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BIOMEDICAL ENL  
18/ENM02/087

Q1

$$T_{\text{initial}} = 10^{\circ}\text{C}$$

$$T = 20^{\circ}\text{C} \text{ @ } 5\text{mins}$$

$$T_{\text{air}} = 25^{\circ}\text{C}$$

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

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

$$\frac{dT}{dt} = k(T - 25)$$

$$\frac{dT}{(T - 25)} = k dt$$

$$\ln(T - 25) = tk + C$$

$$\therefore T - 25 = e^{tk+C}$$

$$T - 25 = e^{+k} \cdot e^C$$

$$\text{let } e^C = A$$

$$T - 25 = A e^{tk}$$

$$T = A e^{tk} - 25$$

at initial conditions,  $t=0$ ,  $T=10^{\circ}\text{C}$

$$10 = A e^0 - 25$$

$$A = 35$$

$$\therefore T = 35 e^{tk} - 25$$

at  $T=20^{\circ}\text{C}$ ,  $t=5\text{mins}$

$$20 = 35 e^{5k} - 25$$

$$45 = 35 e^{5k}$$

$$e^{5k} = 45/35$$

$$5k = \ln(45/35)$$

$$k = \frac{0.251}{5}, k = 0.05$$

$$T = 35 e^{0.05t} - 25$$

$$T = 24^{\circ} \text{ at } t = ?$$
$$24 = 35 e^{0.05t} - 25$$

$$49 = 35 e^{0.05t}$$

$$e^{0.05t} = 49/35$$

$$e^{-0.05t} = \ln(1.426)$$

$$0.05t = 0.355$$

$$t = 7.1 \text{ min}$$

```

1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms t V
6 - mdata=xlsread('onlinequizdata','fluiddata');
7 - t=mdata(1:2:250,1)
8 - V=mdata(1:2:250,2)
9 - plot(t,V)
10 - grid on
11 - grid minor
12 - xlabel('Time (min)')
13 - ylabel('Volume (m3)')
    
```

Current Folder

Workspace

Command Window

```

999.9927
999.9934
999.9940
999.9946
999.9951
999.9956
999.9960
999.9964
999.9967
    
```

fx >>

