Physics 151 Roster No.:_____

Score: **19 pts. possible**

SPRING 2003 Midterm Exam #1, Part A

Exam time limit: 50 minutes. You may use calculators and both sides of 1 page of notes, *handwritten only*. Closed book; no collaboration. For multiple choice questions, circle the letter of the one best answer (unless more than one answer is asked for).

(1 point each, unless otherwise specified)

1. Helen had the face that could launch a thousand ships. How much beauty is required to launch just **one** ship?

A. 1 microhelen
B. 1 centihelen
C. 1 kilohelen
D. 1 megahelen
E. 1 decihelen
F. 1 millihelen

2. At the end of 2002, the total debt of the U.S. government was $5,854,990,000,000. We might rewrite this as:

A. 5.9 Tdollar
B. 5.9 Mdollar
C. 5.9 μdollar
D. 5.9 mdollar
E. 5.9 kdollar
F. 5.9 Gdollar

3. Which one of the following values has the **most significant figures**, and hence is implied to have the best relative precision?

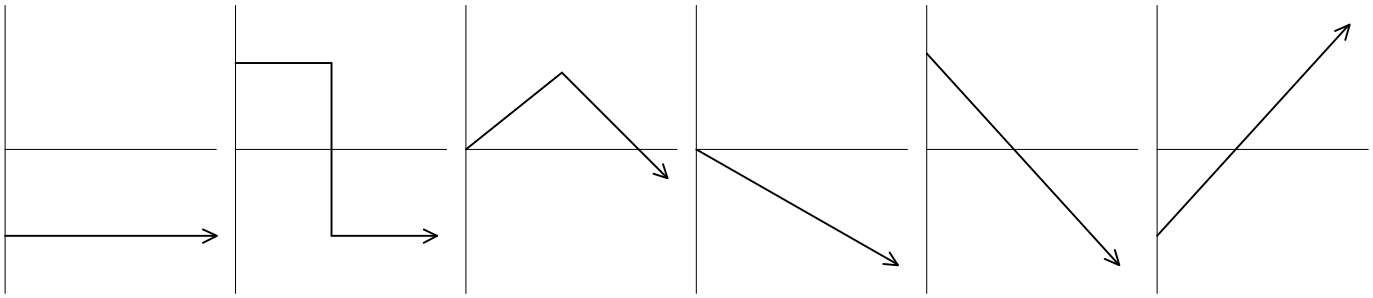
A. 0.00006
B. 0.00600
C. 6.00
D. 6.000×10^1
E. 600.
F. 6×10^3

4. (2 pts.) If ρ has units of kg/m^3, and P has units of N/m^2, what are the **units of *c***, if $c = \sqrt{\frac{5P}{3\rho}}$?

A. s$^{1/2}$
B. m^2·s$^{1/2}$
C. m/s
D. kg$^{1/2}$·m$^{5/2}$/s^2
E. m^3/s
F. kg·m^2/s^2

5. If an object moving along the *x*-axis has a constant **negative acceleration**, then…

A. its velocity can never be zero
B. it must have a negative velocity at all times
C. it must have a negative position at all times
D. it must have a changing velocity at all times



A **B** **C** **D** **E** **F**

6. For a ball thrown directly upward, which one of the above graphs best represents its…

a. acceleration as a function of time?

A. *A*
B. *B*
C. *C*
D. *D*
E. *E*
F. *F*

b. velocity as a function of time?

A. *A*
B. *B*
C. *C*
D. *D*
E. *E*
F. *F*

7. A rock is dropped from rest in a vacuum on the surface of Earth, and again on the surface of Mars. Assume that g_{Mars} is exactly **one-third** of g_{Earth}.

a. After 1 s of freefall, the rock on Earth has a **speed** _____ times that of the rock on Mars.

A. 1
B. 1.33
C. $\sqrt{3}$
D. 3
E. 4.5
F. 9

b. After 1 s of freefall, the rock on Earth has a **displacement** _____ times that of the rock on Mars.

A. 1
B. 1.33
C. $\sqrt{3}$
D. 3
E. 4.5
F. 9

c. (2 pts.) In a slightly different experiment, the rock is dropped from rest on Earth and Mars, and each time is allowed to fall through a distance of exactly 1 m. The **final speed** of the rock on Earth is _____ times the final speed on Mars.

