1. What is the maximum voltage that can be applied across a 300 \( \Omega \) resistor without risking damage, if the resistor’s maximum power rating is \( \frac{1}{4} \) \( W \)?
   a. 5 V
   b. \( 5\sqrt{3} \) V
   c. 10 V
   d. \( 10\sqrt{3} \) V
   e. 25 V

2. Imagine we cook an egg by immersing it into water which is boiled by an electric heater. The heater utilizes a current, \( I \), at a voltage, \( V \), for a time, \( T \). If the change in energy of a newly cooked egg over its raw energy is given by \( \Delta E_{egg} \), the energy wasted in the cooking process is given by which equation below?
   a. \( E_{wasted} = IV \)
   b. \( E_{wasted} = IV + \Delta E_{egg} \)
   c. \( E_{wasted} = IV - \Delta E_{egg} \)
   d. \( E_{wasted} = IVT + \Delta E_{egg} \)
   e. \( E_{wasted} = IVT - \Delta E_{egg} \)

3. What happens to the brightness of light bulbs #2 and #3 when the switch is closed, thus connecting light bulb #1 to the circuit, in parallel with light bulb #2, as shown below? You may assume that all of the bulbs have the same resistance and that brightness increases when current increases (and brightness decreases when current decreases).
   a. #2 and #3 get dimmer
   b. #2 and #3 get brighter
   c. #2 and #3 are not affected
   d. #2 gets dimmer, #3 gets brighter
   e. #2 gets brighter, #3 gets dimmer
4. A 60 kg student runs up 20 m of stairs in 24 seconds. The best estimate of the average power produced by the student during this 24 second exercise?
   a. 50 W
   b. 100 W
   c. 500 W
   d. 800 W
   e. 1.5 kW

5. Consider a moving hybrid car that has 600 kJ of kinetic energy. If regenerative braking recovers 20% of this energy when the car stops, what is the total charge added to the car’s 240 V battery?
   a. 250 C
   b. 500 C
   c. 1000 C
   d. 2000 C
   e. 2500 C

6. What is the value of resistance between $a$ and $b$?
   a. $R = 245 \, \Omega$
   b. $R = 81.7 \, \Omega$
   c. $R = 35 \, \Omega$
   d. $R = 23.3 \, \Omega$
   e. $R = 20 \, \Omega$
7. The current passing through the horizontal resistor when the switch is open has value $I$ Amps. What happens to the current through the horizontal resistor when the third resistor is added to the circuit by closing the switch?

a. The current decreases to $I/2$ Amps.
b. The current decreases to $2I/3$ Amps.
c. The current stays the same.
d. The current increases to $4I/3$ Amps.
e. The current increases to $2I$ Amps.

8. Which of the following KCL and KVL equations is incorrect for this circuit?

a. $I_1 = I_4$
b. $I_2 = I_3 + I_4$
c. $I_2R_2 + I_3R_3 - V_2 = 0$
d. $I_1R_1 + I_2R_2 + I_4R_4 = V_1$
e. $V_1 - I_1R_1 - I_3R_3 - V_2 - I_4R_4 = 0$
9. If $v_2 = 0.7 \text{ V}$, $v_4 = 0.3 \text{ V}$, $v_5 = 0.5 \text{ V}$ in the circuit below, what is $v_1$?

\[ \begin{align*}
\text{a.} & \quad 0.1 \text{ V} \\
\text{b.} & \quad 0.5 \text{ V} \\
\text{c.} & \quad 0.8 \text{ V} \\
\text{d.} & \quad 1.0 \text{ V} \\
\text{e.} & \quad 1.5 \text{ V}
\end{align*} \]

10. If $i_1 = -10 \text{ mA}$, $i_3 = 5 \text{ mA}$, $i_6 = 2 \text{ mA}$ in the circuit below, what is $i_4$?

\[ \begin{align*}
\text{a.} & \quad 2 \text{ mA} \\
\text{b.} & \quad 3 \text{ mA} \\
\text{c.} & \quad 5 \text{ mA} \\
\text{d.} & \quad 7 \text{ mA} \\
\text{e.} & \quad 13 \text{ mA}
\end{align*} \]