24.7 # 38. Given: The electric power \( P = \frac{144r}{(r + 0.6)^2} \) \( r \) is the resistance in the circuit.

Find the value of \( r \) to make the maximum power.

Solution:

Step 1. Find \( \frac{dp}{dr} = \frac{144(r + 0.6)^2 - 144r \cdot 2(r + 0.6)(1)}{(r + 0.6)^4} = \frac{144(r + 0.6)\left[(r + 0.6) - 2r\right]}{(r + 0.6)^4} \)

\[
\frac{dp}{dr} = \frac{144[(r + 0.6) - 2r]}{(r + 0.6)^3} = \frac{144(0.6 - r)}{(r + 0.6)^3}
\]

Step 2. Let \( \frac{dp}{dr} = 0 \), so \( \frac{144(0.6 - r)}{(r + 0.6)^3} = 0 \), since the denominator not to be zero, the only possible is \( 0.6 - r = 0 \), then \( r = 0.6 \) (Ohm)

Summary: The electric power will reach to the maximum when the resistance of the circuit \( r \) equals to the Internal resistance of the battery 0.6 Ohm.