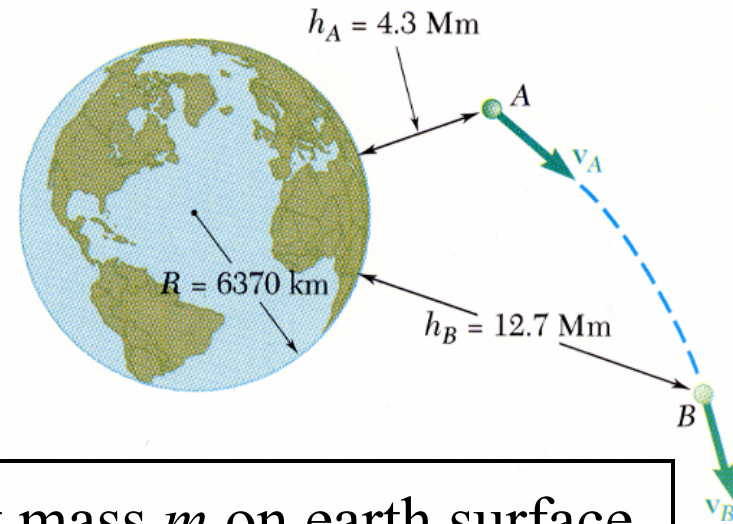**13.87** Knowing that the velocity of an experimental space probe fired from the earth has a magnitude $v_A = 32.5$ Mm/h at point A, determine the velocity of the probe as it passes through point B.

$$T_A + V_A = T_B + V_B$$

$$\frac{1}{2} m\, v_A{}^2 - \frac{G M m}{r_A} = \frac{1}{2} m\, v_B{}^2 - \frac{G M m}{r_B}$$

$h_A = 4.3$ Mm

$R = 6370$ km

$h_B = 12.7$ Mm

$r_A = R + h_A = 10.67$ Mm

$r_B = R + h_B = 19.07$ Mm

$v_B = 25.1$ Mm/h

Test mass m on earth surface

$$\frac{G M m}{R^2} = m\, g$$

$R = 6.37$ Mm

$g = 9.81$ m/s^2

$GM = gR^2 = 3.98 \times 10^{14}$ m^3/s^2