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# CAT Mixtures And Alligations Formulas

- Mixtures and alligations are a common type of quantitative problem that may appear on the CAT. These problems involve mixing two or more substances to form a new mixture, and then finding the ratio or quantity of each substance in the mixture.
- Alligation is a specific method for solving mixture problems that involves representing the ingredients and the mixture as points on a line, and using the distance between these points to find the ratio of the ingredients in the mixture.
- There are many variations of mixture and alligation problems that may appear on the CAT, but they all

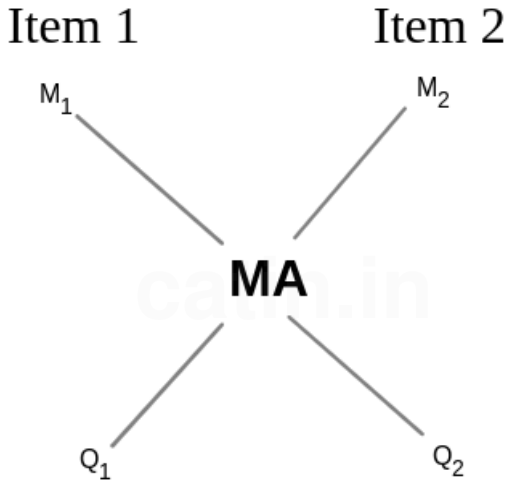
involve some variation of this basic concept. To prepare for these types of problems, it is important to practise solving a variety of mixture and alligation problems, and to become familiar with the basic formulas and methods for solving them.

## Types of mixtures:

- **Simple mixture:** A simple mixture is formed by the mixture of two or more different substances.
  Ex: Water and Wine mixture.

- **Compound mixture:** A Compound mixture is formed by the mixture of two or more simple mixtures.
  Ex: one part of 'water and wine' mixture mixed with two parts of 'water and milk' mixture.

- If $M_1$ and $M_2$ are the values and $Q_1$ and $Q_2$ are the quantities of item 1 and item 2 respectively, and $M_A$ is the weighted average of the two items, then




$$\frac{Q_1}{Q_2} = \frac{M_2 - M_A}{M_A - M_1}$$

- Weighted average $M_A$ can be calculated by

$$M_A = \frac{Q_1 M_1 + Q_2 M_A}{Q + Q}$$

- **Successive Dilution:** If a container has 'a' litres of liquid A and if 'b' litres of solution is withdrawn and is replaced with an equal volume of another liquid B and the operation is repeated for 'n' times, then after nth operation,
  Final quantity of Liquid A in the container

$$= \left[\frac{a-b}{a}\right]^n \times a$$

- The alligation rule can also be applied when cheaper substance is mixed with expensive substance

$$\frac{Quantity\ of\ cheaper}{Quantity\ of\ dearer} = \frac{Price\ of\ cheaper - Mean\ price}{Mean\ Price - Price\ of\ cheaper}$$

- If two mixtures $M_1$ and $M_2$, having substances $S_1$ and $S_2$ in the ratio a:b and p:q respectively are mixed, then in the final mixture,

$$\frac{Quantity\ of\ S_1}{Quantity\ of\ S_2} = \frac{M_1\left[\frac{a}{a+b}\right] + M_2\left[\frac{p}{p+q}\right]}{M_1\left[\frac{b}{a+b}\right] + M_2\left[\frac{q}{p+q}\right]}$$

- If there is a container with 'a' litres of liquid A and if 'b' litres are withdrawn and an equal amount of the mixture is replaced with another liquid B and if this operation is repeated 'n' times, then after the *nth* operation,
- Liquid A in the container

  $= \left[\frac{a-b}{a}\right]^n \times$ Initial quantity of A in the container
- $$\frac{Liquid\ A\ after\ nth\ operation}{Liquid\ B\ after\ nth\ operation} = \frac{\left[\frac{a-b}{a}\right]^n}{1-\left[\frac{a-b}{a}\right]^n}$$