

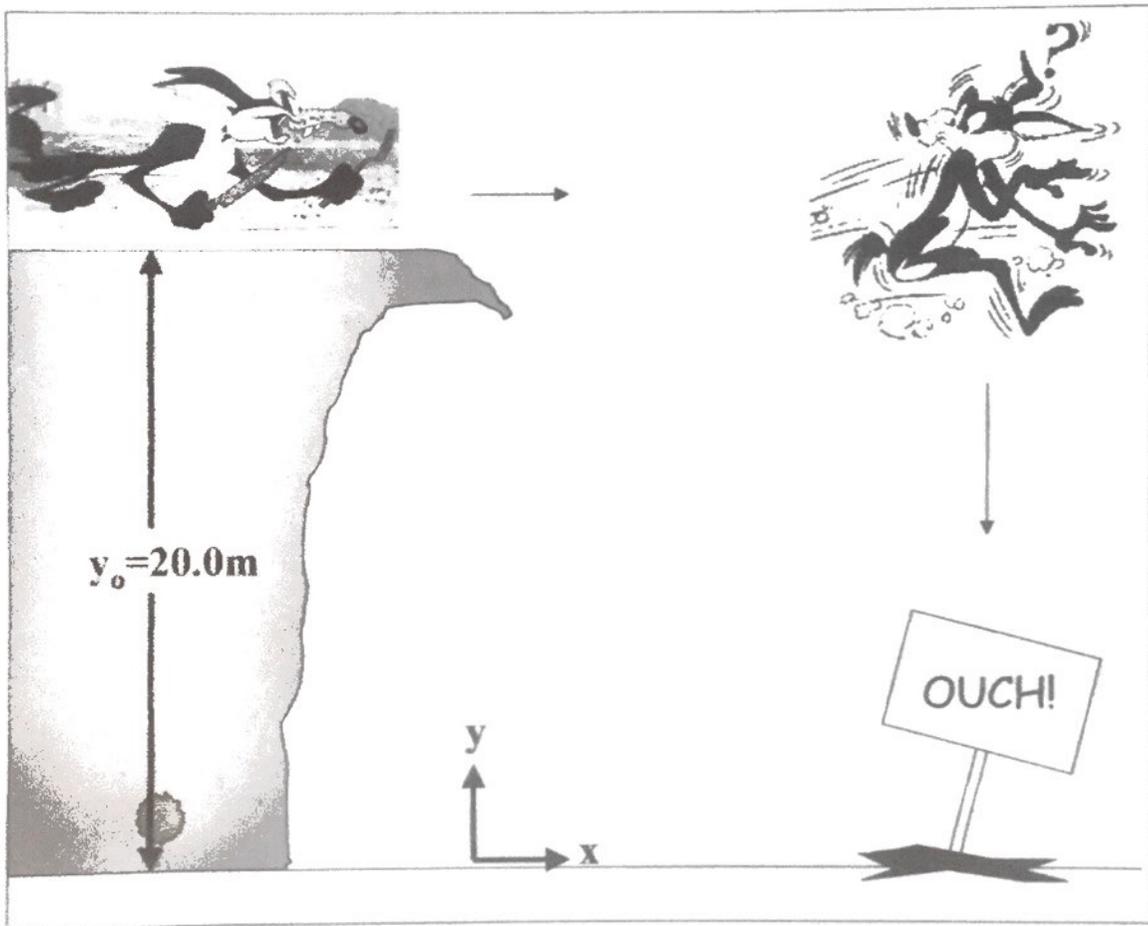
Projectile Motion – Coyotes can't fly...

Wile E. Coyote is on the hunt. Thanks to his spiffy Acme tennis shoes, he's cruising along just behind the Road Runner. However, the Road Runner can run across empty space and the Coyote can't. Halfway across a canyon, Wile E. realizes this, and then he falls...



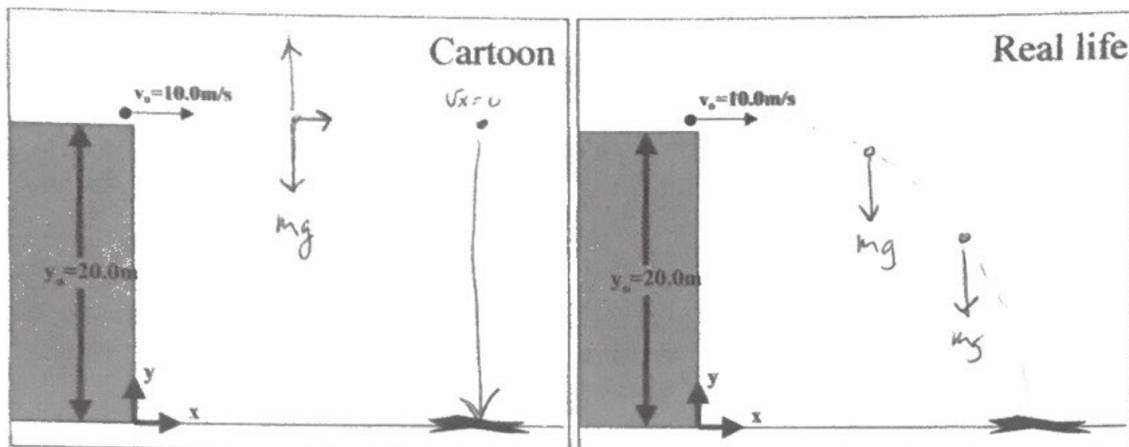
Assumptions:

Wile has a mass of 10.0kg. As he leaves the 20.0m-high cliff, his velocity is $v=10.0\text{m/s}$ x . He travels at this speed until he stops suddenly. When he comes to a stop, gravity takes over and he falls straight down. Air resistance has no effect.



Questions:

1. In the blank pictures below, draw Wile E.'s path. On the left, draw his path in the cartoons; on the right, draw his path as it would be in real life.
2. On each picture, draw the free body diagram for Wile E. for two different points along his path.



3. Looking at the pictures you have drawn, describe the biggest difference between the cartoon and real life.

In the cartoon, there is some magical support force that exists up until Wile E realizes he is no longer standing on solid ground. Only then, does he free fall

4. In real life, how long will Wile E. be in the air before he hits the ground?

$$S_y = \frac{1}{2} a_y t^2 \quad t = \sqrt{\frac{2 \cdot S_y}{a_y}} = \sqrt{\frac{2 \cdot -20}{-9.8}} = \boxed{4.15}$$

5. In real life, how far from the bottom of the cliff will we find a coyote-shaped-hole? (In other words, how far will Wile E. travel horizontally before he hits the ground?) range = ?

$$S_x = u_x \cdot t = 10 \frac{\text{m}}{\text{s}} \times 4.15 = \boxed{41 \text{ m}}$$

6. In real life, how fast will Wile E. be going when he hits the ground? (Ignore the effects of air resistance).

$$v_x = u_x = 10.0 \frac{\text{m}}{\text{s}}$$

$$v_y = u_y + a_y t = -9.8 \frac{\text{m}}{\text{s}^2} \times 4.15 = -40.2 \frac{\text{m}}{\text{s}}$$

$$\text{Final } v = \sqrt{(10^2) + (40.2)^2}$$

$$\boxed{v = 41.4 \frac{\text{m}}{\text{s}}} \quad \boxed{\theta = 76^\circ \text{ below horizontal}}$$

$$\theta = \tan^{-1} \left(\frac{40.2}{10} \right) = 76^\circ$$