A. 1
B. 1.33
C. $\sqrt{3}$
D. 3
E. 4.5
F. 9

8. You have a motorboat capable of going 5.0 m/s in still water. You are at the south bank of a river whose water moves with a constant current of 2.0 m/s due east. If you aim your motorboat due north, what will be the **net velocity** of your boat *relative to stationary landmarks on the shore*?

a. magnitude:
A. 3.0 m/s
B. 4.6 m/s
C. 5.0 m/s
D. 5.4 m/s
E. 6.2 m/s
F. 7.0 m/s

b. direction:
A. 4.6° east of north
B. 9.1° east of north
C. 18° east of north
D. 22° east of north
E. 36° east of north
F. 39° east of north

9. Your physics book is sitting at rest on a level table. Which **one** of the following is FALSE?

A. The sum of the forces on the book is zero.
B. The normal force on the book has a magnitude of $m \cdot g$.
C. The weight of the book has a magnitude of $m \cdot g$.
D. The acceleration of the book is g.

10. You pull your little sister horizontally in a toy wagon, accelerating her at a constant 1.0 m/s^2. All of the following are true EXCEPT:

A. The wagon pulls back on you just as hard as you pull on the wagon.
B. The force of the wagon on you is in the same direction as the force of you on the wagon.
C. The sum of the forces on the wagon is non-zero and horizontal.
D. The wagon's weight and the normal force on the wagon are equal in magnitude & opposite in direction.

11. You have a mass of 50.0 kg and are standing in an elevator.

a. Your **weight** is:

A. zero
B. 5.10 N
C. 9.80 N
D. 50.0 N
E. 98.0 N
F. 490. N

b. While the elevator is accelerating upward at 1.00 m/s^2, the **net force** on you is:

A. zero
B. 5.10 N
C. 9.80 N
D. 50.0 N
E. 98.0 N
F. 490. N

c. While the elevator is moving upward at a constant speed of 1.00 m/s, the **net force** on you is:

A. zero
B. 5.10 N
C. 9.80 N
D. 50.0 N
E. 98.0 N
F. 490. N

Physics 151 Roster No.:_____

Score: **21 pts. possible**

SPRING 2003 Midterm Exam #1, Part B

Exam time limit: 50 minutes. You may use calculators and both sides of 1 page of notes, *handwritten only*. Closed book; no collaboration. Show your work on free-response questions. Be sure to use **proper units** and **significant figures** in your final answers.

1. The UH Manoa Cheerleaders use a special air gun named the "Bowzooka" to shoot tee-shirts and other projectiles up to the highest row of seats in the sports arena. Ignore the effect of air resistance on the projectile.

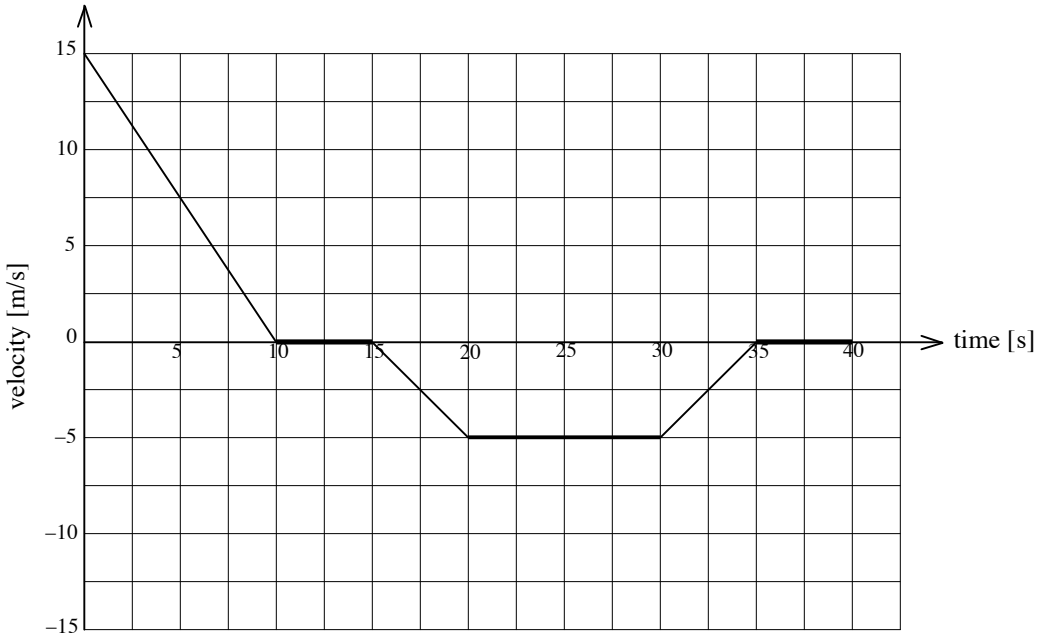
a. (3 pts.) Standing in the very center of the arena, the cheerleaders determine that using an initial angle of 60.0° above the horizontal is best for making a tee-shirt land in the very top row of seats. If the Bowzooka always shoots tee-shirts with an initial velocity $v_0 = 30.0$ m/s, calculate the **vertical and horizontal components, v_{0x} and v_{0y}, of the initial velocity** when shot at this angle.

