# Final Exam

**Date:** ___/___/_____

**Class Number:** PHYS 1061 H002 **Instructor:** Michael Haas **Name:** _____

Please read and follow all instructions carefully. Use the back of the sheet if necessary.
$\sum_{n=1}^{12} n(13-n) = 364$

Score: _____ / 63 + Bonus: _____ / 9 = Total: _____ / 63 || Final: _____% -> [A, B, C, D, F]

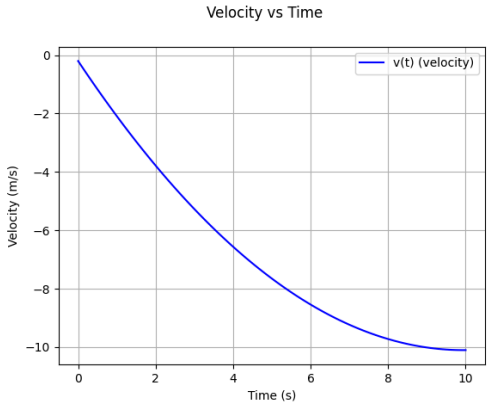
## Problem #1 (3 points)

A red water balloon is thrown horizontally from the top of a bridge. At the same instant, a yellow water balloon is dropped off the bridge from the same height. What can be said about the time it takes for the balloons to hit the ground (assume air resistances is negligible)?

A. The red balloon will hit the ground first.
B. The yellow balloon will hit the ground first.
C. Both balloons will hit the ground at the same time.
D. It is impossible to determine without more information.

## Problem #2 (3 points)

The figure shows the velocity versus time graph for a car driving on a straight road. Which of the following best describes the acceleration of the car?




A. The acceleration is positive and increasing.
B. The acceleration is positive and decreasing.
C. The acceleration is negative and increasing.
D. The acceleration is negative and decreasing.

## Bonus #3 (3 points)

In the song "The Twelve Days of Christmas," how many gifts are given in total? (assume that each time a number of a gift is spoken it is added to the count)

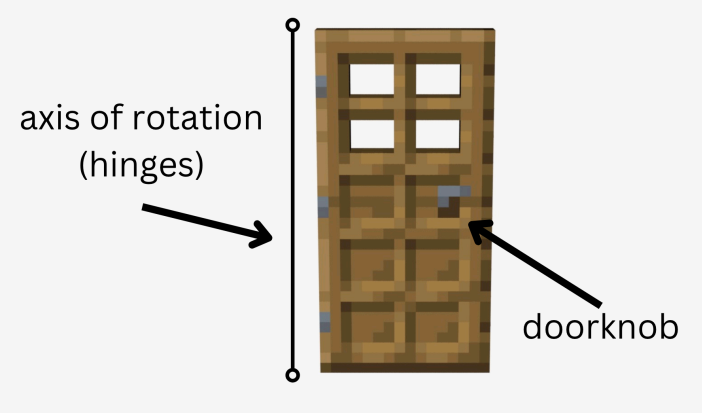
### Problem #4 (3 points)

Arthur Dent is in an elevator on the planet Squornshellous Zeta where the gravitational acceleration is $g_{\text{Squornshellous}} = 12.7\frac{\text{m}}{\text{s}^2}$. The elevator is accelerating upwards at $2.00\frac{\text{m}}{\text{s}^2}$. What is the magnitude of the normal force on Arthur if his mass is $70.0\text{kg}$?

A. $N = mg = 889.\frac{\text{kg}\cdot\text{m}}{\text{s}^2}$
B. $N = mg + ma = 1.03E + 03\frac{\text{kg}\cdot\text{m}}{\text{s}^2}$
C. $N = mg - ma = 749.\frac{\text{kg}\cdot\text{m}}{\text{s}^2}$
D. $N = ma = 140.\frac{\text{kg}\cdot\text{m}}{\text{s}^2}$

### Problem #5 (3 points)

Steve is pulling a door open (applying a force out of the page at the doorknob), what direction is the torque applied relative to the axis of rotation (the hinges).




A. Into the page ($-z$)
B. Out of the page ($+z$)
C. Up ($+y$)
D. Down ($-y$)
E. Left ($-x$)
F. Right ($+x$)

### Problem #6 (3 points)

For an airplane to achieve lift, the wing is formed into a particular shape. This causes the air above the wing to travel _____ resulting in a _____ pressure.

A. faster, lower
B. faster, higher
C. slower, lower
D. slower, higher

### Bonus #7 (3 points)

How many points was test 3 out of? (Hint: it was the same on all 5 tests and it is ***The Answer***)

For the following 3 problems, we are referring to the following situation: Commander William T. Riker (height $188.\text{cm}$ and mass $90.7\text{kg}$) is on vacation on planet Risa (gravitational acceleration $9.91\frac{\text{m}}{\text{s}^2}$) and comes across a river he wants to cross to get to the Risians on the other side having a party. He must swing across with a $42.0\text{m}$ long rope from an initial height of $21.0\text{m}$ and he knows that he must let go at the right time to land on the other side, but he doesn't know when or where. He does know that he must let go when his speed is exactly $2.50\frac{\text{m}}{\text{s}}$. Assume no friction or air resistance.

