Faculty of Engineering and Department of Physics

Engineering Physics 131

Final Examination

April 17, 2010; 2:00 pm – 4:30 pm

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1. No notes or textbooks allowed.
2. Formula sheets are on the last page (may be removed).
3. Non-programmable calculators approved by the Faculty of Engineering permitted.
4. The exam has **8** problems. Attempt all parts of all problems.
5. The value of each problem is indicated below. Budget your time accordingly.
6. Show all work in a neat and logical manner.
7. Box final answers on Questions 4 through 8.
7. Indicate clearly if you use the backs of pages for material to be marked.
8. Turn off all cell-phones, laptops, etc.

DO NOT separate the pages of the exam.

NAME: _____

ID#: _____

Please circle the name of your LECTURE section:

B01: Chow

B02: Isaac

B03: Ru

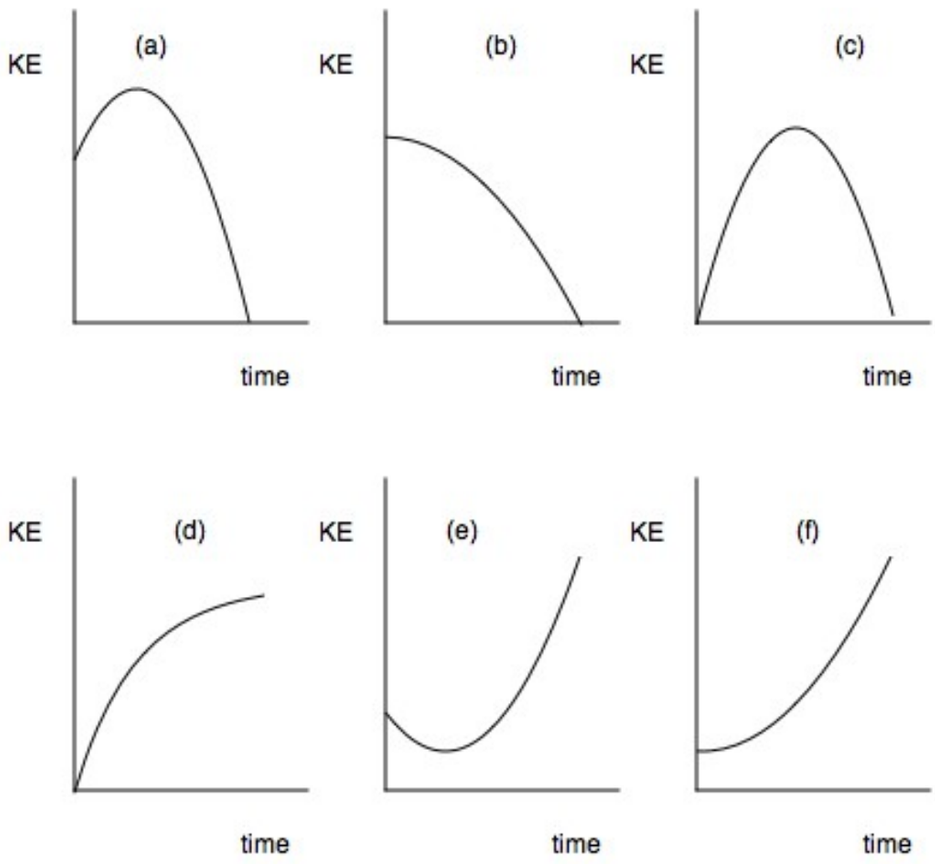
B04: Raboud

B05: Ropchan

B06: Tang

Question	Value	Mark
1	3	
2	3	
3	3	
4	8	
5	9	
6	7	
7	9	
8	8	
Total	**50**	

1. A particle is dropped or launched above or below the horizontal (not necessarily vertically) from the edge of a cliff. During its subsequent motion gravity is the the only force which acts on the particle. Which of the graphs below could possibly represent how the kinetic energy of the particle changes during the flight? The graphs show only a portion of the flight of the particle which occurs from the moment of launch/release to sometime before it hits the ground below.

