Phys. 105 Final Exam December 15, 1997 Sec. (circle one) 001__003__005__007__009_

Print Name_____ Sign Name_____

Fill in the top of each sheet. The exam is closed book and closed notes.

NOTE: Place your SECTION NUMBER in the indicated space. If you place the wrong section number, or if you leave the Sec. No. space blank, we will SUBTRACT ONE POINT from your score.

In Part I, there are 30 multiple choice Questions
The answers for the multiple choice Questions are to be placed on the SCANTRON form provided, and also circled on your exam sheet.

Make sure you put your name, section, and ID number on the SCANTRON form.

For Problems II and III show ALL your work. We want to give you partial credit, but this can be done only if your work is shown.

Correct answers with unsubstantiated work on Problems II and III will receive **ZERO CREDIT**.

You can take $g = 10\ m/s^2$

Here are some useful equations

$\Sigma \mathbf{F} = m\mathbf{a}$ $w = mg$ You can take $g = 10\ m/s^2$

$a_r = v^2/r$ $a_r = r(2\pi/T)^2$ $a_r = r(2\pi f)^2$

$v = v_o + at$ $x - x_o = v_o t + \frac{1}{2} at^2$

$2a(x - x_o) = v^2 - v_o^2$ $x - x_o = \frac{1}{2}(v + v_o)t$

$v_x = v_o \cos\theta_o$ $v_y = v_o \sin\theta_o - gt$

$x = v_o \cos\theta_o t$ $y = v_o \sin\theta_o t - \frac{1}{2} gt^2$

PROB	GRADE
I	
II	
III	
TOTAL	

Impulse $= \mathbf{F_{avg}}\Delta t$, **momentum** $= m\mathbf{v}$, **Impulse** $= \Sigma(m\mathbf{v})_f - \Sigma(m\mathbf{v})_I$

$W = \pm F_{\parallel} S$ $K = \frac{1}{2} mv^2$ $U_g = mgy$ $U_S = \frac{1}{2} kx^2$ $F_S = kx$

$W_{nc} = K_f - K_i + U_{gf} - U_{gi} + U_{Sf} - U_{si}$ or $(K_i + U_{gi} + U_{si}) + W_{nc} = (K_f + U_{gf} + U_{Sf})$

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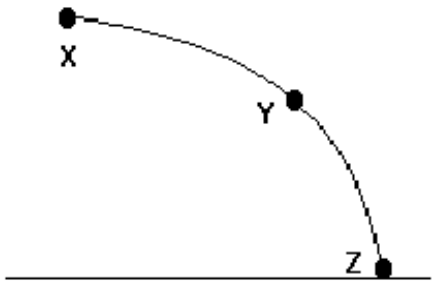
Put the answers to these 30 questions on your SCANTRON sheet. In addition circle your answer on this examination sheet. For numerical answers, choose the answer that is **CLOSEST TO** the answer you think is correct. The answers are based on taking $g = 10\ m/s^2$.

1. An object with an initial velocity of 12 m/s west experiences a constant acceleration of 4 m/s^2 west for 3 seconds. During this time the distance the object travels is

A) 18 m
B) 24m
C) 36 m
D) 54 m
E) 144 m

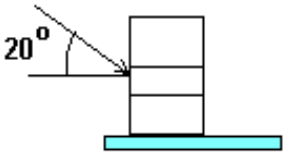
2. A stone is thrown horizontally and follows the path XYZ as shown. The direction of the acceleration of the stone at point Y is closest to

A) ↓
B) ↗
C) ↙
D) ↘
E) →



3. A 15-kg chair is pushed across a frictionless horizontal floor with a force of 20 N, directed 20^0 above the horizontal. The acceleration of the chair is

A) 0.27 m/s^2
B) 0.75 m/s^2
C) 1.25 m/s^2
D) 2.50 m/s^2
E) 13.33 m/s^2



4. A 50-N box rests on a horizontal surface. A person pulls horizontally on it with a force of 10 N and it does not move. To start it moving, a second person pulls vertically upward on the box. If the coefficient of static friction is 0.4, and the coefficient of kinetic friction is 0.25, what is the smallest vertical force for which the box moves?

