Physics 116A, Section 2, Second Exam A, February 26, 2008

Name (Please print)_____

Mulitiple choice questions are worth 3 points each.
Mark your answers in the space provided at the right, and on the OPSCAN sheet
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) A sand mover at a quarry lifts 2,000 kg of sand per minute a vertical distance of 12 meters. The sand is initially at rest and acquires a speed of 5 m/s at the top of the sand mover where it is then discharged into a loading chute. At what rate must power be supplied to this machine, neglecting any frictional losses? 1) _____

A) 4.34 kw B) 3.92 kw C) 524 w D) 1.13 kw E) 6.65 kw

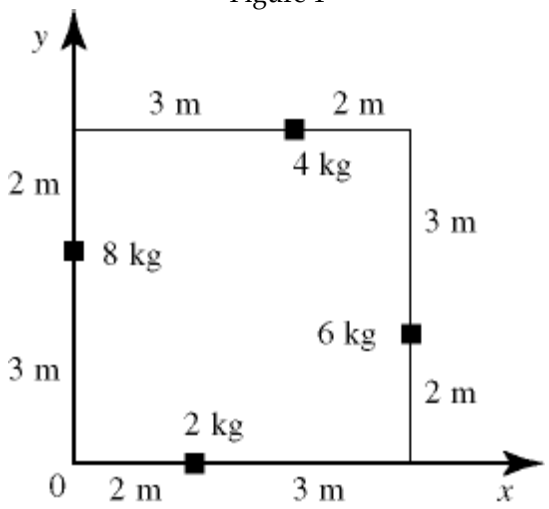
2) A baseball is thrown vertically upward and feels no air resistance. As it is rising which of the following is true, where "conserved" is the same meaning here as "constant": 2) _____

A) Its momentum is not conserved, but its total mechanical energy is conserved.
B) Its gravitational potential energy is not conserved, buts its momentum is conserved.
C) Both its momentum and its kinetic energy are conserved.
D) Its kinetic energy is conserved, but its momentum is not conserved.
E) Both its momentum and its mechanical energy are conserved.

3) A constant horizontal force acts on a sled on a horizontal frictionless ice pond. The sled starts from rest. When the pull acts over a distance x, the sled acquires a speed v and a kinetic energy K. If the same force instead acts over twice this distance: 3) _____

A) The sled's speed will be $2v$ and its kinetic energy will be K.
B) The sled's speed will be $4v$ and its kinetic energy will be $2K$.
C) The sled's speed will be $2v$ and its kinetic energy will be $K\sqrt{2}$.
D) The sled's speed will be $v\sqrt{2}$ and its kinetic energy will be $2K$.
E) The sled's speed will be $v\sqrt{2}$ and its kinetic energy will be $K\sqrt{2}$.

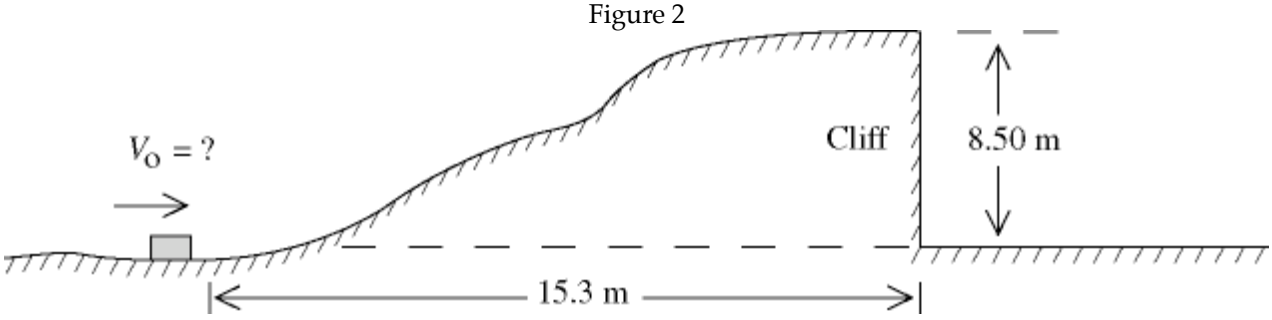
Figure 1



4) In Fig. 1, four point masses are placed as shown. The x– and y–coordinates of the center of mass are closest to: 4) _____

A) (2.3, 2.8) B) (2.2, 2.7) C) (2.2, 2.6) D) (2.3, 2.6) E) (2.3, 2.7)

Figure 2



5) A small hockey puck slides without friction to the top and then over the icy hill, which has a height 8.5 meters above where the puck originally started, as shown in Fig. 2. The puck lands a horizontal distance of 6.20 m from the foot of the cliff with no air resistance. Its speed v_0 when it started at the bottom of the hill is closest to: (HINT: the hockey puck is traveling horizontally when it leaves the top of the cliff.) 5) _____

A) 4.71 m/s B) 20.8 m/s C) 17.4 m/s D) 13.7 m/s E) 14.4 m/s

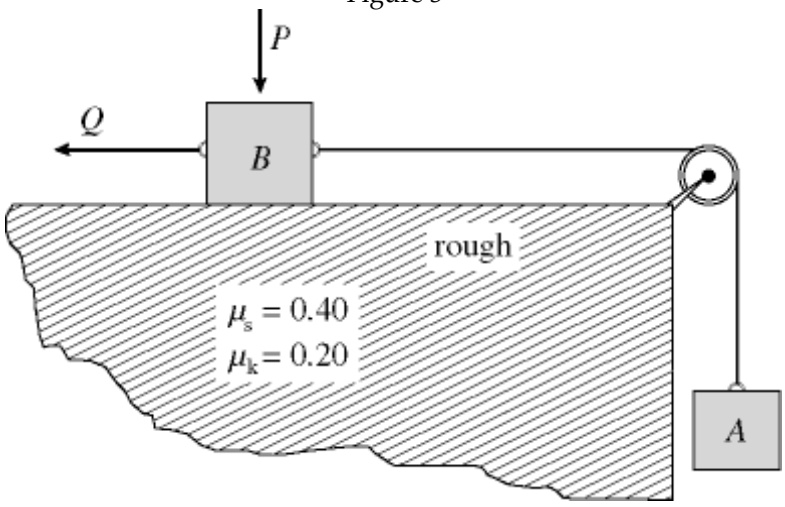
6) Two identical balls are thrown directly upward, ball A at speed v and ball B at speed $2v$, and they feel no air resistance. Which statement about these balls is correct? 6) _____

A) At its highest point, ball B will have twice as much gravitational potential energy as ball A because it started out moving twice as fast.
B) Ball B will go four times as high as ball A because it had four times the initial kinetic energy.
C) At their highest point, the acceleration of each ball is instantaneously equal to zero because they stop for an instant.
D) Ball B will go twice as high as ball A because it had twice the initial speed.
E) The balls will reach the same height because they have the same mass and the same acceleration.

7) A roadway is designed for traffic moving at a speed of 78 m/s. A curved section of the roadway is a circular arc of 190 m radius. The roadway is banked—so that a vehicle can go around the curve—with the lateral friction forces equal to zero. The angle at which the roadway is banked is closest to: 7) _____

A) 71° B) 73° C) 67° D) 69° E) 75°

Figure 3



8) Blocks A and B of masses 19 kg and 15 kg, respectively, are connected by a rope, which passes over a light frictionless pulley, as shown. The horizontal surface is rough. The coefficients of static and kinetic friction are 0.40 and 0.20, respectively. External forces P and Q act on block B, as shown. In Fig. 3, force P equals 60 N. The maximum value of force Q, for which the system remains at rest is closest to: 8) _____

A) 240 N B) 230 N C) 270 N D) 220 N E) 190 N

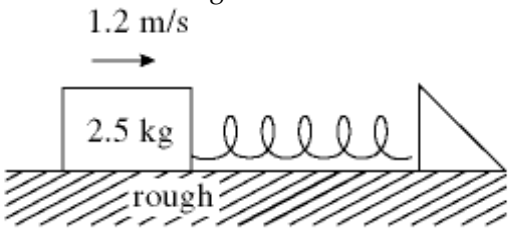
9) In a completely *inelastic* collision: 9) _____

A) Neither kinetic nor momentum is conserved.
B) Both kinetic energy and momentum are conserved.
C) The initial kinetic energy is all converted to heat.
D) Momentum is conserved but kinetic energy is not conserved.
E) Kinetic energy is conserved but momentum is not conserved.

10) A girl throws a stone from a bridge. Consider the following ways she might throw the stone. 10) _____
The speed of the stone as it leaves her hand IS THE SAME in each case.
Case A: Thrown straight up.
Case B: Thrown straight down.
Case C: Thrown out at an angle of 45° above horizontal.
Case D: Thrown straight out horizontally.
In which case will the speed of the stone be greatest when it hits the water below?

A) Case A
B) Case C
C) Case D
D) Case B
E) The speed will be the same in all cases.

Figure 4

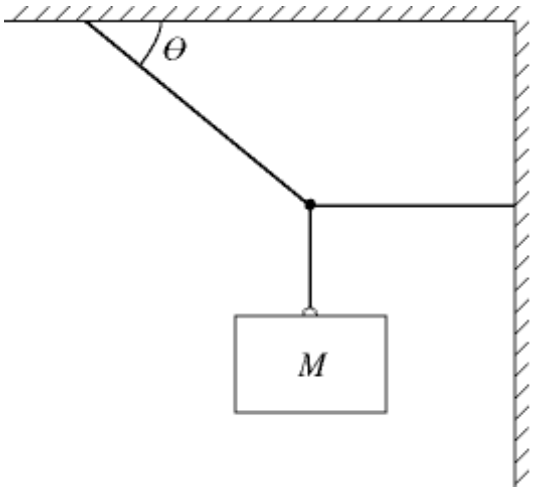


A 2.5 kg, sliding on a rough surface, has a speed of 1.2 m/s when it makes contact with a spring. The block comes to a momentary halt when the compression of the spring is 5.0 cm. The work done by the friction, from the instant the block makes contact with the spring until is comes to a momentary halt, is –0.50 J.

11) In Fig. 4, the force constant of the spring is closest to: 11) _____

A) 990 N/m
B) 940 N/m
C) 890 N/m
D) 840 N/m
E) 1040 N/m

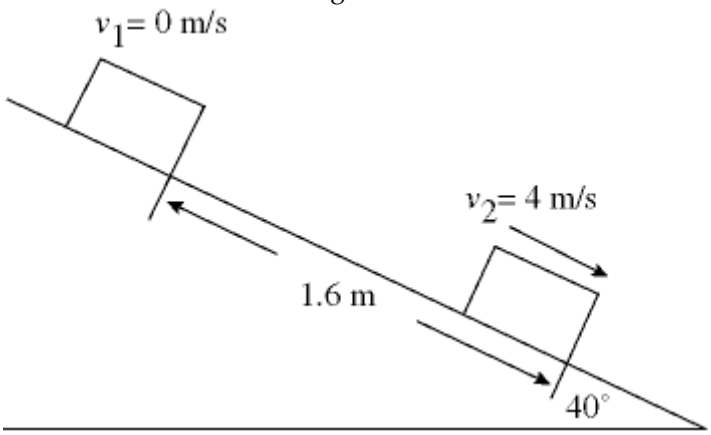
Figure 5



12) In Fig. 5, a block of mass M hangs in equilibrium. The rope that is fastened to the wall is horizontal and has a tension of 55 N. The rope that is fastened to the ceiling has a tension of 63 N, and makes an angle θ with the ceiling. The angle θ is: 12) _____

A) 76° B) 41° C) 29° D) 45° E) 61°

Figure 6

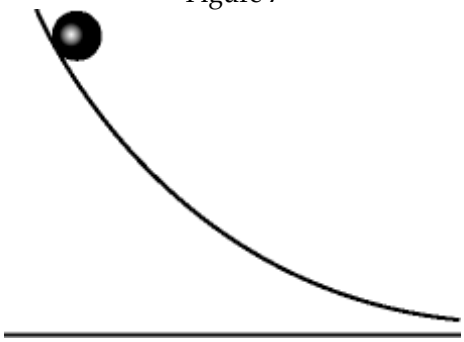


An 8.0–kg block is released from rest, $v_1 = 0$ m/s, on a rough incline which is at an angle of 40 degrees above the horizontal. The block moves a distance of 1.6–m down the incline, in a time interval of 0.80 s, and acquires a velocity of $v_2 = 4.0$ m/s (Warning: not all the numerical information being provided is relevant to the next question).

13) In Fig. 6, the work done by the force of gravity on the weight is closest to: 13) _____

A) +64 J B) –81 J C) +120 J D) +81 J E) –64 J

Figure 7



14) In Fig. 7 as the ball shown rolls down the frictionless hill which of the following happens to the speed and acceleration of the ball (HINT: consider the ball to be a point particle and think of the hill as a series of inclined planes with continously decreasing angle above the horizontal): 14) _____

A) both speed and acceleration remain constant.
B) its speed increases and its acceleration decreases.
C) its speed decreases and its acceleration increases.
D) both its speed and its acceleration increase.
E) both speed and acceleration decrease.

15) A mass is pressed against (but is not glued to) an ideal (massless) horizontal spring on a frictionless horizontal surface. After being released from rest, the mass acquires a maximum speed v and a maximum kinetic energy K. If instead the mass initially compresses the spring twice as far: 15) _____

A) Its maximum speed will be $v\sqrt{2}$ and its maximum kinetic energy will be $2K$.
B) Its maximum speed will be $4v$ and its maximum kinetic energy will be $2K$.
C) Its maximum speed will be $2v$ and its maximum kinetic energy will be $4K$.
D) Its maximum speed will be $2v$ and its maximum kinetic energy will be $\sqrt{2}K$.
E) Its maximum speed will be $2v$ and its maximum kinetic energy will be $2K$.

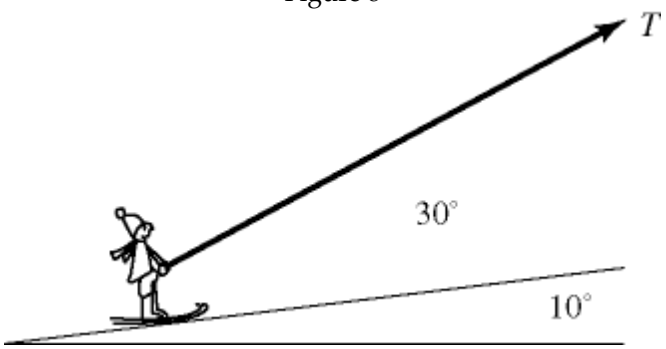
16) Which of the following is an accurate statement? 16) _____

A) Potential energy is always positive.
B) Kinetic energy is always positive.
C) Total energy is always positive.
D) None of these is true.
E) More than one of these is true.

17) A girl of mass 60 kg throws a ball of mass 0.8 kg against a wall. The ball strikes the wall horizontally with a speed of 11 m/s, and it bounces back with this same speed. The ball is in contact with the wall 0.05 s. What is the average force exerted on the wall by the ball? 17) _____

A) 180 N B) 26,400 N C) 350 N D) 6600 N E) 13,200 N

Figure 8



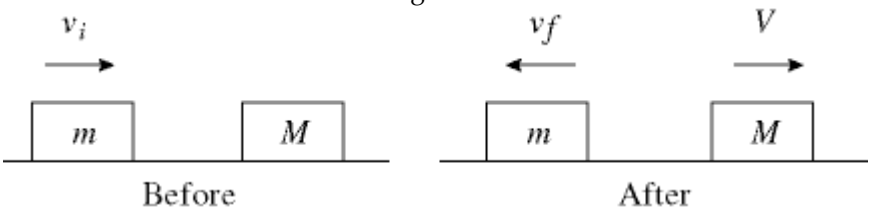
18) In Fig. 8, a T-bar ski tow pulls a skier up a hill inclined at 10° above horizontal. The skier starts from rest and is pulled by a cable that exerts a tension T at an angle of 30° above the surface of the hill. The mass of the skier is 60 kg and the effective coefficient of friction between the skis and the snow is 0.10. What is the maximum tension in the cable if the starting acceleration is not to exceed 0.4 g? 18) _____

A) 246 N B) 366 N C) 535 N D) 431 N E) 187 N

19) Two objects, one of mass m and the other of mass $2m$, are dropped from the top of a building. When they hit the ground: 19) _____

A) The heavier one will have one-fourth the kinetic energy of the lighter one.
B) The heavier one will have twice the kinetic energy of the lighter one.
C) The heavier one will have half the kinetic energy of the lighter one.
D) Both will have the same kinetic energy.
E) The heavier one will have four times the kinetic energy of the lighter one.

Figure 9



20) A block of mass m = 4.2 kg, moving on a frictionless surface with a speed v_i = 2.9 m/s, makes a perfectly elastic collision with a block of mass M at rest. After the collision, the 4.2 block recoils with a speed of v_f = 0.9 m/s. In Fig. 9, the mass M is closest to: 20) _____

A) 18 kg B) 8.0 kg C) 3.8 kg D) 5.5 kg E) 4.2 kg