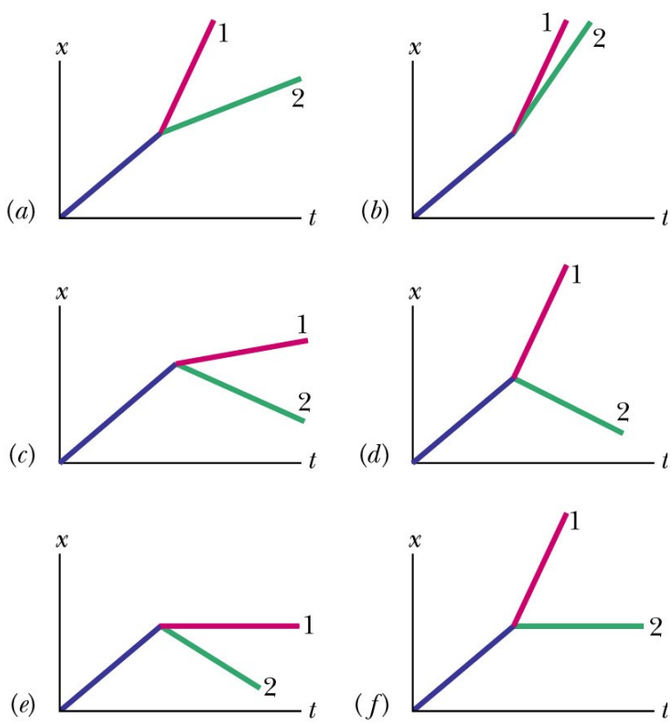


Indicate your answer by checking **either** "Possible" or "Not Possible" for each graph.

Graph	Possible	Not Possible
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		

2. A spaceship is moving along an *x*-axis at a constant speed when it separates into two parts due to an explosion in the engine room. After the explosion, both parts of the ship continue to move along the same *x*-axis.

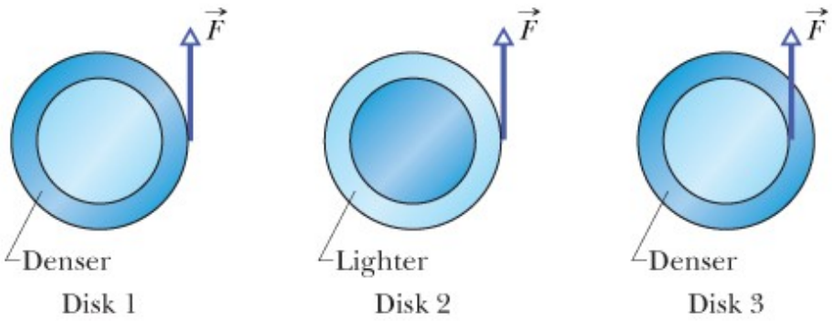
Which of the graphs below could possibly represent the motion (position versus time) of the ship and the two parts of the ship after the explosion?



Indicate your answer by checking **either** “Possible” or “Not Possible” for each graph.

Graph	Possible	Not Possible
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		

3. The figure below shows three flat disks of the same size and shape that can rotate freely about their centers. Each disk consists of the same two materials, one denser than the other. In Disks 1 and 3, the denser material forms the outer half of the disk (by area). In Disk 2 the denser material forms the inner half of the disk (by area). As shown below, forces with identical magnitudes are applied tangentially to the disks, either at the outer edge or at the interface of the two materials as shown.



Rank the disks (greatest first, indicating any ties) according to:

(a) The torque about the center of the disk:

_____

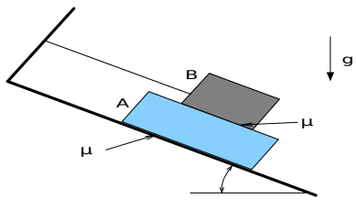
(b) The moment of inertia about the center of the disk:

_____

(c) The angular acceleration of the disk:

_____

4. Two blocks *A* and *B*, each of mass *m,* are on an incline which makes an angle Θ with respect to the horizontal as shown. Block *B* is attached by an inextensible cable to the top of the incline while block *A* slides down the incline. (Note that the cable is parallel to the incline.) The coefficient of kinetic friction between all surfaces in contact is μ.

