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Advanced Cost Accounting/1

Chapter (2)

Direct material costs variances analysis

تحليل أنحرافات تكلفة المواد المباشرة

Costs variances analysis :- تحليل أنحرافات التكاليف

Variance is the difference between Actualcosts and standard costs, and the process of computing this differences and identifying the cause of those differences called *variances analysis.*

الأنحرافهو الفرق أو التباين بين التكاليف الفعلية والتكاليف المعيارية(القياسية), وعملية حساب وتحديد هذه الفروقات تسمى **بتحليل الانحرافات**

Favorable and Unfavorable (Adverse) *variance:*- الأنحراف المفضل وغير المفضل

Favorable variances are those which are profitable for the company and unfavorble (adverse) variances are those which causes loss to the company. الانحرافات المفضلةأو الايجابية هي الانحرافات التي تكون مسببة للربح , وغير المفضلة هي التي تسبب الخسارة للشركة
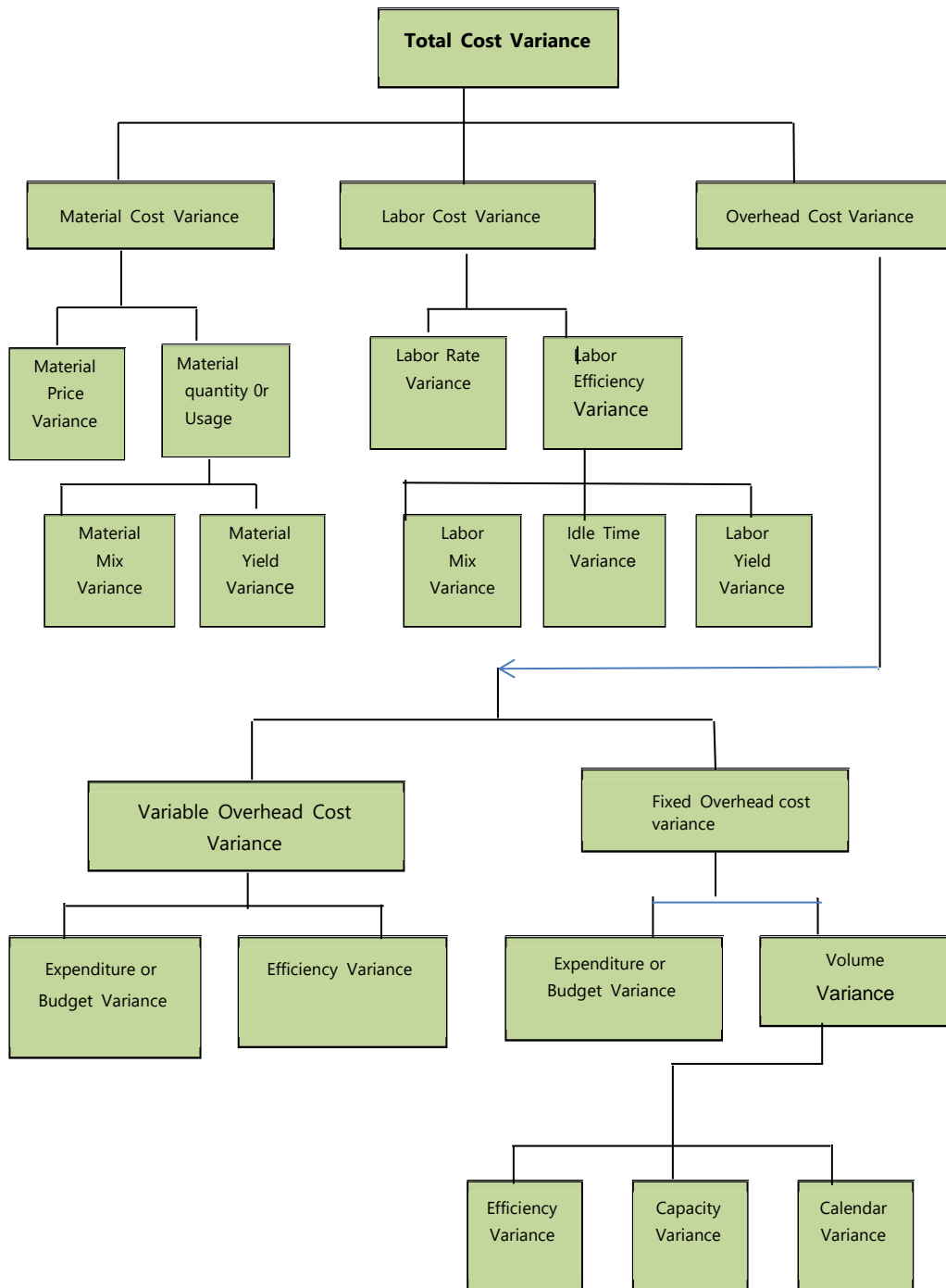
While computing cost variances favorable variance means actual cost is less than standard cost. On the other hand, unfavorble or adverse variance means actual cost is exceeding standard cost.((The situation will be reversed for sales variance. Favorable variances mean actual is more than budgeted and adverse when actual is less than budgeted.)) Favorable variance in short denoted by capital 'F' and Unfavorable variances by capital 'U'.

Students may note that signs of favorable and unfavorable variance may match exactly with mathematical signs i.e. (+) or (-).

عند حساب أنحرافات التكاليف، فإن الانحراف المفضل أو الإيجابي يعني أن التكلفة الفعلية أقل من التكلفةالمعياربة أو القياسية. من ناحية أخرى, يعني الأنحراف غير المفضل(أو الضارأو السلبي) أن التكلفة الفعلية **تتجاوز**التكلفة المعيارية. ((سيتم عكس الوضع بالنسبة لأنحرافات المبيعات. الأنحرافات المفضلة تعني أن الفعلي أكثر من المدرج في الميزانية والعكس عندما يكون الفعلي أقل من المدرج في الميزانية.)) الأنحراف المفضل يشار له بالاختصار Fوالانحراف غير المفضل شار له بالأختصار U) .

