

Instructor(s): *Mueller/Rinzler*PHYSICS DEPARTMENT  
Exam 1

PHY 2048

September 30, 2008

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 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.**

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

1. The volume of a sphere is given by  $V = \frac{4}{3}\pi R^3$ , where  $R$  is the radius. The mass,  $M$ , of a sphere with uniform mass density  $\rho$  is  $M = \rho V$ . A solid sphere has a uniform mass density of  $2.05 \text{ kg/m}^3$ . If the total mass of the sphere is  $68.64 \text{ kg}$ , the radius of the sphere is about:
- (1) 2.0 m                      (2) 1.0 m                      (3) 3.0 m                      (4) 0.5 m                      (5) 4.0 m
2. The speed  $v$  in m/s of an automobile is given by  $v(t) = bt^2 + c/t^3$ , where the time  $t$  is in seconds. The units of  $b$  and  $c$  are respectively:
- (1)  $\text{m/s}^3$ ;  $\text{m}\cdot\text{s}^2$                       (2)  $\text{m}\cdot\text{s}^2$ ;  $\text{m}\cdot\text{s}^4$                       (3)  $\text{s}^3/\text{m}$ ;  $\text{s}^4/\text{m}$                       (4)  $\text{m/s}^2$ ;  $\text{m/s}^3$                       (5)  $\text{m/s}$ ;  $\text{m/s}$
3. A particle moves along the  $x$  axis from  $x_i$  to  $x_f$ . Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?
- (1)  $x_i = -4 \text{ m}$ ,  $x_f = 4 \text{ m}$   
 (2)  $x_i = 4 \text{ m}$ ,  $x_f = 6 \text{ m}$   
 (3)  $x_i = -4 \text{ m}$ ,  $x_f = -8 \text{ m}$   
 (4)  $x_i = -4 \text{ m}$ ,  $x_f = 2 \text{ m}$   
 (5)  $x_i = 4 \text{ m}$ ,  $x_f = -2 \text{ m}$
4. Two automobiles are moving at a constant speed in the same direction along the positive  $x$ -axis. One automobile is moving at  $60 \text{ km/h}$  and the other is moving at  $40 \text{ km/h}$ . If the faster automobile is  $160 \text{ kilometers}$  behind the slower automobile, they will meet in:
- (1) 8.0 hr                      (2) 1.6 hr                      (3) 2.7 hr                      (4) 4.0 hr                      (5) 16.0 hr
5. A particle's position is given by  $x(t) = 16 - 18t + 3t^2$ , in which  $x$  is in meters and  $t$  is in seconds. Where is the particle when it momentarily stops?
- (1)  $x = -11 \text{ m}$                       (2)  $x = 11 \text{ m}$                       (3)  $x = 97 \text{ m}$                       (4)  $x = 16 \text{ m}$                       (5)  $x = 3 \text{ m}$
6. The velocity of an object is given as a function of time by  $v(t) = 4t - 3t^2$ , where  $v$  is in m/s and  $t$  is in seconds. If the object is at  $x = 0$  at  $t = 0$ , where is it at time  $t = 2 \text{ s}$ ?
- (1)  $x = 0 \text{ m}$                       (2)  $x = -2 \text{ m}$                       (3)  $x = 2 \text{ m}$                       (4)  $x = 4 \text{ m}$                       (5)  $x = 16 \text{ m}$
7. Each of four particles move along the  $x$ -axis. Their coordinates (in meters) as functions of time (in seconds) are given by
- particle 1:  $x(t) = 3.5 - 2.7t^3$   
 particle 2:  $x(t) = 3.5 + 2.7t^3$   
 particle 3:  $x(t) = 3.5 + 2.7t^2$   
 particle 4:  $x(t) = 3.5 - 3.4t - 2.7t^2$
- Which of these particles have constant acceleration?
- (1) Only 3 and 4                      (2) All four                      (3) Only 1 and 2                      (4) Only 2 and 3                      (5) None of them
8. Starting at time  $t = 0$ , the coordinate of an automobile in meters is given by  $x(t) = 27t + 4t^3$ , where  $t$  is in seconds. The magnitudes of the initial (at  $t = 0$ ) velocity and acceleration of the auto respectively are:
- (1)  $27 \text{ m/s}$ ;  $0 \text{ m/s}^2$                       (2)  $0 \text{ m/s}$ ;  $12 \text{ m/s}^2$                       (3)  $0 \text{ m/s}$ ;  $24 \text{ m/s}^2$                       (4)  $27 \text{ m/s}$ ;  $12 \text{ m/s}^2$                       (5)  $27 \text{ m/s}$ ;  $24 \text{ m/s}^2$

9. The absolute value squared of a vector is equal to the dot product of the vector with itself as follows:  $|\vec{C}|^2 = \vec{C} \cdot \vec{C}$ . If  $\vec{A}$  and  $\vec{B}$  are non-zero vectors and if  $|\vec{A} + \vec{B}|^2 = |\vec{A}|^2 + |\vec{B}|^2$ , then:

- (1)  $\vec{A}$  and  $\vec{B}$  must be perpendicular
- (2)  $\vec{A}$  and  $\vec{B}$  must be parallel and in the same direction
- (3)  $\vec{A}$  and  $\vec{B}$  must be parallel and in opposite directions
- (4) the angle between  $\vec{A}$  and  $\vec{B}$  must be  $45^\circ$
- (5) not possible

