Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Exam 2 October 20, 2010

Name (print, last first): _____ Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

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$g = 9.80$ m/s^2

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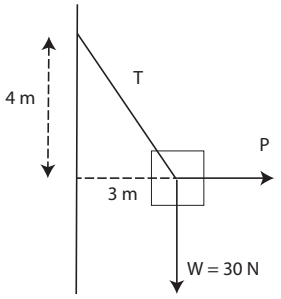
1. (4 points) A force P holds an object weighing 30 N a distance 3 m from the wall as shown as in the figure. The tie rope T is tied 4 m above the horizontal line of action P. Calculate P.

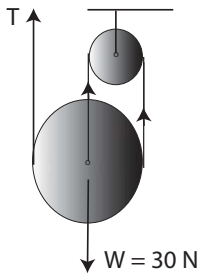


(1) 22.5 N
(2) 45 N
(3) 11.2 N
(4) 4.5 N
(5) 33.7 N

2. (3 points) A ramp inclined at 30 degrees to the horizontal is used to haul a load of 100 N up a height of 1 m. What is the ideal mechanical advantage of this elementary machine?

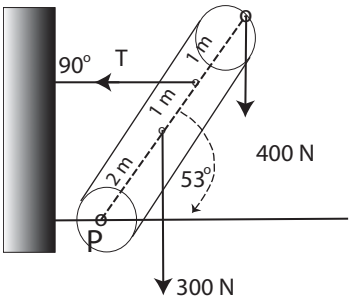
(1) 2.0 (2) 1.0 (3) 0.87 (4) 0.5 (5) 0.25

3. (3 points) The pulley system shown in the figure is used to lift an object that weighs 30 N. The rope is continuous around each pulley What is the tension T in the pulley rope?



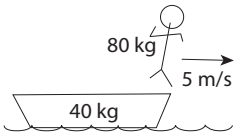
(1) 10 N
(2) 30 N
(3) 15 N
(4) 60 N
(5) 3 N

4. (4 points) The boom shown in the figure has a length of 4 m. and weighs 300 N. It is used to lift a weight of 400 N. If the boom is inclined at 53 degrees to the horizontal, calculate the tension T in the tie which is linked to the boom at a distance of 3 m from the ground.



(1) 550 N
(2) 700 N
(3) 350 N
(4) 100 N
(5) 50 N

5. (4 points) Joe is standing in a canoe that has a mass of 40 kg. The canoe is at rest on the surface of a smooth lake. Joe jumps off the canoe with a speed of 5 m/s. If Joe has a mass of 80 kg, what is the velocity of recoil of the canoe after he jumps?



(1) 10 m/s (2) 20 m/s (3) 0 (4) 5 m/s (5) 7 m/s

6. (4 points) A ping-pong ball of mass 2 gm and traveling with a velocity of 2 m/s collides with stationary tennis ball of mass 10 gm. Calculate the velocity of the ping-pong ball after the collision, assuming the collision is elastic.

(1) 1.3 m/s (2) 0.33 m/s (3) 2 m/s (4) 0.67 m/s (5) 3.9 m/s

7. (4 points) The wheel of a car is rotating at a speed of 3.0 rev/s. If the wheel has a diameter of 30 cm, how fast is the car going along its straight line path?

(1) 2.8 m/s (2) 5.6 m/s (3) 1.4 m/s (4) 3.5 m/s (5) 0.33 m/s

8. (4 points) A phonograph record rotates at 45 rpm (revolutions per minute). A fire ant sits on the record a distance of 5 cm from the center. How fast is the ant moving?

(1) 0.24 m/s (2) 0.50 m/s (3) 4.5 m/s (4) 1.5 m/s (5) 0.12 m/s

Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 2 March 2, 2012

Name (print, last first): _____ Signature: _____

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$g = 9.80$ m/s^2

1. (3 points) A 2000 kg slab of limestone is hauled up a ramp inclined at 20 degrees to the horizontal. What is the ideal mechanical advantage of this elementary machine?

(1) 2.92 (2) 1.46 (3) 12.80 (4) 0.35 (5) 0.87

2. (3 points) A satellite is circling a small planet at a speed of 3.60 rev/day. If the satellite's orbit has a diameter of 30,000 km, how fast is the satellite moving (at a tangent to the orbital path)?

