# Common Exam 3, Covers: chapters, 6(sec.4-10) 7, 8 (sec. 1-3)

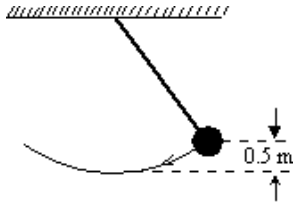
**Problem 1.** A 5.0-kg cart is moving horizontally at 6.0 m/s. In order to increase its speed to 10.0 m/s, the net work done on the cart must be:
A) 160 J
B) 400 J
C) 550 J
D) 40 J
E) 90 J

**Problem 2.** What power is needed to lift a 49-kg person a vertical distance of 5.0 m in 20.0 s?
A) 60 W
B) 120 W
C) 210 W
D) 12.5 W
E) 25 W

**Problem 3.** Which one of the following choices is an example of a conservative force?
A) tension
B) elastic spring force
C) static frictional force
D) motor propulsion force
E) normal force

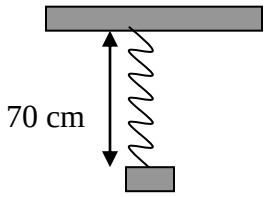
**Problem 4**. The long pendulum shown is drawn aside until the ball has risen 0.50 m. It is then released from rest. The speed of the ball at its lowest position is:

A) 20 m/s
B) 5.8 m/s
C) 4.2 m/s
D) 3.1 m/s
E) cannot be determined unless the mass is known



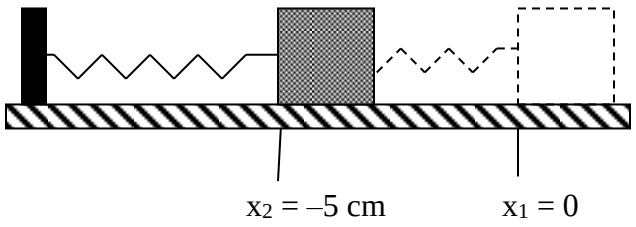

**Problem 5**: A 10-kg mass is attached to one end of a 50-cm-long unstretched spring. When the other end of the spring is attached to the ceiling the mass reaches a stable stationary position as shown in the adjacent diagram. What is the spring constant of the spring?

A) 490 N/m
B) 245 N/m
C) 980 N/m
D) 196 N/m
E) 140 N/m




**Problem 6**. A mass m = 2.5 kg is sliding left along a frictionless table with initial speed *v*. It strikes a coiled spring that has a force constant k = 500 N/m and compresses it a distance 5.0 cm before coming to a momentary rest. The initial speed *v* of the block was

A) 0.50 m/s
B) 0.71 m/s
C) 1.0 m/s
D) 1.4 m/s
E) 1.7 m/s

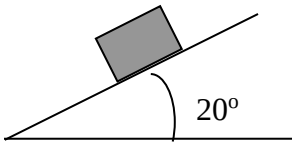


**Problem 7:** What is the work done by a force **F** = (2 N) **x** + (-4 N) **y** that causes a displacement **d** = (-3 m) **x** + (2 m) **y**?

A) 2 J
B) 14 J
C) -14 J
D) -2 J
E) 16 J

**Problem 8**: A man pushes a 2.0-kg block 5.0 m along a frictionless incline at an angle of 20$^o$ with the horizontal at constant speed. What is the work done by his force?

A) 0 J
B) 98 J
C) 34 J
D) 92 J
E) 100 J




**Problem 9**: Starting from rest, it takes 8.00 s to lower with constant acceleration an 80.0-kg couch from a 16.0-m high rooftop of a building all the way to the ground with a single vertical rope tied to its body. What is the work done by the tension in the rope?

A) 1.57 kJ
B) –1.28 kJ
C) –12.5 kJ
D) 12.5 kJ
E) –11.9 kJ

**Problem 10**: A dog must apply its full power of 100 W in order to move a 5.0-kg sled by a distance of 10 m in 4.0 s. What average force does the dog exert on the sled?

