



A collage of various analytical chemistry and data visualization elements. It includes a lightbulb with a brain-like filament, a 3D pie chart, a flowchart with arrows, laboratory glassware like test tubes and flasks, a smartphone, and a laptop. The background features a dark blue gradient with white confetti-like shapes.

EPEA516 ANALYTICAL SKILLS II

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Learning Outcomes



After this lecture, you will be able to

- solve problems based on principal and rate computation.

Problem 1

- Find sum of money that amounts to Rs. 5,000 after 2 years and to Rs. 10,000 after 4 years on compound interest.
- $A_1 = \text{Rs. } 5,000$ and $A_2 = \text{Rs. } 10,000$
- $n_1 = 2$ years and $n_2 = 4$ years
- $P = ?$
- $A = P \left[1 + \frac{R}{100}\right]^n$
- $P = \frac{A}{\left[1 + \frac{R}{100}\right]^n}$

Problem 1

- $A_1 = \text{Rs. } 5,000; A_2 = \text{Rs. } 10,000; n_1 = 2 \text{ years}; n_2 = 4 \text{ years}$
- $P = ?$

$$\bullet A = P \left[1 + \frac{R}{100} \right]^n$$

$$\bullet A_1 = P \left[1 + \frac{R}{100} \right]^{n_1} \dots \dots (1) \text{ and } A_2 = P \left[1 + \frac{R}{100} \right]^{n_2} \dots \dots (2)$$

$$\bullet \frac{A_2}{A_1} = \frac{P \left[1 + \frac{R}{100} \right]^{n_2}}{P \left[1 + \frac{R}{100} \right]^{n_1}}$$

Problem 1

- $A_1 = \text{Rs. } 5000; A_2 = \text{Rs. } 10,000; n_1 = 2 \text{ years}; n_2 = 4 \text{ years}$

$$\bullet \frac{A_2}{A_1} = \frac{\left[1 + \frac{R}{100}\right]^{n_2}}{\left[1 + \frac{R}{100}\right]^{n_1}}$$

$$\bullet \frac{A_2}{A_1} = \left[1 + \frac{R}{100}\right]^{n_2 - n_1}$$

$$\bullet \frac{\cancel{10,000}}{\cancel{5,000}}^2 = \left[1 + \frac{R}{100}\right]^{4-2}$$

$$\bullet 2 = \left[1 + \frac{R}{100}\right]^2$$

Problem 1

- $2 = \left[1 + \frac{R}{100}\right]^2$
- $A_1 = \text{Rs. } 5,000$ and $n_1 = 2$ years
- $P = \frac{5000}{\left[1 + \frac{R}{100}\right]^2}$
- $P = \frac{5,000}{2} 2500$
- $P = \text{Rs. } 2,500$

Problem 2

- Find the sum of money which will amount to Rs. 26010 in 6 months at the rate of 8% p.a. when the interest is compounded half-yearly.
- $A = \text{Rs. } 26,010$
- $n = 6 \text{ months} = \frac{6}{12} \text{ years} = \frac{1}{2} \text{ years (one half)}$
- $R = 8\% \text{ p.a. } (\frac{8}{2} = 4\%)$
- $P = ?$

Problem 2

$A = \text{Rs. } 26,010; 2n = 2 \times \frac{1}{2} = 1; \frac{R}{2} = 4\%; \text{ and } P = ?$

$$\bullet P = \frac{A}{\left[1 + \frac{R}{2 \times 100}\right]^{2n}}$$

$$\bullet P = \frac{26010}{\left[1 + \frac{4}{100}\right]^1}$$

$$\bullet P = \frac{26010}{\left[\frac{26}{25}\right]^1}$$

Problem 2

- $P = \frac{26010}{\left[\frac{26}{25}\right]^1}$
- $P = \frac{26010 \times 25}{26}$
- $P = \text{Rs. } 25009.62 \text{ (approx.)}$

Problem 3

- Find the sum of money which will amount to Rs. 26010 in 6 months at the rate of 8% p.a. when the interest is compounded quarterly.
- $A = \text{Rs. } 26,010$
- $n = 6 \text{ months} = \frac{6}{12} \text{ years} = \frac{1}{2} \text{ years (2 quarters)}$
- $R = 8\% \text{ p.a. compounded quarterly } (\frac{8}{4} = 2\% \text{ per quarter})$
- $P = ?$

Problem 3

$A = \text{Rs. } 26,010; 4n = 4 \times \frac{1}{2} = 2 \text{ quarter}; \frac{R}{4} = 2\% \text{ per quarter};$

and $P = ?$

$$\bullet P = \frac{A}{\left[1 + \frac{R}{400}\right]^{4n}}$$

$$\bullet P = \frac{26010}{\left[1 + \frac{2}{50}\right]^2}$$

$$\bullet P = \frac{26010}{\left[\frac{51}{50}\right]^2}$$

Problem 3

$$\bullet P = \frac{26010}{\left[\frac{51}{50} \right]^2}$$

$$\bullet P = \frac{\cancel{26010}^{510} \times 50 \times 50}{\cancel{51 \times 51}^{10}}$$

$$\bullet P = \text{Rs. } 25,000$$

Problem 4

- At what rate percent p.a. of compound interest will Rs.16,000 amount to Rs.1, 21,500 in 5 years?

