Exam 2 Chapters 6-8 in Young 9e

Multiple choice questions. Circle the correct answer. No work needs to be shown and no partial credit will be given.

(5 pts) 1. A 5.00 m long light rope is tied to the ceiling. A steel ball with mass 2.00 kg is attached to the lower end of the rope. The ball is pulled to one side and released, and swings back and forth as a pendulum. As the ball passes through its lowest point, with the rope vertical, its speed is 6.00 m/s. As the ball swings through this point, what is the tension in the rope?

(a) 34.0 N
(b) 26.8 N
(c) 19.6 N
(d) 14.4 N
(e) 12.4 N
(f) 5.2 N
(g) none of the above answers

(5 pts) 2. You tie a light rope to a pail of water and you swing the pail in a vertical circle of radius 0.600 m. What minimum speed must the pail have at the highest point of its circular path if no water is to spill from it?

(a) 1.98 m/s
(b) 2.21 m/s
(c) 2.42 m/s
(d) 3.92 m/s
(e) 4.00 m/s
(f) 5.88 m/s
(g) none of the above answers

(5 pts) 3. A spring with force constant 720 N/m has one end attached to a wall. A 5.00 kg block on the floor is pushed against the spring, compressing it 5.00 cm. The block is released from rest and moves away from the wall. Friction between the block and the floor can be neglected. What is the speed of the block after it leaves the spring?

(a) 0.300 m/s
(b) 0.600 m/s
(c) 0.720 m/s
(d) 0.960 m/s
(e) 1.20 m/s
(f) none of the above answers
(5 pts) 4. Two blocks are at rest on a horizontal frictionless surface with a compressed spring of negligible mass between them. Block A has mass 2.00 kg and block B has mass 5.00 kg. The blocks are released from rest and move off in opposite directions, leaving the spring behind. If block B has speed 0.800 m/s after it leaves the spring, what is the speed of block A after it leaves the spring? (Block A is the less massive block.)

(a) 0.63 m/s  
(b) 0.95 m/s  
(c) 1.00 m/s  
(d) 1.26 m/s  
(e) 1.50 m/s  
(f) 2.00 m/s  
(g) none of the above answers

On the following problems show all your work. Partial credit will be given, if earned. Write your answers in the blanks provided. All answers must include the correct plus or minus sign (if appropriate) and the correct units.

(18 pts) 5. On a horizontal frictionless surface block A (mass 2.00 kg) is sliding toward the east with speed \( v_{Ai} \) and block B (mass 4.00 kg) is sliding north at speed \( v_{Bi} \). The blocks collide and stick together. After the collision the combined object (mass 6.00 kg) is moving at 36.9° north of east at \( v_f = 8.00 \text{ m/s} \).

\[ 2 \text{ kg} \quad \rightarrow \quad 2 \text{ kg} \quad \uparrow \quad 4 \text{ kg} \quad \rightarrow \quad 6 \text{ kg} \quad 36.9° \quad \rightarrow \]

a) What was the initial speed \( v_{Ai} \) of block A? \hspace{1cm} \text{Ans. } 19.2 \text{ m/s} \\

b) What was the initial speed \( v_{Bi} \) of block B? \hspace{1cm} \text{Ans. } 7.20 \text{ m/s}
(20 pts) 6. A box with mass 5.00 kg is pulled up a 36.9° incline by a constant force $\vec{F}$ that has magnitude 75.0 N and that is parallel to the incline. The distance along the incline from the bottom to the top is 6.00 m. During the motion of the box, the surface of the incline exerts a constant friction force $f_k = 18.0$ N on the box, in a direction opposite to the motion.

(a) For the motion from the bottom of the incline to the top, how much work is done by each of the following forces? In addition to giving the magnitude of the work, be sure to indicate whether the work done is positive or negative.

(i) the force $F$ that pulls the box

Ans. $+450 \, J$

(ii) the friction force $f_k$

Ans. $-108 \, J$

(iii) the gravity force

Ans. $-171 \, J$

(iv) the normal force

Ans. $0$

(b) If the box starts from rest at the bottom of the incline, what is the kinetic energy of the box when it reaches the top of the incline?

Ans. $165 \, J$
(20 pts) 7. A small rock is tied to a light string and set in motion in a horizontal circle with constant speed. The string is 8.00 m long and makes a constant angle of 36.9° with the vertical direction. The tension in the string is 6.20 N.

a) What is the radius \( r \) of the circular path of the rock?  
   Ans. 4.80 m

b) What is the mass of the rock?  
   Ans. 0.506 kg

c) What is the magnitude of the acceleration of the rock as it moves in its circular path?  
   Ans. 7.36 m/s²

d) How much time does it take the rock to complete one revolution?  
   Ans. 5.08 s
(22 pts) 8. Planet X has radius $4.00 \times 10^4$ m and mass $5.00 \times 10^{24}$ kg.

a) You stand on the surface of Planet X and throw a rock vertically upward with a speed of 12.0 m/s. What is the maximum height above your hand reached by the rock?

\textbf{Ans. } 3.45 \text{ m}

b) A satellite is in a circular orbit around planet X. If the speed of the satellite is 5400 m/s, how much time does it take the satellite to complete one orbit?

\textbf{Ans. } 1.33 \times 10^4 \text{ s} \\
= 221 \text{ min}