CG1111 Engineering Principles and Practice I

Tutorial for Week 3

Energy, Battery Design & Basic DC Circuit Principles

1. Calculate the total capacity of a battery given that it can provide a current of 3 A for 9 hrs.

   Ans: 27000 mAh

2. How long would a 6000 mAh battery last if it is operated at 10C rate?

   Ans: 6 mins

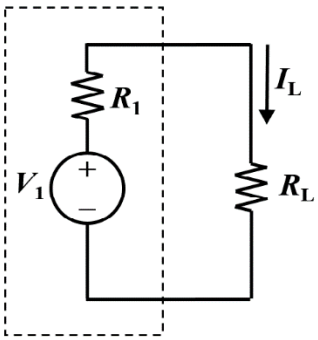
3. An electric device has an input power of 100 W. The device has converted 4500 J into useful work in 1 min. Find the power efficiency of the device.

   Ans: 75%

4. What is the discharging C-rate of a battery of capacity 6000 mAh if the discharge current is 3 A?

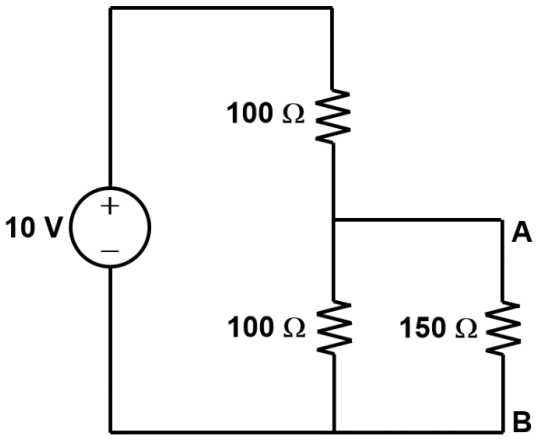
   Ans: 0.5C

5. Consider the following battery with open-circuit voltage V_1 = 12 V, and internal resistance R_1 = 0.15 Ω. Find the load current I_L and the corresponding power efficiency η_L for the following load: (i) R_L = 10 Ω, and (ii) R_L = 1 Ω.



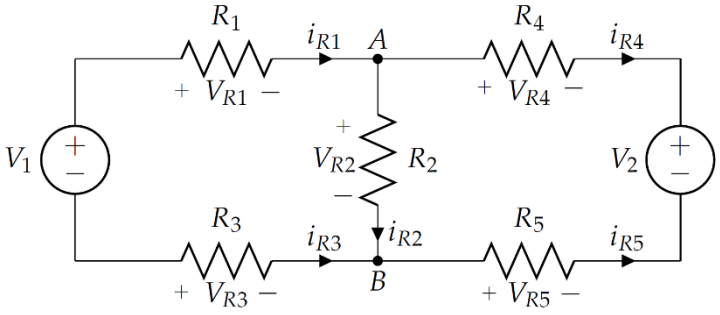
   Ans: (i) I_L = 1.18 A, η_L = 98.5%
   (ii) I_L = 10.4 A, η_L = 87.0%

6. The figure below shows a **loaded** voltage divider circuit. Calculate the voltage difference V_{AB} (given by $V_A - V_B$).



Ans: 3.75 V

7.



Considering the circuit diagram shown in the figure above, which one of the following correctly applies <u>both</u> KVL and KCL?

(a) $V_1 - V_{R1} - V_{R2} - V_{R3} = 0$; $i_{R1} - i_{R2} - i_{R4} = 0$

(b) $V_1 + V_{R3} - V_{R1} - V_{R2} = 0$; $i_{R1} + i_{R3} = 0$

(c) $V_2 + V_{R4} + V_{R2} + V_{R5} = 0$; $i_{R4} + i_{R5} = 0$

(d) $V_2 + V_{R4} - V_{R2} - V_{R5} = 0$; $i_{R3} - i_{R2} - i_{R5} = 0$