

# Electron Mass and Charge



Here is the text extracted from the uploaded image:

1.

(i) Calculate the number of electrons which will together weigh one gram.

(ii) Calculate the mass and charge of one mole of electrons.

Ans.

(i) Mass of one electron =  $9.11 \times 10^{-31}$  kg, i.e.  $9.11 \times 10^{-31}$  kg = 1 electron

Therefore,  $10^{-3}$  kg =  $\frac{1}{9.11 \times 10^{-31}} \times 10^{-3}$  electrons

i.e.  $10^{-3}$  kg (1g) =  $1.098 \times 10^{27}$  electrons.

(ii) Mass of one electron =  $9.11 \times 10^{-31}$  kg

Therefore, Mass of one mole of electrons =  $(9.11 \times 10^{-31}) \times (6.022 \times 10^{23})$

=  $5.486 \times 10^{-7}$  kg

Charge on one electron =  $1.602 \times 10^{-19}$  coulomb

Therefore, Charge on one mole of electrons =  $(1.602 \times 10^{-19}) \times (6.022 \times 10^{23})$

=  $9.65 \times 10^4$  coulombs.

2.

(i) Calculate the total number of electrons present in one mole of methane.

(ii) Find (a) the total number and (b) the total mass of neutrons in 7 mg of  $^{14}\text{C}$ .

(Assume that the mass of a neutron =  $1.675 \times 10^{-27}$  kg)

(iii) Find (a) the total number and (b) the total mass of protons in 34 mg of  $\text{NH}_3$  at STP.

Will the answer change if temperature and pressure are changed?

Ans.

(i) 1 molecule of  $\text{CH}_4$  contains electrons =  $6 + 4 = 10$

Therefore, 1 mole, i.e.,  $6.022 \times 10^{23}$  molecules will contain electrons =  $6.022 \times 10^{23} \times 10$   
=  $6.022 \times 10^{24}$

(ii)

(a) 1 g atom of  $^{14}\text{C}$  = 14 g =  $6.022 \times 10^{23}$  atoms

1 atom of  $^{14}\text{C}$  contains  $14 - 6 = 8$  neutrons

Thus, 14 g or 14000 mg have  $8 \times 6.022 \times 10^{23}$  neutrons

Therefore, 7 mg will have neutrons

=  $\frac{8 \times 6.022 \times 10^{23}}{14000} \times 7$

=  $2.4088 \times 10^{21}$

(b) Mass of 1 neutron =  $1.675 \times 10^{-27}$  kg

Therefore, Mass of  $2.4088 \times 10^{21}$  neutrons

=  $(2.4088 \times 10^{21}) \times (1.675 \times 10^{-27})$

=  $4.0347 \times 10^{-6}$  kg

(iii)

(a) 1 mol of  $\text{NH}_3$  = 17 g of  $\text{NH}_3$

=  $6.022 \times 10^{23}$  molecules of  $\text{NH}_3$

Total number of protons present in 1 molecule of  $NH_3 = 7 + 3 = 10$

Number of protons in  $6.023 \times 10^{23}$  molecules of  $NH_3$

$$= (6.022 \times 10^{23}) \times (7 + 3) \text{ protons}$$

$$= 6.022 \times 10^{24} \text{ protons.}$$

Therefore, 34 mg i.e., 0.034 g of  $NH_3$

$$= \frac{6.022 \times 10^{24}}{17} \times 0.034 \text{ protons}$$

$$= 1.2044 \times 10^{22} \text{ protons.}$$

(b) Mass of one proton =  $1.6726 \times 10^{-27}$  kg

Therefore, Mass of  $1.2044 \times 10^{22}$  protons

$$= (1.6726 \times 10^{-27}) \times (1.2044 \times 10^{22}) \text{ kg}$$

$$= 2.0145 \times 10^{-5} \text{ kg}$$