

Physics 111 Practice Final Exam, Spring 2013, Version A

STUDENTS: PLEASE NOTE that this practice exam is only a small selection of possible problems which could be on the final. While all of these problems would be 'fair game' for the final exam, there will be problems on the final exam which are NOT represented in this practice exam. Please use other practice exams, common exams from this year, online HW problem sets, and class examples as other sources for your final exam preparation.

Name (Print): _____ 4 Digit ID: _____ Section: _____

Honors Code Pledge: For ethical and fairness reasons all students are pledged to comply with the provisions of the NJIT Academic Honor Code. You must answer the exam questions entirely by yourself. **Turn off all cell phones, pagers, or other communication devices.** Use only your own calculator.

Instructions:

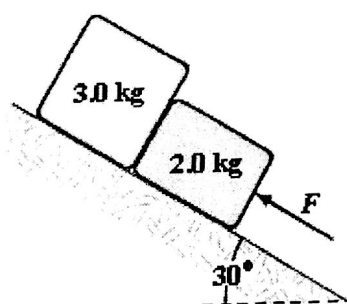
- First, write your name and section number on **both** the Scantron card and this exam sheet.
- Use the formula sheet (last exam booklet page) and no other materials.
- Budget your time. There are 25 multiple choice problems.
- Answer each question on the Scantron card using #2 pencil. Also circle your answers on question papers.
- Do not hesitate to ask for clarification of any exam question, if needed, from your proctor or Professor.

A

1. A particle moving with a constant acceleration has a velocity of 20 cm/s when its position is $x = 10$ cm. Its position 7.0 s later is $x = -30$ cm. What is the acceleration of the particle?

- a. -7.3 cm/s^2
- b. -8.9 cm/s^2
- c. -11 cm/s^2
- d. -15 cm/s^2
- e. -13 cm/s^2

2. The surface of the inclined plane shown is frictionless. If $F = 30 \text{ N}$, what is the magnitude of the force exerted on the 3.0-kg block by the 2.0-kg block?



- a. 18 N
- b. 27 N
- c. 24 N
- d. 21 N
- e. 15 N

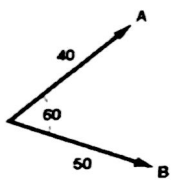
3. The position of a particle moving along the x axis is given by $x = 6.0t^2 - 1.0t^3$, where x is in meters and t in seconds. What is the position of the particle when it achieves its maximum speed in the positive x direction?

- a. 24 m
- b. 12 m
- c. 32 m
- d. 16 m
- e. 2.0 m

4. At $t = 0$, a particle leaves the origin with a velocity of 9.0 m/s in the positive y direction and moves in the xy plane with a constant acceleration of $(2.0\mathbf{i} - 4.0\mathbf{j}) \text{ m/s}^2$. At the instant the x coordinate of the particle is 15 m, what is the speed of the particle?

- a. 10 m/s
- b. 16 m/s
- c. 12 m/s
- d. 14 m/s
- e. 26 m/s

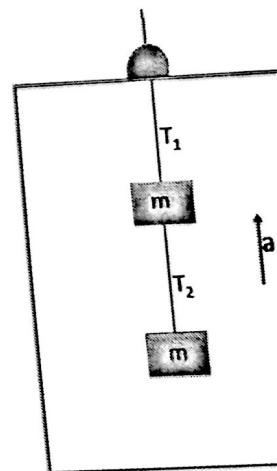
5. Vectors \vec{A} and \vec{B} are shown. What is the magnitude of a vector \vec{C} if $\vec{C} = \vec{A} - \vec{B}$?



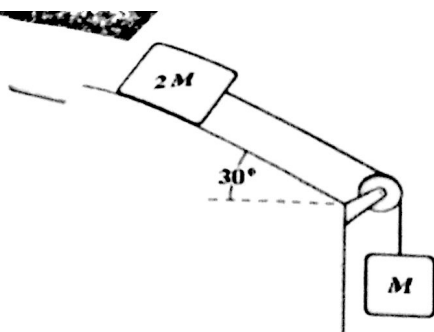
- a. 46
- b. 10
- c. 30
- d. 78
- e. 90

6. Two blocks, each of mass $m = 3.5 \text{ kg}$, are hung from the ceiling of an elevator as shown in the picture. If the elevator moves with an upward acceleration of magnitude 1.6 m/s^2 , find the tension T_1 and T_2 in the upper and lower strings.

