(Chapter-01) Basic Concepts

PRACTICE PROBLEMS

Q1. A homeowner consumes 700 kWh in January. Determine the electricity bill for the month using the following residential rate schedule:

Base monthly charge of $12.00.

First 100 kWh per month at 16 cents/kWh.

Next 200 kWh per month at 10 cents/kWh.

Over 300 kWh per month at 6 cents/kWh.

(Answer: 10.2 cents/kWh)

Q2. Referring to the residential rate schedule in Q1, calculate the average cost per kWh if only 400 kWh are consumed in July when the family is on vacation most of the time.

(Answer: 13.5 cents/kWh.)

Q3. A rechargeable flashlight battery is capable of delivering 85 mA for about 12 h. How much charge can it release at that rate? If its terminal voltage is 1.2 V, how much energy can the battery deliver?

(Answer: q=3.888 kC, E=5.832 kJ)

Q4. The current entering the positive terminal of a device is ***i(t)=3e^(-2t) A*** and the voltage across the device is ***v(t)=5di/dt V***.

(a) Find the charge delivered to the device between t=0 and t=2s.

(b) Calculate the power absorbed.

(c) Determine the energy absorbed in 3 s.

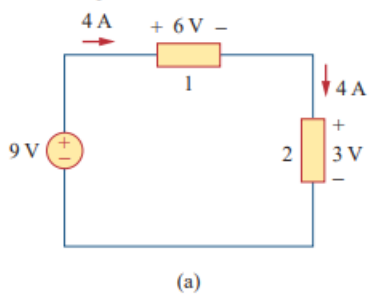
(Answer: a) 2.945 mC, b) –720e^(–4t) µW, c) –180 µJ)

Q5. If the current flowing through an element is given by

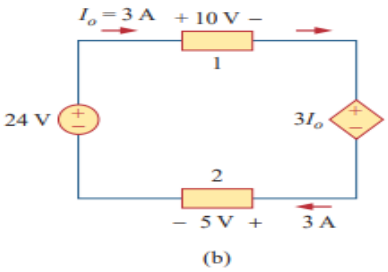
$$i(t) = \begin{cases} 3t\text{A}, & 0 \leqq t < 6\text{ s} \\ 18\text{A}, & 6 \leqq t < 10\text{ s} \\ -12\text{A}, & 10 \leqq t < 15\text{ s} \\ 0, & t \geqq 15\text{ s} \end{cases}$$

Plot the charge stored in the element over 0 6 t 6 20 s.

Q6. Calculate the power absorbed or supplied by each element in Fig. given below:

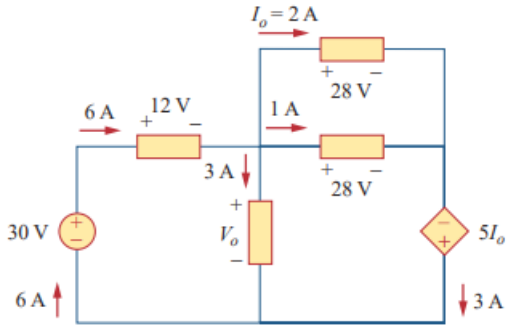


(a)



(b)

Q7. Find ***Vo*** in the circuit of Fig. given below:



(Answer: 18 V)

Q8. A 12-V car battery supported a current of 150 mA to a bulb. Calculate:

(a) the power absorbed by the bulb,

(b) the energy absorbed by the bulb over an interval of 20 minutes.

(Answer: a)80 mA, b) 0.48 W, c) 0.0048 kWh)

Q9. A constant current of 3 A for 4 hours is required to charge an automotive battery. If the terminal voltage is V, where t is in hours,

(a) how much charge is transported as a result of the charging?

(b) how much energy is expended?

(c) how much does the charging cost? Assume electricity costs 9 cents/kWh.

(Answer: a) 43.2kC, b) 475.2 kJ, c)1.188cents)

Q10. Reliant Energy (the electric company in Houston, Texas) charges customers as follows:

Monthly charge $6

First 250 kWh @ $0.02/kWh

All additional kWh @ $0.07/kWh

If a customer uses 1,218 kWh in one month, how much will Reliant Energy charge? (Ans: $164.02)