CLASSIFICATION OF COSTS VARIANCES: تصنيف الانحرافات

*Variances are broadly classified into two parts namely Revenue variance and Cost variance.*الانحرافات بشكل واسع تصنف الى نوعين أنحرافات الايرادات وانحرافات التكاليف. *At Revenue side variances is calculated by comparing actual sales from budgeted (standard) sales. On the other hand, Cost side reflects variances in cost components.* في جانب *Cost*. أنحرافات الأيرادات التي تحسب من خلال مقارنة المبيعات الفعليه مع المخططة بالموازنة (المعيارية) *variance classification is shown below with the help of a structured diagram.* تصنيف أنحرافات التكاليف مبينة أدناه بمساعدة الخطط الأتي :-

Total Cost Variance

- Material Cost Variance
  - Material Price Variance
  - Material quantity 0r Usage
    - Material Mix Variance
    - Material Yield Variance
- Labor Cost Variance
  - Labor Rate Variance
  - Labor Efficiency Variance
    - Labor Mix Variance
    - Idle Time Variance
    - Labor Yield Variance
- Overhead Cost Variance
  - Variable Overhead Cost Variance
    - Expenditure or Budget Variance
    - Efficiency Variance
  - Fixed Overhead cost variance
    - Expenditure or Budget Variance
    - Volume Variance
      - Efficiency Variance
      - Capacity Variance
      - Calendar Variance

Classification of Variances

COMPUTATION OF VARIANCES: حساب الانحرافات

As discussed earlier variances are classified into two parts. Here we will start from cost side and discuss all cost components one by one with the help of appropriate example and illustrations.

### Material Cost Variances analysis :- تحليل أنحرافات المواد المباشرة

Material Variances reflect the deviation of actual cost incurred on material from the standards. These deviation in material cost could because of changes in material price, quantity used, change in mix of various materials used or output achieved.

انحرافات المواد تعكس الاختلاف بين التكلفة الفعلية المتحققة للمواد عن تكلفتها المعيارية او القياسية. هذه الانحرافات في تكلفة المواد تتحقق بسبب التغير في اسعار المواد , كميتها المستخدمة , التغير في المزيج لمواد مختلفة المستخدمة , او في الانتاج او المخرجات المنجزة

There are five material Variances:

1. *Total Material Cost Variance* (**MCV**) الانحراف الكلي لتكلفة المواد
2. *Material Price Variance* (**MPV**) **انحراف سعر المواد**
3. *Material Quantity (or Usage) Variance* (**MQV**) انحراف كمية (او استخدام) المواد
4. *Material Mix Variance* (**MMV**) **انحراف مزيج المواد**
5. *Material Yield Variance* (**MYV**) انحراف عائد او غلة المواد

These variances can be diagrammatically represented as:
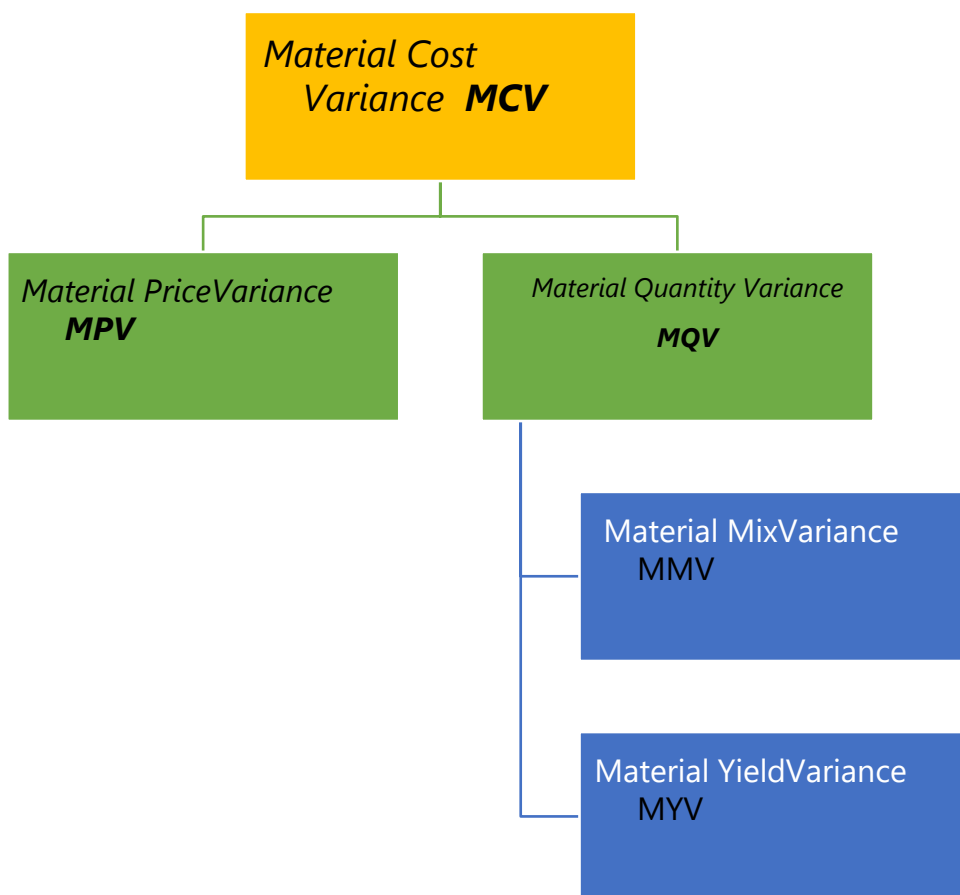
A - Total material cost variance :- الانحراف الكلي لتكلفة المواد

Material cost variance is the **difference between Actual cost of materials and the Standard cost of used(allowed for actual output) materials**. Mathematically it is written as follow :.

انحراف تكلفة المواد (الكلي) هو الفرق بين التكلفة الفعلية للمواد والتكلفة المعيارية للمواد المستخدمة (والمسموحة للانتاج الفعلي). ويمكن تمثيل الأنحراف رياضيا كما ادناه:ـ

Material Cost Variance = [Standard Cost for actual output − Actual Cost]

Or

=[(Actual Price × Actual Quantity) - (Std. price x Std. Quantity Allowed)]

= (AP x AQ) - (SP x SQ)

(The difference between the Actual Cost of Material and the Standard Material Cost of the actual production volume)

Reasons for variance: *Material cost variance arises mainly because of either difference in material price from the standard price or difference in material quantity consumped or used from standard consumption or both the reasons. Analysis of material cost variance is done dividing it into two parts namely Material Price variance and Material Usage variance.*

ينشأ أنحراف كلفة المواد بشكل رئيسي إما بسبب الاختلاف في سعر المادةالفعلي عن السعرالمعياري أو القياسي, أوبسبب الاختلاف في كمية المواد المستهلكة أو المستخدمة عن الاستهلاك القياسي أو كلا السببين. يتم تحليل أنحراف تكلفة المواد بتقسيمها إلى قسمين هما أنحراف أسعار المواد وأنحراف كمية أو استخدام المواد .

