# Phys 211 / 211A / 216
# Sample Test #1
# University Physics I/IA


**NAME:  (1 point)** _____


**Circle your professor:**


**Curie**                              **Einstein**                              **Feynman**


**Hawking**                              **Meitner**                              **Noether**


**Section # or Class Time:** _____

# Scores:  Do <u>not</u> write on this page

0. _____/1  (point for name)

1. _____/3

2. _____/3

3. _____/3

4. _____/3

5. _____/3

6. _____/3

7. _____/3

8. _____/3

9. _____/3

10. _____/3

11. _____/3

12. _____/3

13. _____/3



EXAM  INSTRUCTIONS

NO X

NO X

NO X

YES ✓

14. _____/20

15. _____/20

16. _____/20

TOTAL/100

**Part I: Multiple Choice (3 points each).**

**Circle <u>one</u> answer for each question in a clear and unambiguous way.**

**1.** In the Metric (SI) system, a newton (N) may also be written as

      A. $kg \cdot m \cdot s$
      B. $kg \cdot m^2/s$
      C. $kg \cdot m/s$
      D. $kg \cdot m/s^2$
      E. $g \cdot cm/s$

**2**. A ball is tossed at a 30° angle from the ground. At the instant when the ball is at its maximum height, which one of the following statements is true?

      A. The acceleration of the ball is zero
      B. The velocity of the ball is zero
      C. The acceleration of the ball is downwards
      D. The velocity of the ball is downwards
      E. None of the above

**3.** A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following coordinate versus time graphs best describes the motion?
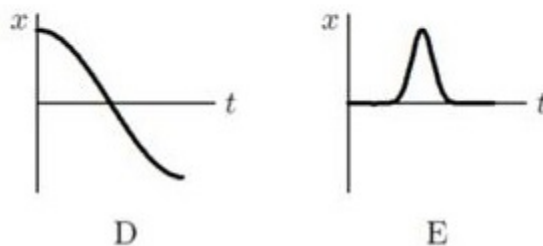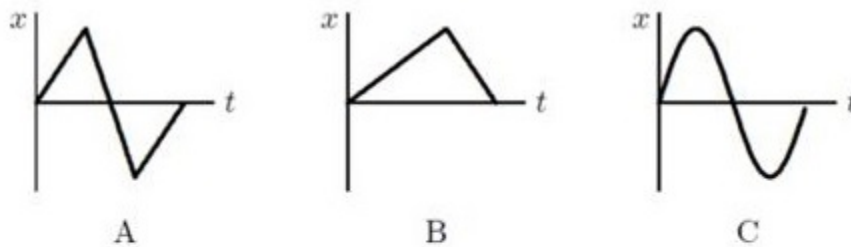
**4.** Consider two blocks attached by a rope as shown. Ignore friction. The 9 kg is being pulled to the right by a rope, causing both blocks to accelerate to the right. The tension is the right rope is $T_2$. The tension in the joining rope between the blocks is $T_1$. How does $T_1$ compare to $T_2$?
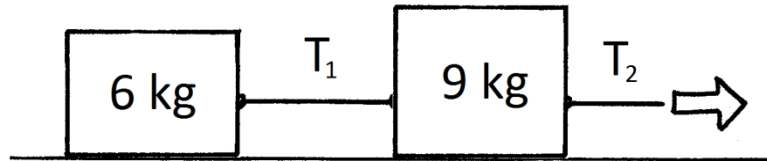


A. $T_1 < T_2$
B. $T_1 = T_2$
C. $T_1 > T_2$
D. require the magnitude of the pulling force to answer this
E. none of the above

**5.** A student of mass m is standing on a scale in an elevator that is near the surface of the Earth. The elevator is moving **downward** and **slowing down** with an acceleration of magnitude g/4. What weight does the scale read?