- A) $T_1 = 79.8 \text{ N}$ and $T_2 = 39.9 \text{ N}$
- B) $T_1 = 32.8 \text{ N}$ and $T_2 = 50.2 \text{ N}$
- C) $T_1 = 14.2 \text{ N}$ and $T_2 = 2 \text{ N}$
- D) $T_1 = 93.2 \text{ N}$ and $T_2 = 84 \text{ N}$
- E) $T_1 = 5.8 \text{ N}$ and $T_2 = 45.9 \text{ N}$

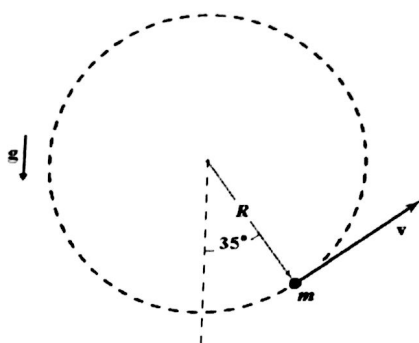


7. In the figure shown, the coefficient of kinetic friction between the block and the incline is 0.29. What is the magnitude of the acceleration of the suspended block as it falls? Disregard any pulley mass or friction in the pulley.



- a. 5.4 m/s^2
- b. 5.2 m/s^2
- c. **4.9 m/s^2**
- d. 5.6 m/s^2
- e. 7.9 m/s^2

8. A 4.0-kg mass attached to the end of a string swings in a vertical circle of radius 2.0 m. When the string makes an angle of 35° with the vertical as shown, the speed of the mass is 5.0 m/s. At this instant what is the magnitude of the force the string exerts on the mass?



- a. 50 N
- b. **82 N**
- c. 89 N
- d. 11 N
- e. 61 N

9. If the scalar product of two vectors, \vec{A} and \vec{C} , is equal to -3.5 , if $|\vec{A}| = 2.0$, and the angle between the two vectors when drawn starting from the same point is equal to 130° , what is the magnitude of \vec{C} ?

- a. 2.1
- b. 2.5
- c. 2.3
- d. **2.7**
- e. 3.1

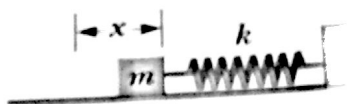
10. A 5.0-kg object is pulled along a horizontal surface at a constant speed by a 15-N force acting 20° above the horizontal. How much work is done by this force as the object moves 6.0 m?

- a. 78 J
- b. **82 J**

- c. 88 J
- d. 94 J
- e. 43 J

11. A 20-kg block on a horizontal surface is attached to a light spring (force constant = 8.0 kN/m). The block is pulled 10 cm to the right from its equilibrium position and released from rest. When the block has moved 2.0 cm TOWARDS its equilibrium position, its kinetic energy is 13 J. How much work is done by the frictional force on the block as it moves the 2.0 cm?

- a. -2.5 J
- b. -1.4 J
- c. -3.0 J
- d. -1.9 J
- e. -14 J



12. If $\mathbf{A} \cdot \mathbf{C} = -7.5$, $\mathbf{A} = 3\mathbf{i} - 4\mathbf{j}$, and $|\mathbf{C}| = 6.5$, what is the angle between the two vectors when they are drawn starting from the same point?

- a. 118°
- b. 107°
- c. 112°
- d. 103°
- e. 70°

13. A 12-kg projectile is launched with an initial vertical speed of 20 m/s. It rises to a maximum height of 18 m above the launch point. What is the change in mechanical energy caused by the dissipative (air) resistive force on the projectile during this ascent?

