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PHYS101-042 Final Exam                                            4 June 2005
Department of Physics, KFUPM                                              MSK
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Q1 Q0 A simple pendulum of mass m=20 kg and length L is pulled
   Q0 back and held with a horizontal force of 100 N (see Fig 1).
   Q0 The tension in the string at this equilibrium position is:
   Q0
   A1 220 N
   A2 60  N
   A3 120 N
   A4 190 N
   A5 260 N
   Q0
Q2 Q0 A horizontal aluminum rod (shear modulus = 2.5*10**10 N/m**2)
   Q0 projects L=5.0 cm from the wall (see Fig 6). The cross sectional
   Q0 area of the rod A =1.0*10**(-5) m**2. A shearing force of 500 N
   Q0 is applied at the end of the rod. Find the vertical deflection
   Q0 delta(x) of the end of the rod.
   Q0
   A1   1.0 *10**(-4) m
   A2   2.0 *10**(-4) m
   A3   3.0 *10**(-4) m
   A4   4.0 *10**(-4) m
   A5   5.0 *10**(-4) m
   Q0
Q3 Q0 A uniform rod AB is 1.2 m long and weighs 16 N. It is suspended
   Q0 by strings AC and BD as shown in Fig 2. A block P weighing 96 N
   Q0 is attached at point E, 0.30 m from A. The tension in the string
   Q0 BD is:
   Q0
   A1   32  N
   A2   24  N
   A3   64  N
   A4   48  N
   A5   112 N
   Q0
Q4 Q0 Four point masses are at the corners of a square whose side is
   Q0 20 cm long (see Fig 3). What is the magnitude of the net
   Q0 gravitational force on a point mass m5 = 2.5 kg located at the
   Q0 center of the square?
   Q0
   A1 3.3*10**(-8) N
   A2 1.1*10**(-8) N
   A3 2.2*10**(-8) N
