## **Compound Interest**

• The growth per unit time is called the **rate of growth**.

If  $V_0$  is the current measure of quantity and V is the measure of quantity after *n* years, *r* is the rate of growth per year, then  $V = V_0 \left(1 + \frac{r}{100}\right)^n$ .

The decrease in value per unit time is called the rate of depreciation.
If *r* is the rate of depreciation per year; V<sub>0</sub> is the current value and V is the value

after *n* years, then 
$$V = V_0 \left(1 - \frac{r}{100}\right)^n$$

• When a quantity increases in the first year at the rate of  $r_1\%$ , then decreases at the rate of  $r_2\%$  in the second year and then increases at the rate of  $r_3\%$  in the third year, then the formula is  $V = V_0 \left(1 + \frac{r_1}{100}\right) \left(1 - \frac{r_2}{100}\right) \left(1 + \frac{r_3}{100}\right)$ .

Here,  $V_0$  is the initial measure and V is the quantity after 3 years.

## **Example:**

Priya bought a diamond necklace worth Rs 300000. The value of the necklace appreciates by 6% every year. What will be the value of the necklace after 3 years?

## Solution:

 $P = Rs \ 300000$ 

Rate of appreciation, R = 6% p.a.

Therefore, the value of the necklace after 3 years

$$= \text{Rs } 300000 \left(1 + \frac{6}{100}\right)^{3}$$
$$= \text{Rs } 300000 \times \left(\frac{53}{50}\right)^{3}$$
$$= \text{Rs } 300000 \times \frac{53 \times 53 \times 53}{50 \times 50 \times 50}$$
$$= \text{Rs } 357304.80$$

- The interest calculated on the amount of the previous year (or duration at which interest is compounded) is known as **compound interest**. Compound interest allows the principal to grow faster than simple interest.
- Amount (A) when interest is compounded annually is  $A = P(1 + \frac{R}{100})^n$  here, P = Principal, R = Rate of interest, n = Time period.

For example, if Supriya invested Rs 75000 in a bank at the rate of 10% per annum for 2 years then the amount received by her can be calculated as follows:

Here, P = Rs 75000, R = 10%, n = 2 years  

$$A = P \left( 1 + \frac{R}{100} \right)^n$$

$$= 75000 \left( 1 + \frac{10}{100} \right)^2$$

$$= 75000 \times \frac{121}{100}$$

$$= Rs 90750$$

Thus, Supriya received Rs 90750 after 2 years.

• Amount when interest is compounded half yearly is given by,  $A = P \left(1 + \frac{R}{200}\right)^{2n}$ 

Where,  $\frac{\mathbb{R}}{2}$  = Half-yearly rate and 2n = Number of half years

• Amount when interest is compounded quarterly is given by,  $A = P \left(1 + \frac{R}{400}\right)^{4n}$ 

Where,  $\frac{R}{4}$  = Quarterly rate and 4n = Number of quarters