Chapter 28 Examples:

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Example 28.1:-
A battery ...... of 3.00Ω

Solution:- (A)

$$I = \frac{\mathcal{E}}{R+r} = \frac{12.0V}{(3.00\Omega + 0.05\Omega)} = \boxed{3.93A}$$

$$\Delta V = \mathcal{E} - Ir = 12.0 - (3.93)(0.05)\Omega = \boxed{11.8V}$$

$$\Delta V = IR = (3.93A)(3.00\Omega) = \boxed{11.8V}$$

(B):. calculate ..... battery.

$$P_R = I^2R = (3.93A)^2(3.00\Omega) = \boxed{46.3W}$$
$$P_r = I^2R = (3.93A)^2(0.05\Omega) = \boxed{0.772W}$$

$$P = P_R + P_r = 46.3W + 0.772W = \boxed{47.1W}$$

example 28.2:-
Find ..... Active figure.

Solution:-

(1) $$P = I^2R = \frac{\mathcal{E}^2R}{(R+r)^2}$$

$$\frac{dP}{dR} = \frac{d}{dR}\left[\frac{\mathcal{E}^2R}{(R+r)^2}\right] = \frac{d}{dR}\left[\mathcal{E}^2R(R+r)^{-2}\right] = 0$$

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$$[\mathcal{E}^2 (R+r)^{-2}] + [\mathcal{E}^2 R (-2) (R+r)^{-3}] = 0$$

$$\frac{\mathcal{E}^2 (R+r)}{(R+r)^3} - \frac{2\mathcal{E}^2 R}{(R+r)^3} = \frac{\mathcal{E}^2 (r-R)}{(R+r)^3} = 0$$

$$\boxed{R = r}$$

example 28.4:

Four ..... show in fig.

Solution (A):-

$$R_{eq} = 8.0\,\Omega + 4.0\,\Omega = 12.0\,\Omega$$

$$\frac{1}{R_{eq}} = \frac{1}{6.0\,\Omega} + \frac{1}{3.0\,\Omega} = 3/6.0\,\Omega$$

$$R_{eq} = 2.0\,\Omega$$

$$R_{eq} = 12.0\,\Omega + 2.0\,\Omega = \boxed{14.0\,\Omega}$$

(B) what ..... between a and c?

$$I = \frac{\Delta V_{ac}}{R_{eq}} = \frac{42V}{14.0\,\Omega} = \boxed{3.0A}$$

$$\Delta V_1 = \Delta V_2 \rightarrow (6.0\,\Omega) I_1 = (3.0\,\Omega) I_2 \rightarrow I_2 = 2I_1$$

$$I_1 + I_2 = 3.0A \rightarrow I_1 + 2I_1 = 3.0A \rightarrow \boxed{I_1 = 1.0A}$$

$$I_2 - 2I_1 \rightarrow 2(1.0A) = \boxed{2.0A}$$

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example 28·5:-

Three ...... point a and b.

Solution:- (A):-

$$\frac{1}{R_{eq}} = \frac{1}{3.00\,\Omega} + \frac{1}{6.00\,\Omega} + \frac{1}{9.00\,\Omega} = \frac{11.0}{18.0\,\Omega}$$

$$R_{eq} = \frac{18.0\,\Omega}{11.0} = \boxed{1.64\,\Omega}$$

(B) Find the current in each resistor.

$$I_1 = \frac{\Delta V}{R_1} = \frac{18.0\,V}{3.00\,\Omega} = \boxed{6\,A}$$

$$I_2 = \frac{\Delta V}{R_2} = \frac{18.0\,V}{6.00\,\Omega} = \boxed{3\,A}$$

$$I_3 = \frac{\Delta V}{R_3} = \frac{18.0\,V}{9.00\,\Omega} = \boxed{2\,A}$$

(C) calculate ...... of resistors:

$3\,\Omega$: $P_1 = I_1^2 R_1 = (6\,A)^2 (3\,\Omega) = \boxed{108\,W}$

$6\,\Omega$: $P_2 = I_2^2 R_2 = (3\,A)^2 (6\,\Omega)$ $\boxed{54\,W}$

$9\,\Omega$: $P_2 = I_3^2 R_3 = (2\,A)^2 (9\,\Omega)$ $\boxed{36\,W}$

example 28·6:-

A single ...... circuit.

Solution:-

$$\Sigma \Delta V = 0 \rightarrow \mathcal{E}_1 - IR_1 - \mathcal{E}_2 - IR_2 = 0$$

$$(1)\; I = \frac{\mathcal{E}_1 - \mathcal{E}_2}{R_1 + R_2} = \frac{6.0\,V - 12\,V}{8.0\,\Omega + 10\,\Omega} = \boxed{-0.33\,A}$$

(P.T.O)

example 28.7:-

Find . . . . . . shown in fig.