   A4 4.4*10**(-8) N
   A5 6.6*10**(-8) N
   Q0
Q5 Q0 An object is fired vertically upward from the surface of
   Q0 the Earth (Radius = R) with an initial speed of (Vesc)/2,
   Q0 where (Vesc = escape speed). Neglecting air resistance,
   Q0 how far above the surface of Earth will it reach?
   Q0
   A1 R/3
   A2 R/2
   A3 3*R
   A4 2*R
   A5 R
   Q0
```

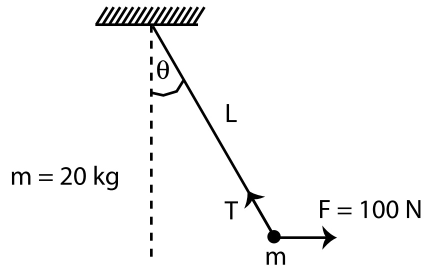

Figure 1

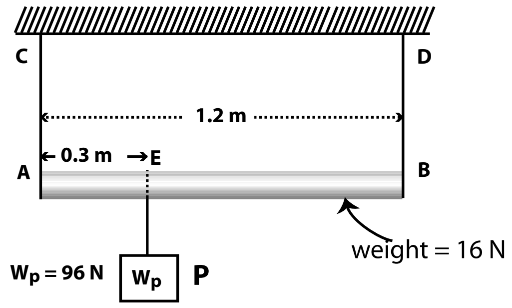

Figure 2

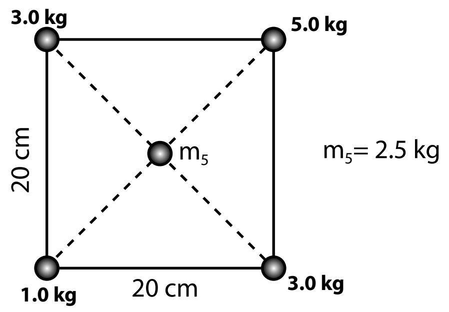

Figure 3

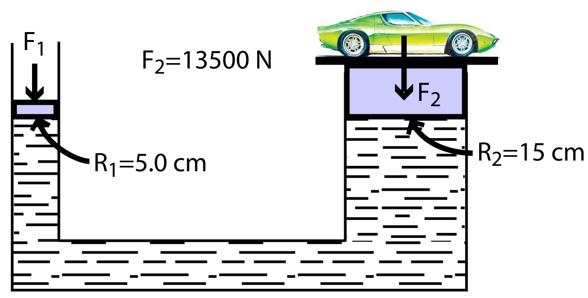

Figure 4

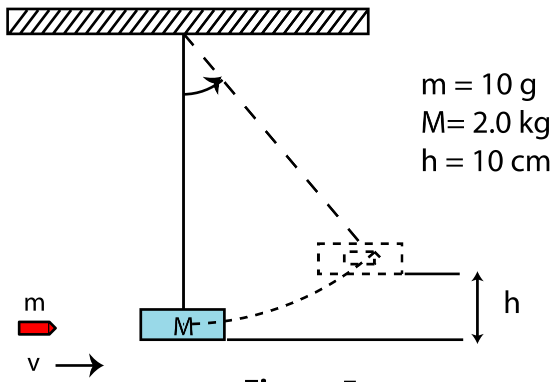

Figure 5

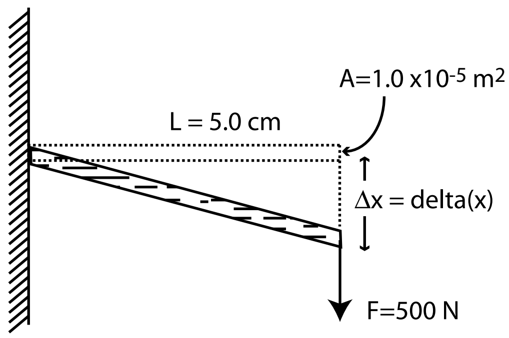

Figure 6

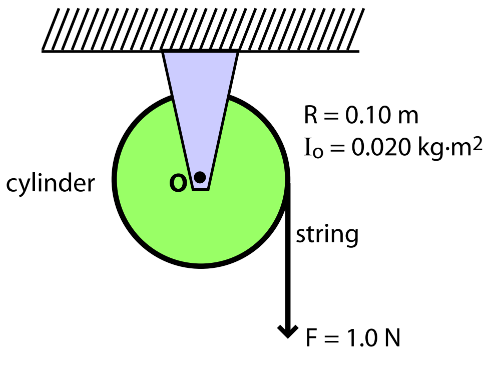

Figure 7

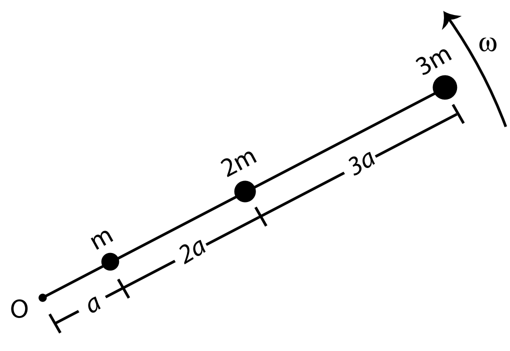

Figure 8

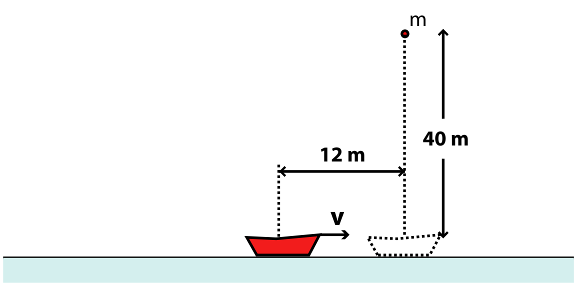

Figure 9

M_{earth} = 5.98×10^{24} kg
R_{earth} = 6.37×10^{6} m
G = 6.67×10^{-11} $N{\cdot}m^2/kg^2$

```
Q6 Q0 What is the escape speed on a spherical planet whose radius
   Q0 is 3200 km and whose gravitational acceleration at the surface
   Q0 is 4.00 m/s**2?
   Q0
   A1 5.06   km/s
   A2 3.58   km/s
   A3 11.2   km/s
   A4 9.80   km/s
   A5 4.00   km/s
   Q0
Q7 Q0 A planet requires 300 (Earth) days to complete its circular
   Q0 orbit about its sun (mass M = 6.0*10**30 kg).
   Q0 The orbital speed of the planet is:
   Q0
   A1 4.6*10**4 m/s
   A2 5.4*10**4 m/s
   A3 6.5*10**4 m/s
   A4 3.5*10**4 m/s
   A5 7.5*10**4 m/s
   Q0
Q8 Q0 A water hose of 1.00 cm radius is used to fill a container of
   Q0 volume 20.0*10**3 cm**3. It takes 60 s to fill the container.
