

Name: _____

DISC: _____

Score: ____ / 20

Instructions:

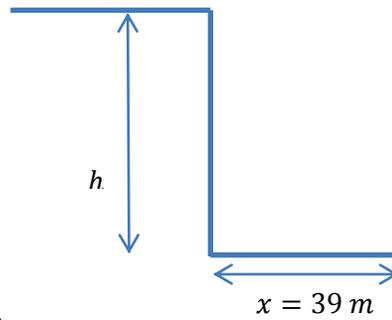
- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers.

Q1	Q2	Q3	Q4
10	10	5	5

1. A ball is thrown off a cliff of height h at an angle $\theta = 45^\circ$ with respect to the horizontal ground. The ball has an initial velocity of 18 m/s and reaches the ground after traveling $x = 39 \text{ m}$. Let the x -direction be horizontal and the y -direction be vertical.

a. Draw a picture of the path you expect the ball to take to the ground. *Include the coordinate system.*

Picture (1 pt):



b. Now let's work on the motion of the ball.

1 pt each
Acceleration:
Direction:
 v_x
 v_y :

- What is the acceleration of the ball?
- What is the direction of the acceleration?
- What is the x -component of the ball's initial velocity (v_{0x})?
- What is the y -component of the ball's initial velocity (v_{0y})?

c. Now we want to find the height h . Select the equations you could use to calculate h (select all correct equations).

Choice (1 pt):

- $x(t) = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$
- $y(t) = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$
- $v_x^2 = v_{0x}^2 + 2 a_x \Delta x$
- $v_y^2 = v_{0y}^2 + 2 a_y \Delta y$

d. How much time does it take the ball to reach the ground?

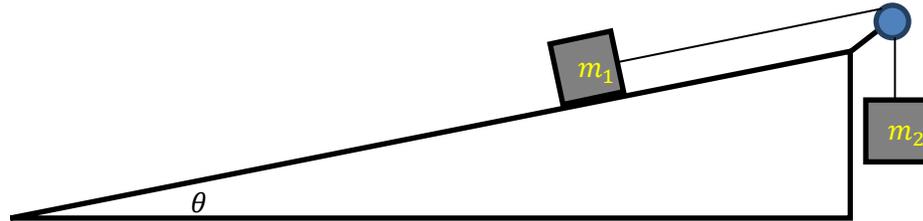
Solution (2 pts):

e. What is h ?

Solution (2 pts):

2. A block of mass m_1 is located on a *frictionless* ramp. The angle between the ramp and the floor is $\theta = 19^\circ$. It is connected to a second block of mass m_2 by a massless cord over a frictionless pulley as shown in the diagram.
- a. Select a coordinate system and complete the free-body diagram. *Include your coordinate system(s) on the diagram.* (Hint: Will it be easier to give each block its own coordinate system?)

Diagram (2pts):



- b. Let's consider the motion of the blocks (Hint: $F_{net} = ma = \sum F$):
- Can this system be in equilibrium?
 - Use Newton's laws to describe the forces on m_1 .
 - Use Newton's laws to describe the forces on m_2 .

Equilibrium:

F_1 :

F_2 :

- c. If the system is in *equilibrium*, what is the ratio $\frac{m_1}{m_2}$?

Solution (5 pts):