Answer on Question #53063 – Chemistry – General chemistry

Question:

The conductivity of KCl solution of 0.02 mol/dm^3 is 0.2768 s/m. A measuring cell filled with this solution has resistance of 453 Ohm/m. The same measuring cell is filled with a $CaCl_2$ solution of 0.555 g/dm^3, the resistance is measured as 1050 ohm/m. Calculate, (1) Cell constant, (2) The conductivity of the $CaCl_2$ solution, (3) The molar conductivity of the $CaCl_2$ solution. Molecular Weight of $CaCl_2$ is 111 g/mol).

Solution:

1) The cell constant can be found according to the equation:
   $K = \chi(KCl) \times R(KCl)$, where χ – conductivity, R – resistance.
   $K = 0.2768\ s/m \times 453\ Ohm/m = 125.39\ s\ Ohm/m^2$

2) Since the same cell is used, K has the same value. The conductivity of the $CaCl_2$ solution is calculated according to an equation: $\chi(CaCl_2) = K/R(CaCl_2)$
   $\chi(CaCl_2) = 125.39\ s\ Ohm/m^2 / 1050\ Ohm/m = 0.1194\ s/m$

3) The molar conductivity of $CaCl_2$ is : $\lambda_m = \chi(CaCl_2)/(1000 \times C_m)$, where $C_m = C/M_w$, C_m – molar concentration and C – weight concentration (0.555 g/dm^3), M_w – molecular weight of $CaCl_2$ (111 g/mol.
   $\lambda_m = (0.1194\ s/m \times 111\ g/mol) / (1000 \times 0.555\ g/dm^3) = 23.88 \times 10^{-3}\ s\ m^2/mol$

Answers: **(1) 125.39 s Ohm/m^2**

(2) 0.1194 s/m

(3) 23.88×10^{-3} s m^2/mol