(B) - *Material Price Variance* (MPV):- أنحراف سعر المواد

*It measures variance arises in the material cost due to **difference in actual material purchase price from standard material price**. Mathematically it is written as :-*

:

Material Price Variance = [Actual Cost - Standard Cost of Actual Quantity*]

Or

[(AP × AQ) – (SP × AQ)]

Or

(AP – SP) x AQ

(The difference between the Actual Cost and Standard Price for the Actual Quantity used)

*Here actual quantity means actual quantity of material *used.* If in the question material purchase is not given, it is taken as equal to material consumed.

هنا يقصد بالكمية الفعلية للمواد هي الكمية الفعلية المستخدمة ٫ في حالة عدم اعطاء الكمية المشتراة، وهنا تكون الكمية المستخدمة مساوية للمشتراة

Explanation: *Material price variance can also be calculated taking material purchase as actual quantity instead of material used. This method is also correct but doesnot serve the purpose of variance computation. Material price variance may arise from variety of reasons out of which some may be controllable and some may bebeyond the control of the purchase department. If price variance arises due to inefficiency of purchase department or any other reason within the control of thecompany, then it is very important to report variance as early as possible and thiscan be done by taking purchase quantity as actual quantity for price variance computation.*

يمكن أيضًا حساب أنحراف أسعار المواد مع أخذ كميةالمواد المشتراة الفعلية بدلاً من كمية المواد المستخدمة. هذه الطريقة صحيحة أيضًا ولكنها لا تخدم غرض حساب الانحراف. قد ينشأ أنحراف أسعار المواد نتيجة لمجموعة متنوعة من الأسباب، بعضها قد يكون قابلاً للتحكم وبعضها قد يكون خارجًا عن سيطرة قسم المشتريات. إذا نشأ أنحراف السعر بسبب عدم كفاءة قسم المشتريات أو أي سبب آخر ضمن سيطرة الشركة، فمن المهم جدًا الإبلاغ عن الأنحراف في أقرب وقت ممكن ويمكن القيام بذلك عن طريق أخذ كمية الشراء ككمية فعلية لحساب أنحراف السعر

Responsibility for Material Price Variance: المسؤولية عن انحراف سعر المواد

 Generally, purchase department purchases materials from the market. Purchase department is expected to perform its function very prudently so that company never suffers loss due to its inefficiency. Purchase department is held responsible for adverse price variance arises due to the factors controllable by the department.

(A) Material Quantity (or Usage) Variance (MQV) :-

It measures variance in material cost due to Quantity used/ consumption of materials. It is computed as below:

Material Quantity Variance = (Standard Cost of Actual Quantity* - Standard Cost of Standard Quantity for Actual Production

Or

= { Actual Quantity - (AQ) Std. Quantity (SQ) } x std.price(sp)

= (AQ – SQ) x SP

OR

= (AQ x SP) - (SQ x SP)

(The difference between the <u>Standard Quantity</u> specified for actual production and the <u>Actual Quantity</u> used, at <u>Standard Price</u>)

*Here actual quantity means actual quantity of material <u>used.</u>

Responsibility for material quantity (usage) variance: *Material usage is the responsibility of production department and it is held responsible for unfavorable* quantity variance.

Reasons for variance: *Actual material consumption may differ from the standard quantity either due to difference in proportion used from standard proportion or due to difference in actual yield from standard yield.*

Material Quantity variance is divided into two parts:- يقسم أنحراف كمية المواد الى جزئين

(a) Material   mix variance MMV , and أنحراف مزيج (تشكيلة) المواد

(b) Material yield variance MYV. انحراف عائد (غلة) المواد

(a) Material Mix Variance (MMV) :- **أنحراف مزيج المواد**

*Variance in material Quantity consumption may arise due to **difference in proportion actually used from the standard mix/ proportion**.* الانحراف في كمية المواد المستخدمة قد ينشا بسبب أختلاف نسب المزج الفعلية المستخدمة عن نسسب المزج المعيارية

It only arises when two or more inputs are used to produce a product. Mathematically,

أنه فقط يظهر عند استخدام مادتين أو أكثر لانتاج المنتوج.

Material Mix Variance = [Standard Cost of Actual Quantity - Standard Cost of Actual Quantity in Standard Proportion]

Or

*= { Actual Quantity **(AQ -** Revised Std. Quantity **(RSQ**) }x std. price(**sp**)*

Or

[(AQ × SP) - (RSQ × SP))]

(The difference between the Actual Quantity in standard proportion and Actual Quantity in actual proportion, at Standard Price)

$$RSQ = \frac{Standard\ Quantity\ of\ one\ material}{total\ standard\ Quantities\ of\ all\ materials} \times total\ of\ actual\ Quantities\ of\ all$$

materials

Or :-

RSQ *= standard material mix percentage x total of actual quantities of all materials*

RSQ(Revised standard Quantity) :- وتعني) الكمية المعيارية المنقحة لكل مادة

الكمية الفعلية حسب نسب مزجها المعيارية)

Note:-

There are more methods or formulas than above to compute the material mix variance , of them the below formula:-

MMV *= actual quantities of all materials x(Actual mix percentage –   Std. mix percentage) x Std. price*

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(b) *Material Yield Variance   (MYV)* أنحراف العائد

Variance in material consumption which arises due to yield or productivity of the inputs.
It may arise due to use of sub- standard quality of materials, inefficiency of workers or due to wrong processing.

