1. The rate constant of a reaction is 1.5 x 107 S-1 at 50 deg C. and 4.5 x 107 at 100 deg C. Calculate the Arrhenius activation energy

Formula to remember is

2.303 log ( K2 / K1) = Ea/ R [ T2 –T1 / T2T1]

2.303 x log [ 4.5 x 107 / 1.5 x 107] = Ea / 8.314 [ 373 - 323 / 373 x 323]

Ea = 2.2 x 104 J mol-1

1. A first order reaction is 10 % complete in 10 min . Calculate the time required for its 90 % completion

When t = 10 min, [A] = 100 -10 = 90

K = 1 /t ln [ A]0 / [A] = 1 /10 ln 100 /10

When 90 % reaction is complete, [A] = 100 -90 = 10

K = 1 /t ln 100 /10 = 1/ t ln 10

Equating both the rate constants and solving for t, it is 217. 4 min

1. The half life of a radioactive isotope is 150 years What fraction of it would remain unintegrated after 500 years ?

ln [A]0 / [A] = kt and k = 0.693 / t1/2

ln [ A]0 / [A] = (0.693 / t1/2) x t =0.693 / 150 x 500

= log [A]0 / [A] = 1.0032 = [A]0 / [A]= anti log ( 1.0032) = 10

Fraction unintegrated would be [ A] / [A]0  = 0.10

1. Calculate the rate constant for the reaction having the activation energy 39.3 kcal mol -1 300 deg C. and the frequency constant ( pre- exponential factor) 1.11 x 1011 S-1.

Given A = 1.11 x 10 11 S -1, R = 1.987 Cal

Ea = 39.3 kcal mol -1 T = 573 K

K = A e – Ea / RT Substituting all the values in the formula

K = 1.14 x 10 -4  S-1