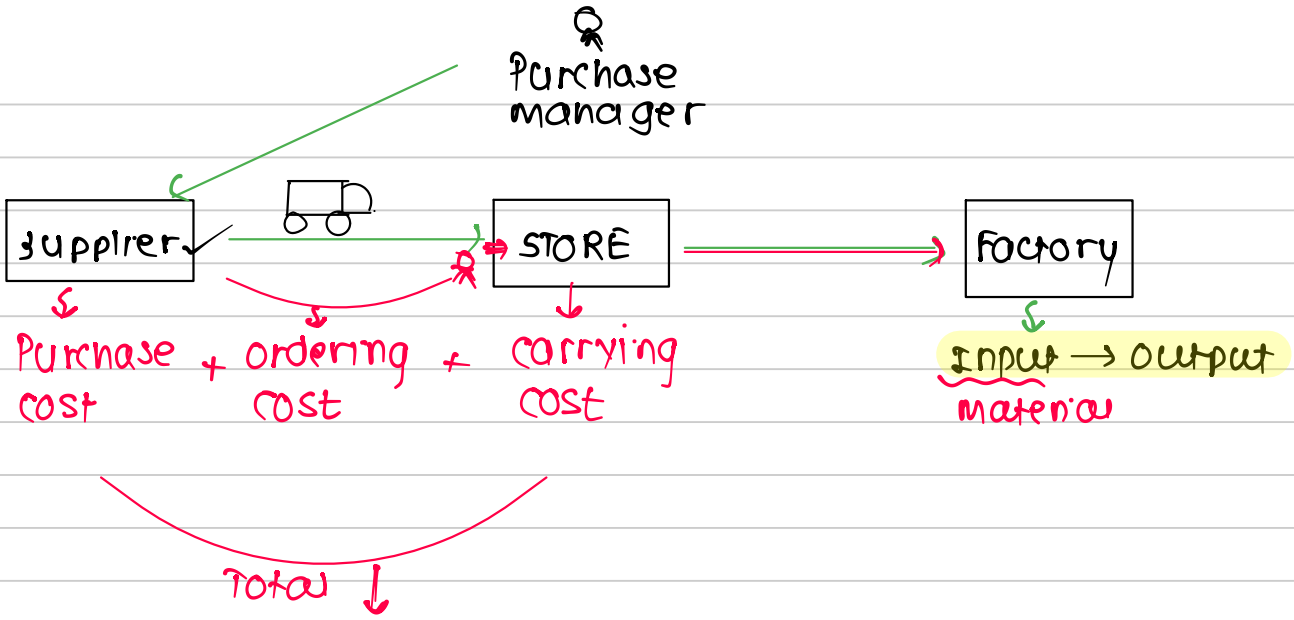
- There is inverse relationship between ordering & carrying cost.

3. Economic Order Quantity: [EOQ]

Purchase manager

Question: How many units of RM should be purchased in a single order.

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


Purchase manager
Supplier
STORE
Factory
Purchase cost
+
ordering cost
+
carrying cost
Input → output
material
total

4.

4. Example for derivation of EOQ formula:

A : Annual Purchase of RM : 6000 kgs
O : Ordering cost per order : 1000 per order
PC : Purchase cost per unit of RM 30 per unit
% : : 10% p.a.
C : Carrying cost per unit p.a. : 30 x 10% = 3 per unit p.a

Options:

Q: Quantity to be purchased in a single order a) 1000 kgs
or b) 2000 kgs
or c) 3000 kgs

Select the best option.

Solution:

Statement showing Total Annual Cost:

Particulars	Quantity (Q) 1000	2000	3000
A) Annual Purchase cost: (A x PC)	180,000 (6000 x 30)	180,000 (6000 x 30)	180,000 (6000 x 30)
B) Annual ordering cost: $\left(\frac{A}{Q} \times O\right)$ (No of orders)	6000 $\left(\frac{6000}{1000} \times 1000\right)$	3000 $\left(\frac{6000}{2000} \times 1000\right)$	2000 $\left(\frac{6000}{3000} \times 1000\right)$
C) Annual carrying cost: $\left(\frac{Q}{2} \times C\right)$	1500 $\left(\frac{1000 \times 3}{2}\right)$	3000 $\left(\frac{2000}{2} \times 3\right)$	4500 $\left(\frac{3000}{2} \times 3\right)$
Total cost	187500	186000	186500

Recommendation:

Company should place order for 2000 units as total cost is lowest.