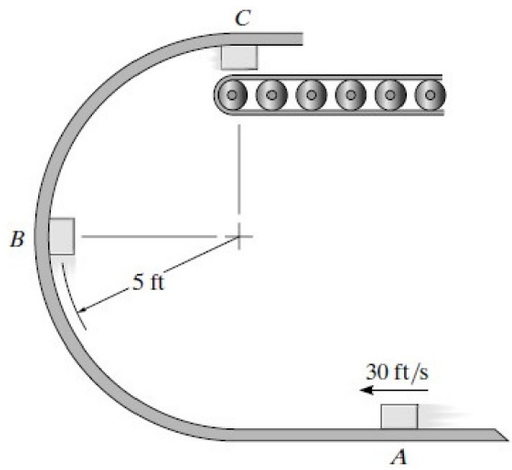


If block *A* is released from rest and begins sliding down the ramp, determine:

(a) The acceleration of block *A*.
(b) The tension *T* in the cable.

Express your answers in terms of *m*, *g*, Θ and μ.

5. A 2 lb block slides onto a smooth circular ramp as shown. If the block has a velocity of 30 ft/s at *A*, determine



(a) The speed of the block when it is at
  (i) Point *B*,
  (ii) Point *C*.

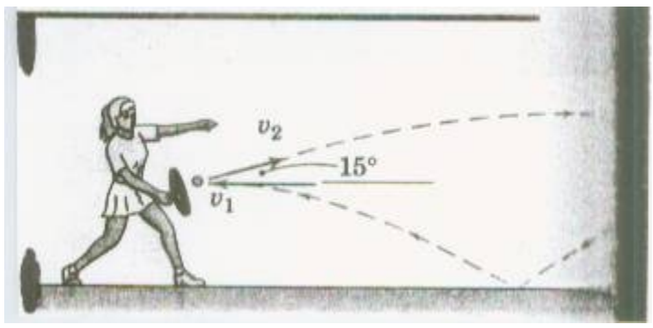
(b) The normal force acting on the block at
  (i) Point *B*,
  (ii) Point *C*.

Assume that the radius of curvature of the path at *C* is still 5 ft.
Note that $g = 32.2$ ft/s^2.

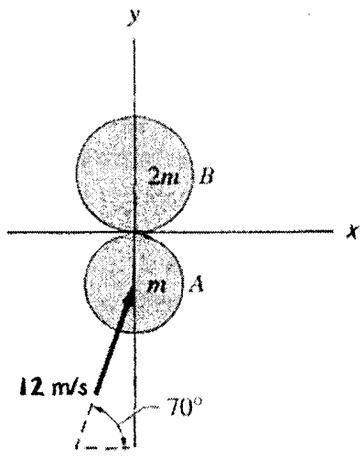
6. A tennis player strikes a tennis ball with her racket when the ball is at the uppermost point of its trajectory as shown. Just after impact, the velocity of the ball is directed at an angle of 15° above the horizontal. If the 125 gram ball is in contact with the racket for 0.02 sec, and the average impulsive force exerted by the racket on the ball is of magnitude of 200 N and directed at an angle 9° above the horizontal, determine:

(a) the magnitude of velocity v_2 (m/s) of the ball just after impact;
(b) the magnitude of velocity v_1 (m/s) of the ball just before impact;

You may neglect the effect of gravity during the impact.



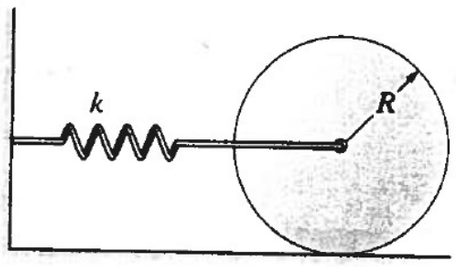
7. Two disks, *A* (mass *m*) and *B* (mass 2*m*), lie on a smooth horizontal *x-y* plane as shown. Disk *A* is initially moving with the velocity indicated when it collides with disk *B* which is initially at rest. After the impact, the motion of *A* is parallel to the x-axis.



(a) Determine the coefficient of restitution between the two disks.

(b) Determine the velocity (clearly indicate both the magnitude and direction) of each disk after the collision.

8. A uniform disk, of mass m = 60 kg and radius R = 0.5 m, is attached to a fixed surface by a horizontal spring with a constant k = 600 N/m. The disk is displaced to the left on the horizontal surface until the spring is compressed 0.3 m and then released from rest.



(a) If the disk rolls without slipping, what is its angular acceleration at the instant it is released?

(b) What is the minimum coefficient of static friction for which the disk will not slip when it is released?

(c) If the disk rolls without slipping, what are the angular velocity and angular acceleration of the disk when the spring becomes uncompressed?

Extra Page

Extra Page