"Perplexing" Name:_____ Block:____ Date:_____

Perplexing Projectile Puzzles

For all of these puzzles, ignore effects of air resistance. Let g = 9.80 m/s^2.

1. Tom the cat is chasing Jerry the mouse across a table surface 1.5 m above the floor. Jerry steps out of the way at the last second, and Tom slides off the edge of the table at a speed of 4.8 m/s. Where will Tom strike the floor, and what velocity components will he have just before he hits?

Ans:

Ans:

2. A student stands at the edge of a cliff and throws a stone horizontally over the edge with a speed of 18.0 m/s. The cliff is 48.0 m above a flat horizontal beach. How long after being released does the stone strike the beach below the cliff? With what speed and angle of impact does it land?

Ans:

Ans:

Ans:

3. A brick is thrown upward from the top of a building at an angle of 25.0° to the horizontal and with an initial speed of 14.8 m/s. If the brick is in flight for 2.98 s, how tall is the building?

Ans:

4. A place kicker must kick a football from a point 36.0 m from the goal, and the ball must clear the crossbar, which is 3.05 m high. When kicked, the ball leaves the ground with a speed of 20.0 m/s at angle of 53.0° to the horizontal. By how much does the ball clear or fall short of clearing the crossbar? Does the ball approach the crossbar while still rising or while falling? (Justify your answer.)

Ans:

5. A car is parked on a cliff overlooking the ocean on an incline that makes an angle of 24.0° below the horizontal. The negligent driver leaves the car in neutral, and the emergency brakes are defective. The car rolls from rest down the incline with a constant acceleration of 4.00 m/s^2 for a distance of 48.0 m to the edge of the cliff. The cliff is 30.0 m above the ocean. Find the car’s position relative to the base of the cliff when the car lands in the ocean and the length o’ time the car is in the air.

Ans:

Ans:

6. A firefighter, 50.0 m away from a burning building, directs a stream of water from a ground level fire hose at an angle of 30.0° above the horizontal. If the speed of the stream as it leaves the hose is 40.0 m/s, at what height will the stream strike the building?

Ans:

7. A projectile is launched with an initial speed of 58 m/s at an angle of 30.0° above the horizontal. The projectile lands on a hillside 4.0 seconds later. What is the projectiles velocity at the highest point of it's trajectory? What is the *straight-line* distance from where the projectile was launched to where it hits? (Sketch!!!)

Ans:

Ans:

8. A daredevil decides to jump a canyon of width 10.0 m. To do so, she drives a motorcycle up an incline sloped at an angle of 15°. What minimum speed must she have in order to clear the canyon and land at the same height on the other side?

Ans:

9. An artillery shell is fired with an initial speed of 1.70×10^3 m/s at an angle of 55.0° above the horizontal. Find the time it is in motion and the horizontal distance traveled.

Ans:

Ans:

10. The coyote is chasing the roadrunner while wearing a brand-new pair of Acme rocket skates which provide a constant horizontal acceleration of 15 m/s^2. The coyote starts off at rest 67.5 m from the edge of a cliff at the instant the roadrunner zips by in the direction of the cliff. You know what happens…If the cliff is 1.00×10^2 m above the base of a canyon, determine where the coyote lands in the canyon. (Assume that his skates are still in operation and that his horizontal component of acceleration is a constant 15 m/s^2 during his entire "flight.")

Ans:

BONUS 1: (+1 pt) A rocket is launched at an angle of 50.0° above the horizontal with an initial speed of 1.00×10^2 m/s. It moves for 3.00 s along its initial line of motion with an acceleration of 30.0 m/s^2. At this time its engines fail and the rocket proceeds to move as a free body. Find the maximum altitude reached by the rocket, its total time in flight and its horizontal range.

Ans:

Ans:

Ans:

BONUS 2: (+1 pt) Derive expressions for maximum height, $\boldsymbol{h}$, and range, $\boldsymbol{R}$, of a projectile fired at speed $\boldsymbol{v}$ and at angle $\boldsymbol{\theta}$ with free fall acceleration $\boldsymbol{g}$.