A. mg/4
B. 3mg/4
C. mg
D. 5mg/4
E. 3mg
F. 5mg

**6.** In the same situation as the previous problem, where a student is standing on a scale in an elevator that is moving downward and slowing down, which of the following statements is true:
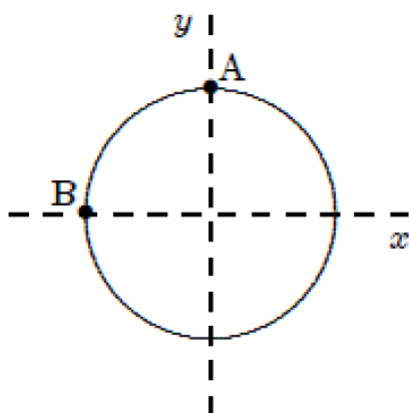
A. The force of the scale on the student is greater in magnitude than the force of the student on the scale.

B. The force of the scale on the student is equal in magnitude to the force of the student on the scale.

C. The force of the scale on the student is lesser in magnitude than the force of the student on the scale.

D. There is not enough information to determine whether any of the above answers is correct.

**7.** The position of an object moving on a 2 dimensional plane is given by:
$r(t) = 18t\ \hat{\imath} - 2t^3\ \hat{\jmath}$, where the position is measured in meters. What is the **speed** of the object at t = 2 seconds?

    A. 6 m/s
    B. 20 m/s
    C. 30 m/s
    D. 39 m/s
    E. 72 m/s

**8.** A toy racing car moves with constant speed around the circle shown below. When it is at the point **A** its coordinates are $x = 0, y = 3\ m$ and its velocity is (6 m/s) $\hat{\imath}$. When it is at the point **B** its velocity and acceleration are:



    A. ( 6 m/s) $\hat{\jmath}$ and (12 m/s$^2$) $\hat{\imath}$ respectively
    B. (6 m/s) $\hat{\imath}$ and (- 12 m/s$^2$) $\hat{\imath}$ respectively
    C. (- 6 m/s) $\hat{\jmath}$ and (12 m/s$^2$) $\hat{\imath}$ respectively
    D. (6 m/s) $\hat{\imath}$ and (2 m/s$^2$) $\hat{\jmath}$ respectively
    E. (6 m/s) $\hat{\jmath}$ and $\vec{0}$ respectively

**9.** A block of mass 20.0 kg is initially sitting at rest on level ground. A person then pushes on the block with a horizontal force P. The coefficient of kinetic friction between the block and the ground is 0.200 and the coefficient of static friction is 0.300. What is the <u>minimum</u> force P that the person must push with in order to start the box moving?
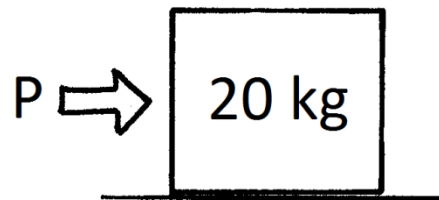
    A. 4.00 N
    B. 19.6 N
    C. 39.2 N
    D. 58.8 N
    E. 98.0 N

**10.** A stone is thrown directly upward from the surface of the Earth with an initial speed $v_0$. Ignore air resistance. The total time of flight, from when it's initially thrown straight up until it hits the ground, will be:
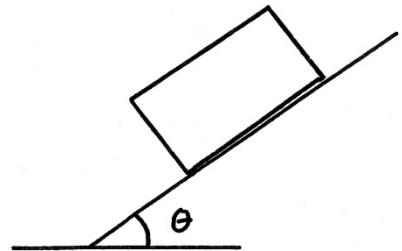
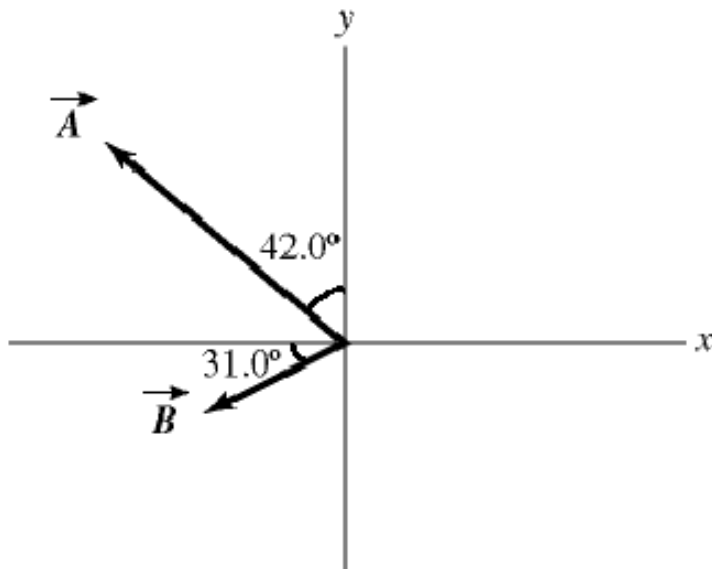A. $v_o/4g$

