

Problems

1. How many coulombs are represented by these amounts of electrons?

a- 6.482×10^{17}

b- 1.24×10^{18}

c- 2.46×10^{19}

d- 1.628×10^{20}

Answer: (a) – 0.10384 C (b) – 0.19865 C (c) – 3.941 C (d) – 26.08 C

2- Determine the current flowing through an element if the charge flow is given by

a- $q(t) = (3t + 8) \text{ mC}$

b- $q(t) = (8t^2 + 4t - 2) \text{ C}$

c- $q(t) = (3e^{-t} - 5e^{-2t}) \text{ nC}$

d- $q(t) = 10 \sin 120\pi t \text{ pC}$

e- $q(t) = 20e^{-4t} \cos 50t \text{ } \mu\text{C}$

Answer:

(a) 3 mA

(b) $(16t + 4) \text{ A}$

(c) $(-3e^{-t} + 10e^{-2t}) \text{ A}$

(d) $1200\pi \cos 120\pi t \text{ pA}$

(e) $-e^{-4t}(80 \cos 50t + 1000 \sin 50t) \text{ } \mu\text{A}$

3- The charge flowing in a wire is plotted in Fig. 1. Sketch the corresponding current.

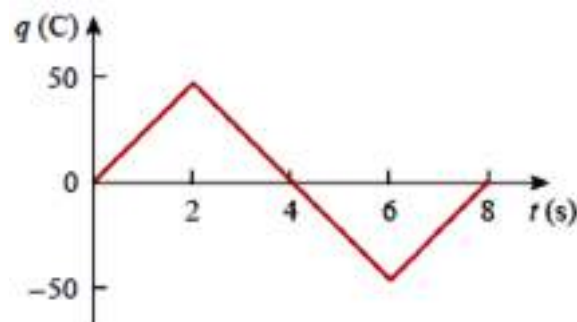


Fig. 1

4- The current flowing past a point in a device is shown in Fig. 2. Calculate the total charge through the point.



Fig. 2

5- The current through an element is shown in Fig. 3. Determine the total charge that passed through the element at:

- (a) $t = 1$ s (b) $t = 3$ s (c) $t = 5$ s

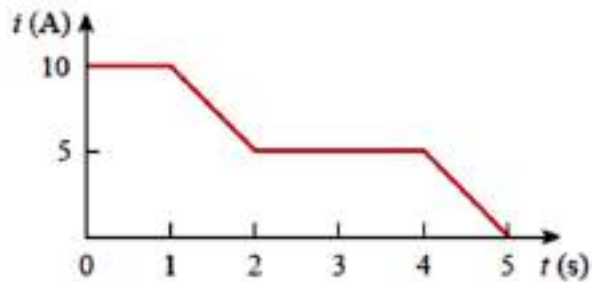


Fig. 3

6- 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: $q = 3.672$ C, $W = 4406.4$ J

7- If the current flowing through an element is given by

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

Plot the charge stored in the element over $0 < t < 20$

8- The charge entering the positive terminal of an element is $q = 10 \sin 4\pi t$ mC while the voltage across the element (plus to minus) is $v = 2 \cos 4\pi t$ mC

(a) Find the power delivered to the element at $t = 0.3$ s

(b) Calculate the energy delivered to the element between 0 and 0.6 s.

Answer: (a) 164.5 mW, (b) 78.34 mJ

9- The voltage v across a device and the current i through it are

$$v(t) = 5 \cos 2t \text{ V}, \quad i(t) = 10(1 - e^{-0.5t}) \text{ A}$$

Calculate:

(a) the total charge in the device at $t = 1$ s

(b) the power consumed by the device at $t = 1$ s.

Answer: (a) 2.131 C, (b) - 8.188 W

10- The current entering the positive terminal of a device is $i(t) = 3e^{-2t}$ A and the voltage across the device is $v(t) = \frac{5di}{dt}$ V.

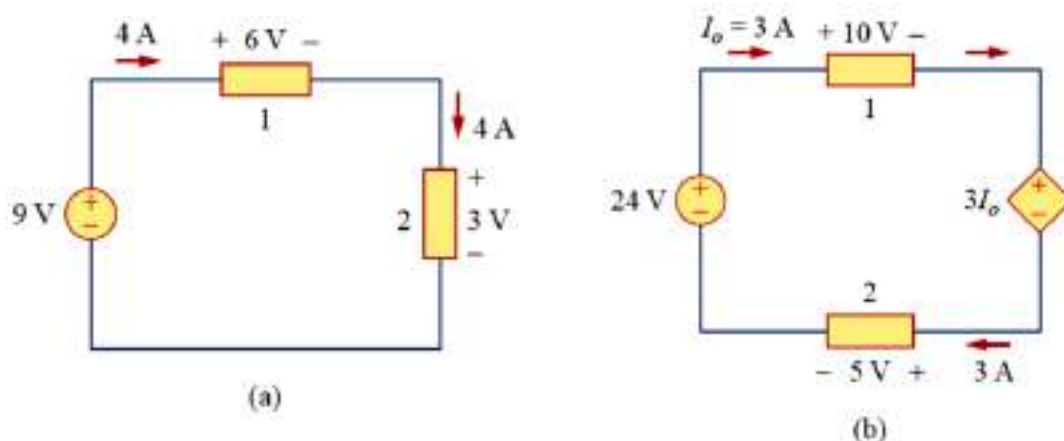
(a) Find the charge delivered to the device between $t = 0$ and $t = 2$ s.

(b) Calculate the power absorbed.

(c) Determine the energy absorbed in 3 s.

Answer: (a) 1.4725 C, (b) - 90e^{-4t} W

11- Calculate the power absorbed or supplied by each element in Fig. 4.



12- Find v_o in the circuit of Fig. 5.

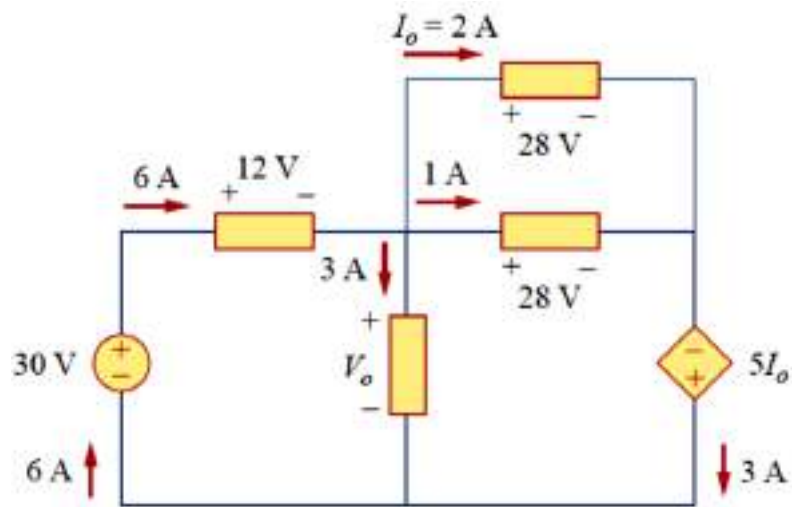


Fig. 5

Answer: 18 V