A) 4 N
B) 10 N
C) 14 N
D) 25 N
E) 35 N

5. An object is constrained by a cord to move in a circular path of radius 0.5 m on a horizontal frictionless surface. The cord will break if its tension exceeds 16 N. The maximum kinetic energy of the object at this moment is

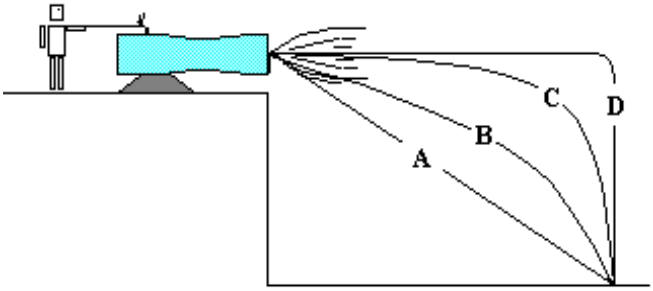
A) 4 J
B) 8 J
C) 16 J
D) 32 J
E) 64 J

6. Two spacemen are floating together with zero speed in a gravity-free region of space. The mass of spaceman A is 100 kg and that of spaceman B is 75 kg. Spaceman A pushes B away from him with B attaining a final speed of 0.7 m/s. The final recoil speed of A is

A) 0.33 m/s
B) 0.53 m/s
C) 0.73 m/s
D) 1.33 m/s
E) 1.55 m/s

7. Which of the following paths in the diagram below represents the path of the cannonball?

A) A
B) B
C) C
D) D
E) other

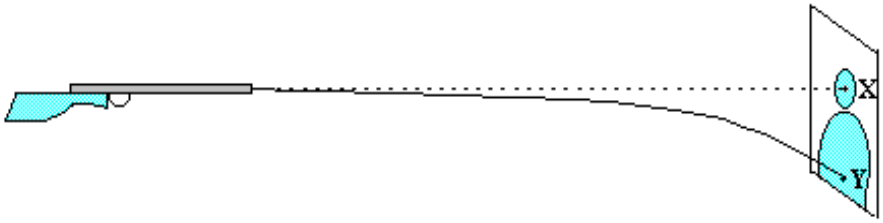


8. A boy throws a steel ball straight up. Disregarding any effects of air resistance, the force(s) acting on the ball after it leaves the boy's hand is (are):

A) Its weight vertically downward along with a steady decreasing upward force.
B) A steady decreasing upward force from the moment it leaves the hand until it reaches its highest point, beyond which there is a steady increasing downward force of gravity as the object gets closer to earth.
C) A constant downward force of gravity along with an upward force that steadily decreases until the ball reaches its highest point, after which there is only the constant downward force of gravity.
D) A constant downward force of gravity only.
E) None of he above, the ball falls back down to earth simply because that is its natural action.

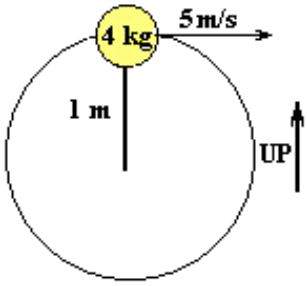
9. A bullet is shot horizontally toward X at 100 m/s, as shown. It makes a hole in the man's image at Y 0.3 seconds later. The distance XY is

A) 0.10 m
B) 0.25 m
C) 0.45 m
D) 0.67 m
E) 1.33 m



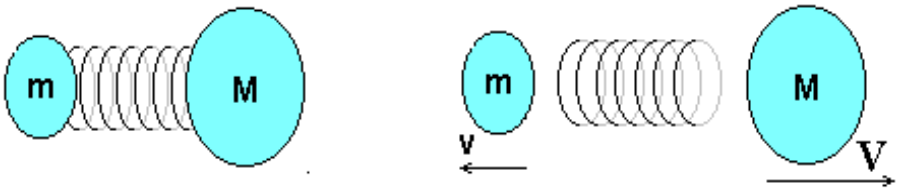
10. One end of a 1 m string is fixed and the other end is attached to a 4-kg mass. The mass swings in a vertical circle passing the top point at 5 m/s. The tension in the string at this point is