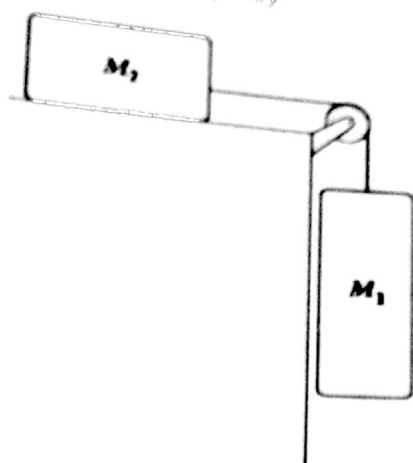
- a. -0.64 kJ
- b. -0.40 kJ
- c. -0.52 kJ
- d. -0.28 kJ
- e. -0.76 kJ

14. An all-terrain vehicle of 2 000 kg mass moves up a 15.0° slope at a constant velocity of 6.00 m/s. The rate of change of gravitational potential energy with time is

- a. 5.25 kW.
- b. 24.8 kW.
- c. 30.4 kW.
- d. 118 kW.
- e. 439 kW.

15. A 4.0-kg particle is moving horizontally with a speed of 5.0 m/s when it strikes a vertical wall. The particle rebounds of 3.0 m/s. What is the magnitude of the impulse delivered to the particle?

16. A mass ($M_1 = 5.0 \text{ kg}$) is connected by a light cord to a mass ($M_2 = 4.0 \text{ kg}$) which slides on a smooth surface, as shown in the figure. The pulley (radius = 0.20 m) rotates about a frictionless axle. The acceleration of M_2 is 1.5 m/s^2 . What is the moment of inertia of the pulley?



- a. $0.29 \text{ kg}\cdot\text{m}^2$
- b. $0.42 \text{ kg}\cdot\text{m}^2$
- c. $0.20 \text{ kg}\cdot\text{m}^2$
- d. $0.62 \text{ kg}\cdot\text{m}^2$
- e. $0.60 \text{ kg}\cdot\text{m}^2$

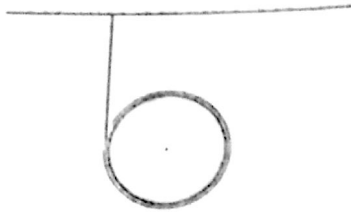
17. A uniform rod (mass = 2.0 kg , length = 0.60 m) is free to rotate about a frictionless pivot at one end. The rod is released from the horizontal position. What is the magnitude of the angular acceleration of the rod at the instant it is 60° below the horizontal?

- a. 15 rad/s^2
- b. 12 rad/s^2
- c. 18 rad/s^2
- d. 29 rad/s^2
- e. 23 rad/s^2

18. A wheel spins about an axis with a rotation angle given by the equation $\theta(t) = t^3 / 9 - 3t + 10$ (with θ in radians and t in seconds). What is the angular velocity at $t = 3$ second?

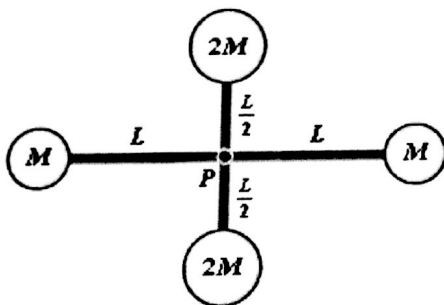
- A) Impossible to determine without knowing the wheel's moment of inertia
- B) 3 rad/s
- C) 2 rad/s
- D) 4 rad/s
- E) 0

19. A massless rope is wrapped around a uniform cylinder that has radius R and mass M , as shown in the figure. Initially, the unwrapped portion of the rope is vertical and the cylinder is horizontal. The linear acceleration of the cylinder is



- a. $(2/3)g$
- b. $(1/2)g$
- c. $(1/3)g$
- d. $(1/6)g$
- e. $(5/6)g$

20. The rigid object shown is rotated about an axis perpendicular to the paper and through point P. The total kinetic energy of the object as it rotates is equal to 1.4 J. If $M = 1.3$ kg and $L = 0.50$ m, what is the angular velocity of the object? Neglect the mass of the connecting rods and treat the masses as particles.

