Pipes & Cisterns Complete Notes

1. Basic Concept
If a pipe fills a tank in T hours, 1-hour work = 1/T.
If a pipe empties a tank in T hours, 1-hour work = -1/T.

2. Two Filling Pipes
Example: A = 1/12, B = 1/6
Together = 1/12 + 1/6 = 1/4 → 4 hours.

3. One Filling + One Emptying
A = 1/12, B = -1/20
Net = 1/12 - 1/20 = 1/30 → 30 hours.

4. Pipes Opening at Different Times
A alone for some hours, then A+B together.
Work = rate × time.
Remaining work ÷ combined rate = remaining time.

5. Leak Problems
Leak acts as an emptying pipe.

Detailed Solved Examples

Example 1:
A fills in 10 hr → 1/10.
B fills in 6 hr → 1/6.
Together = 1/10 + 1/6 = 1/4 → 4 hr.

Example 2:
A = 12 hr, B = 20 hr (emptying).
Net = 1/12 - 1/20 = 1/30 → 30 hr.

Example 3 (A first, then A+B):
A = 10 hr → 1/10.
B = 15 hr → 1/15.
A works alone 2 hr = 2/10 = 1/5.
Remaining = 4/5.
A+B = 1/10 + 1/15 = 1/6.
Time = (4/5)/(1/6) = 24/5 = 4.8 hr.
Total = 2 + 4.8 = 6.8 hr = 6 hr 48 min.

Example 4 (Leak):
A = 9 hr → 1/9.
Leak = 30 hr → -1/30.
Net = 1/9 - 1/30 = 7/90.
Time = 1 / (7/90) = 90/7 = 12 hr 51 min.

Example 5 (A first, then A+B+Leak):
A = 12 hr → 1/12.
B = 18 hr → 1/18.
Leak = 36 hr → -1/36.
A alone 3 hr = 3/12 = 1/4.
Remaining = 3/4.
Net rate = 1/12 + 1/18 - 1/36 = 1/9.

Time = (3/4)/(1/9) = 27/4 = 6.75 hr = 6 hr 45 min.
Total = 3 + 6 hr 45 min = 9 hr 45 min.

Key Formula
TIME = WORK ÷ RATE.

End of Notes