Derivation of EOQ formula:

Total cost is minimum when,

Annual ordering cost = Annual carrying cost

$$\frac{A}{Q} \times O = \frac{Q}{2} \times C$$

$$\frac{2AO}{Q} = QC$$

$$2AO = Q^2 C$$

$$\frac{2AO}{C} = Q^2$$

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

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

$$= \sqrt{\frac{2 \times 6000 \times 1000}{3}}$$

$$= 2000$$

CW. 1

(WN-1) Details:

A : 10,000
O : 50
PC : 2 per unit
% : 8% p.a.
C : 2 × 8% = 0.16

1. $EOQ = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 10,000 \times 50}{0.16}}$ = 1500 kgs.

2. No of orders = $\frac{A}{Q} = \frac{10,000}{1500}$ = 4 orders.

CW. 2

(WN-1) Details:

Correct Purchase cost		Incorrect Purchase cost
A : 5000		A : 5000
O : 16		O : 16
PC : 20	→	PC : 12.8
% : 20% (2+12+6)		% : 20% (2+12+6)
C : 20 × 20% = 4	→	C : 12.8 × 20% = 2.56

1. EOQ:

$\sqrt{\frac{2 \times 5000 \times 16}{4}}$ = 200 units

$\sqrt{\frac{2 \times 5000 \times 16}{2.56}}$ = 250 units

i. Statement showing Total Cost:

Particulars	200 units	250 units
A) Annual Purchase cost (A×PC)	100,000 (5000 × 20)	64000 (5000 × 12.8)
B) Annual ordering cost [No of orders (A/Q) × O]	400 [(5000 ÷ 200) 25 × 16]	320 [(5000 ÷ 250) 20 × 16]
C) Annual carrying cost $\left(\frac{Q}{2} \times C\right)$	400 $\left(\frac{200}{2} \times 4\right)$	320 $\left(\frac{250}{2} \times 2.56\right)$
Total cost.	100800	64640

CW. 3

(WN-1) Details:

A : 4000 × 12 months = 48000 →
O : 120
PC : 20
% : 10%.
C : 20 × 10% = 2

A = Annual RM
RM : FG
(component ×) (Product)
1 : 1
? : 48000 (4000 × 12)

i. $EOQ = \sqrt{\frac{2 \times 48000 \times 120}{2}}$ = 2400 units

ii. Statement showing Total Annual Cost

Particulars	EOQ 2400 units	minimum 4000 units
a) APC (A×PC)	960,000 (48000 × 20)	960,000 (48000 × 20)
b) AOC [(A ÷ Q) No of orders × O]	2400 [(48000 ÷ 2400) 20 × 120]	1440 [(48000 ÷ 4000) 12 × 120]
c) ACC $\left(\frac{Q}{2} \times C\right)$	2400 $\left(\frac{2400}{2} \times 2\right)$	4000 $\left(\frac{4000}{2} \times 2\right)$
Total cost	964800	965440

Extra cost to be incurred = Rs. 640.

3. **Minimum carrying cost:**

Out of two available options, minimum carrying cost is at EOQ i.e. Rs.2400.

CW. 5

(WN-1) **Details:**

A : 40,000
O : 750 (360+390)
Pc : 60
% : -
C : Carrying per unit p.a.

0.5 × 12 = 6

9

15

RM: (Kgs)	FG (units)
1	2.5
?	100,000

1. $EOQ = \sqrt{\frac{2 \times 40,000 \times 750}{15}}$ = 2000 Kgs.

2. **Frequency of orders:**

a) No of orders = $\frac{A}{Q} = \frac{40000}{2000}$ = 20 orders.

b) **Frequency:**

orders	days
20	365
1	?

