Instructor(s): J. Ipser

PHYSICS DEPARTMENT

PHY 2004	Final Exam	December 14, 2007
Name (print, last first):	Signature:	

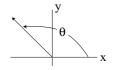
On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

- (1) Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number). Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. Circle your answers on the test form. At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
- (4) Blacken the circle of your intended answer completely, using a #2 pencil or <u>blue</u> or <u>black</u> ink. Do not make any stray marks or some answers may be counted as incorrect.
- (5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, **leave the form blank**.
- (6) Hand in the answer sheet separately.

$$q = 9.80 \text{ m/s}^2$$

1. In this problem, all angles θ are measured counterclockwise with respect to the positive x axis. A hiker walks 100 m at 180° and then 300 m at 45°. What is the angle of the net displacement?



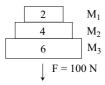
- $(1) 60^{\circ}$
- $(2)\ 280^{\circ}$
- $(3) 40^{\circ}$
- $(4) 20^{\circ}$
- $(5) 80^{\circ}$

2. A ball is thrown straight down with speed 20 m/s from the top of a tower of height h. At the same moment another ball is thrown straight up from the ground with speed 30 m/s. The balls are at the same height 2 s later. What is the height h of the tower?



- (1) 100 m
- (2) 20 m
- (3) 40 m
- (4) 60 m
- (5) 80 m
- 3. The acceleration of gravity on the Moon is 1/6 that on Earth. On Earth a cannon shoots a cannonball a horizontal distance of 500 m when it is aimed at 45° above the horizontal. How far does the cannon shoot a cannonball on the Moon if it is aimed at 30° above the horizontal?
 - (1) 2600 m
- (2) 3000 m
- (3) 2200 m
- (4) 1800 m
- (5) 300 m

4. Three masses, $M_1=2$ kg, $M_2=4$ kg and $M_3=6$ kg, are glued together and move above Earth. A downward force F=100 N is applied to M_3 . What is the magnitude of the force of M_3 on M_2 ?



- (1) 50 N
- (2) 25 N
- (3) 75 N
- (4) 100 N
- (5) 125 N
- 5. An auto accelerates from rest with acceleration $a = 5 \text{ m/s}^2$ for 10 s. It then maintains constant velocity for a period of time. Finally, in phase 3, it accelerates uniformly to rest over a period of 20 s. It travels a total distance of 1000 m. How much time does it spend traveling at constant speed?
 - (1) 5 s
- (2) 10 s
- (3) 2.5 s
- $(4)\ 15\ s$
- (5) 20 s

6. A 3000 kg elevator is initially moving up at 10 m/s. The tension in the elevator cable is T=15,000 N. If the initial height of the elevator is 100 m, what is its height 3 s later?



- (1) 108 m
- (2) 127 m
- (3) 93 m
- (4) 82 m
- (5) 62 m

7. In the previous problem, a 50 kg lady stands on a scale in the elevator. What is the reading on the scale, in N?

- (1) 250
- $(2)\ 350$
- (3) 450
- (4) 550
- (5) 650

8. A 15 kg block accelerates from rest at a rate of 2 m/s² across a horizontal surface, due to a horizontal applied force F=75 N. What is the value of the coefficient of kinetic friction?



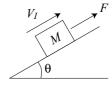
- (1) 0.3
- (2) 0.45
- (3) 0.6
- (4) 0.75
- (5) 0.9

9. A 15 kg block accelerates from rest at a rate of 2 m/s² across a horizontal surface, due to a horizontal applied force F = 75 N. How much work is done by friction during the first 10 s of motion?



- (1) -4500 J
- (2) -3500 J
- (3) +4000 J
- (4) -2000 J
- (5) -1000 J

10. A block of mass M=50 kg is initially moving with speed 10 m/s up along an incline that makes an angle $\theta=30^\circ$ with respect to the horizontal. An applied force F=200 N acts on the block in the upward direction along the incline. The coefficient of kinetic friction is 0.6. How far along the incline does the block move before its speed drops to zero?

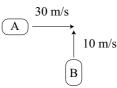


- (1) 8.3 m
- (2) 6.7 m
- (3) 3.2 m
- (4) 1.3 m
- (5) 13.8 m

11. A massive tractor/trailer and a small auto undergo an elastic collision. The tractor/trailer's mass is 50 times greater than that of the auto. Before the collision the tractor/trailer's velocity in the x direction is +30 m/s. After the collision the auto's velocity is +20 m/s. What is the auto's velocity before the collision? (Hint: Think in terms of gap closing and opening.)

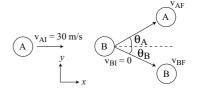
- (1) 40 m/s
- (2) -20 m/s
- (3) 20 m/s
- (4) 30 m/s
- (5) 50 m/s

12. A 2000 kg auto is initially moving with velocity 30 m/s in the positive x direction. A 3000 kg auto is initially moving with velocity 10 m/s in the positive y direction. The autos undergo a completely inelastic sticking collision. What is the kinetic energy of the two autos after the collision?



- (1) $4.5 \times 10^5 \text{J}$
- (2) $1.6 \times 10^4 \text{J}$
- (3) $2.4 \times 10^3 \text{J}$
- $(4) 6.3 \times 10^5 J$
- $(5) 8.8 \times 10^4 \text{J}$

13. Two equal-mass autos A and B undergo a 2-dimensional collision. Before the collision, B is at rest and A is moving along the x axis with velocity 30 m/s. After the collision, the y-component of the velocity of A is 10 m/s, and the x-component of the velocity of B is 20 m/s. What is the value of the angle θ of the final velocity of A with respect to the x axis?



- $(1) 45^{\circ}$
- $(2) 30^{\circ}$
- $(3) 15^{\circ}$
- $(4) 60^{\circ}$
- $(5) 75^{\circ}$
- 14. A wheel spins up from rest to 300 rpm in 10 s. What is its angular acceleration in rad/s²?
 - (1) 3.14
- (2) 1.21
- (3) 8.39
- (4) 0.64
- (5) 12.42
- 15. A auto accelerates from rest to 30 m/s in 6 s. During this time its tires rotate through a total angle of 270 radians (no slipping). What is the radius of the tires? (Hint: consider the distance that the auto travels.)
 - (1) 0.33 m
- (2) 0.28 m
- (3) 0.46 m
- (4) 0.21 m
- (5) 0.14 m
- 16. A satellite is in a circular orbit around planet X. The radius of its orbit is R_I and the satellite's speed is 10^4 m/s. The satellite is then moved to a new orbit of radius $4R_I$. What is the satellite's speed in its new orbit?
 - $(1) 5 \times 10^3 \text{m/s}$
- $(2) 6 \times 10^4 \text{m/s}$
- (3) $2.5 \times 10^3 \text{m/s}$
- $(4) 10^3 \text{m/s}$
- $(5) 10^5 \text{m/s}$