Phys 211 / 211A / 216
Sample Test #2
University Physics I/IA

NAME: (1 point) _____

Circle your professor:

Chabot	**Maharjan**		**Narayanan**
Trayling	**Aditya Y.G.**	**Vazquez**	**Zwickl**

Section # or Class Time: _____

Scores: Do <u>not</u> write on this page

0. _____/1 (point for name)

1. _____/3

2. _____/3

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10. _____/3

11. _____/3

12. _____/3

13. _____/3

14. _____/20

15. _____/20

16. _____/20

TOTAL/100

Part I: Multiple Choice (3 points each).

Circle <u>one</u> answer for each question in a clear and unambiguous way.

1. In the Metric (SI) system, the unit joule [J] is equivalent to

A. kg·m/s
B. $kg \cdot m/s^2$
C. $kg \cdot m^2/s^2$
D. $kg \cdot m^3/s^2$
E. $kg \cdot m^2$

2. A particle is displaced by $\Delta\vec{r} = (30.0\text{ m})\hat{\imath} - (10.0\text{ m})\hat{\jmath}$ while being acted upon by a constant force $\vec{F} = (1.00\text{ N})\hat{\imath} - (2.00\text{ N})\hat{\jmath} - (3.00\text{ N})\hat{k}$. The work done on the particle by this force is

A. - 10.0 J
B. 0 J
C. 10.0 J
D. 50.0 J
E. impossible to calculate without knowing what other forces might be involved

3. A force acting upon a particle is called conservative if

A. it obeys Newton's Second Law
B. it obeys Newton's Third Law
C. its work equals the change in the kinetic energy of the particle
D. its work is independent of the path between any two points
E. it is not a frictional force

4. An object moves in a circular path at constant speed. The work done by the centripetal (radial) force is zero because

A. the magnitude of the acceleration is zero
B. the average force for each revolution is zero
C. there is no friction
D. the displacement for each revolution is zero
E. the centripetal (radial) force is perpendicular to the velocity

5. An object moving along the x-axis is acted on by a force F_x that varies with position as shown. How much work is done by this force on the object as it moves from x = 2.00 m to x = 8.00 m?

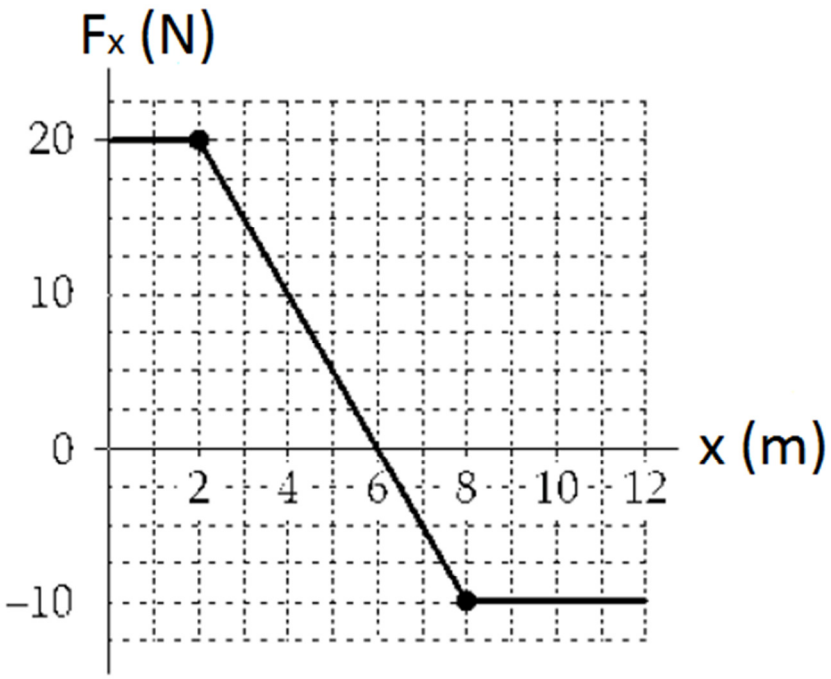
A. -30.0 J

B. -10.0 J

C. 10.0 J

D. 30.0 J

E. 60.0 J

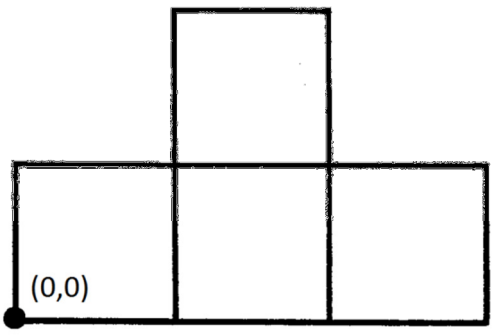


6. The potential energy of a body of mass m is given by $U = \frac{1}{2}kx^2 + mgx + 5$. The corresponding force on the mass is

A. $kx^3/6 - mgx^2/2 + 5x$
B. $-kx^3/6 - mgx^2/2 + 5$
C. $kx/2 + mg$
D. $kx + mg$
E. $-kx - mg$

7. Four squares of equal mass and sides of length L are arranged as shown with the origin at the lower left. The (x,y) coordinates of the center of mass of the object are:

A. (3L/2, 3L/16)
B. (3L/2, 3L/8)
C. (3L/2, 3L/4)
D. (3L/2, L)
E. (3L/2, 3L/2)



8. A block is given an initial speed v and then moves across a level surface with coefficient of kinetic friction μ_k. How far does it travel across the rough surface before stopping?

A. $\sqrt{\frac{2\mu_k g}{m}}$

B. $\sqrt{2\mu_k mg}$

C. $\frac{mv^2}{2\mu_k g}$

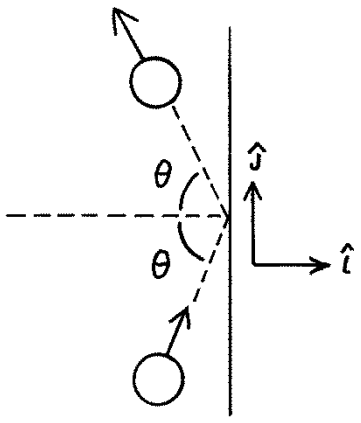
D. $\frac{v^2}{2\mu_k g}$

E. $\frac{mv^2}{\mu_k}$

9. A 5.00 kg object is acted on by a net force in the x-direction that does 600 J of work as it moves a distance of 2.00 m in 6.00 s. The average power being applied to the object is:

A. 100 W
B. 200 W
C. 900 W
D. 2400 W
E. 3600 W

10. A ball of mass m strikes a massive wall at speed v_o at an angle θ with the normal to the wall. It bounces off with the same speed and angle. If the ball is in contact with the wall for a time t, what is the magnitude of the impulse applied to the ball by the wall?



A. $2mv_0$

B. $2mv_o \sin\theta$

C. $2mv_o \cos\theta$

D. $mv_0 \tan\theta$

E. mv_0/t

11. A ball of unknown mass is thrown off of a building of height *h* at some unknown angle. Its speed just before striking the level ground below is v_f. What is the initial speed of the ball, ignoring air resistance?

A. $\sqrt{{v_f}^2 + 2hg}$

B. $\sqrt{{v_f}^2 - 2hg}$

C. $\sqrt{-{v_f}^2 + 2hg}$

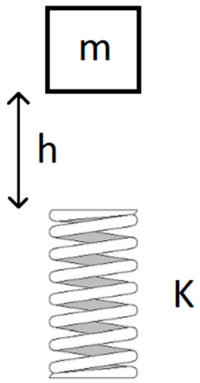
D. One needs to also know both the launch angle and the mass to answer this.

E. One needs to also know the launch angle, but not the mass, in order to answer this.

12. A force is given by $F(t) = 3.0\ t^2$. It acts on an object from t = 0 until t = 3.0 s. The object has a mass of 9.0 kg and starts from rest. What is the speed of the object at 3.0 seconds?

A. 2.4 m/s
B. 3.0 m/s
C. 5.2 m/s
D. 18 m/s
E. 27 m/s

13. A block of mass m drops from rest a height h onto a spring with a spring constant k. The collision between the block and the spring is elastic and there are no frictional forces involved. The greatest compression y_m of the spring can be found by;



A. setting $mgh = \frac{1}{2}ky_m^2$
B. setting $mg = ky_m$
C. setting $mgh = \frac{1}{2}k(h + y_m)^2$
D. setting $mg(h + y_m) = \frac{1}{2}ky_m^2$
E. None of the above will work because momentum is not conserved when the block collides with the spring.

THE FOLLOWING PAGES GIVES FOUR EXAMPLES OF EXAM-APPROPRIATE "LONG PROBLEMS" WHERE PARTIAL CREDIT IS ALLOWED.

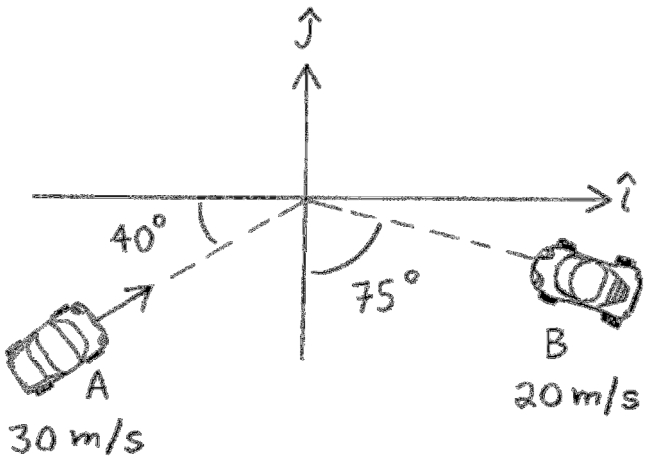
THE ACTUAL EXAM WILL ONLY HAVE THREE LONG PROBLEMS, WORTH ROUGHLY 20 POINTS EACH.

For all long problems, you must show all work completely, legibly and in logical order, starting with basic concepts.

Long problem Example 1:

Car A of mass 800 kg and car B of mass 1200 kg are headed towards each other as shown (top view). Immediately before impact, car A has a speed of 30.0 m/s and makes and angle of 40^o with the x-axis as shown. Car B has a speed of 20.0 m/s and makes and angle of 75^o with the y-axis as shown. After the collision, the cars stick together and move as one.

a) What is the velocity of the cars immediately after the collision, expressed in unit **vector (Cartesian) notation**. Clearly show all work for full credit.



b) Is the collision elastic or inelastic? Justify you answer with some sort of calculation.

Long problem Example 2:

A crate of mass 15 kg is on a level floor that has a coefficient of kinetic friction of 0.230. A person is pushing the crate across the floor by applying a force parallel to the ground. They are getting tired as they push so the force they exert is given by $F = (80 – 10x)$ N, where $x = 0$ is the starting position. They push the crate from rest a total of 5.0 m.

a) What is the work done by the normal force?

b) What is the work done by the force of gravity?

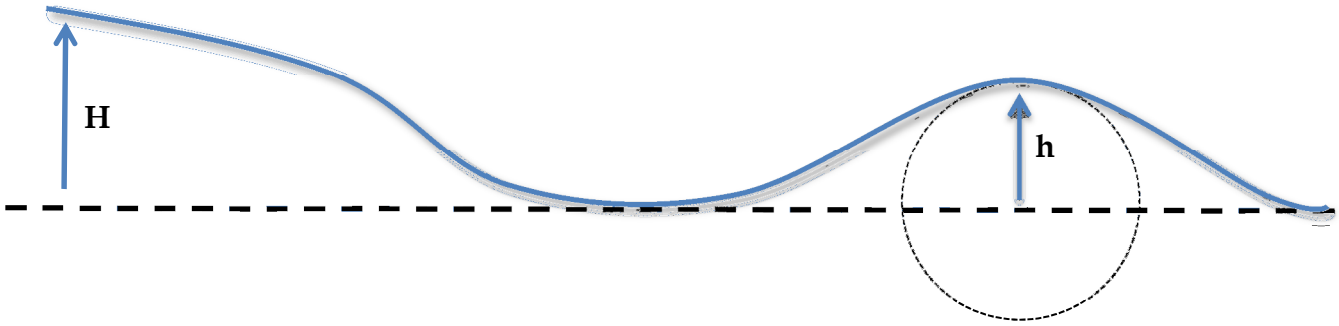
c) What is the work done by the force of friction?

d) What is the work done by the person's pushing force?

e) What is the speed of the block at 5.0 m?

Long problem Example 3:

A block of mass m starts from rest at the top of a frictionless hill of height H. It slides down the hill and then over another hill of height h as shown. The top of the second smaller hill can be modeled as part of a circle with radius h. If $H = 5h/4$, what is the normal force that the track exerts on the block when it is at the top of the second hill? Express your answer in terms of m and g. If any part of your solution involves a free-body diagram, it must be clearly shown.



Long problem Example 4:

A block of mass *m* travels over a frictionless circular hill of radius and height *R*, as shown. At the top of the hill, the normal force on the moving block is found to be (*mg*/4). The block then continues down the hill, where it collides with and sticks to another block of mass 3*m*. The two blocks then travel through a rough patch of level ground where the coefficient of kinetic friction is μ_k. How far do they travel through the rough patch before coming to rest? Put your answer in terms of m, g, R, and μ_k only.