18.25

Approx 18 days

CW. 4

Reference Notes:

- ZED company is trader so it will purchase FG (not RM)
  ∴ A = Annual FG ~~RM~~
- Lead time means delivery time:

(WN-4): **Details:**

A : 40,000 packs
O : 8
PC : 40
% : 10%
C : 40 × 10% = 4

1. $EOQ = \sqrt{\frac{2 \times 40{,}000 \times 8}{4}} = 400$ packs.

2. No of orders $= \frac{40{,}000}{400} = 100$ orders

3. **Total cost:**

Annual ordering cost (100 × 8)	800
Annual carrying cost [(400 ÷ 2) × 4]	800
	1600

4. **Placement of next order:**

a) No of days for which present inventory can be used — 3 days

Packs	Days
40,000	360
333	?

b) Lead time (Delivery time) — (3 days)

Company should place order immediately

2.Various Stock Levels

Concept Question

Particulars	Consumption (Usage)	Lead time (Re-order period)
minimum	10 Kgs	2 days
Normal (Average)	20 Kgs $\left(\frac{10+30}{2}\right)$	3 days $\left(\frac{2+4}{2}\right)$
maximum	30 Kgs	4 days

Re-order Quantity = 1000 Kgs
Safety stock = 60 Kgs.
Calculate various stock levels.

Solution

1. Re-order Level (ROL) = maximum consumption × maximum Lead time
= 30 × 4
= 120

"OR"

ROL = Safety stock + (Average consumption × Average Lead time)
= 60 + (20 × 3)
= 60 + 60
= 120

2. minimum stock level (safety stock) = Re-order Level − (Average consumption × Average Lead time)
= 120 − (20 × 3)
= 60

3. maximum stock level = Re-order Level + Re-order Quantity − (minimum consumption × minimum lead time)
= 120 + 1000 − (10 × 2)
= 1120 − 20
= 1100

4. Average stock level :

a) $\frac{\text{minimum stock} + \text{maximum stock}}{2}$

$= \frac{60 + 1100}{2}$

$= 580$

b) $\text{minimum stock level} + \left(\frac{\text{ROQ}}{2}\right)$

$= 60 + \left(\frac{1000}{2}\right)$

$= 60 + 500$

$= 560$

CW. 8

(CW-4) Details:

Particulars	A consumption	A Lead time	B consumption	B Lead time
minimum	25	4	25	2
Average	50	5 $\left(\frac{4+6}{2}\right)$	50	3 $\left(\frac{2+4}{2}\right)$
maximum	75	6	75	4
	ROQ = 300		ROQ = 500	

Particulars	A	B
1. Re-order Level	75×6 = 450	75×4 = 300
2. minimum stock level =	$450 - (50 \times 5)$ = 200	$300 - (50 \times 3)$ = 150
3. maximum stock level =	$450 + 300 - (25 \times 4)$ = 650	$300 + 500 - (25 \times 2)$ = 750
4. Average stock level =	$\frac{200 + 650}{2}$ = 425	$\frac{150 + 750}{2}$ = 450

CW. 9

(WN-1) Details

A : 5000
O : 20
C : 5

(WN-2) ROQ

If question is silent then EOQ = ROQ

$$\sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 5000 \times 20}{5}} = 200 \text{ units}$$

(WN-3) Details

Particulars	consumption	lead time
minimum	* 10	5 days
Average	15	10 days
maximum	20	15 days

ROQ = 200 units

Emergency lead time = 4 days

* Avg consumption = $\frac{\text{min} + \text{max}}{2}$

$$15 = \frac{\text{min} + 20}{2}$$

$$(15 \times 2) - 20 = \text{min}$$

$$\text{min} = 10$$

1. Re-order Level = 20 x 15 = 300 units

2. maximum stock level = 300 + 200 - (10 x 5) = 450 units

3. minimum stock level = 300 - (15 x 10) = 150 units

4. Danger Level = Average consumption × Emergency Lead time

= 15 × 4

= 60 units

If Average consumption is not given then take minimum consumption.

