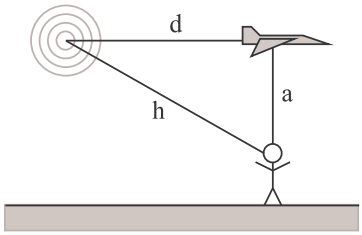
Chapter 14 Problem 61 †



Given
$a = 5.2\ km$
$\theta = 35°$
$v_s = 330\ m/s$

Solution
Find the speed of the plane.

From trigonometry the distance to the apparent sound source is related to the distance travelled by the plane, d, by the relationship

$$\sin\theta = \frac{d}{h} \tag{1}$$

The distance the sound travels is the velocity of sound times the time it takes to get to the listener.

$$h = v_s t \tag{2}$$

During this same time the plane travels from the apparent sound source to directly overhead. This distance is the speed of the plane times the time.

$$d = v_p t \tag{3}$$

Substituting equations 2 and 3 into 1 gives

$$\sin\theta = \frac{v_p t}{v_s t} = \frac{v_p}{v_s}$$

Solving for the speed of the plane gives

$$v_p = v_s \sin\theta = (330\ m/s)\sin 35°$$

$$v_p = 189\ m/s$$

†Problem from Essential University Physics, Wolfson