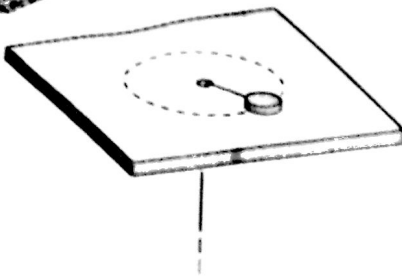


- a. 1.3 rad/s
- b. 1.5 rad/s
- c. 1.7 rad/s
- d. 1.2 rad/s
- e. 2.1 rad/s

21. A particle located at the position vector $\hat{r} = (\hat{i} + \hat{j})$ m has a force $\vec{F} = (2\hat{i} + 3\hat{j})$ N acting on it. The torque about the origin is

- a. $(1\hat{k})\text{N}\cdot\text{m}$
- b. $(5\hat{k})\text{N}\cdot\text{m}$
- c. $(-1\hat{k})\text{N}\cdot\text{m}$
- d. $(-5\hat{k})\text{N}\cdot\text{m}$
- e. $(2\hat{i} + 3\hat{j})\text{N}\cdot\text{m}$

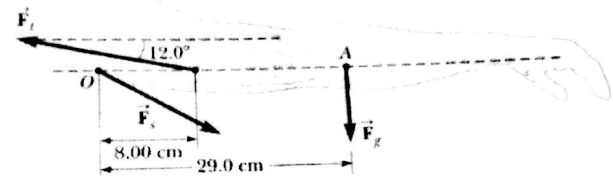
22. A puck on a frictionless air hockey table has a mass of 5.0 kg and is attached to a cord passing through a hole in the surface as in the figure. The puck is revolving at a distance 2.0 m from the hole with an angular velocity of 3.0 rad/s. The angular momentum of the puck (in $\text{kg}\cdot\text{m}^2/\text{s}$) is



- a. 80
- b. 20
- c. 30
- d. 60
- e. 50

23. The arm in the figure below weighs 41.5N. The center of mass on the arm acts through point A. \vec{F}_s is the force exerted by the shoulder on the upper arm bone. Determine the magnitude of the tension force \vec{F}_t in the deltoid muscle to hold the arm in the position shown.

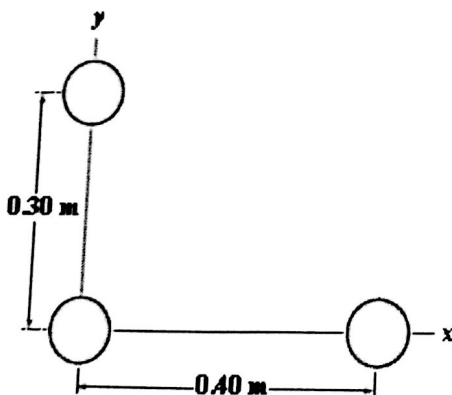
- A) 3.46 N
- B) 724 N**
- C) 179 N
- D) 571 N
- E) 9.8 N



24. A satellite circles planet Roton every 2.8 h in an orbit having a radius of 1.2×10^7 m. If the radius of Roton is 5.0×10^6 m, what is the magnitude of the free-fall acceleration on the surface of Roton?

- a. 31 m/s^2
- b. 27 m/s^2**
- c. 34 m/s^2
- d. 40 m/s^2
- e. 19 m/s^2

25. Three 5.0-kg masses are located at points in the xy plane, as shown. What is the magnitude of the resultant force (caused by the other two masses) on the mass at $x = 0, y = 0.30$ m?



- a. $2.6 \times 10^{-8} \text{ N}$

- b. $2.0 \times 10^{-8} \text{ N}$
- c. $2.9 \times 10^{-8} \text{ N}$
- d. $2.3 \times 10^{-8} \text{ N}$
- e. $2.1 \times 10^{-8} \text{ N}$