ADVANCED PHYSICS CLUB

MAY 4, 2025

Useful resources

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2024`
The practical information about the club and contacts can be found on the same web page.

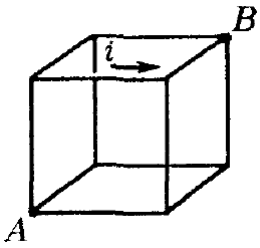
Today's meeting

We continue solving problems on electric circuits.

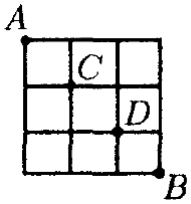
Homework

1. A cube is constructed from wire, with each of its 12 edges having the same resistance r. A battery is connected across two vertices A and B, as shown on the figure. It is known that the current through one specific edge (marked in the figure) is i. Determine the following:

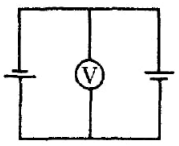
(a) The potential difference between points A and B
(b) The equivalent resistance between points A and B
(c) The total current flowing from A to B.



2. In the circuit shown in the figure, each side has the same resistance r. Determine the equivalent resistance a) between points A and B; b) between points C and D.



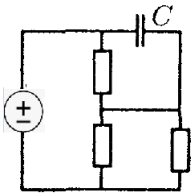
3. In the circuit shown in the figure, two batteries each have an EMF of $\epsilon = 1.5$ V but different internal resistances: $r_1 = 3\Omega$ and $r_2 = 1\Omega$. Find the reading on the voltmeter.



4. A battery is connected to a resistor R_1. Then, this resistor is replaced by another resistor R_2. In both cases, the same amount of heat is generated per unit time in each resistor. Determine the internal resistance of the battery.

5. The thermal power released into the environment from a stove-top burner is proportional to the temperature difference between the burner and the surrounding air in the room : $P = k(T - T_0)$. The resistance of the burner also linearly depends on the same temperature difference: $R = R_0[1 + \alpha(T - T_0)]$. A constant current I is passed through the burner. Determine the equilibrium temperature of the burner.

6. In the circuit shown in the figure all resistors have the same resistance R and the ideal battery has voltage V. Determine the charge on the capacitor C in steady state.



For the next meeting

IMPORTANT: The next (and last this year) club's meeting is at **2:30pm**, **in person**, on Sunday, **May 11**.