Material Yield Variance = [– Standard Cost of Actual Quantity **-** Standard Cost of Standard Quantity for Actual Proportion]

Or

= { Revised Standard Quantity **(RSQ -** Std. Quantity **(SQ**))} **x** Std. price (**SP**)

= (**RSQ – SQ) x SP**

Or

=[**(RSQ × SP) – (SQ × SP)**]

(The difference between the <u>Standard Quantity</u> *specified for actual production* and <u>Actual Quantity</u> *in standard proportion*, at <u>Standard PurchasePrice</u>)

Or we can used the below formula :-

MYV = (total standard quantity of all material – total actual quantity of all materials) x Std. mix percentage x std. price

Verification of the formulae:

Material Cost Variance = Material Quantity Variance + Material Price Variance*

MCV = MPV + MQV

Or, Material Cost Variance = (Material Mix Variance + Material Revised usage

Variance) + Material price variance

MCV = MPV + (MMV + MYV)

Meaning of the terms used in the formulae:

Term	Meaning
Standard Quantity (SQ)	Quantity of inputs to be used to produce actual output.
Actual Quantity (AQ)	Quantity of inputs actually used to produce actual output.
Revised Standard Quantity (RSQ)	If Actual total quantity of inputs were used in standard proportion.

EXAMPLE 1

The Baghdad company makes containers 300 gallon plastic water tanks for a variety uses .the standard per unit material are as follows:-

 Direct material   80 pounds at (@) $2 per pound.

During may 2021 , the company produce 500 tanks.and actual data for may 2021are as follows:-

 Direct material purchased 42000 pounds @ $ 1.90 per pounds.

 Direct material used in production: 40500 pounds (all from may''s purachases)

Required:- calculate the materials variances

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    * Standard materiales quantity allowed for actual production= std.quantity per unit x actual units produce(output)

        = 80 pounds per tank x 500 tanks = 40,000 pounds

    **   Performance report(to calculated total variances)

Cost items	Actual costs(**AP x AQ**)	Standard costs (**SP x SQ**)	Total variances
DM	($ 1.90 x 40,500)=$ 76,950	($ 2 x 40,000 pounds)=76,950	- 3,050 F
DL			
FOH			
Total cost			

    *1- Material Price variance (**MPV**) = (**AP - SP) x AQ***
                    = ($ 1.90 - $ 2.00) x 40,500
                    = - $ 4050 F
    *2- material quantity(usage) variance (**MQV**) = (**AQ - SQ) x SP***
                    = (40,500 - 40,000) x $2
                    = + $ 1,000   U

Verifiction (proof):-
   TMCV = MPV + MQV
   - 3,050 F =   - 4,050 F + + 1,000 UF

   - 3,050 F = - 3,050 F

    (NOTE : That there are no mix and yield material variances , due to the absence of exist more than two materials)

EXAMPLE 2

NEC Manufacturing , Concern furnishes the following information:

Standard:	Material for one unit of finished products	10 kg.
	Price of material	$ 1 per kg.
Actual:	Output	30,000 unit.
	Material used	280,000 kg.
	Cost of Materials	$252,000

CALCULATE: (a) Material price variance, (b) Material Quantity variance, (c) Materialcost variance.

SOLUTION

Standard Quantity allowed for actual output (SQ)= 10 kg/unit×30,000 unit = 300,000 kg
$$= 300,000 \ kg$$

Actual Price (AP) = ($252,000 ÷ 280,000 kg) = $ 0.90 per kg.

(a) Material Quantity Variance **MQV** = **(AQ – SQ) × SP**
$$= (280,000 – 300,000) \times \$1$$
$$= \$ 20,000 \ (F)$$

(b) Material Price Variance **MPV** = **(AP – SP) × AQ**
$$= (0.90 - 1) \times 280,000 = \$ 28, 000 \ (F)$$

(c) Material Cost Variance **MCV** = **(AP × AQ) – (SP × SQ)**
$$= (0.90 \ x \ 280,000) – (\$1 \times 300,000)$$
$$= - \$ 48,000 \ F$$

Check :-

MCV = MPV + MQV

`   48, 000 (F) = 28, 000 (F) + 20, 000 (F)

EXAMPLE 3

The standard cost card shows the following details relating to the materials needed to produce 1 unit of product X12:

- *Quantity required: 3 kg/unit*
- *Price of materials: $2.5/kg*

Actual production data are given as follows:

- *Production during the month: 1,000 unit*
- *Quantity of material used: 3,500 kg*
- *Price of material: $3/kg*

Required:

1. *Calculate the material <u>cost</u> variance MCV*
2. *Calculate the material price variance MPV*
3. *Material quantity variance MQV*

Solution

First, note the following:

- *Standard Quantity (SQ)allowed = 1,000 unit of production x 3kg /unit = 3,000 kg*
- *Standard Price (SP) = $2.5/kg*
- *Actual Quantity = 3,500 kg*
- *Actual Price (AP) = $3/kg*

Now, the variances can be calculated as follows:

*(1) Material Cost Variance **MCV= AC − SC***
$$= (AP \ x \ AQ) - (SP \ x \ SQ)$$
$$= (3 \ x \ 3.500) - (2.5 \ x \ 3,000)$$
$$= \$ + 3,000 \ (U)$$

*(2) Material Price Variance **MPV= (AP - SP) x AQ***
$$= (3 \ - \ 2.50) \ x \ 3,500$$
$$= \$ + 1,750 \ (U)$$

*(3) Material quantity Variance **MQV= (AQ − SQ) x SP***
$$= (3,500 - 3,000) \ x \ 2.50 = \$ +1,250 \ (U)$$

EXAMPLE 4

Using the information provided, calculate:

1. *Material total cost variance*
2. *Material price variance*
3. *Material usage variance*

A summary of the information needed to complete this task is given as follows:

- *Quantity of material purchased = 3,000 kg*
- *Value of material purchased = $9,000*
- *Standard quantity of material required per tone of output = 30 kg*
- *Standard rate(price) of material = $2.50 per kg*
- *Opening stock of materials = Nil*
- *Closing stock of material = 500 kg*
- *Output during the period = 80 tons*

Solution

As an initial step, note the following:

- *Actual quantity of material purchased = 3,000 kg*
- *Value of material purchased = $9,000*
- *Actual price per kg = $9,000 / 3,000 units = $3*
- *Standard price per kg = $2.50 per kg*
- *Standard quantity = 80 tons x 30 kg per tons = 2,400 kg*
- *Actual quantity used = Opening stock + __Purchase__ – Closing stock = Nil + 3,000 – 500 = 2,500 units*

Now, the variances can be calculated as follows:

*(**1**) Material Cost Variance = (AC – SC)*
= (AP x AQ) – (SP x SQ)
*= ($ 3 x 2.500) – ($ 2.50 x 2,400) = $ + 1,500 (**U**)*

*(**2**) Material Price variance = (AP – SP) x AQ*
*= (3 -2.50) x 2,500 = $ + 1,250 (**U**)*

*(**3**) Material Quantity Variance = (AQ – SQ) x SP*
*= (2,500 – 2,400) x 2.5 = $ +250 (**U**)*

EXAMPLE   (5) -

al-furat company mix two materials , A and B to produce a unit of product XY.

