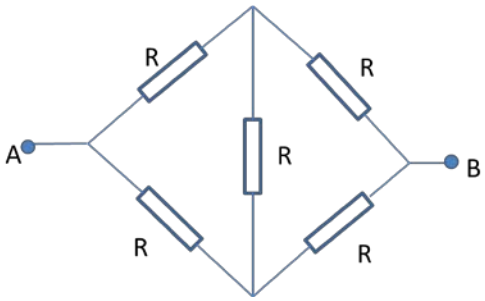
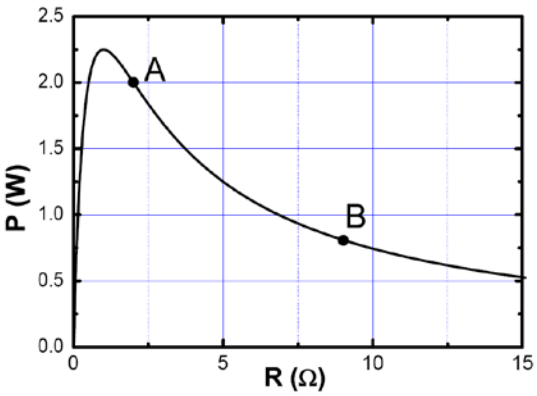
Quiz: ELECTRICITY
July, 2016

1. Find the equivalent resistance, between A and B, of this circuit.



a) $\frac{2R}{3}$ b) R c) $2R$ d) $\frac{4R}{5}$

2. A battery with electromotive force E and internal resistance r supplies electric power to a variable resistance, R (usually called rheostat). The figure shows the measured electric power P dissipated on rheostat as a function of R. The shown pairs (R;P) of experimental data points have their coordinates A(2;2) and B(9;0,81), with all units stated in the International System of Units (ISU). The values of the electromotive force E and internal resistance r are given by:



a) $E=3V; r=1\Omega$ b) $E=2{,}8V; r=1\Omega$ c) $E=9V; r=1\Omega$ d) $E=2{,}8V; r=0{,}5\Omega$

3. A resistor is warmed up starting from ℃, up to 100˚C . By what percent did its resistance increase? The temperature cofficient is $\alpha = 4\times10^{-3}\,grad^{-1}$.

a) 100% b) 140% c) 400% d) 40 %

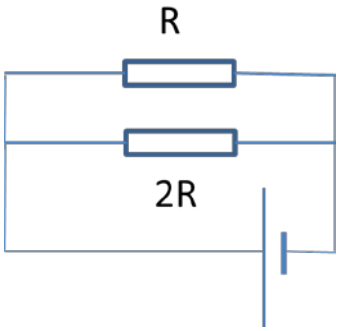
4. A battery with electromotive force E and internal resistance r is connected to a resistance $R=nr$, where n is some positive number. The measured voltage drop on R is U_0 if using an ideal voltmeter, and U when using a voltmeter with internal resistance $R_V = n^2 r$. Given the ratio $\frac{U_0}{U} = \frac{2016\times2017+1}{2016\times2017}$, find the numerical value of n.

a) $n=2015$ b) $n=2016$ c) $n=2017$ d) $n=2018$

5. A circuit contains a nonideal battery connected to a variable resistance (rheostat). We want the electric efficiency of this circuit to equal the ratio of battery internal resistance r and rheostat resistance R. What is the value of R as a function of r, for this requirement be satisfied?

a) $R=\frac{r\left(1+\sqrt{5}\right)}{2}$ b) $R=\frac{r\left(1+\sqrt{6}\right)}{2}$ c) $R=\frac{r\left(1+\sqrt{3}\right)}{2}$ d) $R=\frac{7r}{\sqrt{5}+1}$

6. The circuit on the right contains an ideal battery, two resistors, and connecting wires with negligible resistance. The electromotive force of the battery is *E*. The electric current *I* flowing through resistance R is:



a) $I = \frac{E}{R}$ b) $I = \frac{E}{2R}$ c) $I = \frac{3E}{2R}$ d) $I = \frac{R}{E}$

7. An electric heater with resistance R_1 brings a certain amount of water to the boiling point in some time, t_1. Under the same conditions, what time t_2 needs a similar heater, but having a resistance R_2, to bring the same amount of water to the boiling point?

a) $t_2 = t_1$ b) $t_2 = t_1\sqrt{\frac{R_2}{R_1}}$ c) $t_2 = t_1\frac{R_1}{R_2}$ d) $t_2 = t_1\frac{R_2}{R_1}$

8. The parameters to normally operate an electric bulb are: $P = 100W$, $U = 220V$. What is the electric current *I* through its filament under normal operating conditions?

a) $I \approx 0{,}45A$ b) $I \approx 2{,}2A$ c) $I \approx 0{,}45mA$ d) $I \approx 2A$

9. A resistor with $R = r\sqrt{7}$ is connected to a battery having an internal resistance r. The power dissipated on *R* is *P*. When replacing *R* by a parallel grouping of *n* identical resistors *R*, the power dissipated on the grouping is, again, *P*. How many resistors form the parallel grouping?

a) $n = 2016$ b) $n = 2017$ c) $n = 7$ d) $n = 49$

10. Two ohmic wires made of the same conducting material have equal lengths, but the second one has a cross-sectional area seven times larger than the first one. Two students make contradictory statements: the first student states that the electric resistance of the thinner wire is larger than the resistance of the thicker, while the second student states the oposite. Which one is right?

a) the first student b) the second student c) none of them d) both of them

11. A current of 1A flows through a resistive wire. How many electrons per second run through an arbitrary cross-sectional area of this wire?

a) $1{,}6\cdot10^{-19}$ b) 1000 c) $6{,}25\cdot10^{18}$ d) $2\cdot10^{19}$

12. A battery with electromotive force $E = 3V$ and internal resistance $r = 0{,}5\Omega$ is connected to a resistor with $R = 10\Omega$. What is the voltage drop U on this resistor?

a) $U = 3V$ b) $U = 0V$ c) $U = \frac{20}{7}V$ d) $U = 2{,}8V$