Dirft velocity in gases E.B. Holzer, B. Dehning 18.09.03

$e := 1.6 \cdot 10^{-19} C$

electrons:

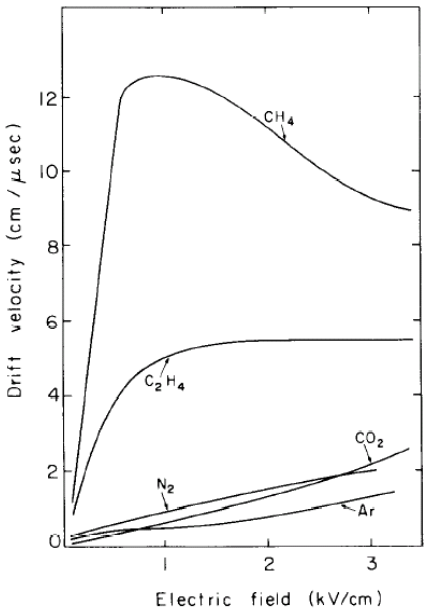

Fig. 26 Drift velocity of electrons in several gases at normal conditions[12,22,23])

=>

$E_{drift} := 7 kV \cdot cm^{-1}$

assumption: Ne almost same as Ar and no variation from E=3 to E=7 kV/cm

$m_{elec} := 9.1 \cdot 10^{-31} kg$

elec. speed:

$w_{elc} := \frac{e}{2 m_{elc}} \cdot E_{drift} \cdot \tau$

τ: mean time between collisions, speed here taken from graph

$w_{electron\_max\_7kVcm} := 10 \cdot 10^{6} \frac{cm}{s}$

$w_{electron\_max\_7kVcm} = 1 \times 10^{5} \frac{m}{s}$

$E_{elec} := \frac{1}{2} m_{elec} w_{electron\_max\_7kVcm}^{2}$

$E_{elec} = 4.55\, 10^{-21} J$

$E_{elec} = 0.028\, e \cdot V$

ions:

$\mu_{plus} := 13 cm^{2} s^{-1} V^{-1}$

ion speed:

$w_{ion} := \mu_{plus} \cdot E_{drift}$

$w_{ion} = 910 \frac{m}{s}$

$w_{ion} = 0.091\, 10^{6} \frac{cm}{s}$

Table 2

Classical mean free path, velocity, diffusion coefficients, and mobility for molecules, under normal conditions[18-21])

Gas	λ (cm)	u (cm/sec)	D^+ (cm^2/sec)	μ^+ (cm^2 sec^{-1} V^{-1})
H_2	1.8×10^{-5}	2×10^{5}	0.34	13.0
He	2.8×10^{-5}	1.4×10^{5}	0.26	10.2
Ar	1.0×10^{-5}	4.4×10^{4}	0.04	1.7
O_2	1.0×10^{-5}	5.0×10^{4}	0.06	2.2
H_2O	1.0×10^{-5}	7.1×10^{4}	0.02	0.7

$m_{ion\_Ar} := 40 \cdot 1836 \cdot m_{elec}$

$E_{ion} := \frac{1}{2} m_{ion\_Ar} \cdot w_{ion}^{2}$

$E_{ion} = 27.671\, 10^{-21} J$

$E_{ion} = 0.173\, e \cdot V$