CHAPTER FIVE

BUSINESS MATHEMATICS

- **Business mathematics involves the application of various topics such as percentage, simple interest and ratio.**

- **It also requires basic business knowledge.**
- **Before solving questions based on this topic, the question must be analyzed and solved systematically or step by step.**

Billing by utility companies:

- **A utility company such as the electricity company has its own mode or method, used in billing it customers.**
- **There may be a fixed charge a customer may be required to pay monthly, whether or not he uses electrical power or not.**
- **Under certain circumstances, this fixed charge will not exist.**
- **There may also be a charge for each unit used, which may changed with reference to number of units used.**
- **In fact, there are countless methods which can used to determine the amount that consumers have to pay.**

(Q1.) Within a certain city, electricity billing is as follows:
First 20 units is at 2p per unit.
Next ten units is at 4p per unit.
Any extra unit is at 7p per unit.
(a) Determined the June bill for Mr. Adu, who used 70 units of electricity during that month.
(b) Assuming the electricity company had increased it charges by 12½%, find how much Mr. Adu will pay for the electricity used in June.

Soln

Since the first 20 units is at 2p per unit ⇒ cost of the first 20 units = 20×2 = 40p .

Since the next ten units is at 4p per unit ⇒ cost of the next 10 units = 10×4p = 40p.

The number of units used so far = 20+10 = 30 units.
Total number of units used by Mr. Adu = 70 units.

⇒The number of extra units used by Mr. Adu =70 – 30 =40 units.

Since cost of each extra unit is 7p ⇒ the cost of the extra 40 units used by Mr. Adu = 40 ×7 = 280p.

Cost of electricity used by Mr. Adu = the cost of the first 20 units + the cost of the next 10 units + the cost of the extra units = 40p +40p + 280p = 360p (GHc 3.60p).

(Q2.) Within a certain community, electricity charges are as follows:

Fixed charge = 10p.
Cost of the first 30 units is at 3p per unit.
Cost of the next 20 units is at 6p per unit.
Cost of the next 15 units is at 7p per unit.
Cost of each additional unit is 8p.
(a) If Prince Agbo used 120 units of electricity two months ago, how much did he pay for that particular month?
(b) Last month Mr. Raymond Quaye was brought a bill of GH¢ 3.65. Determine the number of units of electricity he used.

Soln

(a) Fixed charge = 10p.
Cost of the first 30 units = 30 × 3 = 90p.
Cost of the next 20 units = 20 × 6 = 120p.
Cost of the next 15 units = 15 × 7 = 105p.
Number of units used so far =30+20+15 = 65 units.
Number of units used by Mr. Agbo = 120 units.
Extra units he used = 120 – 65 = 55 units.
Cost of these extra units = 55 × 8p = 440p.
Amount paid by Mr. Agbo = Fixed charge + cost of the first 30 units + the cost of the next 20 units + the cost of the next 15 units + the cost of the extra units = 10p + 90p +120p + 105p + 440p = 765p (GHc 7.65).
(b) Amount paid by Mr. Quaye = GHC 3.65 = 365P.
Since the fixed charged =10p ⇒the actual cost of the units used = 365 – 10 = 355p.
Since the cost of the first 30 units = 90p, cost of the next20 units = 120p and the cost of the next 15 units = 105p,⇒ the cost of the first (30+20+12) units = 90p+120p+105p,⇒ cost of the first 65 units = 315p.
But the cost of the first 65 units + the cost of the additional units = the actual cost of the units.
⇒315 + cost of extra units used = 355,
⇒ Cost of extra units used = 355 – 315 = 40p.
But cost of each extra unit = 8p, ⇒ 8p = 1 unit therefore 40p = $\frac{40 \times 1}{8}$ **= 5units.**
Since **the number of extra units used by Raymond Quaye = 5 units, ⇒ the total number of units used by Mr. Quaye = 65 + 5 = 70 units.**
(Q3) In Axim, the customers of the electricity company are charged as follows:
(i) There is a fixed charge of 20p.
(ii) The cost of the first 10 units is at 3p per unit.
(iii) Cost of the next 40 units is at 5p per unit.
(iv) Cost of any extra unit used is 9p.
(a) Determine the bill of Sister Naana, who used 7 units of electricity.
(b) How much will be paid by uncle Ebo, who used 80 units of electricity.
(c) Determine the number of units used by uncle Ato, whose bill was GHC 3.40.

Soln:

(a) Cost of the first 10 units is at 3p per unit,
⇒the cost of the 7 units used by Sister Naana =7× 3 =21p.

