RATIOS AND RATES

When we are faced with the problem of comparing like quantities we can use ratios. If a boy carries a load weighing 10kg while his younger brother carries a load weighing 5kg. We can compare the weight carried by the elder brother to the weight carried by the younger brother as 10kg to 5kg. Another way of saying this is to say that 10kg is to 5kg as $\frac{10kg}{5kg} = 2$ i.e. the older boy is carrying 2 times the weight carried by the younger brother.

If in an examination, Francis scores 25%, Agnes scores 75%. Agnes scored 3 times (i.e. $\frac{75\%}{25\%} = 3$ as much marks as Francis. John walks 4km to the school while Chima walks 1km to the school. Chima walks ¼ if the distance that John walks to the School. Occasionally, one may want a printed photograph enlarged. The photographer would like to know the ration a : b, is equal to the quotient $\frac{a}{b}$ or fraction $\frac{a}{b}$.

So ratio is another way of expressing fractions. The colon (:) is the symbol for "is to." The quantities *a* and *b* must be expressed in the same unit and they must be like-quantities. It is important to note:

(i) The order of the quantities *a* and *b* since a : b is not the same as b : a, so we denote the ratio as the first quantity : second quantity, i.e. a : b

(ii) The ratio a : b is meaningful only if $a \neq 0$ and $b \neq 0$.

(iii) We can multiply or divide a ratio a : b by the same number without changing the value of the ration just as we do with fraction, i.e. we can multiply or divide the numerator and the denominator of a fraction by the same number without changing the value of the fraction.

(iv) One number alone cannot constitute a ratio. There must be at least two numbers that are being compared. Sometimes, three or more quantities are being compared, e.g. a father wising to share out pocket money to his four children can give money out in the ratio of 4 : 3 : 2 : 1 from the eldest to the youngest respectively. In this case, the eldest child receives 4 times the amount of money the youngest receives and double what the 3rd child gets, etc.

Whenever we express a ratio, m : n say, it is better always to leave it in its simplest term by dividing m and n by a common factor, if possible.

Examples

1. Express in its simplest form the ratio of 27 days to 21 days.

   Solving

   27 days : 21 days
   Divide through with 3
   $27\ days : 21\ days \equiv \frac{27}{21} = \frac{9}{7}$
   $27\ days : 21\ days \equiv 9\ days : 7\ days$

2. An alloy is made of 84g of copper and 96g of zinc find the ratio of the weight of zinc. Also find the weight of copper to the weight of the alloy.

   Solving

   a. Ratio of copper to zinc
      84g : 96g
      $\frac{84}{96} = \frac{7}{8}$
      7g : 8g
   b. Copper to alloy
      7g : 7g + 8g
      7g : 15g

Rates

In ratio, we compare quantities of the same kind, but in ratios we compare quantities of different kinds, e.g.

- Number of kilometres travelled and number of hours taken gives speed which is a rate
- The amount of electricity consumed and the amount of money paid for it gives rate of charge for electricity

- The number of people in a particular land area gives population density.
- The volume of a solid in centimetre cube and the weight in grams of that solid gives density of the solid, etc.

Rates are given by the first quantity per unit of the second quantity. For example if a plane travels 1200km in 2hours then its rate of travelling is $\frac{1200km}{2hr} = 600km/hr$. Rate in this case is called speed; i.e.

$$Speed = \frac{Distance}{Time\ taken}$$

Hence

$$Distance\ gone = Speed\ \times Time\ taken$$

And

$$Time\ taken = \frac{Distance}{Speed}$$