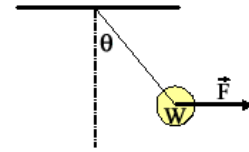
10. If  $\vec{A} = 1.0\hat{i} + 2.0\hat{j} + 3.0\hat{k}$  and  $\vec{B} = 1.0\hat{i} + 2.0\hat{k}$ , and if  $\vec{C} = \vec{A} \times \vec{B}$ , then the angle between the vector  $\vec{A}$  and the vector  $\vec{C}$  is:

- (1)  $90^\circ$
- (2)  $180^\circ$
- (3)  $45^\circ$
- (4)  $135^\circ$
- (5) zero

11. Near the surface of the Earth, a dart is thrown horizontally with an initial speed of 18 m/s toward point P, the bull's-eye on a dart board. It hits at point Q on the rim, vertically below P, 0.20 s later. The distance PQ is:

- (1) 19.6 cm
- (2) 9.8 cm
- (3) 39.2 cm
- (4) 2.0 cm
- (5) 0.196 cm

12. A pendulum bob with weight  $W$  is held at rest at an angle  $\theta$  from the vertical by a horizontal force  $\vec{F}$  as shown in the figure. The tension in the string supporting the pendulum bob is:

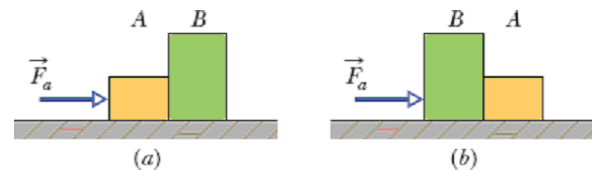


- (1)  $W/\cos\theta$
- (2)  $W/\sin\theta$
- (3)  $W\cos\theta$
- (4)  $F - W$
- (5)  $F + W$

13. A stone of mass  $M$  is placed on a scale inside an elevator. When the elevator is at rest on the surface of the Earth, the scale reads 200 lbs. What does the scale read when the elevator is in outer space (*i.e.* no gravity) and accelerating upward with a constant acceleration of  $9.8 \text{ m/s}^2$ ?

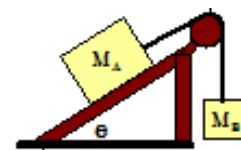
- (1) 200 lbs
- (2) 100 lbs
- (3) 400 lbs
- (4) 9.8 lbs
- (5) zero since there is no gravity

14. A constant horizontal force  $\vec{F}_a$  is applied to block A, which pushes against block B with a 10.0 N force directed horizontally to the right (see Fig. a). In Fig. b, the same force is applied to block B; now block A pushes on block B with a 20.0 N force directed horizontally to the left. The blocks have a combined mass of 6.0 kg. If there is no friction between the blocks and the surface, the mass of block A and block B respectively are:

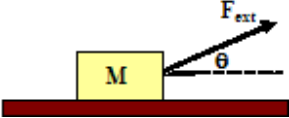


- (1) 4kg; 2kg
- (2) 2kg; 4kg
- (3) 3kg; 3kg
- (4) 5kg; 1kg
- (5) 1kg; 5kg

15. Near the surface of the Earth, a block of mass  $M_A$  on a frictionless plane inclined at an angle  $\theta$  is connected by a cord over a massless, frictionless pulley to a second block of mass  $M_B$ . If  $M_A = 5M_B$  and if when released from rest block B accelerates upward at an acceleration of  $4.9 \text{ m/s}^2$ , the angle  $\theta$  is:



- (1)  $53.1^\circ$
- (2)  $48.6^\circ$
- (3)  $60.0^\circ$
- (4)  $30.0^\circ$
- (5)  $38.7^\circ$

16. A forward horizontal force of 12N is used to pull a crate weighing 240N at constant velocity across a horizontal floor. The coefficient of kinetic friction is:
- (1) 0.05                      (2) 0.5                      (3) 2                      (4) 0.2                      (5) 20
17. Near the surface of the Earth, a car is traveling at 15 m/s on a horizontal road. The brakes are applied and the car skids to a stop in 4.0 s. The coefficient of kinetic friction between the tires and road is:
- (1) 0.38                      (2) 0.69                      (3) 0.76                      (4) 0.92                      (5) 1.11
18. Near the surface of the Earth, a block of mass  $M = 2$  kg slides along the floor while an external force  $F_{ext} = 12$  N is applied at an upward angle  $\theta = 26^\circ$ . If the coefficient of kinetic friction between the block and the floor is 0.488, what is the magnitude of the acceleration of the block?
- 
- (1) 1.89 m/s<sup>2</sup>                      (2) 4.78 m/s<sup>2</sup>                      (3) 11.46 m/s<sup>2</sup>                      (4) 3.78 m/s<sup>2</sup>                      (5) 0.95 m/s<sup>2</sup>
19. A massless rope is used to swing an object with a mass of 2 kg around in a circle with a radius of 2 m. If the object undergoes uniform circular motion with a constant speed  $v = 3$  m/s and if there is no gravity present, what is the tension in the rope?
- (1) 9 N                      (2) 4 N                      (3) 6 N                      (4) 3 N                      (5) zero, since there is no gravity
20. Near the surface of the Earth, a car is traveling at a constant speed  $v$  around a flat circular race track with a radius of 50 m. If the coefficient of static friction between the car's tires and the road is 0.4, what is the maximum speed the car can travel without slipping?
- (1) 14 m/s                      (2) 28 m/s                      (3) 196 m/s                      (4) 22 m/s                      (5) 7 m/s