B. $v_o/2g$

C. $v_o/g$

D. $2v_o/g$

E. $4v_o/g$

**11.** A crate first slides **up** an inclined ramp ($0°< \theta < 90°$), momentarily comes to rest, and then slides back down the ramp. **There is friction** between the crate and the ramp. Which of the following statements is true?

A. The magnitude of the block's acceleration is greatest as it travels up the ramp.
B. The magnitude of the block's acceleration is the same going up or down the ramp.
C. The magnitude of the block's acceleration is greatest as it travels down the ramp.
D. The static coefficient of friction is greater than tan $\theta$.
E. There is not enough information given to determine any of these options.

**12.** Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure, where $\vec{A}$ is 42.0° from the y axis and $\vec{B}$ is 31.0° below the negative x axis. The magnitude of vector $\vec{A}$ is 16.00 m and the magnitude of vector $\vec{B}$ is 7.00 m. Vector $\vec{C}$ is given by $\vec{C} = \vec{A} + \vec{B}$. What is the component of the vector $\vec{C}$ along the $\hat{\imath}$ direction?



A. -17.9 m $\hat{\imath}$     B. -16.7 m $\hat{\imath}$     C. -15.5 m $\hat{\imath}$     D. -4.70 m $\hat{\imath}$     E. +8.28 m $\hat{\imath}$

**13.** A pendulum bob with a weight of 1 N is held at an angle θ from the vertical by a 2 N horizontal force F as shown. The tension in the string supporting the pendulum bob is:

A.  **1 N**

B.  **$\sqrt{3}$ N**

C.  **3 N**

D.  **$\sqrt{5}$ N**

E.  **4 N**
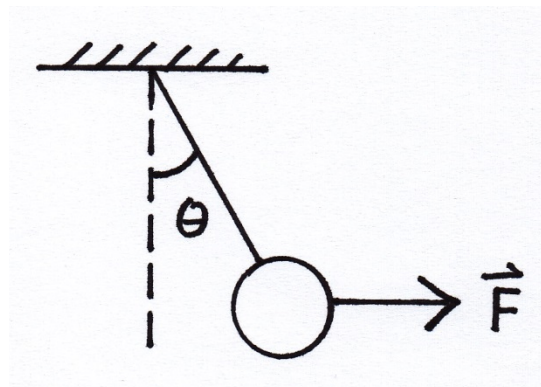
THE FOLLOWING PAGES GIVES FOUR EXAMPLES OF EXAM-APPROPRIATE "LONG PROBLEMS" WHERE PARTIAL CREDIT IS ALLOWED.

**THE ACTUAL EXAM WILL ONLY HAVE THREE LONG PROBLEMS, WORTH ROUGHLY 20 POINTS EACH.**

For all long problems, you must show all work completely, legibly and in logical order, starting with basic concepts.

