Instructor(s): *Rinzler/Qiu*

PHYSICS DEPARTMENT

PHY 2053 Exam 1 February 23, 2011

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. If you believe that no listed answer is correct, leave the form blank.**

(6) Hand in the answer sheet separately.

Use $g = 9.80$ m/s^2

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1. Two points are given in polar coordinates as $(r_1, \theta_1) = (10.3\text{m}, 45.0°)$ and $(r_2, \theta_2) = (7.6\text{m}, 225.0°)$. The distance between the two points is:

(1) 17.9 m (2) 15.2 m (3) 12.7 m (4) 10.3 m (5) 8.9 m

2. 4 quarts = 3.786 liters and 1000 cm^3 = 1 liter. An ice cream company is going to distinguish its product by selling its one quart of ice cream in cubical metal containers. The inside edge length (in centimeters) of that cubical quart container is:

(1) 9.818 (2) 10.00 (3) 9.465 (4) 9.212 (5) 9.028

3. A position vector is 3.00 m long at an angle of 30° measured counter-clockwise from the positive y-axis. The signed x- and y- components of this vector expressed as (x, y) in meters are:

(1) $(-1.50, 2.60)$ (2) $(-2.60, 1.50)$ (3) $(2.60, 1.50)$ (4) $(1.50, 2.60)$ (5) $(-2.60, -1.50)$

4. A remote controlled toy car accelerates from rest at 2.00 m/s^2 under the power of its own wheels on a horizontal balcony until it shoots off the edge of the balcony 3.00 m from its starting point. The balcony is 10.0 m high. The horizontal distance from the point it left the balcony to where the car lands on level ground is:

(1) 4.95 m (2) 3.68 m (3) 4.24 m (4) 5.12 m (5) 5.85 m

5. A river flows east at 1.70 m/s. A boat crosses the river from the north shore to the south shore maintaining a constant velocity of 8.00 m/s due south relative to the water. If the river is 500 m wide, how far downstream has the boat moved on reaching the south shore?

(1) 106 m (2) 42 m (3) 74 m (4) 88 m (5) 136 m

6. A dolphin at Seaworld is to jump through a hoop held in the air by a trainer. The dolphin leaves the water at an angle of 40.0° relative to the water and travels 10.0 m through the air. At what speed did the dolphin leave the water?

(1) 10 m/s (2) 8.0 m/s (3) 12 m/s (4) 14 m/s (5) 16 m/s

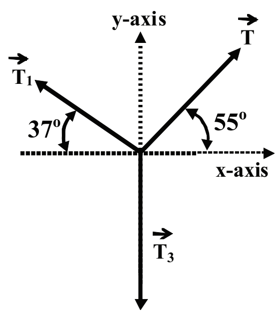
7. A cannon ball is fired with a muzzle velocity of 108 m/s at an angle of 60° above the horizontal. How high above the end of the cannon does the ball get?

(1) 446 m (2) 472 m (3) 495 m (4) 522 m (5) 595 m

8. If the momentum of an object is doubled, then its kinetic energy:

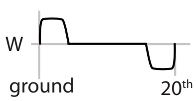
   (1) increases by a factor of 4
   (2) increases by a factor of 2
   (3) stays the same
   (4) decreases by a factor of 4
   (5) decreases by a factor of 2

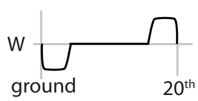
9. The system shown in the sketch is in equilibrium (*i.e.,* the sum of all forces acting at the origin are zero). Tension T_2 has a magnitude of 45.0 N. Tension T_3 must be:

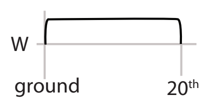


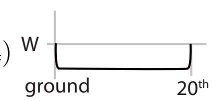
   (1) 56.3 N
   (2) 45.0 N
   (3) 36.8 N
   (4) 90.0 N
   (5) 76.3 N

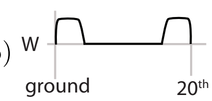
10. An elevator going up accelerates from rest until reaching its maximum speed. It then travels with that constant speed until it approaches the 20th floor and finally it decelerates until stopping at the 20th floor. You are in the elevator standing on a floor scale that reads your weight (W at rest). Which of the following plots best represents the scale reading on this journey from the ground to the 20th floor?