1- The standard mix per unit is as follows :-

　　　Material A   2 kg @ $ 12 per kg

　　　Material B   1 kg   @ $ 10 per kg

2- Actual costs and quantity of materials used for march are as follows

　　　Material A   190 kg   @ $ 13

　　　Material B   140 kg   @ $ 9

.3- Actual output(unit produced of product XY) is 100 units.

.

required :- calculate the materials variances ?

Solution :-

to calculate the total material variance , we must calculate the standard material quantity allowed for actual units produced:-

* standard allowed for actual output for material A = 2 kg per unit x 100 unit = 200 kg

 standard allowed for actual output for material B = 1 kg per unit x 100 unit = 100 kg

** Performance report for calculate total variances:-

Material	Actual cost (AQ x AP)		Standard cost(SQ x SP)		Total variance
A	(190 x 13)	2470	(200 x 12)	2400	+ 70 U
B	(140 x 9)	1260	(100 x 10)	1000	+ 260 U
Total	**330**	**3730**	**300**	**3400**	**+ 330 U**

Material price variance :-

1- **MPV for material A = (AP – SP) x AQ** = (13 – 12) x 190 = + 190 U

2- *MPV for material B = (AP – SP) x AQ = (9 – 10) x 140 = - 140 F*

Material quantity variance :-

1- **MQV for material A = (AQ - SQ) x** *SP = (190 - 200) x 12 = - 120 F*

2- *MQV for material B = (AQ - SQ) x SP = (140 - 100) x 10 = +400 U*

Verification(check):-

Total material cost variance for A (MCV) = MPV + MQV = + 190 U +-120F = +70 U

Total material cost variance for B (MCV)= MPV+MQV = - 140F + +400U = + 260 U

Material mix variances :-

1- MMV = (AQ – RSQ) x SP

$$RSQ = \frac{STD.quantity\ for\ material\ A}{STD.quntity\ for\ all\ materials} \times SP$$

RSQ for A = $\frac{200}{300}$ x 330 = 220

RSQ for B = $\frac{100}{300}$ x 330 = 110

MMV for A = (190 – 220) x 12 = - 360 F

MMV for B = (140 – 110) x 10 = +300 U

2- MYV = (RSQ – SQ) x SP

MYV for A = (220 – 200) x 12 = + 240 U

MYV for B = (110 – 100) x 10 = + 100 U

Verification :-

MQV = MMV + MYV

For material A :-

120 F = + 360 F + - 240 U

120 F = 120 F

For material B :-

- 400 U = - 300 U + - 100 U

-400 U = - 400 U

EXAMPLE (6) :

The standard mix to produce one unit of product is as follows:

Material A	60 lbs .@ $ 15 per lbs.
Material B	80 lbs @ $ 20 per lbs
Material C	100 lbs @ $ 25 per lbs

During the month of July , 10 units were actually produced and consumption was as follows:

Material A	640 lbs @ $ 17.50 per lbs
Material B	950 lbs @ $ 18.00 per lbs
Material C	870 lbs @ $ 27.50 per lbs

required :-:Calculate material variances

Solution :-

First of all prepare a **performance report** and put all the available figures in requisite columns:

Material	Actual costs **AC**(for 10 units)			Actual costs **SC** (for 10 units)			Total variances = **AC-SC**
	Qty	Price	Cost	Qty	price	cost	=**MCV**
A	640	17.50	11,200	600(60x10)	15	9,000	+2,200 U
B	950	18.00	17,100	800(80x10)	20	16,000	+1,100 U
C	870	27.50	23,925	1,000(100x10)	25	25,000	- 1,075 F
Total	2,460		52,225	2,400		50,000	+ 2,225 U

Fist material variance is Material Cost VarianceAs discussed earlier the formula is :

 Total Material Cost Variance(MCV) = Standard Cost of actual Output -Actual Cost

Standard cost of actual Output= Standard quantity for actual Output * standard Price

Actual Cost= actual quantity * Actual Price

Since in this case, standard and actual output is same , 10 units total standard cost is taken as standard cost of actual output i.e. 50,000

 Total Actual Cost = 52,225

MCV= 50000- 52,225= 2,225(U)

2,225(U) is read as unfavorable or adverse

Since, the answer is negative, we use the (U) to indicate material cost variance is negative, i.e. actualcost incurred on material is more than the standard set.

Material Price Variance (MPV)= (Actual Price- standard Price) * actual Quantity

MPV= (AP - SP) x AQ

Material A   =   (17.50 -15) x 640 = $_+$ 1600   U

Material B   =   (18.00 -20.00) x950 =   - 1900   F

Material C   =   (25 -27.50) x 870 =   + 2175   U

+ 1,875(U)

    We have just entered values for standard price , actual price and actual quantity. All these figures aregiven to us for all three material. We have calculated material price variance for each of the materialsseparately and then found the total which is 1875(U), implying MPV is also unfavorable.

Also observe for material B, MPV is positive, so we have referred to as by the use of symbol (F), whichis read as favorable.

Material Usage (or Quantity) Variance:-

Material Quantity Variance(MQV)= (Standard Quantity for Actual Output- Actual Quantity)* Standard Price

MQV =   (AQ - SQ) x SP

Material A= (640-600) x 15= +600U

Material B= (950 - 800) x 20 = +3000 U

Material C= (870-1,000) x 25= - 3250F

$+$ **350(U)**

Now this is rule to check our answer

MCV=MPV +MQV

Material cost variance has to be equal to the total of Material Price variance and Material quantity Variance

2,225(U) = 1875(U) + 350(U)

Left hand side is equal to right hand side, so we can proceed.

