Answers:

1.

$$\left.\frac{dM_s}{dt}\right|_{CV} = S_1\rho_1 A_1 V_1 - S\rho A_2 V_2$$

2.

$$\left.\frac{dM_{dust}}{dt}\right|_{CV} = -C\rho A_o V_o$$

3.

$$\left(\frac{dm}{dt}\right)_{syst} = \frac{d}{dt}\left(\rho_b \frac{4}{3}\pi R^3\right) - \rho_1 A_1 V_1$$

4. $V_1$ = 1.58 m/s; $V_2$ = 20.4 m/s

5.

$$U_b = \frac{A_p}{A - 0.7\,A_p}$$

6. Exit mass flow rate = -11.8 kg/s.

7. Force = 500 N

8. Force required to move the plate = - 7.5 N

9.

$$a_{blob} = \frac{dV}{dt} = g$$

10. Weight of body = 2.5 N

11. Required depth = 0.66 m

12. Pump power = 33.7 kW

13. Power required by fan = 54 kW

14.

$$P_{max} = \frac{1}{2}\rho A_j V_j^3 \quad \text{at} \quad \Omega R = \frac{V_j}{2}$$