SIMPLE & COMPOUND INTEREST

Detailed SSC CGL Examination Notes

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1. SIMPLE INTEREST - COMPLETE CONCEPTS

Basic Definition

Simple Interest is calculated only on the principal amount throughout the tenure without considering any interest on interest.

Simple Interest Formula:

```
SI = (P × R × T) / 100
```

Amount Formula:

```
A = P + SI = P + (P × R × T)/100 = P[1 + (R × T)/100]
```

Where:

```
P = Principal Amount
R = Rate of Interest per annum
T = Time period in years
SI = Simple Interest
A = Total Amount
```

Key Variations & Derived Formulas

```
P = (SI × 100) / (R × T)
R = (SI × 100) / (P × T)
T = (SI × 100) / (P × R)
A = P[1 + (R × T)/100]
```

Important: When time is given in months, convert to years by dividing by 12.
Example: 6 months = 6/12 = 0.5 years

2. COMPOUND INTEREST - DETAILED ANALYSIS

Basic Concept

Compound Interest is calculated on the principal amount plus accumulated interest from previous periods. Interest compounds over time.

When compounded annually:

```
A = P(1 + R/100)^T
CI = A - P = P[(1 + R/100)^T - 1]
```

When compounded half-yearly:

```
A = P(1 + R/200)^(2T)
CI = A - P
```

When compounded quarterly:

```
A = P(1 + R/400)^(4T)
CI = A - P
```

When compounded monthly:

```
A = P(1 + R/1200)^(12T)
CI = A - P
```

Compounding Frequency Comparison

Compounding	Rate per period	Number of periods	Formula
Annually	R%	T	P(1 + R/100)^T
Half-yearly	R/2%	2T	P(1 + R/200)^(2T)
Quarterly	R/4%	4T	P(1 + R/400)^(4T)
Monthly	R/12%	12T	P(1 + R/1200)^(12T)
Daily	R/365%	365T	P(1 + R/36500)^(365T)

3. DIFFERENCE BETWEEN SI AND CI

Key Differences

Aspect	Simple Interest	Compound Interest
Calculation Base	Only on principal amount	On principal + accumulated interest
Growth	Linear growth	Exponential growth
Formula	SI = (P×R×T)/100	CI = P[(1+R/100)^T - 1]
Returns	Lower returns	Higher returns
Suitability	Short-term loans	Long-term investments

CI - SI Relationship Formulas

For 2 years:

$$CI - SI = P(R/100)^2$$

For 3 years:

$$CI - SI = P(R/100)^2 \times (3 + R/100)$$

For n years:

$$CI - SI = P[(1 + R/100)^n - 1 - nR/100]$$

4. POPULATION & DEPRECIATION PROBLEMS

Population Growth

Population after n years:

$P_n = P_o(1 + R/100)^n$

Population n years ago:

$P_o = P_n/(1 + R/100)^n$

Where:

P_o = Initial Population
P_n = Population after n years
R = Growth rate per annum

Depreciation

Value after n years:

$V_n = V_o(1 - R/100)^n$

Value n years ago:

$V_o = V_n/(1 - R/100)^n$

Where:

V_o = Initial Value
V_n = Value after n years
R = Depreciation rate per annum

5. ADVANCED PROBLEM TYPES

Type 1: Equal Installments

Problem: A sum of ₹10,000 is borrowed at 10% CI. What equal annual installment will discharge debt in 2 years?

Solution Approach:

- Let each installment be ₹x
- Present value of 1st installment = $x/(1 + 10/100)^1$
- Present value of 2nd installment = $x/(1 + 10/100)^2$
- Total present value = 10000
- Equation: $x/1.1 + x/1.21 = 10000$
- Solve: $x(0.9091 + 0.8264) = 10000$
- $x \times 1.7355 = 10000$
- x = **₹5762.33**

Type 2: Difference between CI and SI

Problem: Difference between CI and SI on ₹8000 at 5% per annum for 3 years

Solution:

- Using formula: $CI - SI = P(R/100)^2 \times (3 + R/100)$
- $= 8000 \times (5/100)^2 \times (3 + 5/100)$
- $= 8000 \times 0.0025 \times 3.05$
- $= 8000 \times 0.007625$
- = **₹61**

6. COMPREHENSIVE PRACTICE SET

Problem 1: Find SI on ₹5000 at 8% per annum for 3 years

Detailed Solution:

- Principal (P) = ₹5000
- Rate (R) = 8% per annum
- Time (T) = 3 years
- SI = (P × R × T)/100
- SI = (5000 × 8 × 3)/100
- SI = (120000)/100
- SI = **₹1200**

Problem 2: Find CI on ₹10,000 at 10% per annum compounded annually for 2 years

Detailed Solution:

- Method 1: Using Amount Formula
- A = P(1 + R/100)^T = 10000(1 + 10/100)^2
- A = 10000 × (1.1)^2 = 10000 × 1.21 = ₹12100
- CI = A - P = 12100 - 10000 = **₹2100**

- Method 2: Direct CI Formula
- CI = P[(1 + R/100)^T - 1]
- CI = 10000[(1 + 10/100)^2 - 1]
- CI = 10000[1.21 - 1] = 10000 × 0.21 = **₹2100**

Problem 3: A sum becomes ₹1331 in 3 years at 10% CI. Find principal

Detailed Solution:

- A = P(1 + R/100)^T
- 1331 = P(1 + 10/100)^3
- 1331 = P(1.1)^3
- 1331 = P × 1.331

- P = 1331/1.331 = **₹1000**

7. SHORTCUTS & MEMORY TECHNIQUES

Quick Calculation Methods

SI Shortcut: For 1 year, SI = (P × R)/100
CI Shortcut: For 2 years, CI = P × R × (200 + R)/10000
Double Principle: Time to double money at R% = 72/R years (Rule of 72)
Triple Principle: Time to triple money at R% = 110/R years (Rule of 110)

Important Values to Remember

Rate	Time to double (SI)	Time to double (CI)
5%	20 years	14.4 years
10%	10 years	7.2 years
12%	8.33 years	6 years
15%	6.67 years	4.8 years
20%	5 years	3.6 years

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