Material Mix Variance:-

Material Mix Variance(MMV)= (Revised Standard Quantity – Actual Quantity)* Standard Price

RSQ= $\dfrac{\text{Standard Quantity of one material}}{\text{Standard Quantities of all materials}}$ * *Total of actual Quantities of all Materials*

Revised Standard Quantity(RSQ) :-

Material A = $\dfrac{600}{2,400}$ *x 2,460 = 615 lbs*

Material B = $\dfrac{800}{2,400}$ *x 2,460 = 820 lbs = 2,460*

Material C = $\dfrac{1,000}{2,400}$ *x 2,460 = 1025 lbs*

Material Mix Variance MMV =(AQ - RSQ) x SP
Material A =   (640 – 615)x 15 =   + 375 U
Material B =   (950- 820) x 20 =   +2600 U
Material C =   (870- 1,025)x25 =   - 3875 F
                                    -900(F)

Material Yield Variance
Material yield variance = (RSQ – SQ) x SP   **=**
Material A = (615 – 600) x 15 =   +225 (U)
Material B = (820 – 800) x 20 =   +400 (U)
Material C = (1025 – 1000) x 25 = + 625 (U)
                                    + 1,250 (U)

Check:-

materials	MPV	MQV			MCV
		MMV	MYV	Total MQV	
A	+ 1,600 U	+375U	+225U	+600U	+ 2,200 U
B	- 1,900 F	+2,600U	+400 U	+3,000U	+ 1,100U
C	+ 2,175 U	-3,875F	+ 625U	-3,250F	-1,075F
Total	+ 1,875 U	-900 F	+ 1,250U	+350 U	+2,225U

Example 6 : -   al-furat company mix two materials , A and B to produce aunit of product XY. *The standard mix per unit is as follows :-*

Material A   2 kg @ $ 12 per kg

Material B   1 kg   @ $ 10 per kg

Actual costs and quantity of materials used for march are as follows

Material A   190 kg   @ $ 13

Material B   140 kg   @ $ 9

. Actual output(unit produced of product XY) is 100 units.

.

required *:- calculate the materials variances ?*

Solution :-

to calculate the total material variance , we must calculate the standard material quantity allowed for actual units produced:-

standard allowed for actual output for material A = 2 kg per unit x 100 unit = 200 kg

standard allowed for actual output for material B = 1 kg per unit x 100 unit = 100 kg

Performance report for calculate total variances

material	Actual cost **AC**=(AP x AQ)		Standard cost **SC**=(SPxSQ)		Total variance **MCV**
A	(13 x 190)	2,470	(12 x 200)	2,400	+ 70 U
B	(9 x 140)	1,260	(10 x 100)	1,000	+ 260 U
Total	330	3,730	300	3,400	+ 330 U

Material price variance :-

1- *MPV for material A = (AP – SP) x AQ = (13 – 12) x 190 = + 190 U*

 2- MPV for material B = (AP – SP) x AQ = (9 – 10) x 140 = - 140 F

Material quantity variance :-

1- *MQV for material A = (AQ - SQ) x SP = (190 - 200) x 12 = -120 F*

2- MQV for material B = (AQ - SQ) x SP = (140 - 100) x 10 = + 400 U

Verification(check):-

Total material cost variance for A (MCV) = MPV + MQV = + 190 U +-120F = +70 U

Total material cost variance for B (MCV)= MPV+MQV = - 140F + +400U = + 260 U

Material mix variances :-

3- *MMV = (RSQ – AQ) x SP*

$$RSQ = \frac{STD.quantity\ for\ material\ A}{STD.quntity\ for\ all\ materials} \textbf{ x total actual quantity of all}$$

materials

RSQ for A = $\frac{200}{300}$ x 330 = 220

RSQ for B = $\frac{100}{300}$ x 330 = 110

MMV for A = (190 – 220) x 12 = - 360 F

MMV for B = (140 – 110) x 10 = + 300 U

4- *MYV = (SQ – RSQ) x SP*

MYV for A = (220 – 200) x 12 = + 240 U

MYV for B = (110 – 100) x 10 = +100 U

Verification OR Check:-

materials	MPV	MQV			MCV
		MMV	MYV	Total MQV	
A	+ 190 U	-360F	+240U	-120F	+ 70 U
B	- 140 F	+300U	+100 U	+400U	+ 260U
Total	+ 50 U	-60 F	+ 340U	+280 U	+ 330U

Example 7 :-

Assume that Ali company mixes two direct materials X and Y ,to produce a unit of product AB, the standard mix is as follows:-

    Material X : 1.2 kg @ standard price of $ 0.80 per kg

    Material Y : 0.40 kg @ standard price of $ 0.90 per kg

Actual costs for march,2021, are as follows:-

    Material X :   5,200 kg @ actual price of $ 0.82

    Material Y : 1,300 kg @ actual price of $ 0.97

    Units produced are 4,000 unit during the month.

Required :- compute the material variances ?

solution :-

   to compute the standard quantity allowed for actual output (production) :

standard quantity allowed for actual output for material X = 1.2 kg /unit x 4,000 unit = 4,800 kg

standard quantity allowed for actual output for material Y = 0.4 kg/unit x 4,000 unit = 1,600 kg

 performance report for compute total material variance

Cost items	AC = AP x AQ		SC = SP x SQ		Total variance**MCV**
Material X	(0.82 x 5,200) = 4,264		(4,800 X 0.80) = 3,840		+ 424 U
Material Y	(0.97 x 1,300) = 1,261		(1,600 x 0.90) = 1,440		- 179 F
Total	6,500	5,525	6,400	5,280	+ 245 U

Variances analysis :-

1- Materials price variances:-

MPV for X = (AP - SP) x AQ = (0.82 - 0.80) x 5,200 =   + 104 U

MPV for Y =   = (0.97 − 0.90) x 1,300 =   + 91 U

2- Materials quntity variances:-

MQV for x = (AQ - SQ) x SP = (5,200 − 4,800) x 0.80 = + 320 U

MQV for Y =   = (1,300 − 1,600) x 0.90 =   - 270 F

Check :-

   TMCV = MQV + MPV

For material X:

   + 424 U = + 104 U + +320 U

   + 424 U = + 424 U

For material Y :