## Problem #8 (3 points)

Which of the following pieces of information is not needed to determine when and where Riker should let go of the rope?

A. The gravitational acceleration of Risa
B. The mass of Riker
C. The final speed of Riker
D. The initial height swung from

## Problem #9 (3 points)

The commander (incorrectly) calculates that he must let go of the rope when his height is determined by the following (wrong) equation: $h_f = \frac{gh_i - \frac{1}{2}v}{g}$. Which of these tells us this is wrong?

A. The equation is not dimensionally consistent
B. He forgot to include his mass
C. The equation is missing a minus sign
D. The $\frac{1}{2}$ should be a $2$

## Problem #10 (3 points)

There is a Ferengi chasing him from the starting side of the river demanding to be paid for a game of Dabo. What is the result of Riker throwing $1.34\text{kg}$ of latinum to the Ferengi at the moment he lets go?

A. Riker will not launch at all (drop straight down)
B. Riker will launch with the same speed
C. Riker will launch with a greater speed
D. Riker will launch with a lesser speed

## Problem #11 (6 points)

**Question #1 (3 points)**

What mathematical functions are used to describe waves?

**Question #2 (3 points)**

Give 3 examples of mechanical waves.

## Problem #12 (6 points)

A person is on top of a building and drops a stone which hits the ground $5.50\text{s}$ later.

Choose the planet where this occurs:

A. Earth (g = $-9.81\frac{\text{m}}{\text{s}^2}$)
B. Moon (g = $-1.62\frac{\text{m}}{\text{s}^2}$)
C. Mars (g = $-3.71\frac{\text{m}}{\text{s}^2}$)
D. Jupiter (g = $-24.8\frac{\text{m}}{\text{s}^2}$)

**Question #1 (3 points)**

Determine the velocity of the stone when it hits the ground.

**Question #2 (3 points)**

Determine the height of the building.

## Problem #13 (3 points)

Quinn accelerates at a rate of $2.45\frac{\text{blark}}{\text{zoomer}^2}$.

**Extra information**

$1.00\text{blark} = 1.59\text{yd}$
$1.00\text{yd} = 0.914\text{m}$
$1.00\text{zoomer} = 1.20\text{h}$
$1.00\text{h} = 3.60E+03\text{s}$

**Question #1 (3 points)**

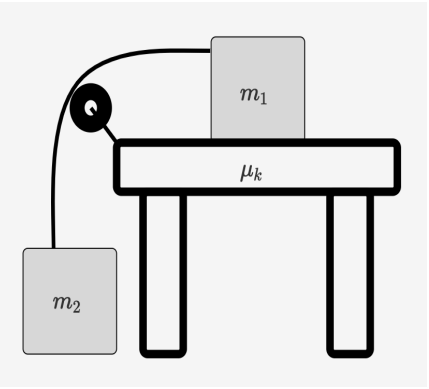
Determine Quinn's acceleration in $\frac{\text{m}}{\text{s}^2}$.

## Problem #14 (12 points)

Two boxes are connected by a string (assume massless, frictionless string that never breaks) over a pulley. Box 1 has mass $10.0\text{kg}$ and is on a table where the coefficient of kinetic friction is $\mu_k = 0.200$. Box 2 has mass $5.00\text{kg}$ and is hanging from the string. The system is in motion (meaning $v_{x_{\text{Box1}}} \neq 0$).

**Question #1 (3 points)**

Draw a free body diagram for each box showing all forces acting on it.




**Question #2 (3 points)**

What is the acceleration of the system? (only give algebraic answer, no numbers yet)

**Question #3 (3 points)**

What is the acceleration of the system? (give a number with units, 3 significant figures)

**Question #4 (3 points)**

What is the tension in the string?

## Problem #15 (12 points)

A DVD (disc) has a mass of $16.0\mathrm{g}$ and a diameter of $12.0\mathrm{cm}$. The player is spinning it at an angular speed of $4640.\mathrm{rpm}$ (one rotation is $2\pi$ radians) when it is turned off and slows to a stop in $1.50\mathrm{s}$.

**Question #1 (3 points)**

What is the moment of inertia of the DVD?

**Question #2 (3 points)**

What is the magnitude and direction of the torque felt by the DVD?

**Question #3 (3 points)**

What is the initial angular momentum of the DVD?

**Question #4 (3 points)**

What is the linear (straight line) speed of two points on the DVD: a point at the edge of the DVD, and a point $2.00\mathrm{cm}$ from the center?

## Bonus #16 (3 points)

What was the most difficult topic for you to comprehend this semester?

1. In this class:
2. In another class: