PHYSICS 191/193

<u>PRACTICE QUESTIONS</u>

FINAL SECTION

1) An 8-g bullet is shot into a 4.0-kg block, at rest on a frictionless horizontal surface. The bullet remains lodged in the block. The block moves into a spring and compresses it by 8.7 cm. The force constant of the spring is 2400 N/m. The initial velocity of the bullet is closest to:

   a) 1070 m/s
   b) 1020 m/s
   c) 1110 m/s
   d) 1150 m/s
   e) 1190 m/s

2) At time t = 0 s, a wheel has an angular displacement of zero radians and an angular velocity of +15 rad/s. The wheel has a constant acceleration of -0.48 rad/s^2. In this situation, the time at which the angular displacement is +78 rad and decreasing is closest to:

   a) 57 s b) 31 s c) 6 s d) 5 s e) 67 s

3) A machinist turns the power on to a grinding wheel, at rest, at time t = 0 s. The wheel accelerates uniformly for 10 s and reaches the operating angular velocity of 42 rad/s. The wheel is run at the angular velocity for 39 s and then power is shut off. The wheel decelerates uniformly at 2.6 rad/s^2 until the wheel stops. In this situation, the angular acceleration of the wheel between t = 0 s and t = 10 s is closest to:

   a) 4.2 rad/s^2
   b) 5.0 rad/s^2
   c) 5.9 rad/s^2
   d) 6.7 rad/s^2
   e) 7.6 rad/s^2

4) A small mass is placed on a record turntable that is rotating at 45 rpm. The acceleration of the mass is

a) directed perpendicular to the line joining the mass and the center of rotation.
b) independent (in magnitude) of the position of the mass on the turntable.
c) greater the closer the mass is to the center
d) greater the farther the mass is from the center
e) zero

5) A turbine blade rotates with angular velocity $\omega(t) = 2 - 0.6t^2$. What is the angular acceleration of the blade at $t = 9.30$ s?

a) -11.2 rad/s^2
b) -5.58 rad/s^2
c) -24.9 rad/s^2
d) -9.16 rad/s^2
e) -49.9 rad/s^2

6) A horizontal disk rotates about a vertical axis through its center. Point P is midway between the center and the rim of the disk, and point Q is on the rim. If the disk turns with constant angular acceleration, which of the following statements about it are true? (There may be more than one correct choice.)

a) At any instant, P and Q have the same tangential acceleration and the same centripetal acceleration.
b) At any instant, the centripetal acceleration of Q is twice as great as the centripetal acceleration of P.
c) At any instant, the tangential acceleration of Q is twice as great as the tangential acceleration of P.
d) At any instant, P and Q have the same angular velocity and the same angular acceleration.
e) The tangential acceleration of Q is equal in magnitude to its centripetal acceleration.

7) A 60-kg person drops from rest a distance of 1.20 m to a platform of negligible mass supported by a stiff spring. The platform drops 6 cm before the person comes to rest. What is the spring constant of the spring?

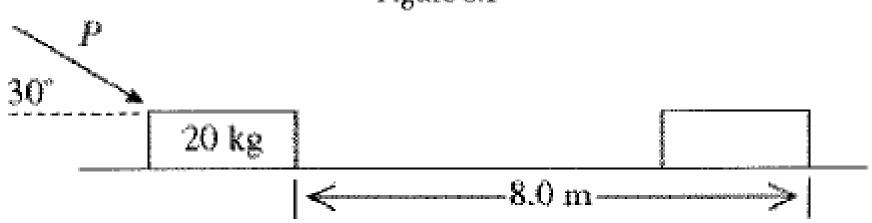
a) 2.56×10^5 N/m
b) 3.92×10^5 N/m
c) 5.45×10^4 N/m
d) 4.12×10^5 N/m
e) 8.83×10^4 N/m

8) A sand mover at a quarry lifts 2,000 kg of sand per minute a vertical distance of 12 metres. The sand is initially at rest and is discharged at the top of the sand mover with speed 5 m/s into a loading chute. At what minimum rate must power be supplied to this machine?

a) 524 w b) 3.92 kw c) 6.65 kw d) 4.34 kw e) 1.13 kw

9) A stone is thrown directly upward at 15.0 m/s from ground level and feels no appreciable air resistance. Use the work-energy theorem to find how high it will be when its speed has been reduced to half of its initial value.

Figure 6.1



10) In Fig. 6.1, a constant external force P = 160 N is applied to a 20-kg box, which is on a rough horizontal surface. The force pushes the box a distance of 8.0 m, in a time interval of 4.0 s, and the speed changes from $\upsilon_o = 0.6$ m/s to $\upsilon_f = 2.6$ m/s. The work done by friction is closest to:

a) -1040 J b) +1110 J c) +1170 J d) +1040 J e) -1170 J

11) What is the definition of the instantaneous power?

12) a) Consider a particle of mass m located at point A as shown in the diagram on the **left** below. The mass is located on top of a large hemispherical mound of frictionless ice whose radius is R. Imagine that the mass is given a negligible push (assume that the initial speed is approximately zero) that causes it to slide along the circular circumference of the hemisphere to a point B as shown in the diagram. Using energy conservation **only**, show that the (tangential) speed of the mass at point B is given by $v = \sqrt{2gR(1-\cos\theta)}$. Note that $R(1-\cos\theta)$ is the vertical distance (Δy) that the mass dropped.

b) Now consider a boy who is seated on the top of an identical hemispherical mound of frictionless ice as shown in the diagram on the **right** below. For purposes of simplicity you can assume that the boy may be treated as a point particle whose mass is m. The boy is also given a negligible push that starts him sliding along the circular circumference of the hemisphere. Show that he **loses contact** with the ice at a point whose height is $2R/3$ above the level of the ground. You will need to use the result of part a) above that his (tangential) speed for any angle θ is given by $\sqrt{2gR(1-\cos\theta)}$. [**HINT**: What is the normal (contact) force at the point where the boy just leaves the ice (i.e., where he just loses contact)? Answer: it is **zero**.]