

ADVANCED PHYSICS CLUB

MARCH 31, 2019

TODAY'S MEETING

Today we talked about voltage and current sources, EMF and internal resistance. For a simple introduction see:

<http://farside.ph.utexas.edu/teaching/3021/lectures/node57.html>

<http://hyperphysics.phy-astr.gsu.edu/hbase/electric/dcex6.html>

https://en.wikipedia.org/wiki/Voltage_source

https://en.wikipedia.org/wiki/Current_source

We have also talked about Thevenin's theorem and superposition principle:

https://en.wikipedia.org/wiki/Thevenin%27s_theorem

ELECTRICAL CIRCUITS

These are some examples of the problems we considered in class.

1. What is the equivalent resistance of the circuit shown in figure if the circuit is infinite?

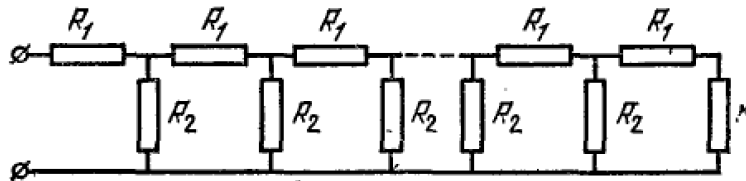


FIGURE 1.

2. Consider the infinite square network built of wire segments of unit electric resistance. Find the resistance between two adjacent nodes of the grid.
3. Solve problems 7,9,31 from PhysicsBowl 2016 and problem 47 from PhysicsBowl 2017.
<https://www.aapt.org/Programs/PhysicsBowl/printexams.cfm>
4. To start the car engine a car battery is connected to the starter. The car battery is marked as 12V battery. A standard AA battery is marked as 1.5V battery. Does it mean that one can use 6 AA batteries connected in series instead of car battery to start the engine? Why?

HOMEWORK

1. The resistor values (which may be different) and the voltage of the source are unknown. If one measures voltage between points A and B the voltmeter reading is V_0 . If points A and B are connected by an ideal wire the current flowing along this wire is I_0 . The points A and B are connected by the resistor R . What is the current through this resistor? Express the answer in terms of V_0 , I_0 and R .
Hint: Use Thevenin's theorem https://en.wikipedia.org/wiki/Internal_resistance
2. Solve problem A2 from USAPhO, 2015.
<https://www.aapt.org/physicsteam/2019/exams.cfm>
Compare to Norton's theorem:
https://en.wikipedia.org/wiki/Norton's_theorem

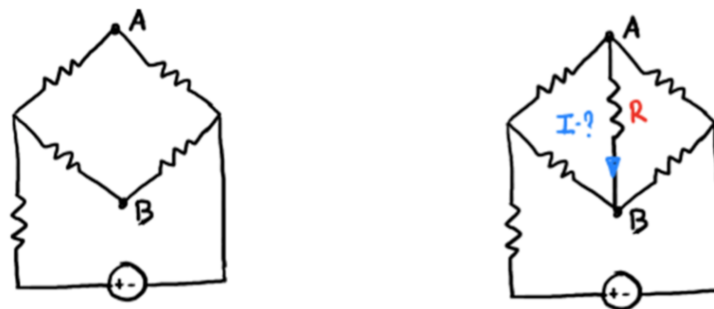


FIGURE 2.

FOR THE NEXT MEETING

The next club's meeting is at 2:40pm, room P-123, on Sunday, **April 7**. We plan to continue solving electricity and magnetism problems.

Important: from March 31 and on the club will meet in the room **P123** (Plaza level of Physics building).