The bill of sister Naana = the fixed charge + 21p = 20p + 21p = 41p.
(b) Number of units used by uncle Ebo = 80 units.
Cost of the first 10 units = 3 × 10 =30p.
Cost of the next 40 units = 5 × 40 = 200p.
Number of units used so far = 10 + 40 = 50 units.
Total number of units used by uncle Ebo = 80 units.
Extra units used by uncle Ebo = 80 – 50 = 30 units.
Cost of these extra units = 9 × 30 =270p.
Amount paid by uncle Ebo = the fixed charged + cost of the first 10 units + cost of the next 40 units + the cost of the extra units = 20p + 30p + 200p + 270p = 520p = GH¢ 5.20.
(c) Amount paid by uncle Ato = GH¢ 3.40 = 340p.
Since the fixed charge = 20p ⇒ the amount paid for the actual number of units used = 340 – 20 =320p.
Since the cost of the first 10 units = 30p and the cost of the next 40 units = 200p, then the cost of the first (10+40) units = 30p + 200p.
⇒Cost of the first 50 units = 230p.
Cost of the first 50 units + cost of the extra units used = the actual cost of the units used,
⇒230 + cost of extra units = 320p,
⇒ cost of extra units used =320 – 230 =90p.
But cost of each unit = 9p , ⇒9p = 1 unit
therefore 90p = $\frac{90 \times 1}{9}$= 10 units,⇒number of extra units = 10 units. Total number of units used = 50 + 10 = 60 units.
Q4. The method used by an electrical energy supplying company, to determine how much its consumers must pay is as follows:
First 20 units is at 2p per unit.
Next 40 units is at 3p per unit.
Next 10 units is at 10p per unit, and the cost of each extra unit used is 10p.
1. Determine the bill for a small company which made use of 100 units of electrical energy.
11. If Kwamena Bilson paid a bill of ¢3for a particular month, find the number of electrical units he used.

Solution

1. a cost of the first 20 units
= 20 x 2 = 40p.
Cost of the next 40 units = 3 x 40 =120p.
Cost of the next 10 units = 10 × 10 = 100p.
Number of units accounted for so far = 20 + 40 + 10 =70 units. Total number of units used by the company = 100 units.
The number of extra units used = 100 – 70 = 30.
Cost of these extra units used = 10 × 30 = 300p.
Bill for the company = cost of the first 20 units + cost of the next 40 units + the cost of the next 10 units + the cost of the extra units used,

=40p + 120p + 100p + 300p
= 560p = ¢5.60.
11. Amount paid by Kwamena Bilson = ¢3 = 300p.
Since the cost of first 20 units = 40p, cost of next 40 units = 120p and cost of the next 10 units = 100p, then the cost of (20 + 40 +10) units = 40p + 120p + 100p = 260p,
⇒cost of the first 70 units = 260p.
But cost of the 70 units + cost of the extra units used = amount paid by Mr. Bilson (since there is no fixed change).
Therefore 260p + cost of the extra units = 300p.
Therefore cost of the extra units used = 300 – 260 = 40p.
But cost of each extra unit = 10p.
if 10p = 1 unit
then $\frac{40p}{10} = 40 \times 1 = 4$ units.
The number of extra units therefore used by Mr. Bilson = 4 units.
The total number of units he used = 70 +4 = 74 units.
Q5. Within a certain town, electricity billing is as follows:
First 20 units - - - Nill.
Next 30 units - - - 2p per unit, and any extra used unit - - – 8p per unit.
a. If Mr. Kwame used 80 units of electricity last June, determine the amount he paid in June.
b. If Sir Jonas paid a bill of ¢1.50, determine the number of units he used.

Solution

Cost of first 20 units = 0p (Since it is free).
Cost of the next 30 units = 2 x30 = 60p.
Cost of the next 10 units =10x5 = 50p.
Number of units accounted for so for = 20 + 30 +10 = 60 units.
Number of units used by Mr. Kwame = 80 units.
Extra units used by Mr. Kwame= 80 – 60 = 20 units.
Cost of these extra units = 8 x 20 = 160p.
Amount paid by Mr. Kwame = cost of the first 20 units + cost of the next 30 units + cost of the next 10 units + cost of the extra units used = 0+60+50+160 = 270p = ¢2.70.
b. Cost of the first 20 units = 0p, cost of the next 30 units = 60p and the cost of the next 10 units =50p.
Cost of (20 + 30 + 10) units= 0p + 60p + 50p = 110p,

⇒cost of the first 60 units = 110p.

But the cost of the first 60 units + the cost of the extra units = bill paid by sir Jonas.

∴110p + cost of the extra units = 150p,⇒ cost of the extra units= 150p - 110 = 40p.

But the cost of each extra unit = 8p.

If 8p = 1unit =>40p = $\frac{40 \times 1}{8}$

= 5 units.

The number of units used by Sir Jonas = 60 + 5 = 65 units.