PHYS 111 FINAL EXAM

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

Honors Code Pledge: *As an NJIT student I* _____, *pledge to comply with the provisions of the NJIT Academic Honor Code. I assert that I have not violated the NJIT Academic Honor Code.*

Instructions:

- First, write your name and section number on **both** the Scantron card and this exam sheet.
- Use the formula sheet (last exam sheet) and no other materials. The exam is "closed book".
- All electronic devices (e.g. cell phones, etc) except calculators must be turned off and put away.
- Budget your time to about 6 minutes/question. (150 minutes/25 questions).
- The questions are all worth the same amount of credit.
- You must show how you got your answers on this set of exam sheets. Use the back if necessary. No work = No credit.

1. An automobile traveling along a straight road increases its speed from 30.0 m/s to 50.0 m/s in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?

a. 6.00 s
b. 4.50 s
c. 3.60 s
d. 4.00 s
e. 9.00 s

2. A ball thrown vertically from ground level is caught 3.0 s later by a person on a balcony who is 14 m above the ground. Determine the initial speed of the ball.

a. 19 m/s
b. 4.7 m/s
c. 10 m/s
d. 34 m/s
e. 17 m/s

3. A student walks 10 miles at an angle of 30° relative to the +x axis and then 25 mile in a direction 130° relative to the +x axis . What is the direction of his final position (with respect to the + axis) relative to his initial position?

a. 17°
b. 73°
c. 107°
d. 163°
e. 100°

4. A particle leaves the origin with a velocity of 7.2 m/s in the positive y direction and moves in the xy plane with a constant acceleration of $(3.0\hat{\mathbf{i}} - 2.0\hat{\mathbf{j}})$ m/s^2. What is the value of its x coordinate at t = 10 s?

a. 30 m
b. 91 m
c. 54 m
d. 78 m
e. 150 m

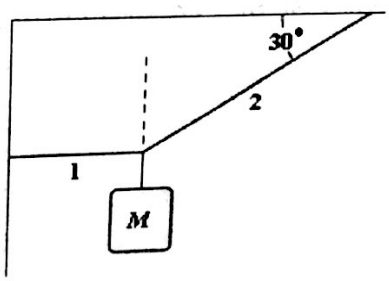
5. The initial speed of a cannon ball fired at a 37° angle relative to the horizontal is 0.20 km/s. What is the approximate total time of flight for the ball if its target is at the same height as the launch point? (use closest answer).

a. 16 s
b. 21 s
c. 25 s
d. 14 s
e. 19 s

6. A race car moving with a constant speed of 60 m/s completes one lap around a circular track in 50 s. What is the magnitude of the acceleration of the race car?

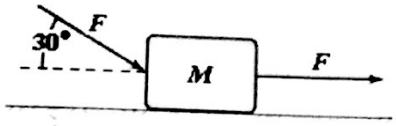
a. 8.8 m/s^2
b. 7.5 m/s^2
c. 9.4 m/s^2
d. 6.3 m/s^2
e. 5.3 m/s^2

7. If M = 2.0 kg, what is the tension in string 1?



a. 1.2 N
b. 11 N
c. 34 N
d. 3.5 N
e. 40 N

8. The horizontal surface on which the block slides is frictionless. If $F = 20$ N and $M = 5.0$ kg, what is the magnitude of the resulting acceleration of the block?

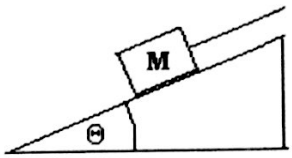


a. 5.3 m/s^2
b. 6.2 m/s^2
c. 7.5 m/s^2
d. 4.7 m/s^2
e. 3.2 m/s^2

9. A point particle of 0.2 kg mass at a distance $\vec{r} = 3\hat{i} - 4\hat{j}$ (meters) from the origin experiences a force $\vec{F} = -25\hat{i} + 75\hat{k}$ (Newtons). The angular acceleration with respect to the origin is given by (rad/s^2):

a. $-12\hat{i} - 9\hat{j} - 4\hat{k}$
b. $-1.2\hat{i} - 8.5\hat{j} - 0.3\hat{k}$
c. $-60\hat{i} - 45\hat{j} - 20\hat{k}$
d. $-10\hat{i} + 75\hat{j} - 120\hat{k}$
e. $-0.1\hat{i} - 50\hat{j} - 60\hat{k}$