Solution:-

1) $I_1 + I_2 - I_3 = 0$

2) $10.0V - (6.0\Omega)I_1 - (2.0\Omega)I_3 = 0$
↳ abcda

befeb → $-(4.0\Omega)I_2 - 14.0V + (6.0\Omega)I_1 - 10.0V = 0$

3) $-24.0V + (6.0\Omega)I_1 - (4.0\Omega)I_2 = 0$

$10.0V - (6.0\Omega)I_1 - (2.0\Omega)(I_1 + I_2) = 0$

4) $10.0V - (8.0\Omega)I_1 - (2.0\Omega)I_2 = 0$

5) $-96.0V + (24.0\Omega)I_1 - (16.0\Omega)I_2 = 0$

6) $30.0V - (24.0\Omega)I_1 - (6.0\Omega)I_2 = 0$

$-66.0V - (22.0\Omega)I_2 = 0$

$\boxed{I_2 = -3.0A}$

$-24.0V + (6.0\Omega)I_1 - (4.0\Omega)(-3.0A) = 0$

$-24.0V + (6.0\Omega)I_1 + 12.0V = 0$

$\boxed{I_1 = 2.0A}$

$I_3 = I_1 + I_2 = 2.0A - 3.0A = \boxed{-1.0A}$

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example 28.8:-

Many...... capacitor?

Solution:-

The wipers are part of an RC circuit whose time constant can be varied by selecting different values of R through a multiposition switch. As the voltage across the capacitor increases, the capacitor reaches a point at which it discharges and triggers the wipers. The circuit then begins another charging cycle. The time ~~time~~ interval between the individual sweeps of the wispers is determined by the value of the time constant.

example 28.9:-

An..... function of time.

Solution:-

$$T = RC = (8.00\times10^{5}\,\Omega)(5.00\times10^{-6}F)$$

$$\boxed{T = 4.00\,s}$$

$$Q = C\mathcal{E} = (5.00\,\mu F)(12.0V) = 60.0\,\mu C$$

$$I_i = \frac{\mathcal{E}}{R} = \frac{12.0V}{8.0\times10^{5}\,\Omega} = 15.0\,\mu A$$

$$q(t) = (60.0\,\mu C)(1 - e^{-t/4.00s})$$

$$\boxed{I(t) = (15.0\,\mu A)e^{-t/4.00s}}$$

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example 28.10:-

consider .... Active fig.

Solution (A):.

$$\frac{Q}{4} = Q e^{-t/RC}$$

$$\frac{1}{4} = e^{-t/RC}$$

$$-\ln 4 = -\frac{t}{RC}$$

$$t = RC\ln 4 = 1.39RC$$

$$\boxed{t = 1.39\tau}$$

(B) The .... value?

$$u(t) = \frac{q^2}{2C} = \frac{Q^2}{2C} e^{-2t/RC}$$

$$\frac{1}{4}\frac{Q^2}{2C} = \frac{Q^2}{2C} e^{-2t/RC}$$

$$\frac{1}{4} - e^{-2t/RC}$$

$$-\ln 4 = \frac{-2t}{RC}$$

$$t = \frac{1}{2}RC\ln 4$$

$$= 0.639RC$$

$$\boxed{t = 0.693\tau}$$

Example 28.11:-

A . . . . capacitor?

solution!-

$$\Delta U + \Delta E_{int} = 0$$

$$(0 - U_c) + (E_{int} - 0) = 0 \rightarrow E_R = U_c$$

$$E_R = \frac{1}{2} C \mathcal{E}^2$$

$$E_R = \frac{1}{2}(5.00 \times 10^{-6} F)(800 V)^2 = \boxed{1.60 J}$$

$$P = \frac{dE}{dt} \rightarrow E_R \int_0^{\infty} P dt$$

$$E_R = \int_0^{\infty} I^2 R dt$$

$$E_R = \int_0^{\infty} \left(-\frac{Q}{RC} e^{-t/RC}\right)^2 R dt.$$

$$= \frac{Q^2}{RC^2} \int_0^{\infty} e^{-2t/RC} dt = \frac{\mathcal{E}^2}{R} \int_0^{\infty} e^{-2t/RC} dt$$

$$\boxed{E_R = \frac{\mathcal{E}^2}{R}\left(\frac{RC}{2}\right) = \frac{1}{2} C \mathcal{E}^2}$$