If stock reaches danger level then company has to place order on immediate basis. (i.e. emergency purchase)

CW. 10

Working:

	Kgs
A	10
B	4
C	6

→ Machine → FG. 1 unit → Min: 175, Avg: 200, Max: 225

Consumption (RM) depends upon production (FG)

1. Minimum stock of A:

Re-order Level = (Avg consumption × Avg Lead time)

8000 − [(200×10) × 2]

8000 − 4000

4000 kgs

2. Maximum stock of B

Re-order Level + Re-order Qty − (Minimum consumption × minimum Lead time)

4750 + 5000 − [(175×4) × 3]

7650 kgs

3. **Re-order level of C:**

maximum consumption × maximum lead time

(225 × 6) × 4

5400 kgs

4. **Avg stock level of A:**

minimum stock level + $\frac{ROQ}{2}$

$4000 + \left(\frac{10,000}{2}\right)$

9000 kgs

If another formula used then 10125 kgs

CW. 11

(CW-1) **Details:**

A : 54000
O : 9000
C : 300

Average consumption = 150 (54000 ÷ 360)
Average Lead time = 6 days

1. $EOQ = \sqrt{\frac{2 \times 54000 \times 9000}{300}}$ = 1800 castings

2. **15% Risk of being out of stock:**

a) Re-order level = 7 days × 150 = 1050 castings
b) Safety stock = ROL − (Avg consumption × Avg Lead time)
= 1050 − (6 × 150)
= 150 castings

3. **5% Risk of being out of stock:**

a) Re-order level = 9 days × 150 = 1350 castings
b) Safety stock = ROL − (Avg consumption × Avg Lead time)
= 1350 − (6 × 150)
= 450 castings

4. Total Annual Cost (5% Risk)

a) Annual ordering cost

$\left(\frac{A}{Q} \times O\right)$

$\left(\frac{54000}{1800} \times 9000\right)$ = 270,000

b) Annual carrying cost ✓

$\left(\text{Safety Stock} + \frac{Q}{2}\right) \times C$

$\left[\left(450 + \frac{1800}{2}\right) \times 300\right]$ = 405000

675000

5. New EOQ & Frequency

a) New EOQ:

$\sqrt{\frac{2 \times 54000 \times 600}{720}}$ = 300 castings

b) Frequency:

Old policy (EOQ = 1800)

orders		days
(54000/1800) 30	×	360
1		(?)

120days

New Policy (EOQ = 300)

orders		days
(54000/300) 180	×	360
1		2

2days

CW. 20

Particulars	A	B
1. Inventory Turnover Ratio (Times)		
RMC / Avg Stock	$\frac{10,000+52000-6000}{(10000+6000)\div 2}$	$\frac{9000+27000-11000}{(9000+11000)\div 2}$
	$= \frac{56000}{8000}$	$\frac{25000}{10,000}$
	= 7 times	= 2.5 times
2. Inventory Turnover Ratio (Days)		
365 / Ratio in Times	$\frac{365}{7}$	$\frac{365}{2.5}$
	52 days	146 days

comment: Material A is moving faster than material B.

HW. 8

1. $\frac{250,000}{100,000}$ = 2.5 times

2. $\frac{365}{2.5}$ = 146 days

4. RATE PER UNIT

a) Formula: $\frac{\text{Total cost related to material - scrap value}}{\text{Total Quantity - Normal loss Quantity}}$

CW. 14

(WN-1) Net Quantity:

Particulars	A	B
Total Kgs	10,000	8000
(-) Normal loss	(500)	(320)
	9500	7680
(-) Provision @2%	(190)	(153.6)
	9310	7526.4

1. Rate per kg

Particulars	A	B
Purchase cost	100,000	104000
Custom Duty @10%	10,000 (100000 x10%)	10400 (104000 x10%)
Freight	2133	1707
Total cost	112133	116107
÷ Net Quantity	÷ 9310	÷ 7526.4
	12.04	15.43

	Total	=	A	+	B
(Kg)	18000	=	10,000	+	8000
(₹)	3840	×	?	×	?

