

Name: \_\_\_\_\_

DISC: \_\_\_\_\_

Score: \_\_\_\_\_ / 20

## Instructions:

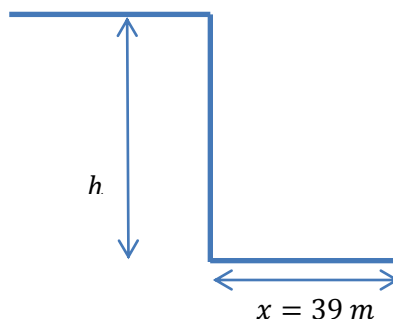
- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers.

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  $18 \text{ m/s}$  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):

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

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

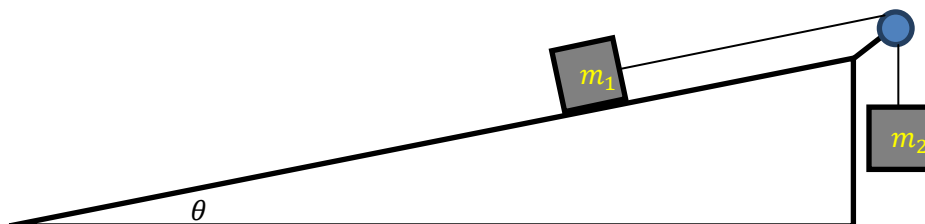
Solution (2 pts):

- 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  $m_2$ .

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

Solution (5 pts):