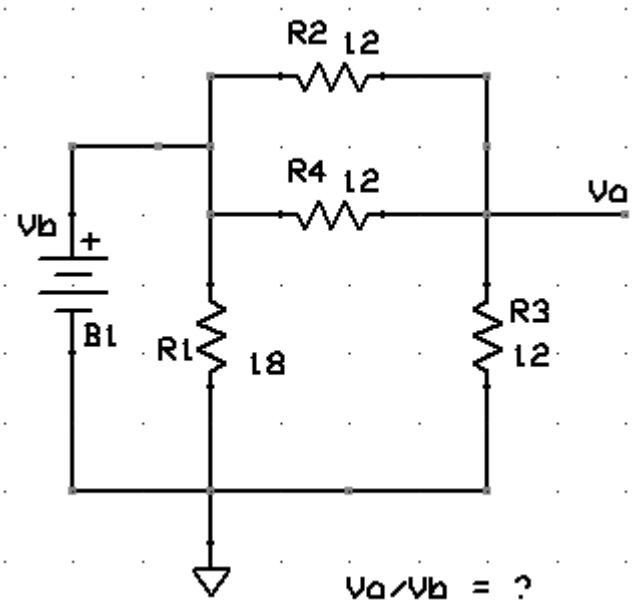
Quiz 9

1. Given the schematic below, what is Vo/Vb? Show your calculations - 2 points



Answer: R2 || R4 = 6, R3 = 12. As a voltage divider it produces 12/(12+6) or 2/3 of the Vb voltage, so Vo/Vb = 0.67.

2. Resistivity of a wire depends on (justify):

(A) length
(B) **material – it is a property of conductive materials (reciprocal of conductivity)**
(C) cross section area
(D) none of the above.

3. What fields and why should the Title Block of the schematic page have?

Answer:

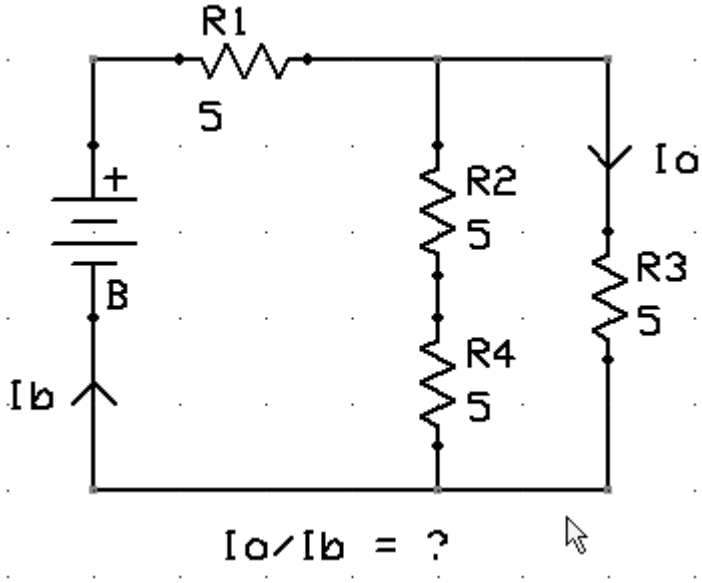
Field	**Reason (what for)**
Name of PCB, Project	Easily identify and find schematic
Designer	For questions, discussions, accountability
Date	Tracking
Revision	Tracking
Document number	Tracking
Name of page	Helps to navigate in complex schematics
Page # (of N, if >1)	Helps to navigate in complex schematics
Name of EDA	To specify which SW (& version) was used for design
Confidentiality Stamp	For proper protection of Intellectual Property

4. When N resistors each of value R are connected in parallel, then resultant resistance is X. When these N resistors are connected in series, total resistance is ? Show your calculations.

(A) N*X
(B) R*N*X
(C) X/N
(D) N^2*X.

Answer:
Parallel: R/N = X, so R = N X;
Serial: Rs = N R = N (N X) = (N^2) * X - answer.

5. Given the schematic below, what is Io/Ib? Show your calculations -2 points



Answer:
Let's call Vo the voltage on R3 and on serial connection of R2 and R4. Then the following can be written: Io * R3 = Ic * (R2+R4). Ic is the current through R2 and R4 and can be expressed as Ib – Io. Io * 5 = (Ib – Io) * 10; 15Io = 10Ib => Io/Ib = 10/15 = 2/3 - Answer

6. Resistance of a wire is R Ohms. The wire is stretched to double its length, then its resistance in ohms is ? Show your calculations
(A) R/ 2
(B) 4 R

(C) 2 R
(D) R/ 4.

Answer:
Wire volume (mass) does not change: L * A = constant (L-length, A-area of cross section), so increasing length twice we decreasing the cross section area twice.
The correct answer is B: 4R

7. ADC has 12-bit resolution measuring 4.096V signal. What is the effective number of bits (binary digits) in this ADC, when it measures 0.5V? Justify

Answer:
ADC has resolution of 1mV: 4096mV/(2^12). Let's express 0.5V (500mV) in binary: 500mV = 1 1111 0100mV. Now it is visible that the ADC uses only 9 effective bits (bits carrying information) to represent this value.
Another approach:
Digitizing error (noise) of ADC = +/-0.5LSB or 0.5 * 4.096V/2^12 = +/-0.5mV.
SNR = 20log(Vs/Vn) = 60dB, and ENOB = (SNR-1.76)/6.02 = 9.67 bits.

By Will Frizzel:
The successive approximation converter of the ADC will successively compare MSB to the 0.5V input voltage. MSB (bit 11) will be set to 1 causing the DAC to output 2.048V, it will compare greater than input voltage and go to zero. Next bit 10 will be set to high and DAC will output 1.024V, same result. Finally Pin 8 will be set to high and DAC will output 0.256V, the DAC output will be lower than the 0.5V input and bit 8 will be the MSB of the measured value and 9 effective bits (0~8) will be used to capture the measurement.

8. Two bulbs marked 200 W - 250 V and 100 W - 250 V are joined in series to 250 V supply. Power consumed in circuit is: Show your calculations

(A) 3.3 W.
(B) 67 W.
(C) 100 W.
(D) 300 W.

Answer:
Resistances of the bulbs are: R1 = 250^2/200 and R2 = 250^2/100 Ohm.
Connected in series, they have total resistance Rt = 312.5 + 625 = 937 Ohm. Power consumption of two bulbs is: P = V^2/Rt = 66.7W.
Correct answer is B: 67W.