(1) 3900 m/s (2) 4.7 m/s (3) 1940 m/s (4) 175 m/s (5) 0.175 m/s

3. (4 points) A 1200 kg car is traveling along a road with a speed of 20m/s at point A. The driver stops accelerating when he passes point A, and 70 m away at point B his speed has dropped to 12 m/s. Calculate the average force of friction between A and B.

(1) 2190 N (2) 219 N (3) 19 N (4) 190 N (5) 0 N

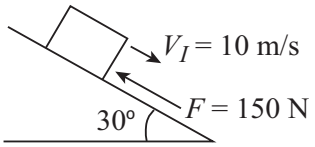
4. (4 points) A hydraulic lift is used to raise an object of weight 30,000 N. If the input piston has a diameter of 0.375 cm and the output piston has a diameter of 8.0 cm. Calculate the force needed at the input piston to raise the weight.

(1) 66 N (2) 13.2 N (3) 132 N (4) 6661 N (5) 13,200 N

5. (3 points) A 17 kg box which is initially at rest is allowed to slide down an inclined plane that makes an angle of 27° to the horizontal. The friction between the box and the surface of the plane is negligible. If the point where the box is released is 2.5 m above the ground at the end of the inclined plane, calculate the box's velocity when it reaches the ground level.

(1) 7.1 m/s (2) 5.2 m/s (3) 1.35 m/s (4) 15.70 m/s (5) 0.35 m/s

6. (5 points) A 25 kg block is sliding down a 30° incline with an initial velocity of 10 m/s. A force $F = 150$ N is applied to the block in the upward direction along the incline. The coefficient of kinetic friction $\mu_k = 0.7$. How far down the incline does the block travel before coming to rest?



(1) 7 m (2) 3 m (3) 1.5 m (4) 14 m (5) 23 m

7. (5 points) A ping-pong ball of mass 4 gm and traveling with a velocity of 4 m/s collides with stationary tennis ball of mass 5 gm. Calculate the magnitude of the velocity of the tennis ball after the collision, assuming the collision is elastic.

   (1) 3.6 m/s (2) 0.44 m/s (3) 2 m/s (4) 0.67 m/s (5) 7.2 m/s

8. (3 points) The wheel of a car is rotating at a speed of 6.0 rev/s. If the wheel has a diameter of 30 cm, how fast is the car going along its straight line path?

   (1) 5.6 m/s (2) 2.4 m/s (3) 1.4 m/s (4) 3.7 m/s (5) 0.33 m/s

Instructor(s): *N. Sullivan*

PHYSICS DEPARTMENT

PHY 2004 Midterm Exam 2 October 19, 2011

Name (print, last first): _____ Signature: _____

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$g = 9.80$ m/s^2

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1. (3 points) A ramp inclined at 15 degrees to the horizontal is used to haul a load of 120 N up a height of 2 m. What is the ideal mechanical advantage of this elementary machine.

   (1) 3.86 (2) 1.93 (3) 2.00 (4) 0.35 (5) 0.87

2. (4 points) Jane is standing in a canoe that has a mass of 40 kg. The canoe is at rest on the surface of a smooth lake. Jane jumps off the canoe heading south with a speed of 6 m/s. If Jane has a mass of 100 kg what is the speed of recoil of the canoe in the southerly direction after she jumps?

   (1) −15 m/s (2) 7.5 m/s (3) 0 (4) 15 m/s (5) −7.5 m/s

3. (4 points) A yellow billard ball of mass 4 gm and traveling with a velocity of 4 m/s collides with stationary red billard ball of mass 5 gm. Calculate the velocity of the red ball after the collision, assuming the collision is elastic.

   (1) 3.6 m/s (2) 0.33 m/s (3) 2 m/s (4) 0.67 m/s (5) 7.2 m/s

4. (4 points) A satellite is circling a small plant at a speed of 3.60 rev/hour. If the satellite's orbit has a diameter of 300 km, how fast is the satellite moving (at a tangent to the orbital path)?

   (1) 940 m/s (2) 4.7 m/s (3) 1940 m/s (4) 175 m/s (5) 0.175 m/s

5. (6 points) A 1200 kg car is traveling along a road with a speed of 20m/s at point A. The driver stops accelerating when he passes point A and 70 m away at point B his speed has dropped to 12 m/s. Calculate the average force of friction between A and B.

