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Class: 9
Subject: Physics
Topic: Motion in a Plane
No. of Questions: 20

Q1.   From the top of a tower 45 m high, two stones are released. One vertically downwards and the other with a horizontal velocity of 30 m/s. How long will each stone take to strike the ground and how far from the tower will each stone strike the ground? (g = 10 m/s^2)

Q2.   Suppose a project is lunched with an initial velocity V_0 at an angle [θ] with respect to the x-axis. What is its Range R?

Q3.   At what angle of projection, Range is maximum?

Q4.   An antitank gun is located on the edge of a plateau that is 60 m above the surrounding plain. The gun crew sights an enemy tank stationary on the plain at a horizontal distance of 2.2 km from the gun. At the same moment, the tank crew sees the gun and starts to more directly away from it with an acceleration of 0.90 m/ s^2. if the antitank gun fires a shell with a muzzle speed of 240 m /s at an elecation of 10 deg above the horizontal, How long should the gun crew wait before firing if they are to hit the tank.

Q5.   Consider a supply airplane attempting to airdrop a box onto a target marked on the group as shown below.
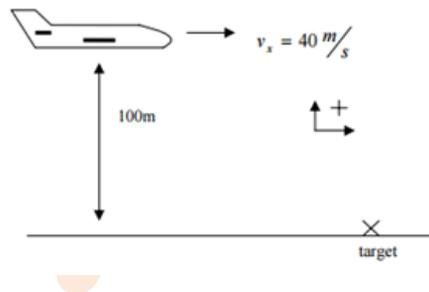

At what range from the target should the package be dropped?

Q6.   A BASE jumper ascends EI Capitan (1200 m) in Yosemite Valley CA and in order to BASE jump rather than walk 8 arduous miles down the Yosemite falls trail. If she leaps horizontally with a velocity of 5 m/s, and due to a technical malfunction is unable to open her parachute until 7 seconds have elapsed, does she live or die?

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Q7. A stone is thrown from the top of a building upward at an angle of 30° to the horizontal with an initial an initial speed of 20 m/s. if the height of the building is 45 m, find: time of flight; range; and the velocity of the stones just before it hits the ground.
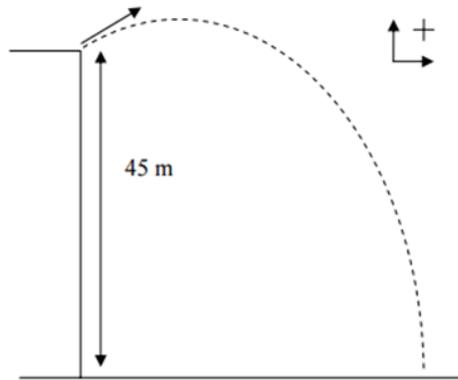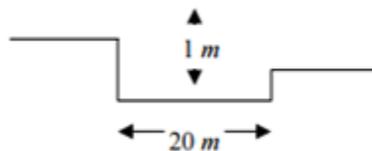

Q8. A mountain biker approaches a ditch from the left at a speed of 16 m/ s. The ditch is 20 m wide and the bank on the opposite side is 1 meter lower. Does the mountain biker make it across?
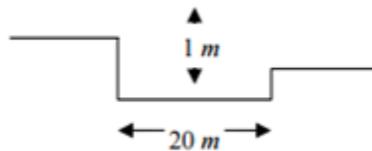
Q9. The mountain biker in the previous example is being chased by a bear and really needs to get across the ditch. Unfortunately he can't pedal any faster. Any suggestion?

(A mountain biker approaches a ditch from the left at a speed of 16 m/ s. The ditch is 20 m wide and the bank on the opposite side is 1 meter lower)

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Q10.   A kicker is capable of booting a football at an angle of θ = 37° with an initial velocity of 20 m/s.

Find:

- Maximum height
- Time of flight
- Range
- Velocity at max. height
- Maximum field goal range if bar is 3 m tall

Q11   A skier cranking down the ridge at pebble Creek hits the cat track with a velocity of 15 m/s. If the skier leaves the car track horizontally and if the ground falls away with a slope of -20⁰ how long is the skier in the air? What is the skier's velocity upon landing? What does this suggest to you about the desirability of steep loadings after if you are going to jump off something on skis or on a dirt or mountain bike?

$v_0 = 15^m\!/_s$

Slope = -20°
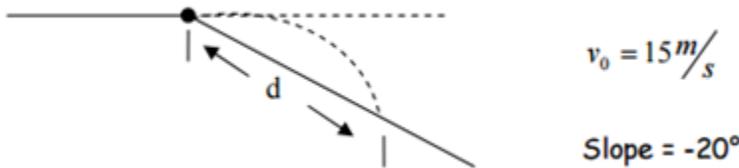
Q12.   A boat lies at anchor 100 meters off shore. I launch a water balloon from the beach at this boat with an initial velocity of 50 m/s. At what angle must I launch the balloon in order to strike the boat?

Q13.   An Object is projected from the origin. The initial velocity components are V_{ix} = 7.07 m/s, and V_{iy} = 7.07 m/s. Determine the x and y position of the object at 0.2 second intervals for 1.4 seconds. Also plot the results.

$$\Delta y = y_f - y_i = v_{iy}\Delta t + \frac{1}{2}a_y\Delta t^2$$
$$\Delta x = x_f - x_i = v_{ix}\Delta t$$

Q14.   Example (text problem 3.50): An arrow is shot into the air with θ = 60° and V_i = 20.0 m/s.

(a) What are V_x and V_y of the arrow when t= 3 sec?
(b) What are the x and y components of the displacement of the arrow during the 3.0 sec interval?

Q15.   Example: How far does the arrow in the previous example land from where it is released?

Q16.   A plane can travel with a speed of 80 mi/hr. with respect to the air. Determine the resultant velocity of the plane (magnitude only) if it encounters a

(a) 10 mi/hr. headwind.
(b) 10 mi/hr. tailwind.
(c) 10 mi/hr. crosswind.
(d) 60 mi/hr. crosswind.

Q17   A motorboat traveling 5 m/s, East encounters a current traveling 2.5 m/s, North.

(a) What is the resultant velocity of the motor boat?
(b) If the width of the river is 80 meters wide, then how much time does it take the boat to travel shore to shore?
(c) What distance downstream does the boat reach the opposite shore?

Q18.   A soccer ball is kicked horizontally off a 22.0-meter high hill and lands a distance of 35.0 meters from the edge of the hill. Determine the initial horizontal velocity of the soccer ball.

Q19.   A motor boat traveling 5 m/s. East encounters a current traveling 2.5 m/s, south.

(a) What is the resultant velocity of the motor boat?
(b) If the width of river is 80 meters wide, then how much time does it take the boat to travel shore to shore?
(c) What distance downstream does the boat reach the opposite shore?

Q20. A motor boat traveling 6 m/s, East encounters a current traveling 3.8 m/s, south.

(a) What is the resultant velocity of the motor boat?
(b) If the width of the river is 120 meters wide, then how much time does it take the boat to travel shore to shore?
(c) What distance downstream does the boat reach the opposite shore?