Shortcut information

Drag-speed

Use this information to answer (b)(iii):
$$D = 10v^2$$

Pressure-volume

Use this information to answer (d)(iv):
$$P = 2\frac{1}{V}$$

Pivot-mass

Use this information to answer (f):
$$r_3 = 0.1\, m_2 + 30$$
$$r_2 = 30.0$$
Note: the above use mass in grams and distance in cm.

Solutions

Drag-speed

Solution for (b)(iii):
$$D = \tfrac{1}{2}\rho v^2 AC$$
$$\therefore D = \tfrac{1}{2}\rho AC\, v^2$$
$$\therefore \tfrac{1}{2}\rho AC = \text{gradient}$$
$$\therefore \tfrac{1}{2}\rho AC = 10$$
$$\therefore C = \frac{10}{\tfrac{1}{2}\rho A} = \frac{10}{\tfrac{1}{2}\times 1.23 \times 0.25} = 65$$

Pressure-volume

Use this information to answer (d)(iv):

$$P = 2\frac{1}{V}$$

Solution for (d)(iv):

$$P = \frac{bT}{V}$$

$$\therefore P = bT\frac{1}{V}$$

$$\therefore bT = \text{gradient}$$

$$\therefore bT = 2$$

$$\therefore T = \frac{2}{b} = \frac{2}{6.71\times10^{-3}} = 300 \text{ K (1 s.f.)}$$

Pivot-mass

Use this information to answer (f):

$$r_3 = 0.1\, m_2 + 30$$
$$r_2 = 30.0$$

Note: the above use mass in grams and distance in cm.

Solution for (f):

$$m_3 r_3 = m_2 r_2 + m_1 r_1$$

$$\therefore r_3 = \frac{m_2 r_2}{m_3} + \frac{m_1 r_1}{m_3}$$

$$\therefore r_3 = \frac{r_2}{m_3} m_2 + \frac{m_1 r_1}{m_3}$$

$$\therefore \frac{r_2}{m_3} = \text{gradient}$$

$$\therefore \frac{r_2}{m_3} = 0.1$$

$$\therefore r_2 = 0.1 \times m_3$$

$$\therefore m_3 = \frac{r_2}{0.1} = \frac{30.0}{0.1} = 300 \text{ g (1 s.f.)}$$