1. What is the total resistance of this circuit?
   \[ 11k\Omega \]

2. How much voltage is dropped by the second resistor, \( R_2 \)?
   Classic voltage divider circuit!
   \[ V_{\text{out}} = V_{\text{in}} \times \frac{R_2}{(R_1+R_2)} = 4.5V \]

3. How much current flows through this circuit?
   Ohm's Law!
   \[ I = \frac{V}{R} \]
   \[ I = \frac{5V}{11k\Omega} = 0.45mA \]

4. Assuming the LED drops 2V and requires a current of 20mA, what value resistor should we use?
   Ohm's Law!
   The resistor drops 3V and produces a current of 20mA.
   \[ R = \frac{V}{I} \]
   \[ R = \frac{3V}{20mA} = 150\Omega \]

5. What effect would using a higher value resistor have on the brightness of the LED?
   A higher value resistor would reduce the current, which would dim the LED.

6. How much current runs through this circuit when the pushbutton is not pressed?
   If switch is not pressed, no current flows!

7. After the switch has been released, why does the capacitor discharge up and over through the LED part of the circuit, and not directly from the capacitor down to ground?
   Because DC current does not pass through a capacitor. So there is only one way the charge in the capacitor can flow to reach ground.
Questions 8 - 10 refer to the following circuit diagram:

8. When the photo-resistor has a resistance of 10kΩ (at maximum light intensity), how much voltage is detected by the Arduino’s pin?
   Voltage Divider!
   \[ V(\text{out}) = V(\text{in}) \times \frac{R_2}{R_1 + R_2} \]
   \[ V(\text{out}) = 5V \times \frac{10k\Omega}{20k\Omega} = 2.5V \]
9. When the photo-resistor has a resistance of 200kΩ (in total darkness), how much voltage is detected by the Arduino’s pin?
   Voltage Divider!
   \[ V(\text{out}) = V(\text{in}) \times \frac{R_2}{R_1 + R_2} \]
   \[ V(\text{out}) = 5V \times \frac{10k\Omega}{210k\Omega} = 0.24V \]
10. What is this type of circuit, where a voltage reading is taken between two resistors in series, called?
    Voltage Divider!

Questions 11 - 12 refer to the following circuit diagram:

11. What is the purpose of the 560Ω resistor in this circuit?
    to limit the current that flows to the LED when the potentiometer is turned all the way down to 0Ω. This prevents it from burning out in that scenario.

12. When the potentiometer is turned so that it offers 10kΩ resistance, how much current is running through the LED?
    Total resistance = 560Ω + 10kΩ = 10,560Ω
    Voltage drop from LED = \(~2V\)
    Voltage dropped by resistor = 3V
    Ohm’s Law
    \[ I = \frac{V}{R} = \frac{5V}{10,560\Omega} = \sim0.5mA \]

13. Is the Atmel microcontroller in an Arduino a type of computer?
    Yes, all microcontrollers are computers.

14. What three things does Crawford say each party in an interaction must do?
    listen          think           speak
    (input)       (process)        (output)

15. Name and briefly describe one trend in human computer interaction.
    increased computer-to-person ratio
    ubiquitous computing (computers in more and more places)
    more of a “digital shadow”
    more usage of robots for automated tasks
    the GUI is inadequate for many human-computer interactions