

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

October 13, 2010

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

1. 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?

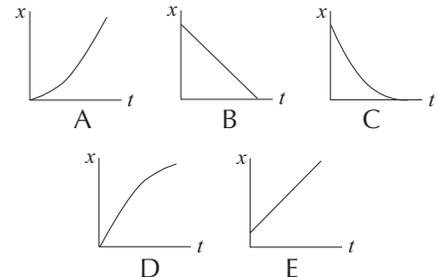
- (1) $x_i = -8 \text{ m}, x_f = 8 \text{ m}$
- (2) $x_i = 8 \text{ m}, x_f = 12 \text{ m}$
- (3) $x_i = -8 \text{ m}, x_f = -16 \text{ m}$
- (4) $x_i = -8 \text{ m}, x_f = 4 \text{ m}$
- (5) $x_i = 8 \text{ m}, x_f = -4 \text{ m}$

2. A car traveling at a constant speed starts at point A, goes 50 km in a straight line to point B, immediately turns around, and returns to point A (in a straight line). The time for this round trip is 2 hours. The magnitude of the average velocity of the car for this round trip is:

- (1) zero
- (2) 50 km/hr
- (3) 100 km/hr
- (4) 200 km/hr
- (5) 25 km/hr

3. Which of the five graphs of position, x , versus time, t , represents the motion of an object whose speed is increasing with time?

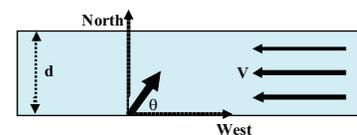
- (1) A
- (2) B
- (3) C
- (4) D
- (5) E



4. A motorist drives along a straight road at a constant speed of 80 m/s. Just as she passes a parked motorcycle police officer, the officer takes off after her at a constant acceleration. If the officer maintains this constant value of acceleration, what is the speed of the police officer when he reaches the motorist?

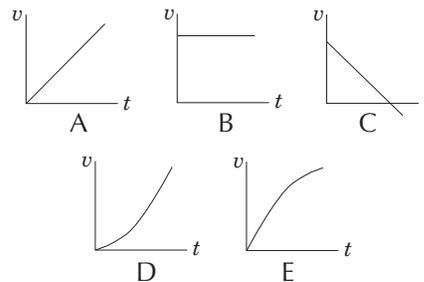
- (1) 160 m/s
- (2) 80 m/s
- (3) 180 m/s
- (4) 100 m/s
- (5) need to know the officer's acceleration

5. A rowboat crosses a river with a velocity of 3.21 mi/h at an angle $\theta = 62.5^\circ$ north of west relative to the water. The river is $d = 0.675 \text{ mi}$ wide and carries an eastward current of $V = 1.25 \text{ mi/h}$ as shown in the figure. How far upstream from the starting point is the boat when it reaches the opposite shore? (1 mile = 5280 ft.)



- (1) 291 ft
- (2) 458 ft
- (3) 374 ft
- (4) 660 ft
- (5) 880 ft

6. An object is thrown vertically upward near the surface of the Earth. Which of the five graphs represents the velocity, v , of the object as a function of the time t ? The positive direction is taken to be upward.



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

7. An object is released from rest at $t = 0$ near the surface of the Earth. How far does it fall during the first second of its fall (*i.e.*, from $t = 0$ s to $t = 1$ s)?

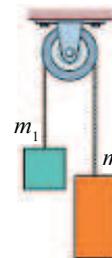
- (1) 4.9 m
- (2) 9.8 m
- (3) 14.7 m
- (4) 19.6 m
- (5) 24.5 m

8. Three blocks (A,B,C), each having mass $M_A = M$, $M_B = 2M$, $M_C = M$ are connected by strings on a horizontal frictionless surface as shown in the figure. Block C is pulled to the right by a horizontal force of magnitude F that causes the entire system to accelerate. What is the magnitude of the net horizontal force acting on block B due to the strings?



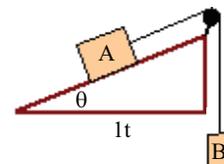
- (1) $F/2$
- (2) $F/3$
- (3) $2F/3$
- (4) zero
- (5) F

9. 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 $m_2 = 5m_1$ what is the magnitude of the acceleration of block 2 when released from rest?



