

Instructor(s): *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004

Final Exam

April 25, 2005

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. **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 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.**

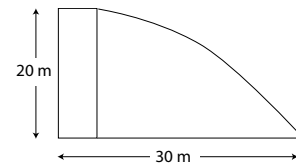
$$g = 9.80 \text{ m/s}^2$$

Hint: Try * problems first.

1. A rock is thrown straight down with speed 10 m/s from a height of 20 m above the ground. At the same moment, another rock is thrown straight up with speed 15 m/s. What is the height of the rocks when they cross each other?

(1) 8.9 m (2) 4.3 m (3) 18.4 m (4) 12.6 m (5) 0

2. * A rock is thrown out horizontally from a tower of height 20 m. The rock hits the ground at a horizontal distance of 30 m from the base of the tower. What is the initial speed of the rock in m/s?



(1) 15 (2) 10 (3) 20 (4) 25 (5) 30

3. Autos A and B have a head-on collision in 1 dimension. At time $t = 0$ the distance between the autos is 100 m. Each auto is initially traveling at 30 m/s. Auto A maintains constant velocity, while auto B decelerates at a constant rate of 10 m/s². At what time t do the autos collide?

(1) 2 s (2) 0.5 s (3) 3 s (4) 4.5 s (5) 9 s

4. On Earth a cannon can shoot a cannonball a distance of 1000 m if it is aimed at an angle of 45° above the horizontal. On planet X, the same cannon can shoot a cannonball a distance of 500 m if it is aimed at an angle of 60° above the horizontal. What is the acceleration of gravity on planet X in m/s²?

(1) 17 (2) 21 (3) 24 (4) 27 (5) 30

5. * A lady whose mass is 50 kg stands on a scale in an elevator. As the elevator approaches the ground floor from above, it is slowing at a rate of 3 m/s². What is the reading on the scale for the lady's apparent weight?

(1) 640 N (2) 350 N (3) 120 N (4) 200 N (5) 75 N

6. Three masses $M_1 = 1\text{kg}$, $M_2 = 2\text{kg}$, and $M_3 = 3\text{kg}$ are glued together and move above the ground. A force $F = 200\text{ N}$ is applied in the downward direction to M_3 as shown. What is the magnitude of the force that M_2 exerts on M_3 ?

(1) 100 N (2) 99.3 N (3) 113.4 N (4) 126.3 N (5) 200 N

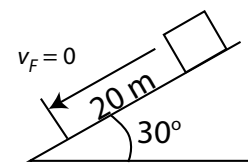
7. An elevator of mass 10^3 kg starts from rest at the 4th floor and is raised and lowered by its motor. After 15 s the elevator is 15 m below the 4th floor and is moving down at 10 m/s. How much work has been done by the motor during this process?

(1) -10^5 J (2) -10^3 J (3) -10 J (4) $+10\text{ J}$ (5) $+10^4\text{ J}$

8. A trunk of mass $m = 50\text{ kg}$ is pulled across a horizontal floor by a force F that acts at an angle of 30° above the horizontal. The coefficient of kinetic friction is 0.75. If the trunk accelerates at 1 m/s^2 , what is the value of F ?

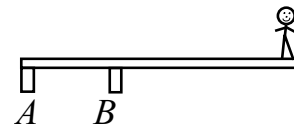
(1) 335 N (2) 300 N (3) 260 N (4) 225 N (5) 165 N

9. * A block of mass $M = 100\text{kg}$ is moving down an incline that makes an angle of 30° relative to the horizontal. The block is initially moving at a speed of 15 m/s. The block moves a distance $x = 20\text{ m}$ down along the incline before it is brought to rest by friction. How much work is done by friction during this process?



(1) $-2.1 \times 10^4\text{ J}$ (2) $-1.1 \times 10^4\text{ J}$ (3) $-3.3 \times 10^4\text{ J}$ (4) $-8.9 \times 10^4\text{ J}$ (5) 10^8 J

10. A diver stands in equilibrium at the end of a uniform diving board of length $L = 5\text{ m}$ and mass 100 kg. The diver's mass is 75 kg. What is the force F_B exerted by support B?

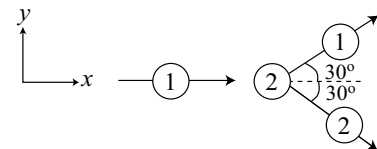


(1) not enough information (2) $9.8 \times 10^3\text{ N}$ (3) $1.96 \times 10^4\text{ N}$ (4) $5 \times 10^4\text{ N}$ (5) $6.8 \times 10^5\text{ N}$

11. * An auto goes from 0 to 30 m/s in 5 s, at a uniform rate of acceleration. The radius of the auto's tires is 0.33 m. How many revolutions per second are the tires making after the auto has traveled for 2.5 s? Assume that the tires don't slip.

(1) 7.2 (2) 6.1 (3) 5 (4) 8.3 (5) 9.5

12. Masses M_1 and M_2 ($M_1 = M_2$) undergo a collision in 2 dimensions. Before the collision, M_1 is moving in the positive x direction at 50 m/s and M_2 is at rest. After the collision, each mass is moving at an angle of 30° with respect to the x axis. What is the final speed v_{2F} of M_2 ?

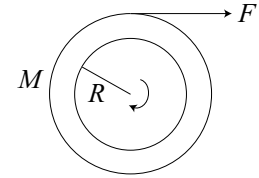


(1) 29 m/s (2) 22 m/s (3) 36 m/s (4) 43 m/s (5) 49 m/s

13. Satellites A and B are in orbits around the Earth. The periods T_A and T_B of the satellite orbits satisfy $T_A = 3T_B$. If R_A is the radius of orbit A, what is the radius of orbit B?

(1) $0.48R_A$ (2) R_A (3) $1.45R_A$ (4) $2.16R_A$ (5) $3.22R_A$

14. A bicycle tire of mass $M = 2$ kg and radius $R = 0.5$ m is spun up from rest by a force $F = 100$ N that acts in a direction parallel to its rim. What is the kinetic energy of rotation of the tire after 10 s?



- (1) 2.5×10^5 J (2) 0.95×10^7 J (3) 0.54×10^7 J (4) 4.7×10^7 J (5) 10^9 J
15. * A bicycle tire of mass $M = 2$ kg and radius $R = 0.5$ m is initially rotating with angular velocity $\omega_I = 20$ rad/s. The mass of the tire is suddenly increased to 4 kg without changing its radius. After the mass is increased in this way, how many revolutions does the tire make in 1 s?
- (1) 1.6 (2) 2 (3) 3 (4) 4.2 (5) 5.6
16. * An iceberg has a density 920 kg/m³ and floats in sea water that has density 1040 kg/m³. What fraction of the iceberg's volume is under the water?
- (1) 0.88 (2) 0.98 (3) 0.51 (4) 0.33 (5) 0.66