   - 179 F = +91 U + - 270 F

   - 179 F = - 179 F

3-Mix and Yield variances :-

Materials	ACTUAL		STANDARD	
	quantity	Mix percentage	quantity	Mix percentage
X	5,200	(5,200/6,500) = 0.80	4,800	(4,800/6,400) = 0.75
Y	1,300	(1,300/ 6,500) = 0.20	1,600	(1,600/ 6,400)= 0.25
Total	6,500	= 1.00	6,400	= 1.00

a- Mix variances :-

RSQ for X = $\frac{4,800}{6,400}$ x 6,500 = 4,875 kg   or RSQ = 0.75 x 6,500 = 4,875 kg

RSQ for Y   = $\frac{1,600}{6,400}$ x 6,500 =   1,625 kg   or RSQ   = 0.25 x 6,500 = 1,625 kg

----

6500

MMV for X = (AQ – RSQ) x SP = (5,200 – 4,875) x 0.80 = +260 U
MMV for Y = = (1,300 – 1,625) x 0.90 = - 292.5 F

Another method
MMV for X = (Actual Mix percentage – Standard mix percentage) x Actual quantities of all material x SP
= (0.80 – 0.75) X 6500 X 0.80 = - 260
MMV for Y = (0.20 – 0.25) X 6500 X 0.90 = + 292.5

Material Yield variances :-

MYV = (standard quantity – revised standard quantity) x std. price

MYV = (RSQ – SQ) x SP

MYV for X = (4875 – 4800) x 0.80 = + 60 U

MYV for Y = (1625 – 1600) x 0.90 = + 22.5 U

MYV = (Actual quantity of all material – Standard quantity of all material) x standard mix percentage x SP
MYV for X = (6500 - 6400) x 0.75 x 0.80 = + 60 U
MYV for Y = (6500 - 6400) x 0.25 x 0.90 = + 22.5 U

Verification or check :-

MQV = MMV + MYV

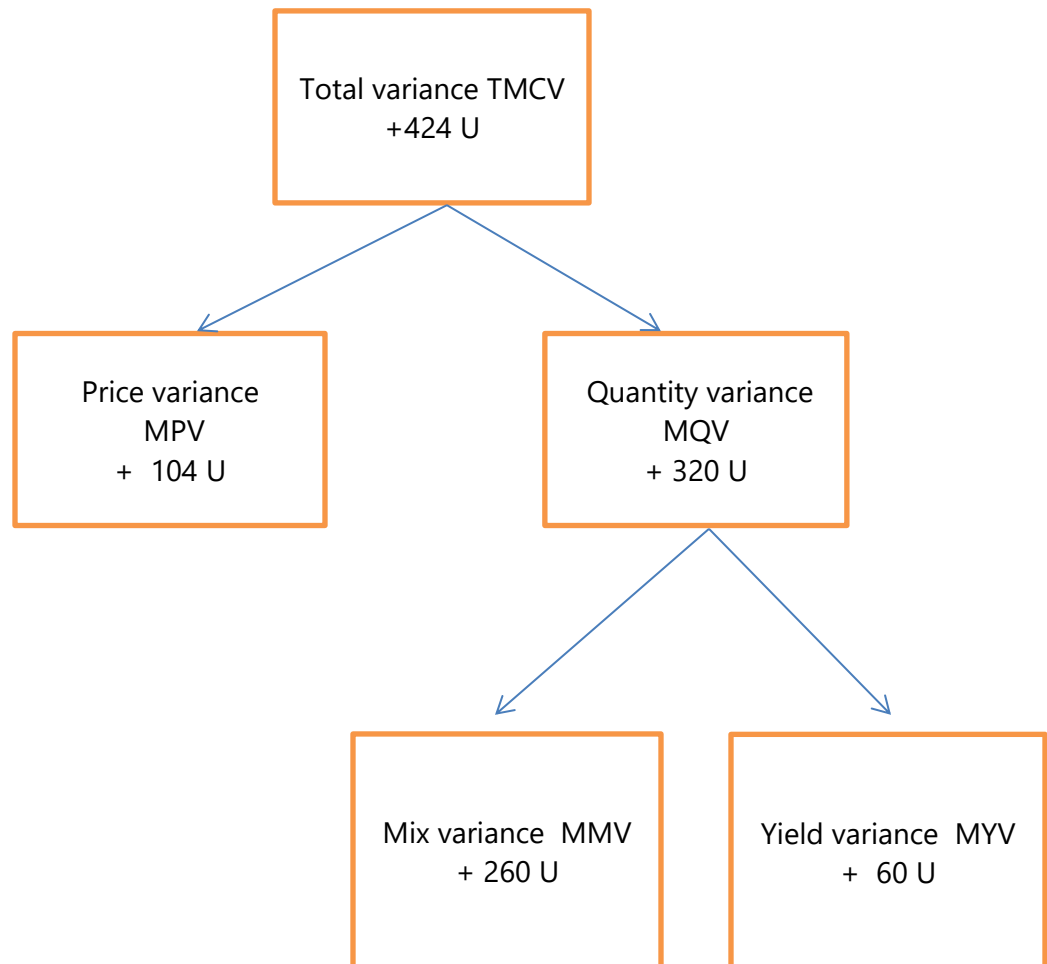*For material X :-*

+320 U = + 260 U + + 60 U

+ 320 U = + 320 U

For material y :-

+ 270 U = + 292.5 U + +22.5 U

+ 270 U = +270 U

Check table :-

Material X variances

```
                    ┌─────────────────────┐
                    │  Total variance TMCV │
                    │       +424 U         │
                    └─────────────────────┘
                       ╱              ╲
        ┌──────────────────┐    ┌──────────────────┐
        │  Price variance  │    │ Quantity variance│
        │       MPV        │    │       MQV         │
        │     +  104 U     │    │     + 320 U       │
        └──────────────────┘    └──────────────────┘
                                   ╱           ╲
                      ┌──────────────────┐  ┌──────────────────┐
                      │ Mix variance MMV │  │Yield variance MYV│
                      │     + 260 U      │  │     +  60 U       │
                      └──────────────────┘  └──────────────────┘
```