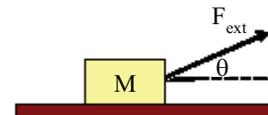
- (1) $2g/3$
- (2) $g/2$
- (3) $g/3$
- (4) $g/5$
- (5) $g/4$

10. The mass of block A is M_A and the mass of block B is M_B , and the angle θ is 30° , as shown in the figure. If block A is at rest, and if $M_A = M_B$, what is the minimum static coefficient of friction such that it will remain at rest after it is released?



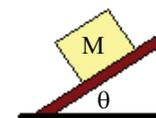
- (1) 0.577
- (2) 0.385
- (3) 0.192
- (4) 0.333
- (5) 0.144

11. Near the surface of the Earth, a block of mass $M = 2$ kg slides along the floor while an external force F_{ext} is applied at an upward angle $\theta = 26^\circ$. If the coefficient of kinetic friction between the block and the floor is 0.488, and the magnitude of the acceleration of the block is 1.89 m/s^2 , what is the magnitude of the external force?



- (1) 12 N
- (2) 10 N
- (3) 24 N
- (4) 6 N
- (5) 2 N

12. Near the surface of the Earth, a block of mass M is at rest on a plane inclined at angle θ to the horizontal. If the coefficient of static friction between the block and the surface of the plane is 0.7, what is the largest angle θ without the block sliding?



- (1) 35°
- (2) 30°
- (3) 60°
- (4) 45°
- (5) 25°

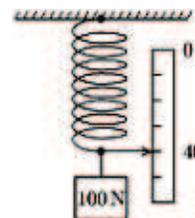
13. Near the surface of the Earth a stone of mass M sits at rest on an elastic spring (*i.e.*, Hooke's Law spring) which is compressed a distance d by the stone. What is the spring constant k ?

(1) Mg/d (2) $Mg/(2d)$ (3) $2Mg/d$ (4) $2Mg/d^2$ (5) Mgd

14. 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

15. An ideal spring, with a pointer attached to its end, hangs next to a linear scale. With a 100-N weight attached, the pointer indicates "40" on the scale as shown. Using a 200-N weight instead results in "60" on the scale. Using an unknown weight W instead results in "30" on the scale. The weight of W is

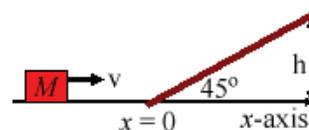


(1) 50 N (2) 75 N (3) 60 N (4) 40 N (5) 25 N

16. 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 of 4.9 m. The magnitude of the impulse due to the collision with the sidewalk is:

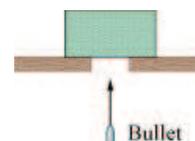
(1) 14.7 N·s (2) 4.9 N·s (3) 19.6 N·s (4) 8.3 N·s (5) 16.6 N·s

17. Near the surface of the Earth a block of mass M and initial velocity 16.97 m/s is sliding to the right along the (negative) x -axis as shown. The surface is frictionless for $x < 0$. At $x = 0$ the block encounters a 45° incline ramp. If the block stops at a height $h = 9.8$ m, what is the kinetic coefficient of friction of the ramp?



(1) 0.50 (2) 0.25 (3) 0.75 (4) 0.35 (5) 0.20

18. Near the surface of the Earth, a bullet 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 mass of the block is 250 times the mass of the bullet, to what maximum height does the block then rise above its initial position?



(1) 20.4 cm (2) 10.2 cm (3) 30.6 cm (4) 5.1 cm (5) 9.8 cm

19. A 75-kg 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. What is the new speed of the cart?

(1) 10 m/s (2) 7.5 m/s (3) zero (4) 2.5 m/s (5) 5 m/s

20. A horizontal force of magnitude 35 N pushes a block of mass 4 kg across a floor where the coefficient of kinetic friction is 0.6. What is the increase in the kinetic energy of the block when the block slides through a displacement of 5 m across the floor?

(1) 57.4 J (2) 117.6 J (3) 175 J (4) 196 J (5) 28.7 J