- $P = \text{Rs.16,000}$

- $A = \text{Rs.1,21,500}$

- $n = 5 \text{ years}$

- $R = ?$

- $R = \left\{ \left[\frac{A}{P} \right]^{1/n} - 1 \right\} \times 100$

Problem 4

- P = Rs.16,000; A = Rs.1,21,500; n = 5 years; & R = ?

$$\bullet R = \left\{ \left[\frac{A}{P} \right]^{1/n} - 1 \right\} \times 100$$

$$\bullet R = \left\{ \left[\frac{121500}{16000} \right]^{1/5} - 1 \right\} \times 100$$

$$\bullet R = \left\{ \left[\frac{243}{32} \right]^{1/5} - 1 \right\} \times 100$$

$$\bullet R = \left\{ \left[\frac{3 \times 3 \times 3 \times 3 \times 3}{2 \times 2 \times 2 \times 2 \times 2} \right]^{1/5} - 1 \right\} \times 100$$

Problem 4

- $R = \left\{ \left[\frac{3 \times 3 \times 3 \times 3 \times 3}{2 \times 2 \times 2 \times 2 \times 2} \right]^{1/5} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{3}{2} \right]^{\cancel{(5 \times 1)}/5} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{3}{2} \right] - 1 \right\} \times 100$
- $R = \left\{ \frac{3 - 2}{2} \right\} \times 100$
- $R = \left\{ \frac{1}{2} \right\} \times \cancel{100}^{50}$
- $R = 50 \% \text{ p.a.}$

Problem 5

- At what rate percent p.a. of compound interest will Rs.16,000 amount to Rs. 17,640 in 2 years?
- P = Rs.16,000
- A = Rs.17,640
- n = 2 years
- R = ?
- $R = \left\{ \left[\frac{A}{P} \right]^{1/n} - 1 \right\} \times 100$

Problem 5

- $P = \text{Rs.}16,000$; $A = \text{Rs.}17,640$; $n = 2$ years; & $R = ?$

- $R = \left\{ \left[\frac{A}{P} \right]^{1/n} - 1 \right\} \times 100$

- $R = \left\{ \left[\frac{17640}{16000} \right]^{1/2} - 1 \right\} \times 100$

- $R = \left\{ \left[\frac{441}{440} \right]^{1/2} - 1 \right\} \times 100$

- $R = \left\{ \left[\frac{21 \times 21}{20 \times 20} \right]^{1/2} - 1 \right\} \times 100$

Problem 5

- $R = \left\{ \left[\frac{21 \times 21}{20 \times 20} \right]^{1/2} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{21}{20} \right]^{\cancel{(2 \times 1)}/2} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{21}{20} \right] - 1 \right\} \times 100$
- $R = \left\{ \frac{21 - 20}{20} \right\} \times 100$
- $R = \left\{ \frac{1}{20} \right\} \times 100^5$
- $R = 5 \% \text{ p.a.}$

Problem 6

- A sum of money Rs. 5,760 amounts to Rs. 6,250 in 1 year compounded half-yearly. Compute rate of interest p.a.
- P = Rs. 5,760
- A = Rs. 6,250
- n = 1 years
- R = ?
- $R = 2 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/2n} - 1 \right\}$

Problem 6

- P = Rs. 5,760; A = Rs. 6,250; 2n = 2 x 1 = 2, & R = ?
- R = $2 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/2n} - 1 \right\}$
- R = $2 \times 100 \times \left\{ \left[\frac{6250}{5760} \right]^{1/2} - 1 \right\}$
- R = $2 \times 100 \times \left\{ \left[\frac{25 \times 25}{24 \times 24} \right]^{1/2} - 1 \right\}$

Problem 6

$$\bullet R = 2 \times 100 \times \left\{ \left[\frac{25 \times 25}{24 \times 24} \right]^{1/2} - 1 \right\}$$

$$\bullet R = 2 \times 100 \times \left\{ \left[\frac{25}{24} \right]^{(2 \times 1)/2} - 1 \right\}$$

$$\bullet R = 2 \times 100 \times \left\{ \frac{25}{24} - 1 \right\}$$

$$\bullet R = 2 \times 100 \times \left\{ \frac{1}{24} \right\}$$

Problem 6

$$\bullet R = 2 \times 100 \times \left\{ \frac{1}{24} \right\}$$

$$\bullet R = \frac{200}{24}$$

$$\bullet R = 8.33\% \text{ p.a.}$$

Problem 7

- A sum of money Rs. 14,641 amounts to Rs. 20,736 in 1 year compounded quarterly. Compute rate of interest p.a.
- P = Rs. 14,641
- A = Rs. 20,736
- n = 1 years (4 quarters)
- R = ?
- $R = 4 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/4n} - 1 \right\}$