b. (2 pts.) If the top row of seats is at a horizontal distance of 50.0 m from the cheerleader, what is the entire **time** of flight for the tee-shirt?

c. (3 pts.) Using your answers to parts (a) and (b), determine the vertical **height** of the top row of seats above the arena floor where the Bowzooka is located.

d. (3 pts.) What is the **maximum height** above the arena floor that the tee-shirt reaches during its trajectory?

2. A car, facing in the $+x$ direction, moves along the x-axis according to the **velocity** vs. time graph shown below:

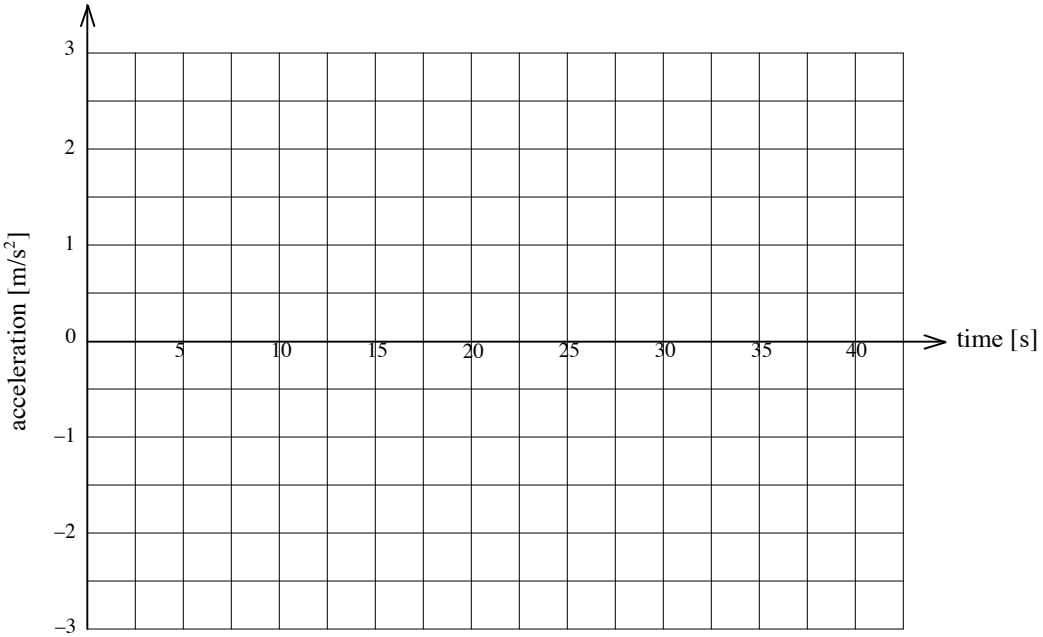


a. (2 pts.) During which time interval(s) is the car moving **backwards** (i.e., in reverse)? *Circle all that apply:*

A. 0 to 10 s
B. 10 s to 15 s
C. 15 s to 20 s
D. 20 s to 30 s
E. 30 s to 35 s
F. 35 s to 40 s

For your following calculations, assume *at least 2 significant figures* on all values.

b. (4 pts.) Carefully and accurately, **graph** the car's **acceleration** vs. time on the axes provided. (You do NOT need to show your work.)



c. (4 pts.) Calculate the car's **displacement** at $t = 40$ s. Show your work.