Sample Paper 6: Paper 1

Question 7 (50 marks)

Question 7 (a)

$F = 71.6^\circ\text{F}$

$C = \frac{5}{9}(F-32) = \frac{5}{9}(71.6-32) = 22^\circ\text{C}$

Question 7 (b)

$k = 1.8\,\text{h}^{-1}, t = 0.5\text{ h}, T_0 = 96^\circ\text{C}, T_a = 22^\circ\text{C}$

$\theta = T_a + (T_0 - T_a)e^{-kt}$

$= 22 + (96-22)e^{-1.8\times 0.5} \approx 52^\circ\text{C}$

Question 7 (c)

$\theta = T_a + (T_0 - T_a)e^{-kt}$

$\theta - T_a = (T_0 - T_a)e^{-kt}$

$\frac{1}{e^{-kt}} = \frac{(T_0 - T_a)}{(\theta - T_a)}$

$e^{kt} = \frac{(T_0 - T_a)}{(\theta - T_a)}$

$kt = \ln\left(\frac{T_0 - T_a}{\theta - T_a}\right)$

Question 7 (d) (i)

t (hours)	$\theta(^\circ\text{C})$
0	37
t	27
$t+1$	26

$T_a = 20^\circ\text{C}, T_0 = 37^\circ\text{C}$

Question 7 (d) (ii)

$kt = \ln\left(\frac{37-20}{27-20}\right) = \ln\left(\frac{17}{7}\right)$

$k(t+1) = \ln\left(\frac{37-20}{26-20}\right) = \ln\left(\frac{17}{6}\right)$

$k(t+1) - kt = \ln\left(\frac{17}{6}\right) - \ln\left(\frac{17}{7}\right)$

$kt + k - kt = \ln\left(\frac{17}{6}\times\frac{7}{17}\right)$

$k = \ln\left(\frac{7}{6}\right) = 0.154\text{ h}^{-1}$

Question 7 (d) (iii)

$0.154t = \ln\left(\frac{17}{7}\right)$

$\therefore t = \frac{1}{0.154}\ln\left(\frac{17}{7}\right) = 5.76\text{ h} = 5\text{ h }46\text{ mins}$

Time of death: 4:44 pm