A) 0 N
B) 40 N
C) 60 N
D) 100 N
E) 140 N



11. Masses M and m are attached to a compressed spring of spring constant 1400 N/m, as shown. When the spring uncoils, mass M is ejected with speed V. The mass m recoils in the opposite direction with speed v given by

A) (m/M)V
B) [m/(m+M)]V
C) (M/m)V
D) [(m+M)/m]V
E) [m/(m-M)]V

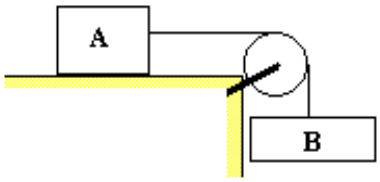


12. Imagine a head-on collision between a large truck and a small compact car. During the collision:

A) The truck exerts a greater amount of force on the car than the car exerts on the truck.
B) The truck exerts a force on the car, but the car doesn't exert a force on the truck.
C) The truck exerts the same amount of force on the car as the car exerts on the truck.
D) The car exerts a greater amount of force on the truck than the truck exerts on the car.
E) neither exerts a force on the other, the car gets smashed simply because it gets in the way of the truck.

13. The 50-kg block A rests on a horizontal table top. The coefficient of static friction is 0.55. A horizontal string is attached to A and passes over a massless, frictionless pulley as shown. The smallest mass m_B that will start A moving when it is attached to the other end of the string is

A) 12 kg
B) 17.5 kg
C) 23.5 kg
D) 27.5 kg
E) 55 kg

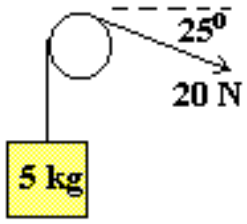


14. A 3-kg object is moving at 4 m/s toward the right. A 5-N force is suddenly applied pointing opposite the direction of motion (toward the left). The force acts for a time interval of 4 s, and then is removed. The final velocity of the object is

A) 0
B) 2.7 m/s pointing left
C) 2.7 m/s pointing right
D) 2.0 m/s pointing left
E) 2.0 m/s pointing right

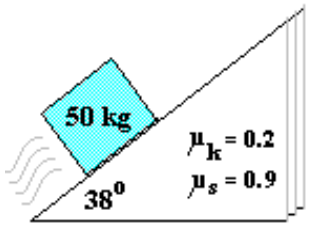
15. The system shown to the right is initially at rest. Assume the pulley to be weightless and neglect axle friction. Determine the acceleration of the block.

A) 2.5 m/s^2
B) 6 m/s^2
C) 8 m/s^2
D) 10 m/s^2
E) 15 m/s^2



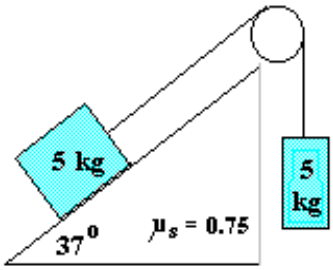
16. The block is sliding up the plane, as shown in the figure. When the block eventually stops, the static friction force is

A) 355 N up the plane
B) 355 N down the plane
C) 308 N up the plane
D) 308 N down the plane
E) 0



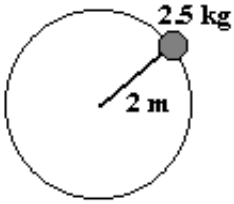
17. The system shown remains at rest. The force of friction on the inclined block is

A) 0 N
B) 10 N
C) 20 N
D) 30 N
E) 50 N



18. The 2.5-kg iron ball shown is being swung in a vertical circle at the end of a 2-m string. How slowly can the ball go through its top position without having the string go slack?

