

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

NAME: (1 point) _____

Circle your professor:

Curie

Einstein

Feynman

Hawking

Meitner

Noether

Section # or Class Time: _____

Scores: Do not write on this page

0. _____/1 (point for name)

1. _____/3

2. _____/3

3. _____/3

4. _____/3

5. _____/3

6. _____/3

7. _____/3

8. _____/3

14. _____/20

9. _____/3

15. _____/20

10. _____/3

16. _____/20

11. _____/3

12. _____/3

TOTAL/100

13. _____/3

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Part I: Multiple Choice (3 points each).

Circle one answer for each question in a clear and unambiguous way.

1. In the Metric (SI) system, the unit joule [J] is equivalent to
 - A. $\text{kg}\cdot\text{m}/\text{s}$
 - B. $\text{kg}\cdot\text{m}/\text{s}^2$
 - C. $\text{kg}\cdot\text{m}^2/\text{s}^2$
 - D. $\text{kg}\cdot\text{m}^3/\text{s}^2$
 - E. $\text{kg}\cdot\text{m}^2$

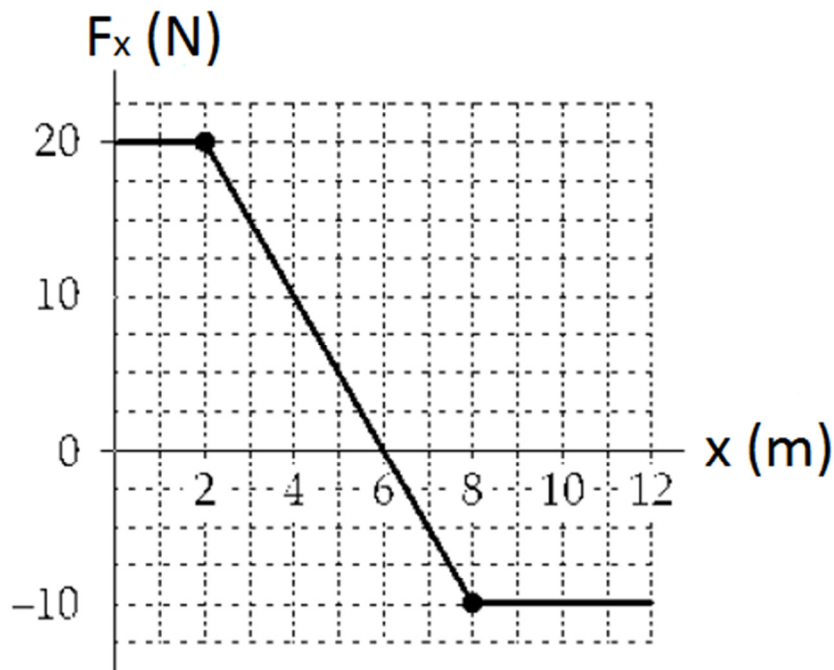
2. A particle is displaced by $\Delta\vec{r} = (30.0\text{ m})\hat{i} - (10.0\text{ m})\hat{j}$ while being acted upon by a constant force $\vec{F} = (1.00\text{ N})\hat{i} - (2.00\text{ N})\hat{j} - (3.00\text{ N})\hat{k}$. The work done on the particle by this force is
 - A. - 10.0 J
 - B. 0 J
 - C. 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

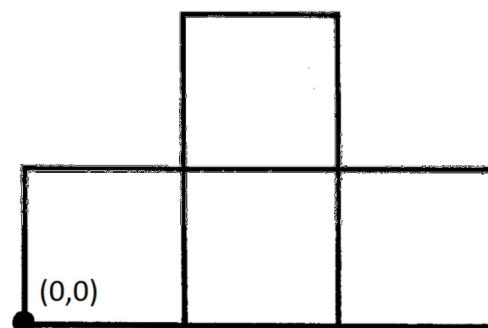


6. The potential energy of a body of mass m is given by $U = \frac{1}{2}kx^2 + mgx + 5$. The corresponding force on the mass is

- 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. $\sqrt{2\mu_k m g}$

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_0 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?

