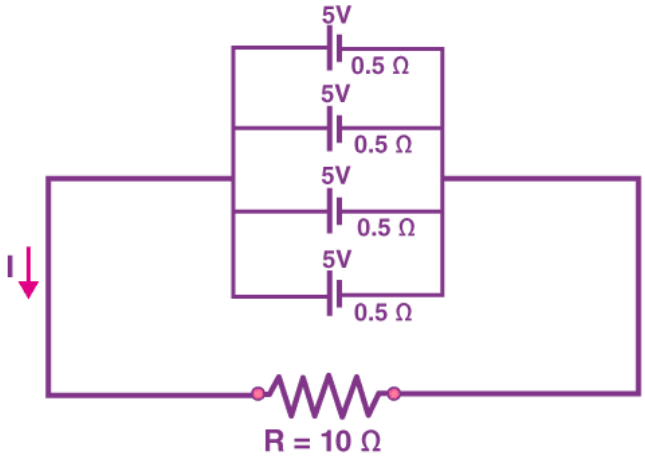
Problem) From the given circuit



Find
(i) Equivalent EMF
(ii) Equivalent internal resistance
(iii) Total current
(iv) Potential difference across each cell
(v) Current from each cell

Solution:

(i) There are four paths through the circuit. The potential difference across each path is 5V. This will be equal to the EMF of each cell. This means that the total EMF provided by the combination is also 5 Volts.
(ii) Since there are 4 cells with internal resistance 0.5Ω connected in parallel. The equivalent internal resistance is given by the formula
1req=1r1+1r2+1r3+1r4
1req=10.5+10.5+10.5+10.5
1req=40.5
r_{eq} = 0.5/4 = 0.125 Ω
(or)
r_{eq} = r/n = 0.5/4 = 0.125 Ω
(iii) Total current, I = ε/ (R + r/n)
I = 5 / (10 + 0.125)
= 5/ 10.125
= 0.5 A
(iv) Potential difference V = IR = 0.5 x 10 = 5 V
(v) Current from each cell
I' = I/n
= 0.5/4 = 0.125 A

(2) If two cells with equivalent internal resistances 2 ohms are connected in parallel. What would be the value of the resistance of each cell if both have the same value?

Solution:
Given
$r_1 = r_2$
1req=1r1+1r2
½ = 2/r_1

r_1 = 4 Ω = r_2