HW. 6

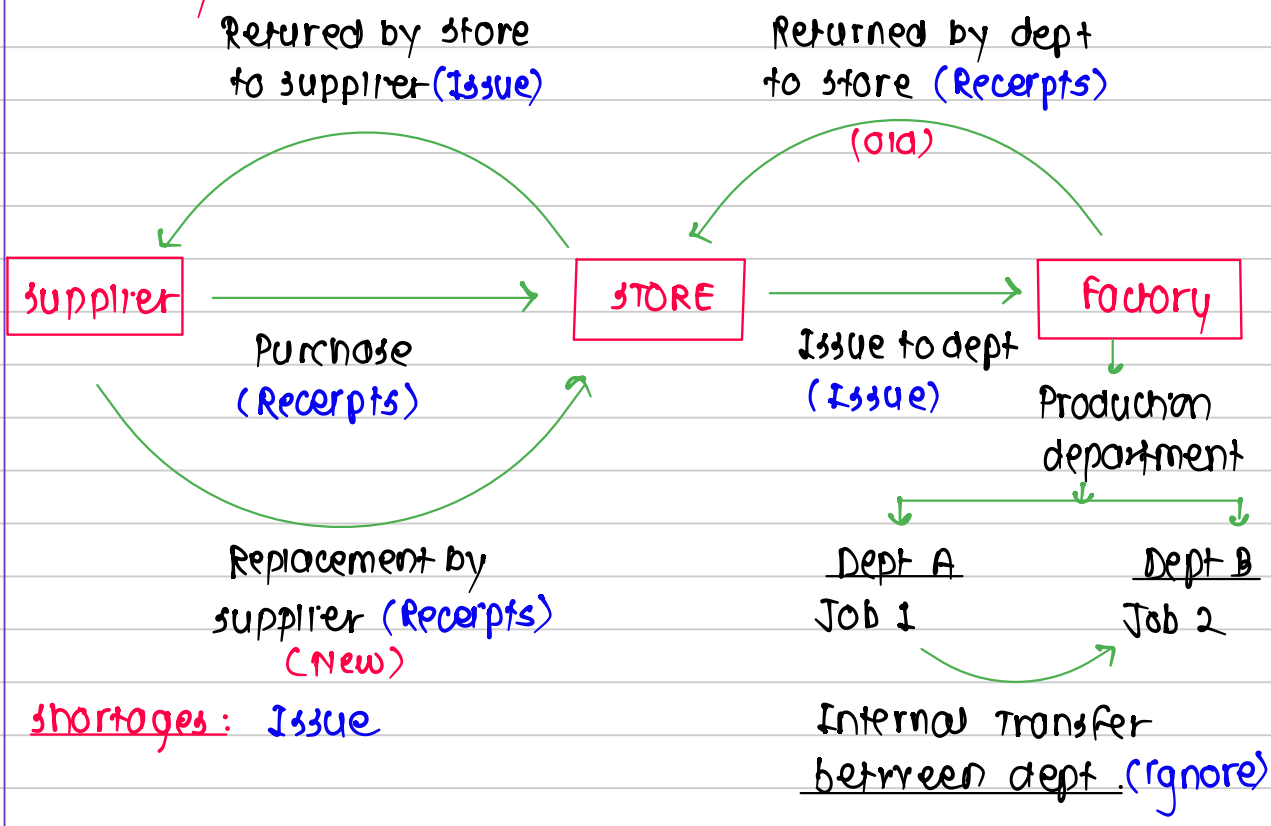
1. Rate per unit

Purchase cost	800
+ Packing cost	50
Total cost	850
÷ Net units	÷200
	4.25

Notes:
a) IGST is ignored as credit is available
b) Cash discount is ignored as it is connected to finance.