A) 12.0 m/s
B) 10.0 m/s
C) 6.5 m/s
D) 4.5 m/s
E) 2.5 m/s



19. A 1800-kg elevator is pulled by a cable. Inside the elevator, there are two 75 kg men. The elevator moves down from rest with an acceleration of 2 m/s^2 . The tension in the cable is

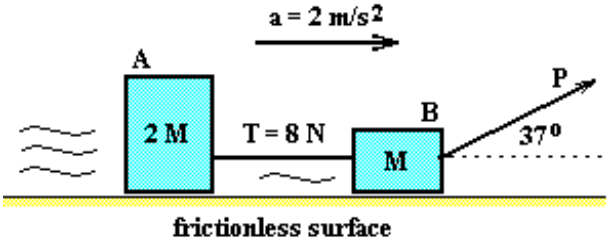
A) 14100 N
B) 15600 N
C) 19500 N
D) 21900 N
E) 23400 N

20. One of the 75-kg men in problem 19 (above) is standing on a bathroom scale. The scale reading is

A) 500 N
B) 600 N
C) 750 N
D) 800 N
E) 900 N

21. The acceleration of the system moving on the frictionless surface shown is 2 m/s^2 toward the right , and the tension in the cord connecting the two bodies A and B is 8 N. The force P makes an angle of 37^0 with the horizontal. The mass M is

A) 2 kg
B) 4 kg
C) 8 kg
D) 16 kg
E) not determinable



22. The velocity of a particle moving along the x axis changes from v_i to v_f. For which values of v_i and v_f is the **total work** done on the particle negative?

A) $v_i = 2$ m/s, $v_f = 5$ m/s
B) $v_i = -2$ m/s, $v_f = 5$ m/s
C) $v_i = -2$ m/s, $v_f = -5$ m/s
D) $v_i = 2$ m/s, $v_f = -5$ m/s
E) $v_i = -5$ m/s, $v_f = 2$ m/s

23. A 5.0-kg cart is moving horizontally at 6.0 m/s. In order to change its speed to 10 m/s, the net work done on the cart must be

A) 40 J
B) 90 J
C) 160 J
D) 400 J
E) 550 J

24. A 3 kg particle on a horizontal frictionless table is attached to a spring with spring constant 200 N/m. The particle (with attached spring) is then pulled out 0.5 m and released form rest. After it moves 0.3 m from the release point its speed is

A) 3.27 m/s
B) 3.74 m/s
C) 5.55 m/s
D) 17. 98 m/s
E) 60.0 m/s

25. A 4.5-kg block is released from rest 60 m above the ground. When it is 20 m above the ground its kinetic energy is

A) 270 J
B) 900 J
C) 1200 J
D) 1800 J
E) 2700 J

26. A projectile of mass 0.7 kg is fired from the ground with an initial speed of 15 m/s at an angle of 48^0 above the horizontal. When the projectile is 5 m above the ground on its way down it's speed is

A) 2.1 m/s
B) 4.8 m/s
C) 8.3 m/s
D) 11.2 m/s
E) 65.0 m/s

27. For a block of mass m to slide without friction up the rise of height shown, it must have a minimum initial speed of:

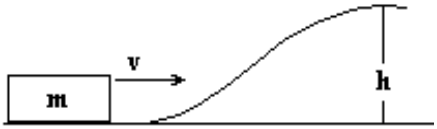
A) $2\sqrt{gh}$

B) $\sqrt{\frac{gh}{2}}$

C) $\sqrt{2gh}$

D) $2\sqrt{2gh}$

E) $\frac{1}{2\sqrt{gh}}$



28. A 2-kg block starts from rest on a rough inclined plane that makes an angle of 25^o with the horizontal. The friction force is 4 N. After a block travels 2.0 m down the plane, the total energy of the block changes by

A) -8 J
B) +8 J
C) -4 J
D) +4 J
E) -2 J

29. A spring is used to fire a 1.5-kg block horizontally across a table top. The spring has a spring constant of 200 N/m and is initially compressed 0.3 m. The friction force acting on the block is 7 N. The speed of the block as it leaves the spring is

A) 2 m/s
B) 3 m/s
C) 4 m/s
D) 5 m/s
E) 9 m/s

30. A block is released from rest at point P and slides along the frictionless track as shown. At point Q, its speed is

A) $\sqrt{2gh_2}$

B) $\sqrt{2gh_1}$

C) $\sqrt{2g(h_1 - h_2)}$

D) $(h_1 - h_2)^2 / 2g$

E) $(h_1 - h_2) / 2g$