

a) at $t=0, y=0$
 $y = y_0 e^{-0.03t} + 20000$
 $0 = y_0 e^{-0.03(0)} + 20000$
 $y_0 = -20000$
 $y = y_0 e^{-0.03t} + 20000$
 $y = -20000 e^{-0.03t} + 20000$

b) $\frac{y_0}{100} \times 20000 = 18000$

$\therefore y = 18000$

$y = -20000 e^{-0.03t} + 20000$
 $18000 = -20000 e^{-0.03t} + 20000$
 $18000 - 20000 = -20000 e^{-0.03t}$
 $-2000 = -20000 e^{-0.03t}$
 $\frac{-2000}{-20000} = e^{-0.03t}$

$0.1 = e^{-0.03t}$

$\ln(0.1) = -0.03t$

$t = \frac{-2.30}{-0.03}$

$\therefore t = 76.8 \text{ minutes.}$

c) Dynamic response for $t=0$ to $t=6 \text{ hours}$ with a stepstone of 5 m/s .

$60 \text{ m/s} \rightarrow 1 \text{ hr.}$

$? \rightarrow 6 \text{ hrs.}$

$60 \times 6 = 360 \text{ m/s}$

$t=0$ to $t=360 \text{ m/s}$ with a stepstone of 5 m/s

d) Steady state value = 20000

e) At the time interval between 60 m/s to 360 m/s the fresh air at steady state was at 20000 ft^3 .