10. A 1.0-kg block is pushed up a rough 22° inclined plane by a force of 7.0 N acting parallel to the incline. The acceleration of the block is 1.4 m/s^2 up the incline. Determine the magnitude of the force of friction acting on the block.



a. 1.9 N
b. 2.2 N
c. 1.3 N
d. 1.6 N
e. 3.3 N

11. A 1000 kg car enters a level, unbanked semi-circular turn of 100 m radius at a speed of 26 m/s. The coefficient of friction between the tires and the road is $\mu = 0.800$. If the car maintains a constant speed of 26 m/s, it will

a. attempt to dig into the road surface.
b. tend to veer toward the center of the semicircle.
c. arrive safely at the end of the semicircle.
d. tend to veer toward the outside of the circle.
e. veer toward the center for the first quarter-circle, then veer toward the outside for the second quarter-circle.

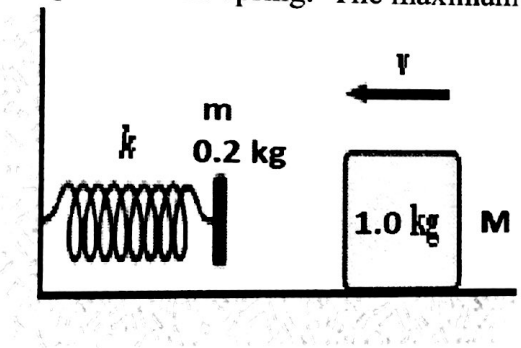
12. A 60 kg skier starts from rest from the top of a 50 m high slope. If the work done by friction is -6.0×10^3 J, what is the approximate speed of the skier on reaching the bottom of the slope?

a. 42 m/s
b. 34 m/s
c. 28 m/s
d. 20 m/s
e. 17 m/s

13. A constant force of 12 N in the positive x direction acts on a 4.0-kg object as it moves from the origin to the point $\left(6\hat{i} - 8\hat{j}\right)$ m. How much work is done by the given force during this displacement?

a. +60 J
b. +84 J
c. +72 J
d. +48 J
e. +57 J

14. A horizontal massless spring of force constant k = 120 N/m is attached to a mass m = 0.20 kg as shown. A mass (M) of 1.0 kg slides on the surface with a speed of 6.0 m/s towards the spring. It sticks to m and compresses the spring. The maximum distance by which the spring is compressed is (in cm)

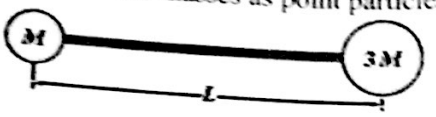


a. 50 cm
b. 40 cm
c. 54 cm
d. 27 cm
e. 35 cm

15. A 5.0-kg object moving 5.0 m/s collides with and sticks to a 5.0-kg object moving at 2.0 m/s in the opposite direction. Determine the kinetic energy lost by the system as a result of this collision.

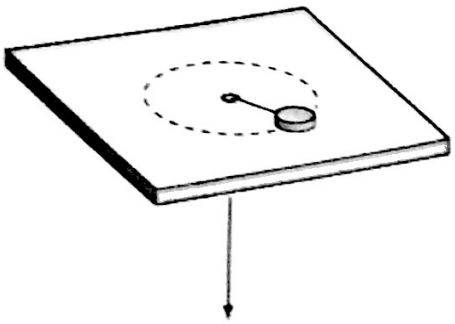
a. 0 J
b. 15 J
c. 35 J
d. 25 J
e. 61 J

16. The rigid body shown rotates about an axis through the center of mass of the smaller mass on the left and perpendicular to the paper. If $M = 2.0$ kg and $L = 80$ cm, what is the approximate kinetic energy of this object when its angular speed about this axis is equal to 5.0 rad/s? Neglect the mass of the connecting rod and treat the masses as point particles.



