

Problem 1

$$Q = 3 \text{ g/s}$$

$$a = 7 \text{ m/s}$$

$$H = 10 \text{ m}$$

$$T_a = 25^\circ\text{C} = 298 \text{ K}$$

$$T_s = 60^\circ\text{C} = 333 \text{ K}$$

$$d = 1 \text{ m}$$

$$v = 0.1 \text{ m/s}$$

$$F_b = g \frac{d^2 V}{4} \left(\frac{T_s - T_a}{T_s} \right)$$

$$= (10) \frac{(1)^2 (0.1)}{4} \left(\frac{333 - 298}{333} \right) = 0.0263$$

$$\Delta H = \frac{1.6 F_b^{1/3} x^{2/3}}{a} = \frac{1.6 (0.0263)^{1/3}}{7} x^{2/3} = 0.068 x^{2/3}$$

$$H = 10 + 0.068 x^{2/3} = 10 + 0.068 (3000)^{2/3} = 24.14 \text{ m}$$

Overcast Night $\Rightarrow$ D

$$\begin{aligned} \sigma_g(3000) &= 200 \text{ m} \\ \sigma_z(3000) &= 60 \text{ m} \end{aligned} \left\{ \begin{array}{l} \text{from plots} \\ \text{From formulas} \end{array} \right. \begin{array}{l} 172 \text{ m} \\ 63 \text{ m} \end{array}$$

$$C = \frac{Q}{4\pi\sigma_g\sigma_z} e^{-\frac{y^2}{\sigma_g^2}} \left[e^{-\frac{(z-H)^2}{\sigma_z^2}} + e^{-\frac{(z+H)^2}{\sigma_z^2}} \right]$$

$$z=0 \quad C = \frac{3}{7(2\pi)(200)(60)} e^{-\frac{0^2}{200^2}} \left[2e^{-\frac{24.14^2}{60^2}} \right]$$

$$= 9.67 \times 10^{-6} \text{ g/m}^3$$

Problem 2

$$m = 10 \text{ kg}$$

$$H = 1 \text{ m}$$

$$t = 650 \text{ s}$$

$$x = 1000 \text{ m}$$

$$y = 0$$

$$z = 0$$

$$u = 1.5 \text{ m/s}$$

$$\text{Stable} \Rightarrow \sigma_x = \sigma_y = 10^{-1.67141 + 0.892629 \log_{10}(1000)} \\ = 10 \cdot 1 \text{ m} \approx 10 \text{ m}$$

$$\sigma_z = 10^{-1.33593 + 0.605993 \log_{10}(1000)} \\ = 3 \text{ m}$$

$$C = \frac{M}{(2\pi)^{3/2} \sigma_x \sigma_y \sigma_z} e^{-\frac{(x-ut)^2}{\sigma_x^2}} e^{-\frac{y^2}{\sigma_y^2}} \left[e^{-\frac{(z+H)^2}{\sigma_z^2}} + e^{-\frac{(z-H)^2}{\sigma_z^2}} \right] \\ = \frac{10}{(2\pi)^{3/2} (10)(10)(3)} e^{-\frac{(1000 - (1.5)(650))^2}{100}} e^{-0} e^{-\frac{1}{9}} \\ = 7.3 \times 10^{-6} \text{ kg/m}^3$$

In class I forgot this 2