PHY 111 **EXAM I-preview** March 8, 2012

This exam is closed book and closed notes. You may use your calculator. You have the regular class-time to complete the exam (4:00 – 5:15). Please put your **name** on the **scantrons and the test, and return everything**. Be careful with your time. The scantron sheet must be used to record all answers except for the 2 written questions. You may write on the test. What follows are actual exam questions from previous exams. These will be very similar to the questions you will be asked. Your exam will have 20 questions worth 1 point each, 20 worth 2 points, 10 questions worth 3 points each, and two written questions worth 10 points each, for a total of 110 points. There is, therefore, a built-in 10 point curve. Be careful with your time!

Range $= V_o^2 \sin(2\theta)/g$ $V_f^2 = V_i^2 + 2a(\Delta R)$ $V_f = V_i + at$ $R = R_o + V_o t + (1/2)at^2$

$D = Vt$ $\sin = \text{opp/hyp}$ $\cos = \text{adj/hyp}$ $\tan = \text{opp/adj}$ $C = 2\pi R$ $a = v^2/r$ $\sum F = ma$

$G = 6.67 \times 10^{-11}$ (mks) $g = 9.8\ m/s^2$ $F = Gmm/(r)^2$ 1 mile = 1609 m = 5280 feet

$W = mg$ $\text{Friction}_k = \mu_k N$ $\text{Friction}_{st} \leq \mu_{st} N$ $v = \Delta x/\Delta t$ $a = \Delta v/\Delta t$

$R(\text{Earth}) = 6.38 \times 10^6$ m $R(\text{Moon}) = 1.74 \times 10^6$ m $M(\text{Earth}) = 5.98 \times 10^{24}$ kg $M(\text{Moon}) = 7.35 \times 10^{22}$ kg

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The next 20 questions are worth 1 point each.

a) TRUE **b) FALSE**

1) If something always has a constant velocity, then it can still accelerate.

2) If something always has a constant speed, then it can still accelerate.

4) It is possible to accelerate towards a certain point in space but never actually get there.

5) While standing still, on a sloped surface, your weight is canceled by the normal force.

7) The D = Vt equation is only valid if acceleration is a constant.

8) Weight and Inertia both have units of Newtons.

9) Because of the t-squared, $x = x_o + v_o t + (1/2)at^2$ is valid if "a" changes in time.

13) An object thrown horizontally from a tall building hits sooner than if dropped.

14) The Moon travels at a constant speed, but is accelerating in its orbit around the Earth.

18) If the net force on an object is zero, it will slow down and eventually stop.

20) The $V_f^2 = V_i^2 + 2a(\Delta R)$ equation is only valid if acceleration is a constant.

The next 20 questions are worth 2 points each.

!! Turn your scantron over !!

***51*))** "Giddy-up horsey"! A horse pulls on a cart and the cart pulls back on the horse; do these two opposing forces cancel? If you are not careful with the logic, and the physics, you might come to the conclusion that no matter how hard the horse pulls, it can never move the cart. But you know a horse can pull a cart in "real life", so where is the flaw in this reasoning? The action and reaction forces do not cancel each other out because:

A) the action and reaction forces do not cancel each other out because they are not equal in magnitude in this situation.
B) they are equal in magnitude, but not precisely opposite in direction.
C) they are equal in mag., opposite in direction, but do not act at the same time.
D) they are not acting on the same body.

54) You are in a space ship and fire a cannonball into empty space. The amount of force necessary to keep the ball moving, in accordance with the laws of inertia, is:

A) twice the force with which it was fired.
B) the same amount of force with which it was fired.
C) one-half the force with which it was fired.
D) no force is required to keep it moving.

56) Although 80 gees are OK, brain trauma, such as concussion or worse, will result if the head suffers an acceleration of more than 100 gees for more than one millisecond. To help protect the brain, cerebrospinal fluid surrounds the tissue inside the scull. However, the density of CSF is greater than the density of grey and white matter. Assume a person is in a moving car that drives straight-on into a large tree. The head comes to a quick stop, either by hitting the steering wheel or an airbag. According to the first law, the area of the brain injury, which is where the brain tissue actually contacts the scull bone, is located where?

A) in the front **B)** in the back **C)** on the sides

57) Why do most cars have anti-lock brakes, or why should you "pump" brakes in an older car if you wish to stop as quickly as possible?

A) A "locked" tire invokes kinetic friction
B) A "locked" tire invokes static friction

58) In 1971, Astronaut Alan B. Shepard Jr. hit 3 golf balls on the moon. The first two were 'duds', as it was hard to get a good swing (his suit weighed about 350 pounds on Earth, and is not very flexible), but the third went flying! If the gravity on Earth is 6 times that of the Moon, how many times further will a golf ball travel on the moon than one hit the same on Earth? Ignore wind resistance.

