Instructor: *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 1st Exam September 29, 2003

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 76–80 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. 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 with scratch work most questions demand.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink**. Do not make any stray marks or the answer sheet may not read properly.
(5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.

>>>>>>>>**WHEN YOU FINISH** <<<<<<<<
Hand in the answer sheet separately.
Suggestion: Try * problems first.
$g = 9.80$ m/s^2

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1. * An airplane travels at a speed of 150 m/s relative to the air. The air blows toward the east relative to the ground. When the pilot aims the plane in a direction 30° to the west of north, the plane ends up traveling directly north relative to the ground. What is the magnitude of the velocity of the air relative to the ground?

   (1) 75 m/s (2) 50 m/s (3) 25 m/s (4) 87 m/s (5) 103 m/s

2. A ball is dropped from a height of 30 m. At the same instant another ball is thrown straight up from the ground with a speed of 30 m/s. How long are the balls in the air before they reach the same height?

   (1) 1 s (2) 0.5 s (3) 2 s (4) 1.5 s (5) 3 s

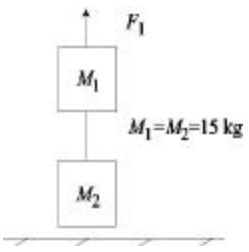
3. A 2000 kg auto decelerates at a constant rate from 30 m/s to rest over a distance of 75 m. The auto's path is horizontal. What is the magnitude of the force of the ground on the auto?

   (1) 2.3 £ 10^4 N (2) 10^4 N (3) 1.6 £ 10^4 N (4) 8.3 £ 10^3 N (5) 6 £ 10^3 N

4. A 50 kg lady stands on a scale in an elevator. While the elevator is moving downward, it slows from a downward speed of 10 m/s to 0 over 3 s. What is the reading on the scale during this process? Assume constant acceleration.

   (1) 657 N (2) 490 N (3) 245 N (4) 980 N (5) 324 N

5. Two identical 15 kg masses are attached together and move together in the vertical direction above the ground as shown. An upward vertical force $F_1 = 150$ N is applied to the top of the higher mass M_1. What is the tension in the rope connecting the two masses?



   (1) 75 N (2) 219 N (3) 150 N (4) 438 N (5) 0

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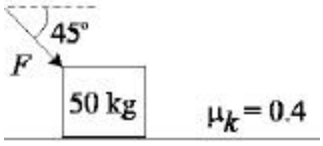
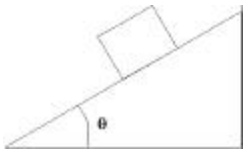
6. A worker pushes a 50 kg trunk across a horizontal floor by exerting a force F that makes an angle of 45° with respect to the horizontal. The coefficient of kinetic friction is $\mu_k = 0.4$. What is the value of F if the trunk is pushed at constant speed?



(1) 462 N (2) 1078 N (3) 198 N (4) 140 N (5) 373 N

7. * A block rests on an incline that makes an angle θ with respect to the horizontal. The block begins to move when the angle θ exceeds 60°. What is the coefficient of static friction?



(1) 1.73 (2) 1 (3) 0.58 (4) 0.40 (5) 0.82

8. * A 10 kg block is given an initial velocity of 2 m/s across a horizontal surface. The coefficient of kinetic friction is 0.30. How far does the block move before it comes to rest?

(1) 0.68 m (2) 2 m (3) 0.33 m (4) 3.3 m (5) 1.4 m

9. In this problem, all angles θ are measured in the counter-clockwise direction relative to the x axis. A hiker walks at $\theta = 30°$ at 3 m/s for 100 s, and then at $\theta = 150°$ at 2 m/s for 200 s. At what angle θ must the hiker subsequently walk in order to return directly to his starting point along a straight line?

(1) 284° (2) 176° (3) 133° (4) 242° (5) 193°

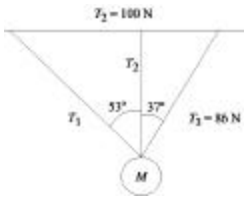
10. Autos A and B are initially 100 m apart and are heading directly at each other. Each auto has initial speed 30 m/s. Auto A begins to decelerate at a constant rate, while B maintains constant speed. The autos collide after 2 s. What is the magnitude of the deceleration of A in m/s^2?

(1) 10 m/s^2 (2) 8 m/s^2 (3) 6 m/s^2 (4) 12 m/s^2 (5) 4 m/s^2

11. A ball is thrown straight down from a tower of height 30 m with initial speed 10 m/s. How much time is required for the ball to reach a height of 10 m?

(1) 1.24 s (2) 2 s (3) 2.31 s (4) 1.76 s (5) 0.51 s

12. Mass M hangs in equilibrium from 3 ropes as shown. What is the value of the mass M?



(1) 21.2 kg (2) 24.3 kg (3) 18.6 kg (4) 10 kg (5) 30 kg

13. A cannonball is shot from ground level at an angle of 60° above the horizontal. After 1.5 s the cannonball has traveled a horizontal distance of 1000 m. What is its height above the ground at this moment?

(1) 1721 m (2) 1689 m (3) 1705 m (4) 1643 m (5) 1666 m

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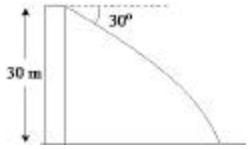
14. Tiger Woods hits a golf ball on Earth at an angle 45° and the ball travels 250 m in the air (neglect air resistance). If he had hit the golf ball on the Moon, where the acceleration of gravity is 1/6 that on Earth, how far would the ball have traveled before returning to the Moon's surface?

(1) 1500 m (2) 42 m (3) 3000 m (4) 1060 m (5) 250 m

15. A rock is thrown out from a height of 30 m at an angle of 30° below the horizontal with initial speed 30 m/s. What is the magnitude of its vertical component of velocity when it reaches the ground?



(1) 28.5 m/s (2) 34.6 m/s (3) 41.3 m/s (4) 47.4 m/s (5) 53.6 m/s

16. * A hiker walks 100 m towards the east at 2 m/s, then 100 m north at 4 m/s. What is the magnitude of his average velocity vector?

(1) 1.89 m/s (2) 6 m/s (3) 3 m/s (4) 2.5 m/s (5) 3.45 m/s