Problem 7

- $P = \text{Rs. } 14,641; A = \text{Rs. } 20,736; 4n = 4 \times 1 = 4, \& R = ?$

- $R = 4 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/4n} - 1 \right\}$

- $R = 4 \times 100 \times \left\{ \left[\frac{20736}{14641} \right]^{1/4} - 1 \right\}$

- $R = 4 \times 100 \times \left\{ \left[\frac{12 \times 12 \times 12 \times 12}{11 \times 11 \times 11 \times 11} \right]^{1/4} - 1 \right\}$

Problem 7

$$\bullet R = 4 \times 100 \times \left\{ \left[\frac{12 \times 12 \times 12 \times 12}{11 \times 11 \times 11 \times 11} \right]^{1/4} - 1 \right\}$$

$$\bullet R = 4 \times 100 \times \left\{ \left[\frac{12}{11} \right]^{(4 \times 1)/4} - 1 \right\}$$

$$\bullet R = 4 \times 100 \times \left\{ \frac{12}{11} - 1 \right\}$$

$$\bullet R = 4 \times 100 \times \left\{ \frac{1}{11} \right\}$$

Problem 7

- $R = 4 \times 100 \times \left\{ \frac{1}{11} \right\}$
- $R = \frac{400}{11}$
- $R = 36.36\% \text{ p.a. (approx.)}$

Problem 8

- At what rate per cent compound interest does a sum of money become nine-fold in 2 years?
- $n = 9$
- $t = 2$ years
- $R = ?$
- $R = 100[(n)^{1/t} - 1]$
- $R = 100[(9)^{1/2} - 1]$

Problem 8

- $R = 100[(9)^{1/2} - 1]$

- $R = 100[(3 \times 3)^{1/2} - 1]$

- $R = 100[(3)^{(2 \times 1)/2} - 1]$

- $R = 100[3 - 1]$

- $R = 100[2]$

- $R = 200\% \text{ p.a.}$

Problem 9

- A sum of money at compound interest amounts to Rs.8,00 in three year and to Rs.1,250 in five years. Find the rate of interest p.a.
- $x = \text{Rs.800}$
- $A = 3 \text{ years}$
- $y = \text{Rs.1,250}$
- $B = 5 \text{ years}$
- $R = ?$

Problem 9

- $x = \text{Rs.}800$; $y = \text{Rs.}1,250$; $A = 3$; $B = 5$; & $R = ?$

$$\bullet R = \left\{ \left[\frac{y}{x} \right]^{1/(B-A)} - 1 \right\} \times 100 \%$$

$$\bullet R = \left\{ \left[\frac{1250}{800} \right]^{1/(5-3)} - 1 \right\} \times 100$$

$$\bullet R = \left\{ \left[\frac{25}{16} \right]^{1/2} - 1 \right\} \times 100$$

$$\bullet R = \left\{ \left[\frac{5 \times 5}{4 \times 4} \right]^{1/2} - 1 \right\} \times 100$$

Problem 9

- $R = \left\{ \left[\frac{5 \times 5}{4 \times 4} \right]^{1/2} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{5}{4} \right]^{(2x1)/2} - 1 \right\} \times 100$
- $R = \left\{ \left[\frac{5}{4} \right] - 1 \right\} \times 100$
- $R = \left\{ \frac{5 - 4}{4} \right\} \times 100$
- $R = \left\{ \frac{1}{4} \right\} \times 100^{25}$
- $R = 25 \% \text{ p.a.}$

Conclusion

- When interest is compounded annually

$$\bullet A = P \left[1 + \frac{R}{100} \right]^n \text{ or } P = A / \left[1 + \frac{R}{100} \right]^n$$

- When interest is compounded half-yearly

$$\bullet A = P \left[1 + \frac{\frac{R}{2}}{100} \right]^{2n} \text{ or } P = A / \left[1 + \frac{\frac{R}{2}}{100} \right]^{2n}$$

- When interest is compounded annually

$$\bullet A = P \left[1 + \frac{\frac{R}{4}}{100} \right]^{4n} \text{ or } P = A / \left[1 + \frac{\frac{R}{4}}{100} \right]^{4n}$$

Conclusion

- When interest is compounded annually

$$\bullet R = \left\{ \left[\frac{A}{P} \right]^{1/n} - 1 \right\} \times 100$$

- When interest is compounded half-yearly

$$\bullet R = 2 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/2n} - 1 \right\}$$

- When interest is compounded quarterly

$$\bullet R = 4 \times 100 \times \left\{ \left[\frac{A}{P} \right]^{1/4n} - 1 \right\}$$

Summary

- Computation of
 - Principal
 - Rate

That's all for now...