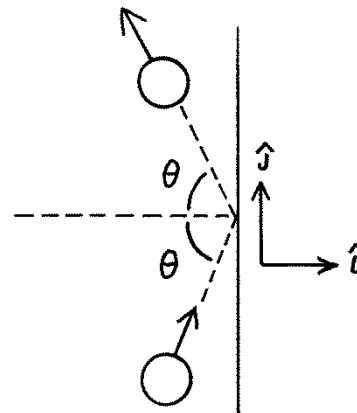
A. $2mv_0$

B. $2mv_0 \sin \theta$

C. $2mv_0 \cos \theta$

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?

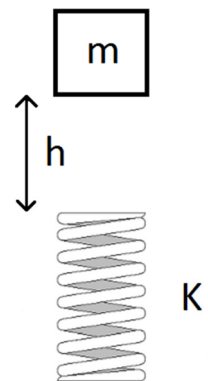
- A. $\sqrt{v_f^2 + 2hg}$
- B. $\sqrt{v_f^2 - 2hg}$
- C. $\sqrt{-v_f^2 + 2hg}$
- D. One needs to also know both the launch angle and the mass to answer this.
- E. One needs to also know the launch angle, but not the mass, in order to answer this.

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.

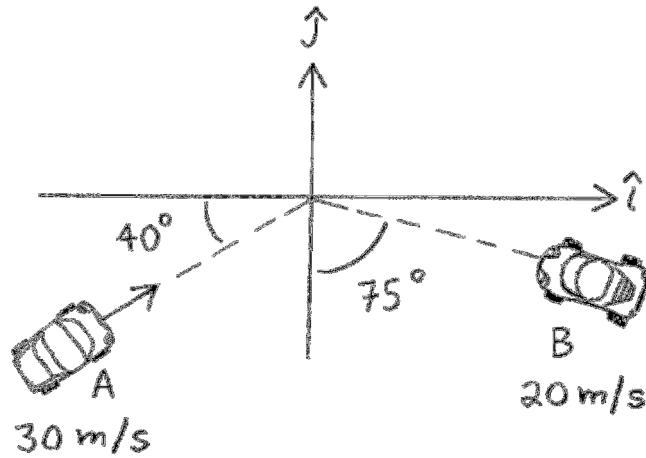
**THE ACTUAL EXAM WILL ONLY HAVE THREE LONG
PROBLEMS, WORTH ROUGHLY 20 POINTS EACH.**

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 an angle of 40° with the x-axis as shown. Car B has a speed of 20.0 m/s and makes an angle of 75° with the y-axis as shown. After the collision, the cars stick together and move as one.

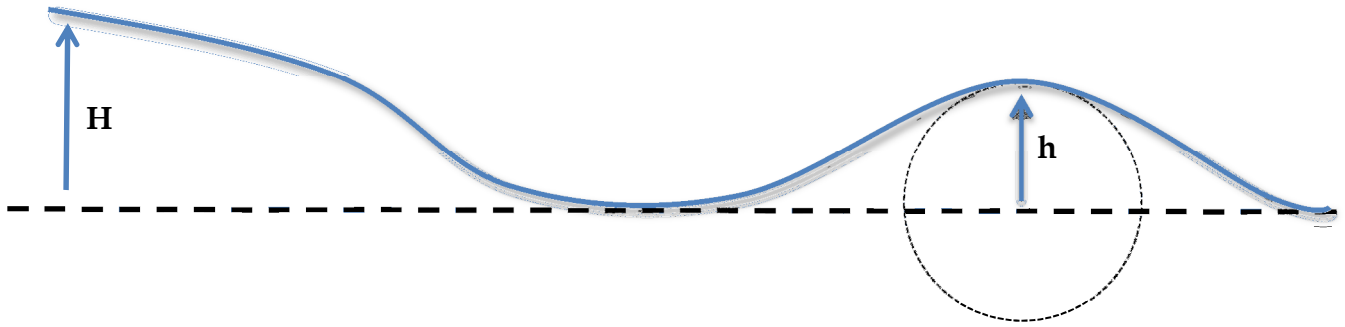
- a) What is the velocity of the cars immediately after the collision, expressed in unit **vector (Cartesian) notation**. Clearly show all work for full credit.



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

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 $3m$. 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.