5. STORE LEDGER

* Summary



Shortages : Issue

CW. 17

1. STORE LEDGER:

FIFO

Date	Receipt Q	P	C	Issues Q	P	C	Balance Q	P	C
Jan 1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
22 (Job 16)				60	1	60	40	1	40
							100	2	200
23 (Job 17)				40	1	40	80	2	160
				20	2	40			
						80			

LIFO

Date	Receipt Q	P	C	Issues Q	P	C	Balance Q	P	C
Jan 1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
22 (Job 16)				60	2	120	100	1	100
							40	2	80
23 (Job 17)				40	2	80	80	1	80
				20	1	20			
						100			

WAM

Date	Receipt Q	P	C	Issues Q	P	C	Balance Q	P	C
Jan 1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
							200	1.5	300
							(300÷200)		
22 (Job 16)				60	1.5	90	140	1.5	210
							(210÷140)		
23 (Job 17)				60	1.5	90	80	1.5	120
							(120÷80)		

2. **Table:**

Particulars	FIFO	LIFO	WAM
Job 16	60	120	90
Job 17	80 → 140	100 → 220	90 → 180
Closing stock	160	80	120

3. **Discuss:**

Particulars		FIFO	LIFO	WAM
Cost of material	:	Minimum	Maximum	Avg
Profit	:	Maximum	Minimum	Avg
Closing stock	:	Maximum	Minimum	Average (It will avg out things)

∴ WAM will be preferred.

Refere Page 2.86 in ICAI module

CW. 18

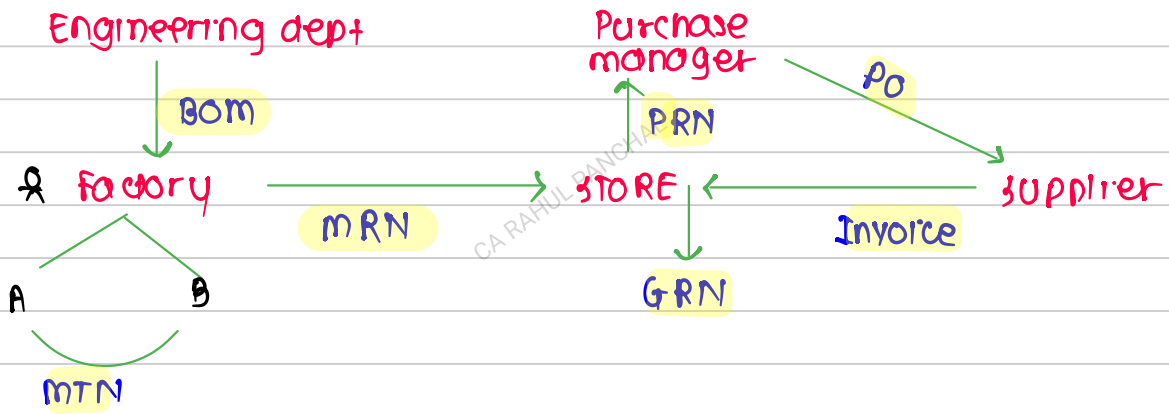
STORE LEDGER (FIFO)

Date	Receipts Q	P	C	Issues Q	P	C	Balance Q	P	C
Sept 20X1									
1.							25	6.5	162.5
								(1625 ÷ 25)	
4				8	6.5	52	17	6.5	110.50
6	50	5.75	287.5				17	6.5	110.50
	(B & Co)						50	5.75	287.50
7				12	6.5	78	5	6.5	32.50
							50	5.75	287.50
10				10	5.75	57.5	5	6.5	32.50
				(Returned to B & Co)			40	5.75	230
12				5	6.5	32.50			
				10	5.75	57.50	30	5.75	172.50
13				20	5.75	115	10	5.75	57.50
15	25	6.10	152.50				10	5.75	57.50
	(M & Co)						25	6.10	152.50
17				10	5.75	57.50	25	6.10	152.50
19	10	5.75	57.50				25	6.10	152.50
							10	5.75	57.50
20	5	5.75	28.75				5	5.75	28.75
							25	6.10	152.50
							10	5.75	57.50

Date	Receipts Q	P	C	Issues Q	P	C	Balance Q	P	C
26				5	5.75	28.75	20	6.10	122
				5	6.10	30.5	10	5.75	57.50
30				2	6.10	12.2	18	6.10	109.8
							10	5.75	57.50
							28	x	167.30

Treatment of shortage:

The material found short as a result of stock taking has been written off at relevant issue price.