A) 49 N
B) 250 N
C) 8.0 N
D) 40 N
E) 200 N

**Problem 11.** A bicyclist is traveling on a horizontal track at a speed of 20.0 m/s as he approaches the bottom of a hill. He decides to coast up the hill and stops upon reaching the top. Determine the vertical height of the hill.

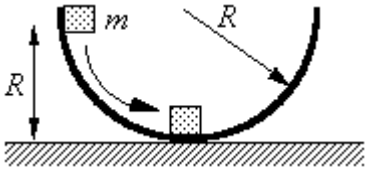
A) 28.5 m
B) 3.70 m
C) 11.2 m
D) 40.8 m
E) 20.4 m

**Problem 12**. Two skiers start from rest at the same place and finish at the same place. Skier A takes a straight, smooth route to finish whereas skier B takes a curvy, bumpy route to the finish. If you assume that friction is negligible, which of the following statements is true?

A) Skier A has the same speed as skier B at the finish.
B) Skier B has greater speed at the finish.
C) Skier A has greater speed at the finish because the route is straight.
D) Skier B has greater speed at the finish because the route is smooth.
E) Skier A has greater speed at the finish because the route is both straight and smooth.

**Problem 13.** A block of mass *m* is released from rest at a height *R* above a horizontal surface. The acceleration due to gravity is *g*. The block slides along the inside of a frictionless circular hoop of radius *R*. Which one of the following expressions gives the speed of the mass at the bottom of the hoop?

A) zero m/s
B) $v = mgR$
C) $v = mg/2R$
D) $v^2 = g^2/R$
E) $v^2 = 2gR$

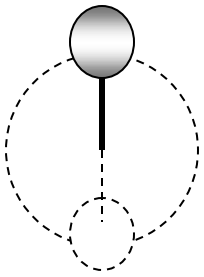



**Problem 14.** A 60-kg skier starts from rest from the top of a 50-m high slope. If the work done by friction is $-6.0 \times 10^3$ J, what is the speed of the skier on reaching the bottom of the slope?

A) 17 m/s
B) 24 m/s
C) 28 m/s
D) 31 m/s
E) 42 m/s

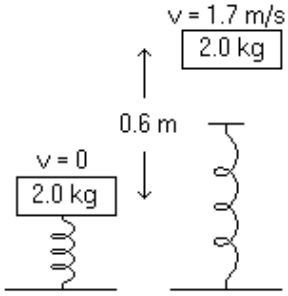
**Problem 15.** A 2.0-kg ball is attached to a light rod that is 1.2 m long. The other end of the rod is loosely pinned at a frictionless pivot. The rod is raised until it is inverted, with the ball above the pivot. The rod is released and the ball moves in a vertical circle. The tension in the rod as the ball moves through the bottom of the circle is closest to:

A) 40 N
B) 100 N
C) 20 N
D) 60 N
E) 80 N



**Problem 16.** A block of mass 2.0 kg is placed on a vertical spring, which is kept compressed 0.050 m by a clamp (The clamp is not shown in the diagram). The spring and the block are not attached. When the clamp is removed, the spring propels the block vertically upward. When the block has risen 0.60 m above its initial position its velocity is 1.7 m/s. How much potential energy was originally stored in the spring?

A) 5.5 J
B) 8.2 J
C) 11 J
D) 15 J
E) 26 J

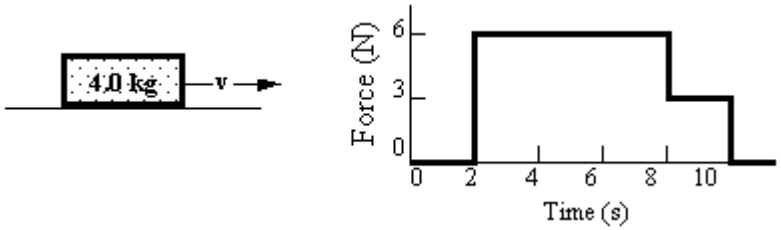



**Problem 17.** A 1.0-kg ball has a velocity of 12 m/s downward just before it strikes the ground and bounces up with a velocity of 12 m/s upward. What is the change in momentum of the ball?
A) zero kg • m/s
B) 12 kg • m/s, downward
C) 12 kg • m/s, upward
D) 24 kg • m/s, downward
E) 24 kg • m/s, upward

**Problem 18.** A 0.2 kg rubber ball is dropped from the window of a building. It strikes the sidewalk below at 30 m/s and rebounds up at 20 m/s. The magnitude of the impulse due to the collision with the sidewalk is:
A) 10 N · s
B) 6.0 N · s
C) 2.0 N · s
D) 19.6 N · s
E) 9.8 N · s

**Problem 19.** A 4.0-kg block slides along a frictionless surface with a constant speed of 5.0 m/s. Two seconds *after* it begins sliding, a horizontal, time-dependent force is applied to the mass. The force is removed eight seconds later. The graph shows how the force on the block varies with time. What is the magnitude of the total impulse of the force acting on the block?

A) 20 N • s
B) 42 N • s
C) 48 N • s
D) 54 N • s
E) 60 N • s



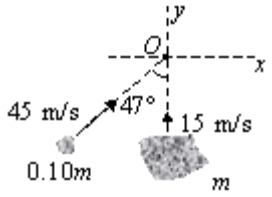

**Problem 20.** A 0.065-kg tennis ball moving to the right with a speed of 15 m/s is struck by a tennis racket, causing it to move to the left with a speed of 15 m/s. If the ball remains in contact with the racquet for 0.020 s, what is the magnitude of the average force experienced by the ball?
A) zero newtons
B) 98 N
C) 160 N
D) $1.6 \times 10^5$ N
E) $9.8 \times 10^4$ N

**Problem 21.** A 3.0-kg cart moving to the right with a speed of 1.0 m/s has a head-on collision with a 5.0-kg cart that is initially moving to the left with a speed of 2 m/s. After the collision, the 3.0-kg cart is moving to the left with a speed of 1 m/s. What is the final velocity of the 5.0-kg cart?
A) zero m/s
B) 0.8 m/s to the right
C) 0.8 m/s to the left
D) 2.0 m/s to the right
E) 2.0 m/s to the left

**Problem 22.** A 1000-kg car traveling east at 20 m/s collides with a 1500-kg car traveling west at 10 m/s. The cars stick together after the collision. What is their common velocity after the collision?

A) 16 m/s, east
B) 6 m/s, west
C) 4 m/s, east
D) 2 m/s, east
E) 1 m/s, west

**Problem 23.** Two asteroids are drifting in space with trajectories shown. Assuming the collision at point *0* between them is completely inelastic, at what angle from its orginal direction is the larger asteroid deflected?




A) 90° above the +*x* axis
B) 69° above the +*x* axis
C) 42° above the +*x* axis
D) 47° above the +*x* axis
E) 80° above the +*x* axis

**Problem 24**. An electric motor rotating a grinding wheel at 100 rev/min is switched off. Assuming constant negative angular acceleration of magnitude 2 rad/s$^2$, A) how long does it take the wheel to stop? B) through how many revolutions does it turn during this time?

**Problem 25**. A Ferris wheel rotating at 20 rad/s decelerates with a constant accelration of 5 rad/s$^2$. How many revolutions will it make before coming to rest?

A) 4.0
B) 2.8
C) 6.4
D) 3.2
E) 1.5

**Problem 26**. A wheel of radius 2 cm has a 4-m cord wrapped around its periphery. Starting from rest, the wheel is given a constant angular acceleration of 1 rad/s$^2$. The cord will unwind in

A) 125 s
B) 85 s
C) 66 s
D) 20 s
E) 15 s

**Answers to Exam 3 – Practice Problems**

1) A
2) B
3) B
4) D
5) A
6) B
7) C
8) C
9) E
10) D
11) E
12) A
13) E
14) C
15) B
16) D
17) E
18) A
19) B
20) B
21) C
22) D
23) E
**24) a) 5.2 sec**
**b) $\theta$ = 4.4 rev**
25) C
26) D
27) A