

## Chem11 Charles' Law : W.S. - 20

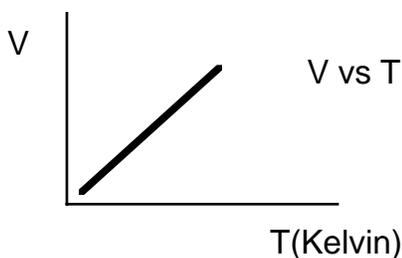
Jacques Charles noticed that at a constant pressure there is a linear relationship between the volume of a gas and its Celsius temperature. Later, scientists found that the relationship is true at very low temperatures. If the volume is decreased to near zero, then the Celsius temperature is  $-273^{\circ}\text{C}$ . Lord Kelvin proposed the Kelvin scale. The zero for this scale is  $-273^{\circ}\text{C}$ . So,  $0^{\circ}\text{C} = +273\text{ K}$ . The relationship between the Kelvin and Celsius scales is :

$$\underline{K = C + 273.}$$

Charles' Law became :  $V/T = \text{a constant}$  or :  $V_1/T_1 = V_2/T_2$

The volume is usually measured in **liters**. (One liter =  $1000\text{ cm}^3 = 1000\text{ ml}$ ) The temperature is in degrees Kelvin. (note : The lowest possible temperature is  $0\text{ K}$ , which is called **Absolute Zero**)

Scientists often speak of **S.T.P.** This means; standard temperature and pressure. That is :  $0^{\circ}\text{C}$  and  $1.0$  atmosphere of pressure.



Problems : **Assume constant pressure.**

1) Convert the following temperatures.

a)  $37^{\circ}\text{C} = \underline{\hspace{2cm}}\text{ K}$       b)  $150.^{\circ}\text{C} = \underline{\hspace{2cm}}\text{ K}$       c)  $-70.^{\circ}\text{C} = \underline{\hspace{2cm}}\text{ K}$

d)  $-300.^{\circ}\text{C} = \underline{\hspace{2cm}}\text{ K}$       e)  $293\text{ K} = \underline{\hspace{2cm}}^{\circ}\text{C}$       f)  $100.\text{ K} = \underline{\hspace{2cm}}^{\circ}\text{C}$

2) If the volume of a gas is  $650.\text{ mL}$  at a temperature of  $300.\text{ K}$ , find the new volume if the temperature is decreased to  $175\text{ K}$ .

3) The volume of a gas at S.T.P. is  $2.00\text{ L}$ . Find the volume at  $85.0^{\circ}\text{C}$ .

4) If the Kelvin temperature of a gas is tripled, what happens to the volume ?

5) Find the final Celsius temperature of a gas, if the initial temperature is  $15^{\circ}\text{C}$  and the volume expands from 1.80 L to 2.70 L.

Answers : 1)a) 310., b) 423, c) 203, d) not possible, e) 20., f) -173.,  
2) 379 mL, 3) 2.62 L, 4) It is tripled., 5)  $159^{\circ}\text{C}$ .