Instructor: *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 1st Exam February 9, 2004

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 some answers may be counted as incorrect.
(5) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.
(6) **Hand in the answer sheet separately.**

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

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1. A hiker walks toward the east for 20 s at a constant speed of 0.75 m/s, and then toward the north for 30 s at a constant speed of 1.25 m/s. What is the magnitude of the average velocity vector for the trip in m/s?

(1) 0.8 (2) 0.6 (3) 0.4 (4) 1.3 (5) 2.9

2. In this problem, all angles are measured in the counterclockwise direction with respect to the x axis. A hiker walks 60 m at $\theta = 30°$, then 80 m at $\theta = 90°$, and then 30 m at $\theta = 180°$. At what angle θ must she then walk in order to return to her starting position?

(1) 258° (2) 221° (3) 180° (4) 166° (5) 93°

3. An auto accelerates from rest for 5 s at a constant rate a, reaches velocity v_F, and then maintains constant velocity v_F for 5 s. The total distance traveled is 125 m. What is the value of the acceleration a in m/s^2?

(1) 3.3 (2) 4.2 (3) 4.9 (4) 5.5 (5) 6.1

4. At $t = 0$, an auto accelerates from rest at 2 m/s^2 for 15 s and then decelerates (slows down) to rest at a constant rate of 4 m/s^2. How far does the auto travel?

(1) 338 m (2) 462 m (3) 529 m (4) 106 m (5) 632 m

5. Autos A and B are heading straight at each other. At time $t = 0$, when the distance between them is 200 m, auto A is traveling at 40 m/s and B at 20 m/s. At this time, auto A decelerates (slows down) at a constant rate of 3 m/s^2 and B accelerates (speeds up) at 3 m/s^2. At what time do the autos collide?

(1) 3.3 s (2) 2.5 s (3) 4.3 s (4) 4.9 s (5) 5.6 s

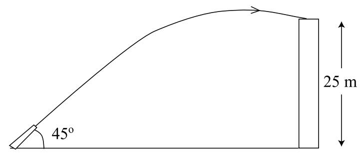
6. At time $t = 0$, rock A is thrown straight up from ground level at 30 m/s and rock B is thrown straight down from a height of 30 m at 20 m/s. At what time are the rocks at the same height?

(1) 0.6 s (2) 0.4 s (3) 0.8 s (4) 1.0 s (5) 1.2 s

7. An auto traveling at initial velocity 20 m/s passes a parked police cruiser. As it passes the cruiser, the auto begins to accelerate at a constant rate of 2 m/s^2, and the cruiser takes off after the auto, accelerating at a constant rate of 5 m/s^2. How far does the cruiser travel before it catches up with the auto?

(1) 444 m (2) 392 m (3) 346 m (4) 298 m (5) 256 m

8. A projectile is shot from ground level at an angle of 45° and strikes the top of a wall that is 25 m high. The projectile is in the air for 7 s. How far does the projectile travel horizontally?

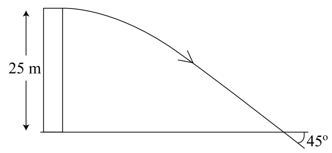


(1) 265 m (2) 302 m (3) 26 m (4) 102 m (5) 189 m

9. A rock is thrown straight up with initial velocity 20 m/s from the top of a tower of height h. The rock is in the air for 6 s before it hits the ground. What is the height h of the tower?

(1) 56 m (2) 21 m (3) 38 m (4) 44 m (5) 83 m

10. A rock is thrown out horizontally from a tower of height 25 m. When the rock reaches ground level, its velocity vector makes an angle of 45° with respect to the horizontal. What is the initial speed of the rock?

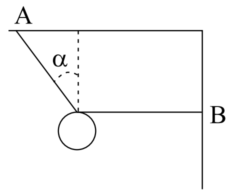


(1) 22 m/s (2) 10 m/s (3) 16 m/s (4) 32 m/s (5) 8 m/s

11. On Earth, a cannon has a maximum range of 3×10^3 m. If the cannon is fired at an angle of 60° above the horizontal on the Moon, how far will the cannonball travel before hitting the Moon's surface? The acceleration of gravity on the Moon is 1/6 that on Earth.

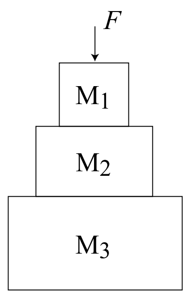
(1) 1.6×10^4 m (2) 2.1×10^3 m (3) 4.3×10^4 m (4) 8.2×10^4 m (5) 2.9×10^5 m

12. A 0.5 kg ball is suspended in equilibrium from two wires. Wire B is horizontal and the tension in it is 4 N. What is the angle α that wire A makes with the vertical direction?



(1) 39° (2) 23° (3) 12° (4) 30° (5) 53°

13. Three masses, $M_1 = 2$kg, $M_2 = 2M_1$, $M_3 = 3M_1$, are glued together and move above the Earth. A force $F = 50$N is applied in the downward direction on the top of M_1 as shown. What is the magnitude of the force that M_1 exerts on M_2?

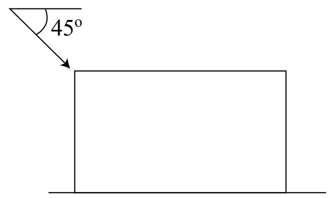


(1) 22 N (2) 33 N (3) 46 N (4) 53 N (5) 66 N

14. A 40 kg mass is placed on a scale in an elevator. The elevator accelerates in the downward direction at 4 m/s^2. What is the reading on the scale in N?

(1) 232 (2) 624 (3) 738 (4) 139 (5) 463

15. A 50 kg trunk is pushed across a horizontal floor by application of a force F at an angle of 45° with respect to the horizontal as shown. When the force $F = 500$N, the trunk starts from rest and is pushed through a distance of 5 m in 5 s (constant acceleration). What is the value of the coefficient of kinetic friction?



(1) 0.4 (2) 0.3 (3) 0.5 (4) 0.6 (5) 0.7

16. An auto is approaching a stopped tractor-trailer at 30 m/s. In order to avoid a collision, how far from the tractor-trailer must the auto's wheels be locked up if the kinetic coefficient of friction is 0.7?

(1) 66 m (2) 72 m (3) 86 m (4) 94 m (5) 107 m