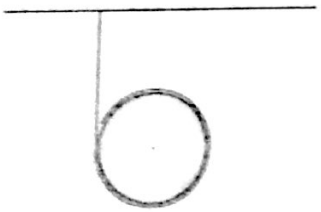
a. 18 J
b. 15 J
c. 48 J
d. 23 J
e. 26 J

17. 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 and anchored to the floor. The puck is revolving at a distance 2.0 m from the hole with an angular velocity of 3.0 rad/s. The approximate angular momentum of the puck (in kg·m^2/s) is



a. 80
b. 20
c. 30
d. 60
e. 120

18. One end of a massless rope is tied to the ceiling and the other end is wrapped around a uniform cylinder of radius R and mass M as shown in the figure. When the cylinder is dropped from rest and the unwrapped rope remains vertical, the linear acceleration of the cylinder is

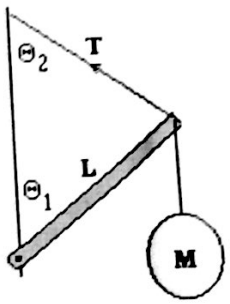


a. (2/3)g
b. (1/2)g
c. (1/3)g
d. (1/6)g
e. (5/6)g

19. The figure shows a uniform rod (length $L = 2.0$ m, mass = 3.0 kg) pivoted about an axis which is at a distance $d = 0.25$ m above its center of mass. The moment of inertia (in kgm^2) about the pivot point is

a. 0.125
b. 0.75
c. 1.20
d. 1.45
e. 0.04

20. A uniform beam of length 5.5 m and negligible mass is attached to the vertical wall and supports a 1176 N ball as shown in the figure. If $\theta_1 = 38^0$ and $\theta_2 = 42^0$ what is the tension T in the cable?



a. 146 N
b. 292 N
c. 342 N
d. 514 N
e. 735 N

21. An earth's satellite with a mass of 500 kg orbits the earth at a distance 480 km from the earth surface. What is the linear speed of the satellite? ($M_E = 5.98 \times 10^{24}$ kg, $R_E = 6.37 \times 10^6$m)

a. 2200 m/s
b. 3825 m/s
c. 7630 m/s
d. 7030 m/s
e. 7910 m/s

22. Planet Zero has a mass of 5.0×10^{23} kg and a radius of 2.0×10^6 m. A space probe is launched vertically from the surface of Zero with an initial speed of 4.0 km/s. What is the speed of the probe when it is 3.0×10^6 m from Zero's center?

a. 3.0 km/s
b. 2.2 km/s
c. 1.6 km/s
d. 3.7 km/s
e. 5.9 km/s

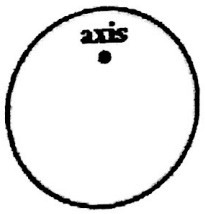
23. The oscillation of a 2.0-kg mass on a spring is described by $x = 3.0\cos(4.0t + 0.80)$ where x is in centimeters and t is in seconds. What is the force constant of the spring?

a. 4.0 N/m
b. 0.80 N/m
c. 16 N/m
d. 32 N/m
e. 2.0π N/m

24. The motion of a particle connected to a spring is described by $x = 10 \sin(\pi t)$. At what time (in s) is the potential energy equal to the kinetic energy?

a. 0
b. 0.25
c. 0.50
d. 0.33
e. 1.0

25. In the figure below, a disk (radius $R = 1.0$ m, mass = 2.0 kg) is suspended from a pivot a distance $d =$ 0.25 m above its center of mass. For a circular disk, $I_{cm} = \frac{1}{2}mR^2$. The angular frequency (in rad/s) for small oscillations is approximately



a. 4.2
b. 2.1
c. 1.5
d. 1.0
e. 3.8

Solution to Final Exam Spring 2012. Note, these are my answers based on a quick once-over, so beware that I may have made mistakes! If you spot any errors, please bring them to my attention. –Dr. Gary

1. B
2. A
3. C
4. E
5. C
6. B
7. C
8. C
9. C
10. A
11. C
12. C
13. D
14. A
15. E
16. C
17. D
18. A
19. C
20. E
21. C
22. B
23. D
24. C
25. B