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17/ENG01/021

Chemical ENGINEERING

ENG 282 ASSIGNMENT 5

(c)

(i) $\frac{dT}{dt} \propto (T - T_A)$

$\frac{dT}{dt} = k(T - T_A)$

$\frac{1}{T - T_A} dT = k \cdot dt$

$\ln(T - T_A) = kt + c$

$T - T_A = e^{kt+c}$

$T - T_A = e^{kt} \cdot e^{c}$

$T - T_A = e^{kt} \cdot T_0$

$T - T_A = T_0 e^{kt}$

@ $t = 0$

$25 - T_A = T_0 e^{k(0)}$

$25 - T_A = T_0$

$25 - 10 = T_0$

$\therefore T_0 = 15$

$T - T_A = 15e^{kt}$

$20 - 10 = 15e^{k(5)}$

$10 = 15e^{5k}$

$10/15 = e^{5k}$

$0.67 = e^{5k}$

$\ln 0.67 = 5k$

$\therefore k = \frac{\ln 0.67}{5} = -0.080$

$T - T_A = 15e^{kt}$

$T - 10 = 15e^{-0.080(t)}$

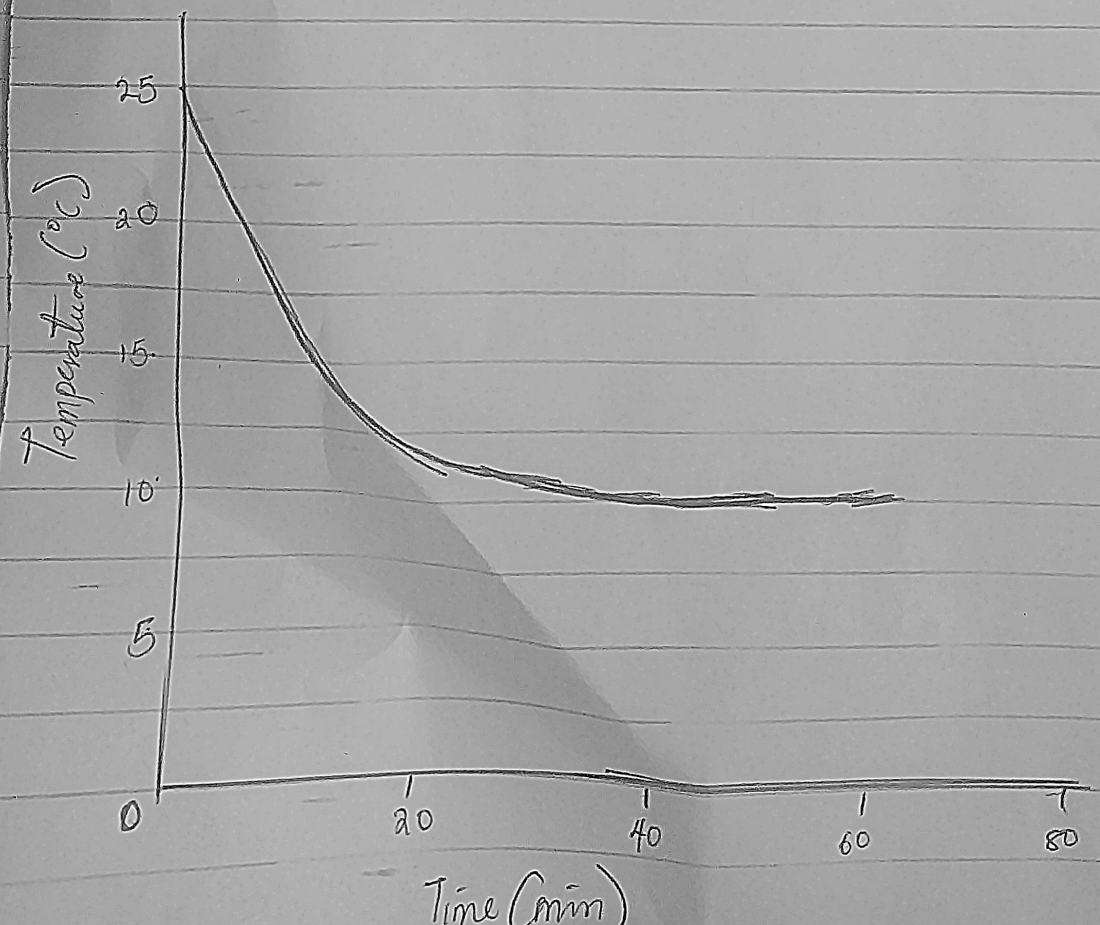
~~$T = 10 + 15e^{-0.080(t)}$~~

$T = 10 + 15e^{-0.080(t)}$ — model of the system.

(iii) MATLAB

Command window

```
clear
clc
Close all
T = 10 + (15*exp*(-0.080*t)
t = 0:1:60
Tn = Subs(T)
Plot (t, Tn)
X label ('time (min)')
Ylabel ('Temperature (°C)')
grid on
grid minor
axis tight.
```



(iv) The steady-state temperature of the system is $10^{\circ}C$

(v) ~~$T = 10 + 15e^{*}$~~

(v) $T = 10 + 15e^{-0.080(\infty)}$

$T = 10 + 15e^{-0.080(\infty)}$

$T = 10 + 25$

$T = 25^{\circ}C$.

(a) A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modelling.

(b) System modelling language
life cycle modeling language