   (1) 2190 N (2) 219 N (3) 19 N (4) 190 N (5) 0 N

6. (5 points) A hydraulic press has an input piston with a diameter of 0.375 cm and an output piston with a diameter of 8.0 cm. Calculate the force needed at the input piston to create an output force of 60,000 N.

   (1) 132 N (2) 13.2 N (3) 66.1 N (4) 6661 N (5) 13,200 N

7. (4 points) A 120 kg barrel which is initially at rest is rolled down an inclined plane. The friction between the barrel and the surface of the plane is negligible. If the point where the barrel is released is 1.5 m above the ground at the end of the inclined plane, calculate the barrel's velocity when it reaches the ground level.

   (1) 5.42 m/s (2) 2.71 m/s (3) 7.35 m/s (4) 15.70 m/s (5) 1.35 m/s

Instructor(s): *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 2nd Exam March 6, 2006

Name (print, last first): _____ Signature: _____

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$$g = 9.80 \text{ m/s}^2$$

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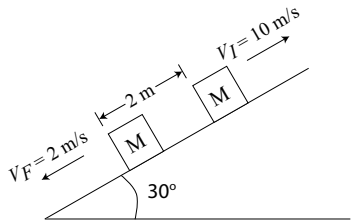
1. A 10 kg block is accelerated across a horizontal floor from rest to 5 m/s in 3 s. The magnitude of the work done by friction on the block is 75 J. How much work is done by the applied force that causes the block to accelerate?

(1) 200 J (2) 50 J (3) 100 J (4) 150 J (5) 300 J

2. At time $t = 0$ a 2000 kg elevator is moving down with speed 7 m/s as it passes the third floor of a building. Twenty seconds later the elevator is moving up with speed 4 m/s as it passes the fifth floor, which is 15 m above the third floor. How much work is done by the elevator motor during this 20 s time interval?

(1) 2.6×10^5J (2) 10^5J (3) 4.8×10^4J (4) -4×10^4J (5) -8×10^5J

3. At time $t = 0$ a 5 kg block is moving up a 30° incline with speed 10 m/s. Only the force of friction and of gravity have components parallel to the incline. 5 s later the block is moving down the incline with speed 2 m/s, at a distance of 2 m down along the incline from its original position. How much work is done by friction during this 5 s interval?

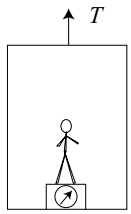


(1) −290 J (2) −125 J (3) −200 J (4) +360 J (5) +25 J

4. A 2000 kg elevator is accelerated upward from rest at a constant rate for 5 s and achieves a final speed of 10 m/s. What is the power output of the elevator motor at this point in time?

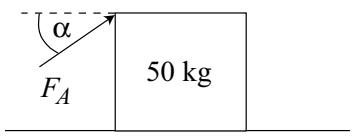
(1) 2.4×10^5W (2) 3.9×10^5W (3) 7.5×10^5W (4) 1.2×10^5W (5) 6.9×10^6W

5. A 50 kg lady (her mass is 50 kg) stands on a scale in an elevator. The scale reads 40 kg. The mass of the elevator system is 2,500 kg. What is the tension in the elevator cable?



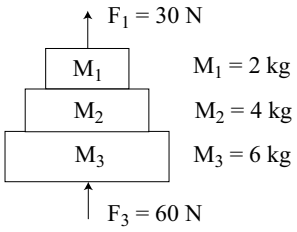
(1) 2×10^4J (2) 10^4J (3) 4×10^4J (4) 6×10^4J (5) 5×10^8J

6. A force F_A is applied as shown to a 50 kg trunk in order to move it across a horizontal floor. The angle α is 45°. If the coefficient of kinetic friction is $\mu_k = 0.5$, what value of F_A is needed to keep the trunk moving at constant velocity?



(1) 231 N (2) 53 N (3) 106 N (4) 403 N (5) 326 N

7. Three blocks are glued together and move above the Earth. The vertical force $F_1 = 30$N and the vertical force $F_3 = 60$N. The system starts from rest. What is the force of M_1 on M_2 5 s later?



(1) 15 N (2) 20 N (3) 25 N (4) 30 N (5) 35 N

8. A 2×10^3 kg auto accelerates along a horizontal track from 0 to 30 m/s in 6 s. What is the <u>total</u> force of the auto on the track? Be sure to consider vertical as well as horizontal forces.

(1) 2.2×10^4N (2) 1.1×10^4N (3) 3.3×10^4N (4) 4.3×10^4N (5) 6.4×10^4N

Instructor(s): *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 Exam 2 March 3, 2008

Name (print, last first): _____ Signature: _____

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$g = 9.80$ m/s^2

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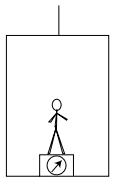
1. Two blocks, with masses $M_1 = M_2 = 5$ kg, are connected together by a horizontal rope, and are pulled across a horizontal floor by a horizontal force F as shown. The force F has magnitude 35 N. The block M_2 is frictionless but M_1 is not. Starting from rest, the speed of the blocks is 10 m/s after 5 s. What is the value of the coefficient of kinetic friction for M_1?

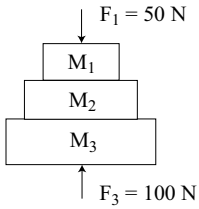
(1) 0.3 (2) 0.1 (3) 0.2 (4) 0.4 (5) 0.6

2. A 50 kg lady stands on a scale in an elevator. Initially, the elevator is moving down at 15 m/s. Three seconds later it is moving down at 5 m/s. Assume that the acceleration of the elevator is constant. What is the reading on the scale for the lady's apparent weight?



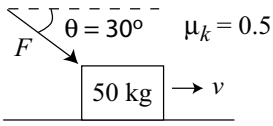
(1) 655 N (2) 325 N (3) 545 N (4) 435 N (5) 210 N

3. Three masses, $M_1 = 2$ kg, $M_2 = 4$ kg, and $M_3 = 6$ kg, are glued together and move above the earth. A force $F_1 = 50$ N acts down on M_1, and a force $F_3 = 100$ N acts up on M_3. What is the magnitude of the force that M_2 exerts on M_1?



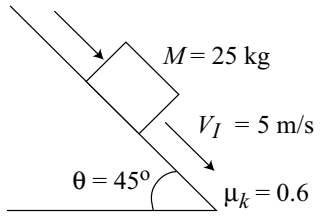
(1) 59 N (2) 31 N (3) 27 N (4) 18 N (5) 7 N

4. A 50 kg trunk is pushed across a horizontal floor by a force F that acts at an angle $\theta = 30°$ below the horizontal, and whose magnitude is 450 N. The block starts from rest. The coefficient of kinetic friction is $\mu_k = 0.5$. How far does the block move in 3 seconds?



(1) 2.9 m (2) 3.7 m (3) 4.9 m (4) 6.1 m (5) 8.8 m

5. A 25 kg block is pushed down a 45° incline by a force $F = 250$ N parallel to the incline in the downward direction. The coefficient of kinetic friction $\mu_k = 0.6$. The block's initial velocity is 5 m/s in the downward direction along the incline. How much time is required for the block to achieve a speed of 15 m/s?

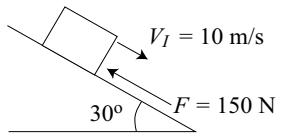


(1) 0.78 s (2) 1.24 s (3) 5.68 s (4) 0.32 s (5) 16.98 s

6. A 2000 kg elevator initially is moving with speed 2 m/s as it passes the 5th floor. Ten seconds later it is traveling up at 8 m/s as it passes the 3rd floor. The 3rd floor is 10 m below the 5th floor. How much work is done by nonconservative forces during the 10 second interval?

(1) -1.4×10^5 J (2) $+1.7 \times 10^5$ J (3) -4.7×10^5 J (4) $+5.9 \times 10^5$ J (5) 0

7. A 25 kg block is sliding down a 30° incline with an initial velocity of 10 m/s. A force $F = 150$ N is applied to the block in the upward direction along the incline. The coefficient of kinetic friction $\mu_k = 0.7$. How far down along the incline does the block travel before coming to rest?



(1) 7 m (2) 3 m (3) 1.5 m (4) 14 m (5) 23 m

8. A projectile is shot from the ground at an angle of 60° above the horizontal. At a later point in time it is traveling horizontally at a height of 10 m above the ground. What is the projectile's initial speed?

(1) 16 m/s (2) 33 m/s (3) 9 m/s (4) 4 m/s (5) 2 m/s