A) 6 times **C)** 36 times **E)** same distance
B) 1/6 as far **D)** 1/36 as far

59) In 2010, the U.S. national debt reached ~ 12.5 trillion dollars, where a trillion is a thousand billion. If payments were made at the rate of $1000 per second, it would take how long to pay off the debt—assuming no interest is charged.

A) about 396 years **B)** about 396 months **C)** about 396 days

60) A Chinook Salmon can swim 3.6 m/s, but can leap out of the water with a speed of 6.3 m/s. The salmon must swim upstream to spawn, and frequently need to jump "up" waterfalls. However, the max height of a waterfall it can 'best' is not merely the distance into the air that a vertical launch @ 6.3 would carry it; as long as it falls into water with a speed of less than 3.6 m/s, it can "swim up" the remainder of the falls from that point.

The next several questions all refer to the preceding graphs. The horizontal axis of each graph is time, while the vertical axis can either be position, speed, acceleration or force. For each question, choose the best answer among the graph options given.

61) If the speed of an object is given by graph 3, which graph best describes the acceleration of that object.

A) Graph 5 **C)** Graph 11 **E)** Graph 7
B) Graph 9 **D)** Graph 6

62) Which graph best depicts the upward force of wind resistance on a sky diver that falls for many seconds in the same body position before opening the parachute?

A) Graph 5 **C)** Graph 7 **E)** Graph 8
B) Graph 1 **D)** Graph 12

The nest 4 problems ask you to find the components of some vectors graphically. Notice that there is a vector and a coordinate system. You are to find the components of the vector in that system. Vector A is 30 Newtons long and points at an angle as shown, with theta being 30 degrees.

65) The X component of this vector in this coordinate system is:

69) An elevator is connected to a cable. The weight of the elevator and
…etc

70) What is the Tension "T" if the elevator is accelerating *down*wards at
…etc

The following 10 questions are worth 4 points each.

!! Use the "baby" scantron here !!

1) If air resistance were zero, how many seconds would it take to fall from the top of the new *Freedom Tower* (to be built at "ground-zero" in NYC), 1776 feet above the street? I assume you know the importance of '1776'!

A) Less than 9 seconds.
B) Between 9 and 10 seconds.
C) Between 10 and 11 seconds.
D) Between 11 and 12 seconds.
E) More than 12 seconds.

2) How fast would you have to throw something straight up to make it go 1776 feet (or 541 meters) vertically into the air. Neglect air resistance.

A) Between 50 and 60 m/s.
B) Between 60 and 70 m/s.
C) Between 70 and 80 m/s.
D) Between 80 and 90 m/s
E) More than 100 m/s.

5) The next 2 questions are about a river 200 meters wide. You swim 2 m/s.
…etc

7) A 10 kg. mass is placed on level ground with a static coefficient of friction of 0.7 and a kinetic coefficient of 0.5. How hard must a person push <u>horizontally</u> on the object to first get it to move.

A) Less than 10 Newtons.
B) 49 Newtons.
C) More than 100 Newtons.
D) 69 Newtons.
E) 98 Newtons.

10) The Olympic bobsleds experience large "g forces" as they round corners at high speed. The speed of the sled is ~ 90 mph, or 40 m/s. If the radius of the curve is ~ 100 feet, or 32 meters, how many "gees" do the riders experience?

ANSWERS

1) If something <u>always</u> has a constant velocity, then it can still accelerate.
NO

2) If something <u>always</u> has a constant speed, then it can still accelerate.
YES

4) It is possible to accelerate towards a certain point in space but never actually get there.
YES—FOR INSTANCE, THE CENTER OF A CIRCLE

5) While standing still, on a sloped surface, your weight is canceled by the normal force.
NO—NOT EVEN IN THE SAME DIRECTION

7) The D = Vt equation is only valid if acceleration is a constant.
ONLY VALID IF A = ZERO

8) Weight and Inertia both have units of Newtons.
NO—W DOES BUT INERTIA IS MASS = KG.

9) Because of the t-squared, $x = x_o + v_o t + (1/2)at^2$ is valid if "a" changes in time.
NO—THE EQN IS ONLY VALID IF A = CONSTANT

13) An object thrown horizontally from a tall building hits sooner than if dropped.
NO--SAME—THE VERTICAL FALLING IS INDEPENDENT OF THE HORIZ VEL

14) The Moon travels at a constant speed, but is accelerating in its orbit around the Earth.
YES

18) If the net force on an object is zero, it will slow down and eventually stop.
NO—IF Fnet = 0, THE OBJECT WILL HAVE A CONSTANT VEL

20) The $V_f^2 = V_i^2 + 2a(\Delta R)$ equation is only valid if acceleration is a constant.
YES

<u>The next 20 questions are worth 2 points each.</u>

!! Turn your scantron over !!