   Q0 What is the speed at which the water leaves the hose?
   Q0
   A1 106 cm/s
   A2 201 cm/s
   A3 154 cm/s
   A4 189 cm/s
   A5 255 cm/s
   Q0
Q9 Q0 Water enters a house through a pipe with a velocity of 4.0 m/s
   Q0 at a pressure of 4*10**5 Pa. The water in a narrower pipe
   Q0 at the second floor bathroom 5.0 m above has a velocity of
   Q0 16 m/s.What is the pressure of water in the bathroom?
   Q0 (Density of water = 1.0*10**3 kg/m**3)
   Q0
   A1 2.3*10**5 Pa
   A2 1.5*10**5 Pa
   A3 5.5*10**5 Pa
   A4 4.5*10**5 Pa
   A5 3.0*10**5 Pa
   Q0
Q10Q0 A block of metal has mass of 0.50 kg and density of 8.0*10**3
   Q0 kg/m**3. It is suspended from a string and completely
   Q0 submerged in water. Find the tension in the string.
   Q0 (Density of water = 1.0*10**3 kg/m**3)
   Q0
   A1 4.3  N
   A2 5.0  N
   A3 0.60 N
   A4 4.9  N
   A5 5.5  N
   Q0
Q11Q0 A piston of radius R1= 5.0 cm is used in a hydraulic press to
   Q0 exert a force F1 on the enclosed liquid to raise a car of weight
   Q0 F2=13,500 N (see Fig 4). If the radius of the larger piston is
   Q0 R2 = 15 cm, Find F1.
   Q0
   A1 1.5*10**3 N
   A2 2.5*10**3 N
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```
   A3 3.5*10**3 N
   A4 4.0*10**3 N
   A5 2.0*10**3 N
   Q0
Q12Q0 A block of mass 0.50 kg is attached to a horizontal spring
   Q0 (k = 160 N/m). The block is pulled a distance 20 cm from its
   Q0 unstretched position on a frictionless horizontal surface. What
   Q0 is the magnitude of its maximum acceleration?
   Q0
   A1  64   m/s**2
   A2  0.80 m/s**2
   A3  0.28 m/s**2
   A4  72   m/s**2
   A5  1.9  m/s**2
   Q0
Q13Q0 A simple pendulum of length = L1 on Earth oscillates with
   Q0 with a period = T. Another pendulum of length = L2 on the Moon
   Q0 oscillates with a period = 2*T. Find the ratio L1/L2.
   Q0 (Take g on Moon = (1/6)*g on Earth.)
   Q0
   A1  3/2
   A2  1/2
   A3  1/4
   A4  2/3
   A5  2
   Q0
Q14Q0 A block-spring system has an amplitude of 4.0 cm and a maximum
   Q0 speed of 0.60 m/s. What is the frequency of oscillation?
   Q0
   A1  2.39 Hz
   A2  120  Hz
   A3  60   Hz
   A4  240  Hz
   A5  0.50 Hz
   Q0
Q15Q0 A particle oscillates according to the equation:
   Q0 x = 0.20 * cos(pi*t), where pi = 3.14.
   Q0 What is the period of the motion?
   Q0
   A1  2.0  s
   A2  2.0  Hz
   A3  0.20 s
   A4  pi   s
   A5  1.0  s
   Q0
Q16Q0 A ball (mass=m) is dropped from a bridge that is 40 m high
   Q0 (see Fig 9). It falls directly into a boat, moving with
   Q0 constant velocity, that is 12 m from the point of impact
   Q0 when the ball is released. What is the speed (v) of the boat?
   Q0
   A1  4.2  m/s
   A2  10   m/s
   A3  7.4  m/s
   A4  2.5  m/s
   A5  9.5  m/s
   Q0
Q17Q0 If A = 3 i - 2 j and B = 2 j what is (A x B).B ?
   Q0
   A1   0
   A2   12
```

```
   A3   4
   A4  -4
   A5  6 i - 4 j
   Q0
Q18Q0 A player kicks a ball with a velocity of 50.0 m/s at an angle
   Q0 of 30 degrees above the horizontal. Find the time the ball takes
   Q0 to reach the maximum height.
   Q0
   A1 2.55 s
   A2 1.35 s
   A3 2.00 s
   A4 1.00 s
   A5 5.10 s
   Q0
Q19Q0 A man of mass 70.0 kg stands on a scale in an elevator. What
   Q0 does the scale read when the elevator accelerates downward at
   Q0 1.20 m/s**2?