**Long problem Example 1:**

A UFO moves in one dimension according to the equation $v(t) = 4.00 - 9.00t^2$ for $t \geq 0$.

a) What are the SI units of 4.00 and the SI units of 9.00 in this equation?

b) At what time is the UFO momentarily at rest?

c) Calculate the acceleration of the UFO at $t = 3.00 \ s$.

d) Suppose the location of the UFO at time $t = 0$ is $x(0) = -7.00 \ m$. Write the position function $x(t)$.

**Long problem Example 2:**

Chuck throws a stone from the edge of the roof of a building with an initial speed of 25.0 m/s at an angle 35.0° *below* the horizontal, as shown in the figure. Chuck releases the stone 90.0 m above the ground. Assume that the ground is perfectly horizontal and air resistance is negligible.



a) Sketch the stone's trajectory in the figure above.

b) Calculate the <u>horizontal distance</u> from the base of the building to where the stone strikes the ground.

c) Calculate the <u>speed</u> of the stone the instant before it strikes the ground **and** the <u>impact angle</u>. Indicate the angle you have calculated clearly on the diagram.
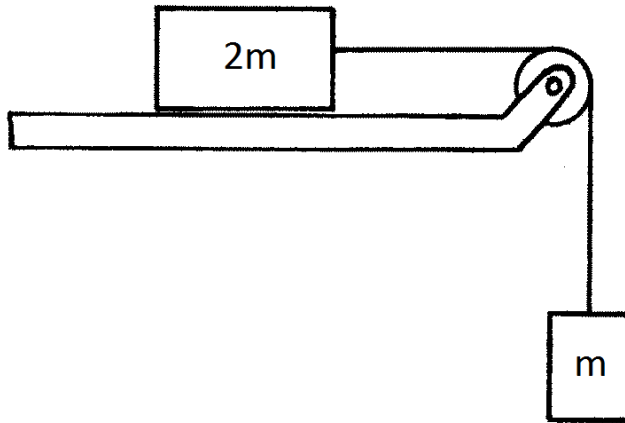
**Long problem Example 3:**
A modified Atwood's machine has a mass 2m __initially sliding to the left__ on a horizontal table as shown, attached to a dangling mass m. The coefficient of kinetic friction between sliding mass and the table is $\mu_k$. Write an expression for the __magnitude__ of the initial acceleration of the system __and__ the tension in the cable in terms of the given parameters $\{m, \mu_k, g\}$. Make sure to draw a Free-Body Diagram, either on the drawing or in the space below (it counts for points).
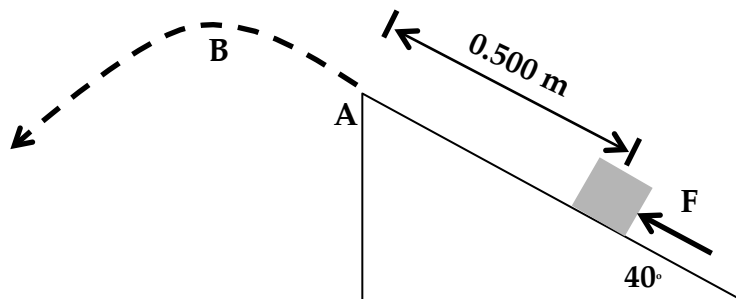
2m

m

Magnitude of the acceleration:

Tension in the cable:

**Long problem Example 4:**

A block of mass 2.00 kg starts from rest a distance 0.500 m from the top edge of a ramp as shown. It is pushed up the ramp by a 30.0 N force, F, acting parallel to the ramp as shown. The ramp makes an angle of 40.0° with the horizontal, and the coefficient of kinetic friction between the block and ramp is 0.250. When the block reaches the top of the ramp, the force F stops acting so that the block is only under the influence of gravity. The block is therefore launched from the top of the ramp and follows a parabolic trajectory in the air. Take the acceleration due to Earth's gravity to be 9.80 m/s².

How long does it take for the block to travel from the edge of the ramp (point A) to the top of its trajectory (point B)? Clearly show all work and steps to receive any credit.

B

0.500 m

A

F

40°

Time between points A and B: