Physics 201 MWF9:10 Fall 2007 (Ford)

Name (printed)_____

Name (signature as on ID)_____

Lab Section Number_____

Exam 2 Chapts. 6-8 in Young&Geller

Multiple Choice questions. Circle the correct answer. No work needs to be shown.

(5 pts) 1. An object with mass 0.10 kg is moving horizontally to the right with a speed of 10 m/s. What magnitude of impulse must be applied to the object to change its velocity to 5 m/s to the left?

(a) 0.5 N·s
(b) 1.0 N·s
C (c) 1.5 N·s
(d) 5.0 N·s
(e) 15.0 N·s
(f) none of the above

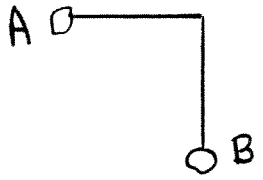
(5 pts) 2. A small rock of mass m is tied to one end of a light string and whirled in a vertical circle of radius R. At the top of the path the tension in the string is twice the weight of the rock, so $T = 2mg$. At this point in its motion, the speed of the rock is

(a) $\sqrt{gR}$
(b) $2\sqrt{gR}$
(c) $\sqrt{2}\sqrt{gR}$
(d) $3\sqrt{gR}$
e (e) $\sqrt{3}\sqrt{gR}$
(f) zero
(g) none of the above answers

(5 pts) 3. A small satellite with mass 500 kg is in a circular orbit around a planet whose mass is 3.0×10^{24} kg. The radius of the planet is 5.0×10^{6} m. The speed of the satellite is 4000 m/s. What is the radius of its orbit?

(a) 5.00×10^{6} m
b (b) 1.25×10^{7} m
(c) 1.75×10^{7} m
(d) 5.00×10^{10} m
(e) none of the above

(5 pts) 4. A small rock is tied to one end of a light string. The other end of the string is attached to the ceiling. When the rock is at point A the string is horizontal and when the rock is at point B the string is vertical. The rock is released from rest at point A and swings through point B. For the motion from A to B, the work done on the rock by the tension in the string is



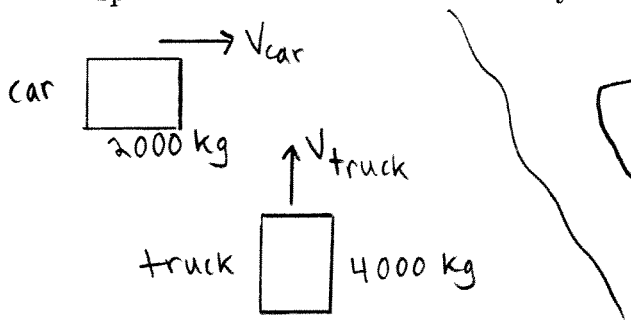
a (a) zero
(b) positive
(c) negative

(5 pts) 5. As an object moves from point 1 to point 2, gravity does positive work on the object. As a result of the displacement of the object, its gravitational potential energy

(a) is conserved, so doesn't change
(b) increases
c (c) decreases

On the following problems show all your work. Partial credit will be given if earned. Write your answers in the blanks provided.

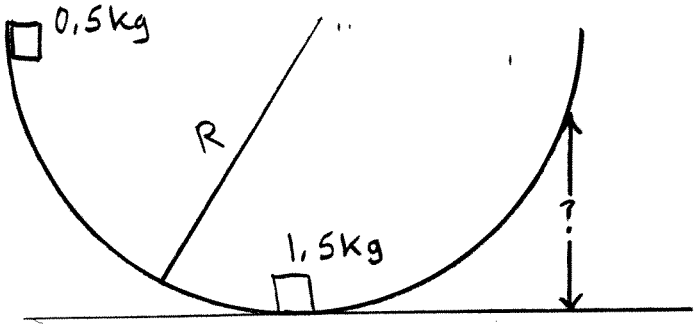
(17 pts) 6. A car with mass 2000 kg traveling due east with speed v_{car} collides with a truck that has mass 4000 kg and that is traveling due north with speed v_{truck}. Assume the road is level and frictionless. As a result of the collision the two vehicles stick together and move with a final speed of $v_{\text{f}} = 20$ m/s at an angle of 37° north of east. What is the speed of each vehicle immediately before the collision?



Ans. $v_{\text{car}} =$ 48 m/s

$v_{\text{truck}} =$ 18 m/s

(18 pts) 7. A small object with mass 0.50 kg is released from rest at the rim of a large hemispherical bowl. The bowl has radius 2.5 m and its surface is frictionless. The 0.50 kg object slides down the surface of the bowl and collides with a 1.50 kg object that is initially at rest at the bottom of the bowl.



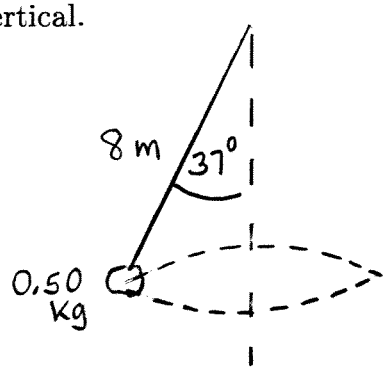
a) What is the speed of the 0.50 kg object just before it collides with the 1.50 kg object?

Ans. 7 m/s

b) After the collision, what is the maximum height above the bottom of the bowl that is reached by the combined object?

Ans. 0.156 m

(20 pts) 8. A small rock with mass 0.50 kg is tied to the free end of a light string that is 8.0 m long. The rock is moving in a horizontal circle and the string makes an angle of 37° with respect to the vertical.



a) What is the radius r of the circular path of the rock?

Ans. 4.8 m

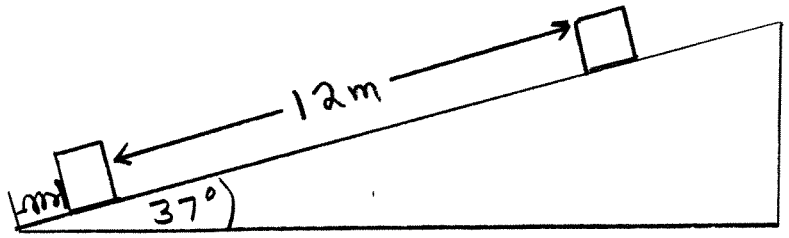
b) What is the tension in the string?

Ans. 6.14 N

c) What is the period of the rock's motion, the time it takes the rock to complete one revolution?

Ans. 5.07 s

(20 pts) 9. A small block with mass 0.20 kg is placed against a compressed spring at the bottom of a 37° degree incline. The spring has force constant 5000 N/m and the spring is compressed 0.10 m. The spring is released and the block moves a distance of 12 m along the incline before momentarily coming to rest. During the motion of the block up the incline, how much work is done on it by friction? (Be sure to indicate whether the work is positive or negative.)



Ans. -10.9 J