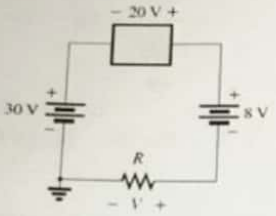
Q4: (worth 0.25 credits)
Using Kirchhoff's voltage law, find the unknown voltage.



$+E_1 + V_1 - E_2 - V_2 = 0$

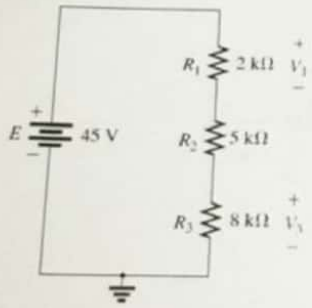
$30 + 20 - 8 - V_2 = 0$

$30 + 20 - 8 = V_2$

$V_2 = 42\ V$

Answers:

Q5: (worth 0.5 credits each worth 0.25 credits)
Using the voltage divider rule, find the indicated voltages.

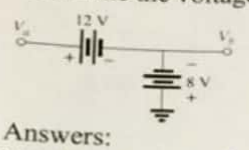


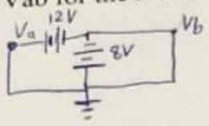
Answers:

V1) $V_1 = R_1\left(\frac{E}{R_T}\right) = 2\times10^3\,\Omega\left(\frac{45\ V}{(15\times10^3)}\right) = 6\ V$

V3) $V_3 = R_3\left(\frac{E}{R_T}\right) = 8\times10^3\,\Omega\left(\frac{45}{(15\times10^3)}\right) = 24\ V$

Q6: (worth 0.75 credits each worth 0.25 credits)
Determine the voltages Va, Vb, and Vab for the network.





Answers:

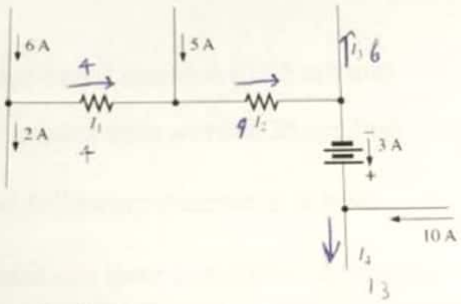
Va) ~~12~~ -8 +12 = 4 V ✓

Excelent !!

Vb) - 8 V ✓

Vab) $V_{ab} = V_a - V_b = 4 - (-8) = 12$ V ✓

Q7: (worth 1.0 credits each worth 0.25 credits)
Using Kirchoff's current law, find the unknown I with directions.



Answers:

I_1 value = 6-2 = 4 A ✓

I_1 direction = Right

I_2 value = 4+5 = 9 A ✓

I_2 direction = Right

I_3 value = 9-3 = 6 A ✓

I_3 direction = up

I_4 value = 10+3 = 13A ✓

I_4 direction = down

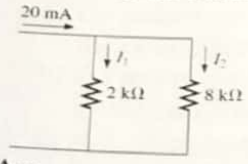
9.2) which of the following statements is true:

a) the polarity of the voltage across a resistor is determined by the direction of the current.
b) the power applied by the dc supply must equal that dissipated by the resistive elements.
c) in a series configuration, maximum power is delivered to the largest resistor.
d) in a series resistive circuit, the larger the resistance, the more of the applied voltage it will capture.
e) All of the above are true.
f) Some of the above are true and some are not.
g) None of the above true.

9.3) which of the following statements is true:

a) two elements, branches, or circuits are in parallel if they have two points in common.
b) the total resistance of parallel resistors is always less than the value of the smallest resistor.
c) if the smallest resistor of a parallel combination is much smaller than the other parallel resistors, the total resistance will be very close to the smallest resistor value.
d) the total resistance of parallel resistors will always drop as new resistors are added in parallel, irrespective of their value.
e) All of the above are true.
f) Some of the above are true and some are not.
g) None of the above true.

Q8: (worth 0.5 credits each worth 0.25 credits)
Determine the currents for the configuration.



Answers:

$I_1 = I_T\left(\frac{R_2}{R_T}\right) = 20\times10^{-3}\,A\left(\frac{8\times10^{3}\,\Omega}{10\times10^{3}\,\Omega}\right) = 0.016\,A = 16\,mA$ ✓

✓

$I_2 = I_T\left(\frac{R_1}{R_T}\right) = 20\times10^{-3}\,A\left(\frac{2\times10^{3}\,\Omega}{10\times10^{3}\,\Omega}\right) = 0.004\,A = 4\,mA$

Part2: Knowledge-based question (0.75 credits)

Q9: (worth 0.75 credits each worth 0.25 credits)

9.1) which of the following statements is true:

a) a short circuit can have a potential difference (voltage) across its terminals, but the current is always zero amperes.
b) an open circuit can carry a current of a level determined by the external circuit, but the potential difference (voltage) across its terminals is always zero volts.
c) voltage sources can be placed in parallel only if they have the same voltage.
d) All of the above.
e) None of the above. ✗

Part1: Math-based question (4.25 credits)

Q1: (worth 0.5 credits each part worth 0.125 credits)

Write the following in specified scientific notation:

a) 0.0001 A = 0.1 mA
b) 2400 Ω = 2.4 kΩ
c) 0.0000009 F = 0.9 μF
d) $7*10^{-6}$ Ω = 7 MΩ

Q2: (worth 0.5 credits each part worth 0.25 credits)

a) How long can a 1.5 V flashlight battery provide a current of 250 mA to light the bulb if the ampere-hour rating is 16 Ah?
b) How long the battery will last if we just switch it ON 20 minutes each hour while switch it OFF 40 minutes each hour?

Answers:

a) $Life = \frac{Ahr}{A} = \frac{16\,Ah}{250\times10^{-3}\,A} = 64\,h$

$x\,h = \frac{40\,min \times 1\,h}{60\,min} = \frac{2}{3}\,h$

64x3 or $\frac{16 \times 3}{250}$

Q3: (worth 0.25 credits)

How many joules of energy does a 2 W nightlight dissipate in 8 h?

Answers:

$P = \frac{W}{t} \Rightarrow W = Pt = 2\,W \times (28800\,s) = 57600\,J$

$1\,h \rightarrow 3600\,s$

$8\,h \rightarrow X\,s$

$X = \frac{3600\,s \times 8\,h}{1} = 28800\,s$