***<u>51</u>*))** "Giddy-up horsey"! A horse pulls on a cart and the cart pulls back on the horse; do these two opposing forces cancel? If you are not careful with the logic, and the physics, you might come to the conclusion that <u>no matter how hard the horse pulls, it can never move the car</u>t. But you know a horse can pull a cart in "real life", so where is the flaw in this reasoning? The action and reaction forces do <u>not</u> cancel each other out because:

D) they are not acting on the same body.

54) You are in a space ship and fire a cannonball into empty space. The amount of force necessary to keep the ball moving, in accordance with the laws of inertia, is:

D) no force is required to keep it moving.

56) Although 80 gees are OK, brain trauma, such as concussion or worse, will result if the head suffers an acceleration of more than 100 gees for more than one millisecond. To help protect the brain, cerebrospinal fluid surrounds the tissue inside the scull. However, the density of CSF is greater than the density of grey and white matter. Assume a person is in a moving car that drives straight-on into a large tree. The head comes to a quick stop, either by hitting the steering wheel or an airbag. The forehead is badly hurt. According to the first law, the area of the brain injury, which is where the brain tissue actually contacts the scull bone, is located where?

B) in the back

57) Why do most cars have anti-lock brakes, or why should you "pump" brakes in an older car if you wish to stop as quickly as possible?

A) A "locked" tire invokes kinetic friction

58) In 1971, Astronaut Alan B. Shepard Jr. hit 3 golf balls on the moon. The first two were 'duds', as it was hard to get a good swing (his suit weighed about 350 pounds on Earth, and is not very flexible), but the third went flying! If the gravity on Earth is 6 times that of the Moon, how many times further will a golf ball travel on the moon than one hit the same on Earth? Ignore wind resistance.

A) 6 times

59) In 2010, the U.S. national debt reached ~ 12.5 trillion dollars, where a trillion is a thousand billion. If payments were made at the rate of $1000 per second, it would take how long to pay off the debt—assuming no interest is charged.

A) about 396 years

60) A Chinook Salmon can swim 3.6 m/s, but can leap out of the water with a speed of 6.3 m/s. The salmon must swim upstream to spawn, and frequently need to jump "up" waterfalls. However, the max height of a waterfall it can 'best' is not merely the distance into the air that a vertical launch @ 6.3 would carry it; as long as it falls into water with a speed of less than 3.6 m/s, it can "swim up" the remainder of the falls from that point.

We can do this one in class…..

The next several questions all refer to the preceding graphs. The horizontal axis of each graph is time, while the vertical axis can either be position, speed, acceleration or force. For each question, choose the best answer among the graph options given.

I will give you some graphs and you have to pick out the correct one….so just go over your class notes to prep for this kind of question……
The nest 4 problems ask you to find the components of some vectors graphically. Notice that there is a vector and a coordinate system. You are to find the components of the vector in that system. Vector A is 30 Newtons long and points at an angle as shown, with theta being 30 degrees.

65) The X component of this vector in this coordinate system is:

Please know how to do the sine and cosine stuff……

69) An elevator is connected to a cable. The weight of the elevator and
…etc
70) What is the Tension "T" if the elevator is accelerating *down*wards at
…etc….we have done several of these kinds in class….

The following 10 questions are worth 4 points each. *!! Use the "baby" scantron here !!*

1) If air resistance were zero, how many seconds would it take to fall from the top of the new *Freedom Tower* (to be built at "ground-zero" in NYC), 1776 feet above the street? I assume you know the importance of '1776'! 1776 ft = 541 meters.

Use eqn "#1" to find time = 10.5 seconds

2) How fast would you have to throw something straight up to make it go 1776 feet (or 541 meters) vertically into the air. Neglect air resistance.

Use eqn "#2" to find speed ~ 103 m/s

5) The next 2 questions are about a river 200 meters wide. You swim 2 m/s.
…etc

We did several of these in class—the river probs and the plane in the wind prob. They involve adding vectors, so please know how to do this.

7) A 10 kg. mass is placed on level ground with a static coefficient of friction of 0.7 and a kinetic coefficient of 0.5. How hard must a person push horizontally on the object to first get it to move.

Friction max (static) = mu*N = .7W = .7mg = 68.6 Newtons.

10) The Olympic bobsleds experience large "g forces" as they round corners at high speed. The speed of the sled is ~ 90 mph, or 40 m/s. If the radius of the curve is ~ 100 feet, or 32 meters, how many "gees" do the riders experience?
Use the v-squared over r formula to get 5 gees---this would be enough to force nearly anyone in this room to pass out, crash, and then probably die. This sport is no joke!!!