(1) 

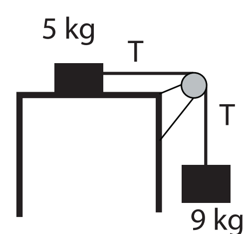
(2) 

(3) 

(4) 

(5) 

11. A 9.0-kg hanging weight is connected by a string over a pulley to a 5.0-kg block sliding on a flat table as shown in the figure. If the coefficient of kinetic friction is 0.20, find the tension in the string (in N).

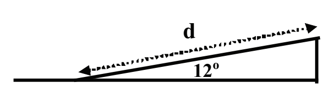


   (1) 37.8
   (2) 25.2
   (3) 31.5
   (4) 19.3
   (5) 87.7

12. A rock is thrown straight down with an initial velocity of 14.5 m/s from a cliff. What is the rock's displacement (in m) after 2.0 s?

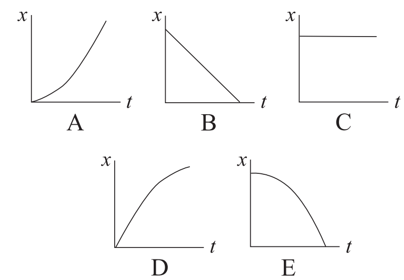
   (1) 48.6 (2) 29.0 (3) 19.6 (4) 64 (5) 97.2

13. A hill makes an angle of 12° with the horizontal. If a 50-kg jogger runs a distance of $d = 481$ m up the hill as shown in the figure, how much work is done by gravity on the jogger (in J)?



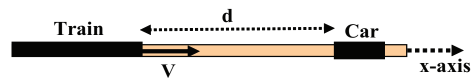
   (1) $-49,000$ (2) 235,690 (3) $-235,690$ (4) zero (5) 49,000

14. Which of the above five graphs of position, x, versus time, t, represents the motion of an object moving with a constant nonzero speed?



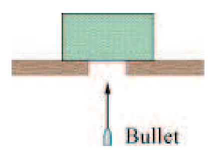
(1) B
(2) A
(3) C
(4) D
(5) E

15. At $t = 0$ the engineer of a high-speed train traveling at speed V = 200 m/s along the x-axis sees that a car has stopped on the track a distance $d = 1,000$ meters ahead as shown in the figure. The engineer of the train immediately applies the brakes. If the train decelerates at a constant rate (*i.e.,* constant acceleration in the negative x-direction), what is the minimum constant deceleration that the train must have in order to prevent a collision with the car?



(1) 20 m/s^2 (2) 200 m/s^2 (3) 2 m/s^2 (4) 40 m/s^2 (5) 10 m/s^2

16. Near the surface of the Earth, a bullet with mass $M = 10$ grams moving directly upward at 1,000 m/s strikes and passes through the center of mass of a block initially at rest as shown in the figure. The bullet then emerges from the block moving directly upward at 500 m/s. If the block rises to a maximum height of 20.4 cm, what is the mass of the block (in kg)?

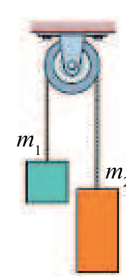


(1) 2.5 (2) 2.0 (3) 1.5 (4) 1.0 (5) 5.0

17. A 0.5-kg rubber ball is dropped from rest a height of 19.6 m above the surface of the Earth. It strikes the sidewalk below and rebounds up to a maximum height H. If the magnitude of the impulse due to the collision with the sidewalk is 14.7 N·s, what is the height H (in meters)?

(1) 4.9 (2) 2.4 (3) 9.8 (4) 12.6 (5) 19.6

18. The figure shows two blocks with masses m_1 and m_2 connected by a cord (of negligible mass) that passes over a frictionless pulley (also of negligible mass). If when released from rest the block m_2 accelerates downward an acceleration of $2g/3$, what is its mass?



(1) $5m_1$
(2) $4m_1$
(3) $2m_1$
(4) $3m_1$
(5) $6m_1$

19. A crate having a mass of 60 kg rests on a long wooden ramp with an incline of 30 degrees relative to the horizontal. A mover gives the crate a shove down the incline so that at the end of the shove the crate has a speed down the ramp of 0.60 m/s. Because of friction the crate stops after sliding 1 m along the ramp. How much work was done by friction in this slide?

(1) −305 J (2) 305 J (3) −1400 J (4) 1400 (5) 0

20. A man is riding in a 25-kg cart at 2.5 m/s along a frictionless horizontal surface. He jumps off in such a way as to land on the ground with no horizontal velocity. If the new speed of the cart is 10 m/s, what is the mass of the man (in kg)?

(1) 75 (2) 100 (3) 25 (4) 50 (5) 60

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