6. Stock out VS Carrying cost

CW. 13

(WN-1): Calculation of Probability:

Stock out of tyres	No of times	Probability (%)
100	2	2%
80	5	5%
50	10	10%
20	20	20%
10	30	30%
0	33	? 33%
	100	100

1. Statement showing Total Cost:

Safety stock level	Stockout (units)	Stockout cost	Carrying cost	Total cost
100	-	-	100 × 50	
			5000	5000
80	20	20 × 150 × 2%	80 × 50	
		60	4000	4060
50	50	50 × 150 × 2%		
	30	30 × 150 × 5%	50 × 50	
		375	2500	2875
20	80	80 × 150 × 2%		
	60	60 × 150 × 5%		
	30	30 × 150 × 10%	20 × 50	
		1140	1000	2140
10	90	90 × 150 × 2%		
	70	70 × 150 × 5%		
	40	40 × 150 × 10%		
	10	10 × 150 × 20%	10 × 50	
		1695	500	2195

Safety stock level	Stockout (units)	Stockout cost	Carrying cost	Total cost
0	100	100 × 150 × 2%		
	80	80 × 150 × 5%		
	50	50 × 150 × 10%		
	20	20 × 150 × 20%		
	10	10 × 150 × 30%		
		2700	-	2700

Decision: Optimum safety stock level = 20 units
(Because total cost is lowest in this case)

CW. 12

Working:

RM
AXE
BXE
(equal ratio)

→ machine → FG → Product A

1. Input (Kgs)

(Product)

	Input	−	Loss	=	Output
(%)	125	−	25	=	100
	?			=	1 kg.

1.25 Kgs

A: 0.625 kgs
B: 0.625 kgs
} Equal ratio.

2. Cost & Sales values:

				%
Material cost: AXE : (0.625 × 150)	93.75			
BXE : (0.625 × 90)	56.25	→	150	100
Production Expenses (150 × 40%)			60	40
Total cost			210	140
+ Profit (210 × 20%)			42	
Sales			252	

Total sales value & Profit will remain same
∴ Total cost will remain same (i.e. 210)
∴ Total material cost should be Rs. 150.

3. Ratio of AXE & CXE:

Let's assume CXE = x kgs
∴ AXE = 1.25 − x

Cost of AXE + Cost of CXE = Total material cost
$[(1.25-x)\times 150] + [x \times 75] = 150$
$187.5 - 150x + 75x = 150$
$187.5 - 150 = 150x - 75x$
$37.5 = 75x$
$x = 0.5$

CXE = 0.5 kgs
AXE = 1.25 − 0.5 = 0.75 kgs

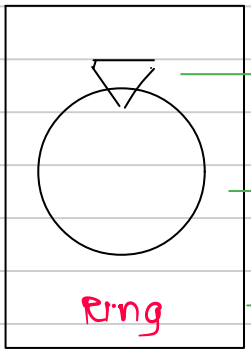
Ratio
AXE : CXE
0.75 : 0.5
3 : 2

CW 15

✓ CW 16

✓ CW 19

7. ABC Analysis



		% Quantity	% Amt
Diamond	:	minimum 10%	maximum 70%
Gold	:	moderate 20%	moderate 20%
Box	:	maximum 70%	minimum 10%

A = Annual Purchase of RM

RM
A : 36200
O : 720
Pc : 125
% : 13.76%
C : 1702.

RM : FG
D : E
2 : 1

36400 RMC → 18200

E

opening	1800	Sales	20,000
Production	18200	Closing	-
	20,000		20,000

opening + Purchase - closing = RMC
200 - NIL = 36400
Purchase = 36200

	Consumption	Lead time (Days)
min		4
Avg	+20	6
max		8

Mat costing

EOQ — stock — I T/O — Rate PU — SL — S/C — ABC

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

stock: ROL, min, max, Avg, danger

I T/O: Time Days

Rate PU: $\frac{TC - SV}{TQ - NL}$

SL: F L W

A

O

PC

%

C

P :

O :

Ci