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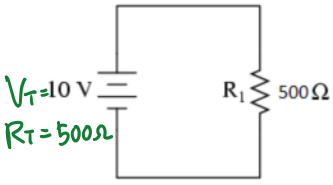
PHYSICS 11 **Circuits** **Practice Test** **Name:** Key

Written Answer Questions

1) Consider the simple circuit. [6 pts total]

a) Determine the current in R1. [2 marks]



$V_T = I_T R_T$

$10 = I_T (500)$

$I_T = 0.02\,A$ (I_1 too)

1a) 0.02 A

b) Determine the power draw for R1. [2 marks]

$P_1 = I_1^2 R_1 = (0.02)^2 \cdot 500 = 0.2$ Watt.

1b) 0.2 W

c) Determine the energy used by R1 if it is connected to the circuit for 10 minutes. [2 marks]

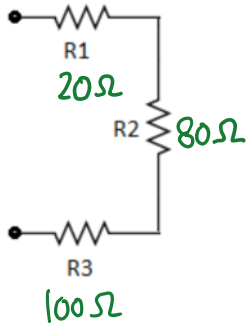
$P = \frac{E}{t}$ $E = P \cdot t = 0.2\,W\,(600\,sec) = 120\,J$

1c) 120 J

2) Determine the equivalent resistance for the following resistor networks. **Use the following resistances:**

R1 = 20 Ω R2 = 80 Ω R3 = 100 Ω R4 = 200 Ω

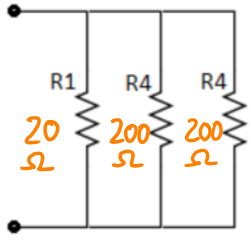
a) [2 marks]



$R_T = 20 + 80 + 100$

$R_T = 200\,\Omega$

b) [3 marks]



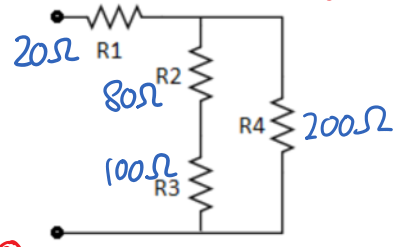
$\frac{1}{R_T} = \frac{1}{20} + \frac{1}{200} + \frac{1}{200}$

$\frac{1}{R_T} = 0.06$

$R_T = \frac{1}{0.06} = 16.7\,\Omega$

c) [3 marks]

① $R_{23} = 180\,\Omega$ series



② $\frac{1}{R_{234}} = \frac{1}{180} + \frac{1}{200}$ $R_{234} = 94.7\,\Omega$

③ $R_T = R_{234} + R_1 = 114.7\,\Omega$ (94.7 + 20)

2a) 200 Ω

2b) 16.7 Ω

2c) 114.7 Ω

① $R_{34} = 17\Omega$

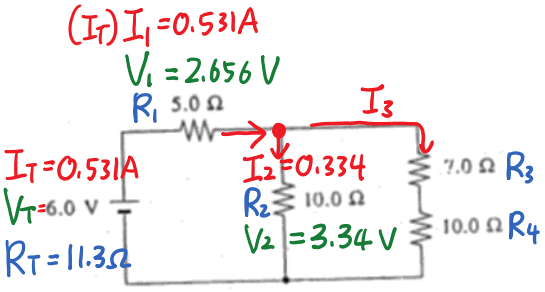
$\frac{1}{R_{234}} = \frac{1}{10} + \frac{1}{17}$ $R_{234} = 6.3\Omega$

② $R_T = 5 + 6.3$ (R_1 R_{234})

$R_T = 11.3\Omega$

3) Consider the circuit pictured to the right. Determine the following:

a) The current through the 7.0 Ω resistor [4 marks]



③ $V_T = I_T R_T$

$6 = I_T\,11.3$

$I_T = 0.531A$

④ $V_1 = I_1 R_1$

$V_1 = 0.531(5)$

$V_1 = 2.656\,V$

⑤ $I_2 = \frac{V_2}{R_2}$

$I_2 = \frac{3.34}{10}$

$I_2 = 0.334\,A$

⑥ Junction

$I_T = I_2 + I_3$

$0.531 = 0.334 + I_3$ $I_3 =$

3a) 0.197 A

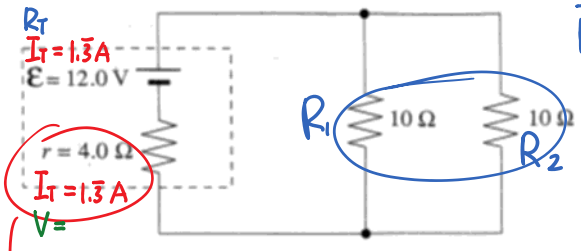
b) The charge (Q is measured in **Coulomb**) that passes through the **7.0 Ω resistor** in 20.0 seconds [2 marks]

$0.197 \rightarrow I = \frac{Q}{t \leftarrow 20\,sec}$

3b) 3.88 C

4) Consider the circuit to the right. Note that resistor r = 4.0 Ω is internal resistance.

a) Determine the terminal voltage. (Hint: you will need I_T first) [4 marks]



$\frac{1}{R_{12}} = \frac{1}{10} + \frac{1}{10}$ $R_{12} = 5\Omega$

$R_T = 5\Omega + 4\Omega = 9\Omega$ (r)

$V_T = I_T R_T$

$12V = I_T(9)$

$I_T = 1.\bar{3}A$

$V_{term} = \mathcal{E} - I_T \cdot r = 12 - 1.3 \cdot (4)$

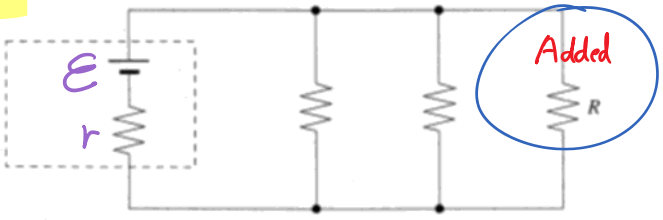
4a) 6.67 V

b) What is the total power consumed by the circuit that is lost to the internal resistance? [2 marks]

$P = I^2 \cdot r = (1.\bar{3})^2 \cdot (4\Omega) = 7.1$ Watt.

4b) 7.1 Watt

c) Another resistor R is added to the circuit from Question 4, giving the circuit shown to the right. **Does this increase, decrease or have no effect on terminal voltage?** Justify your answer. [2 marks]



Add R in parallel (path) → R_T ↓ (dec) (Reduce traffic)

$\mathcal{E} = I_T R_T$ (same) → I_T ↑ (inc)

$V_{terminal} = \mathcal{E} - I_T \cdot r$ ($\mathcal{E}$ same, I_T same)

∴ $V_{terminal}$ dec !!

4c)

Current Split method for Q3