# Assignment-1

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**Subject:** Applied Physics.
**Course code:** GSC-114

## Practice problem 1-1.

Calculate amount of Charge represented by 6.667 billion protons.

### Data:-

Charge on one proton = $1.602 \times 10^{-19}$ C
Total no of proton = 6.667 million $= 6.667 \times 10^{9}$
Total Charge = ?

### Solution:-

Total Charge = Total no of proton $\times 1.602 \times 10^{-19}$
$= 6.667 \times 10^{9} \times 1.602 \times 10^{-19}$

$\boxed{\text{Total Charge} = 1.0680 \times 10^{-9}\ C}$ Ans

## Practice problem 1-2:

The total charge entering a terminal is $q = (10 - 10e^{-2t})$ mC, calculate the current at $t = 1.0s$

Data:-

$q = (10 - 10e^{-2t})\ mC$

$t = 1.0\ s$

$i = ?$

formula:-

$$i = \frac{dq}{dt}$$

$$i = \frac{d}{dt}(10 - 10e^{-2t})\ m\frac{C}{s}$$

$$i = \left(\frac{d}{dt}10 - \frac{d}{dt}(10e^{-2t})\right) mA \qquad \because A = \frac{C}{s}$$

$$i = -10(-2)e^{-2t}\ mA$$

$$i = \frac{20}{e^{2t}}$$

at $t = 1\,s$

$$i = \frac{20}{e^{2(1)}}$$

$$\boxed{i = 2.7067\ mA}$$ Ans

**Practice problem 1-3:**

The current flowing through an element is

$$i = \begin{cases} 4A, & 0 < t < 1 \\ 4t^2 A, & t > 1 \end{cases}$$

Calculate the charge entering the element from $t = 0$ to $t = 2s$.

## Data:-

$$i = \begin{cases} 4\,A, & 0 < t < 1 \\ 4t^2 A, & t > 1 \end{cases}$$

$t_1 = 0s$

$t_2 = 2s$

To find:

Charge $= Q = ?$

## Solution:-

: formula,

$$Q = \int i$$

a) for time interval $0 - 1$

$$Q_1 = \int_{t=0}^{1} i$$

$$= \int_0^1 4\,dt$$

$$= [4t]_0^1$$

$$= [4(1) - 0]$$

$$\boxed{Q_1 = 4\ C}$$

b) for time interval 1-2

$$Q_2 = \int_1^2 4t^2\,dt$$

$$= \left[\frac{4t^3}{3}\right]_1^2$$

$$= \left[\frac{4(2)^3}{3} - \frac{4(1)^3}{3}\right]$$

$$= \frac{32}{3} - \frac{4}{3}$$

$$= \frac{28}{3}$$

$$\boxed{Q_2 = 9.33\ C}$$

Total Charge $= Q_1 + Q_2$

$q = 4 + 9.33$ C

$\boxed{q = 13.33\ C}$ Ans-

**Practice problem 1.4:**

Find the voltage drop $V_{ab}$ (voltage at "a" positive with respect to "b") to move a charge 'q' from point 'b' to "a". The energy used is 25 J for this work done. if a) q = 5 C.
b) q = −10 C

**Data:-**

work done = W = 25 J

q = a) 5C
b) −10C

To find:

Voltage drop = $V_{ab}$ = ?

**Formula:**

$$V_{ab} = \frac{W}{q}$$

for q = 5c

$$V_{ab} = \frac{25}{5}$$

$$\boxed{V_{ab} = 5\ V}$$

for $q = -10C$

$$V_{ab} = \frac{25}{-10}$$

$$\boxed{V_{ab} = -2.5\ V}$$

**Practice problem 1.5:-**

Find the power delivered to an element at $t = 5\ ms$ if current entering its positive terminal is

$$i = 5\cos 60\pi t\ A$$

and voltage is (a) $V = 2i\ V$
(b) $V = \left(10 + 5\int_0^t i\,dt\right) V$

**Data:-**

$i = 5\cos 60\pi t\ A$

$t = 5\ ms = 5 \times 10^{-3}\ s$

To find:

power $= P = ?$

at (a) $V = 2i\ V$
(b) $V = \left(10 + 5\int_0^t i\,dt\right) V$

Solution:-

formula,

$$P = V \times i$$

$$P = V \times (5\cos 6\pi t) \quad \text{—— (1)}$$

a) for $V = 2i$

$$V = 2(5\cos 6\pi t)$$

$$V = 10\cos 6\pi t$$

put in (1)

$$P = (10\cos 6\pi t)(5\cos 6\pi t)$$

$$P = 50\cos^2 6\pi t$$

at $t = 5 \times 10^{-3}$ s

$$P = 50\cos^2 \{6\pi (5 \times 10^{-3})\}$$

$$P = 50\cos^2 (0.9424)$$

$$P = 50(\cos 0.9424)^2$$

$$P = 50(0.3455)$$

$$\boxed{P_a = 17.27\ \text{w}}$$

b) for $V = \left(10 + 5\int_0^t i\,dt\right)V$

$V = \left[10 + 5\int_0^t \cos 60\pi t \, dt\right]$ $\quad \because i = \cos 60\pi t$

$V = \left[10 + \frac{25}{60\pi}\int_0^t \cos 60\pi t (60\pi) dt\right]$

$= \left[10 + \left\{\frac{25}{60\pi}\left[\sin 60\pi t\right]_0^{5\times10^{-3}}\right\}\right]$

$= 10 + \left\{\frac{25}{60\pi}\left[\sin\left\{60\pi(5\times10^{-3})\right\}\right]\right\}$

$= 10 + \left\{\frac{25}{60\pi}(0.809)\right\}$

$= 10 + 0.107$

$V = 10.107\, v$

put in 1

$P = (10.107) \times (5\cos 60\pi t)$

at $t = 5\times10^{-3}$

$P = 10.107(5\cos(60\pi \times 5\times10^{-3}))$

$\boxed{P = 29.70\, w}$