   Q0
   A1  602 N
   A2  770 N
   A3  686 N
   A4  84  N
   A5  980 N
   Q0
Q20Q0 A box slides down a 30 degree incline. If the coefficient of
   Q0 kinetic friction between the box and the surface of the incline
   Q0 is 0.30. What is the acceleration of the box?
   Q0
   A1  2.35 m/s**2
   A2  6.96 m/s**2
   A3  4.90 m/s**2
   A4  0    m/s**2
   A5  9.80 m/s**2
   Q0
Q21Q0 A 4.0 kg cart starts up an incline with a speed of 3.0 m/s and
   Q0 comes to rest 2.0 m up the incline. The total work done on the
   Q0 cart is:
   Q0
   A1 -18   J
   A2  8.0  J
   A3  12   J
   A4 -4.0  J
   A5  0    J
   Q0
Q22Q0 A force of 100 N holds an ideal spring having  200 N/m spring
   Q0 constant in compression. The potential energy stored in the
   Q0 spring is:
   Q0
   A1 25  J
   A2 0.5 J
   A3 5.0 J
   A4 10  J
   A5 200 J
   Q0
Q23Q0 A 6.0 kg block is released from rest 80 m above the ground. When
   Q0 it has fallen 60 m its kinetic energy is:
   Q0
   A1 3500 J
   A2 4800 J
   A3 1200 J
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   A4 120  J
   A5 60   J
   Q0
Q24Q0 A ball is thrown into the air. As it rises, there is an increase
   Q0 in its:
   Q0
   A1 potential energy
   A2 speed
   A3 kinetic energy
   A4 acceleration
   A5 momentum
   Q0
Q25Q0 A 10 g bullet is fired horizontally into a 2.0 kg pendulum block
   Q0 at rest. The bullet remains embedded in the block and the block
   Q0 with the bullet inside rises to a height of 10 cm. What is the
   Q0 initial speed (v) of the bullet? (See Fig 5)
   Q0
   A1 281 m/s
   A2 302 m/s
   A3 182 m/s
   A4 102 m/s
   A5 252 m/s
   Q0
Q26Q0 A 2.0 kg and 3.0 kg masses are moving along the x-axis. At a
   Q0 particular instant, the 2.0 kg  has a velocity of 3.0 m/s and
   Q0 the 3.0 kg  has a velocity of -1.0 m/s. What is the velocity of
   Q0 their center of mass?
   Q0
   A1  0.60  m/s
   A2  1.8   m/s
   A3 -0.60  m/s
   A4 -1.8   m/s
   A5  0.00  m/s
   Q0
Q27Q0 A cylinder is 0.10 m in radius and its rotational inertia, about
   Q0 the axis through O, is 0.020 kg*m**2. A string is wound around
   Q0 the cylinder and pulled with a force of 1.0 N. The angular
   Q0 acceleration of the cylinder is (see Fig 7):
   Q0
   A1 5.0 rad/s**2
   A2 10  rad/s**2
   A3 15  rad/s**2
   A4 20  rad/s**2
   A5 2.5 rad/s**2
   Q0
Q28Q0 A wheel initially has an angular velocity of 18 rad/s but it is
   Q0 slowing at a rate of 2.0 rad/s**2. By the time it stops it will
   Q0 have turned through:
   Q0
   A1 13 rev
   A2 26 rev
   A3 39 rev
   A4 52 rev
   A5 65 rev
   Q0
Q29Q0 Three particles, of mass of m, 2m and 3m, are fastened
   Q0 to each other and to a rotation axis at O by three massless
   Q0 rods, of lengths a, 2a and 3a respectively (see Fig 8).
   Q0 The combination rotates around the rotational axis with
   Q0 angular velocity of w. What is the total angular momentum
```

```
   Q0 of the three particles relative to point O?
   Q0
   A1 127 m*w*a**2
   A2 97  m*w*a**2
   A3 117 m*w*a**2
   A4 137 m*w*a**2
   A5 147 m*w*a**2
   Q0
Q30Q0 When a man on a frictionless rotating seat extends his arms
   Q0 horizontally, his rotational kinetic energy:
   Q0
   A1 must decrease
   A2 must increase
   A3 must remain the same
   A4 may increase or decrease depending on his initial
   A4       angular velocity
   A5 may increase or decrease depending on his gravitational
   A5       potential energy
```