Material Y variances

Total variance TMCV
- 179 F

Price variance
MPV
+ 91 U

Quantity variance
MQV
- 270 F

Mix variance (
MMV)
- 292.5 F

Yield variance (
MYV)
+   22.5 U
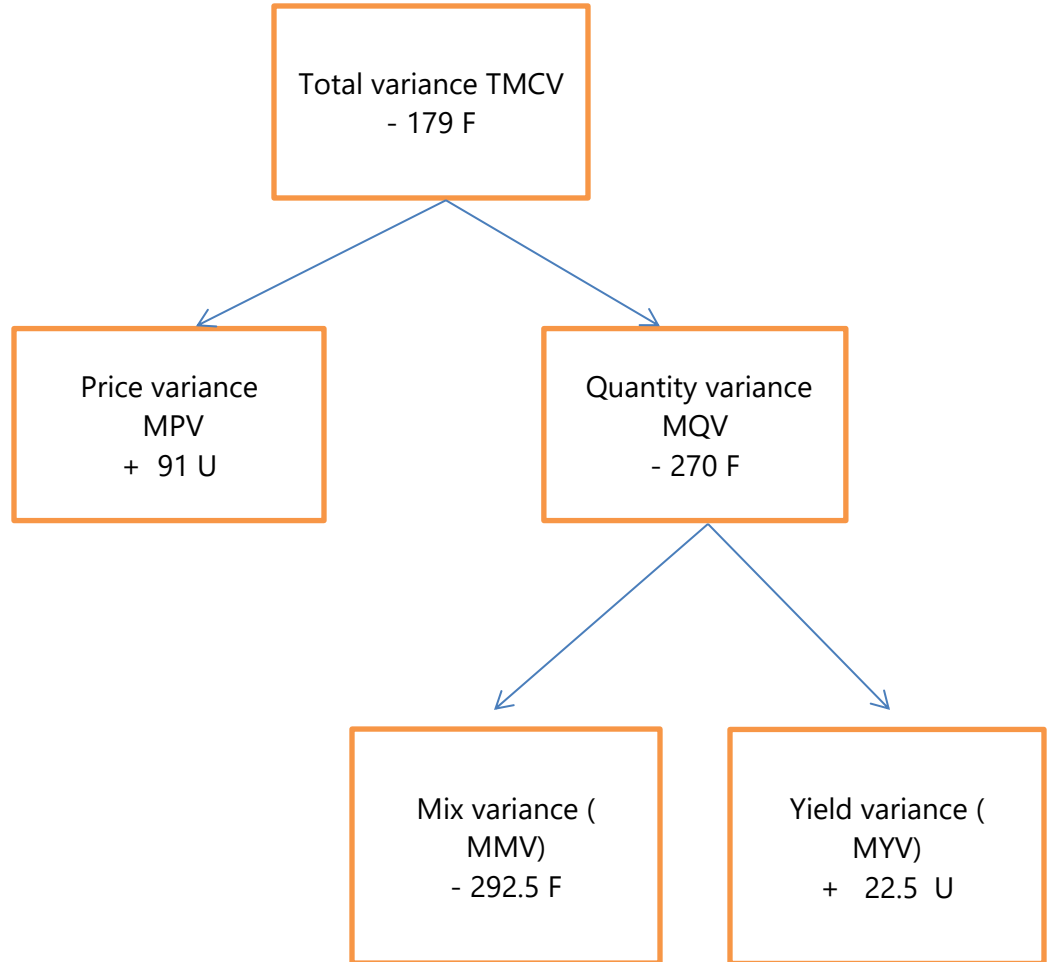
1. The difference between the actual price and the standard price, multiplied by the actual quantity of materials purchased is the
   a) direct labor price variance
   b) direct labor quantity variance
   c) direct materials price variance
   d) direct materials quantity variance

2. XYZ Company has a material standard of 1 pound per unit of output. Each pound has a standard price of $25 per pound. During July, XYZ Company paid $127,250for 4,950 pounds, which they used to produce 4,700 units. What is the direct material price variance?

   a) $3,500 unfavorable
   b) $2,600 favorable
   c) $12,600 unfavorable
   d) $10,000 unfavorable

3. G Company has a material standard of 1.1 pound per unit of output. Each pound has a standard price of $25 per pound. During July, G Company paid
   $118,800 for 5,100 pounds, which they used to produce 4,900 units. What isthe direct materials quantity variance?
   a) $7,250 favorable
   b) $5,000 favorable
   c) $7,250 unfavorable
   d) $5,000 unfavorable

Practice:

Problem #1

C Company manufactures a number of consumer items for general household use. During the recent month, the company manufactured 5,000 units using 12,000 pounds of material. The 14,000 pounds purchased cost the company $21,000. According to the standard cost card, each unit requires 2.2 pounds, at a cost of $1.40 per pound.

Required:- Compute the material price variance and material quantity variance.

Problem #2

Delta Woods Inc., manufactures wood products for the use in small and medium size offices. One of its products is a chair. Last month Delta manufactured 4,000 chairs for which company purchased and used 11,000 feet of wood. The total cost of 11,000 feet of wood was $37,400.
According to **direct materials price and quantity standards**, one chair requires 2.5 feet of wood at a cost of $3.60.

Required:

1. Compute the standard cost of wood needed to manufacture 4,000 chairs.
2. Compute *direct materials* price and quantity variance for the last month.

Problem #3:-

A manufacturing concern, which has adopted standard costing, furnished the following information: Standard Material for 70 kg finished product: 100 kg. Price of materials: Re. 1 per Actual Output: 2,10,000 kg. Material used: 2,80,000 kg. Cost of material: Rs. 2,52,000.

Required:

Calculate: (a) Material Cost Variance **MCV** (b) Material Price Variance **MPV** (c) Material Quantity Variance **MQV**

Problem #4:-

Better Bikes established the following standards based upon the company's experience with previous suppliers. The standards are as follows:

Cost of titanium	$22 per pound
Titanium used per bicycle	8 lb.

Actual results for the first month using the online supplier of titanium are as follows:

Bicycles produced	800
Titanium purchased	8,400 lb. for $159,600
Titanium used in production	7,900 lb.

Required:

Compute the direct materials variances (MCV , MPV , MQV).

Problem #5

For making 1unit of yarn, the standard material requirement is:
Material :- White 86 gm   @ $ 0.50 per gm
     Black 44 gm   @ $ 1.50 per gm
In March, 10,000 unit. of yarn was produced.
The actual consumption of materials is as under:
Material :- white   980,000 gm @ $ 0.45 per gm
     Black   380,000 gm @ $ 1.60 per gm
Required:

Calculate: (1) MCV (2) MPV (3) MUV (4)MMV (5)MYV