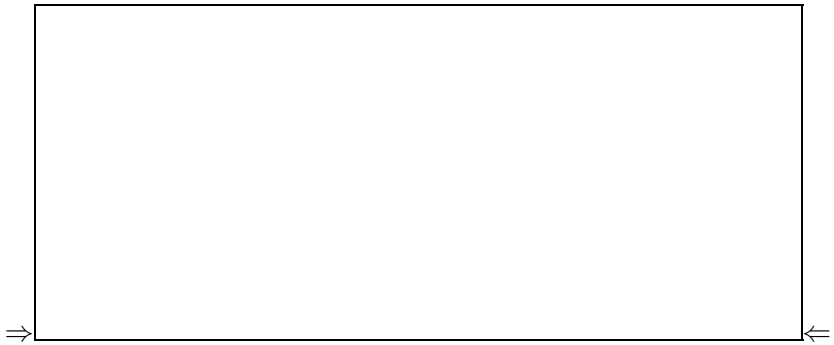
NOTE: This file contains all four versions of the exam.

# Physics 123 - Analytical Physics
# SECOND COMMON HOUR EXAM
# Monday, November 9, 2009 9:40 - 11:00 PM
# Professor R.A. Bartynski



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3. Under STUDENT # enter your 9-digit RUID Number.
4. Enter 123 under COURSE, and your section number (see label above) under SEC.
5. Under CODE enter the exam code given above.
6. During the exam, you may use pencils, a calculator, and one 8.5 x 11 inch sheet (both sides) with formulas and notes.
7. There are 15 multiple-choice questions on the exam. For each question, mark only one answer on the answer sheet. There is no deduction of points for an incorrect answer, so even if you cannot work out the answer to a question, you should make an educated guess. **At the end of the exam, hand in the answer sheet and the cover page.** Retain this question paper for future reference and study.
8. When you are asked to open the exam, make sure that your copy contains all 15 questions. Raise your hand if this is not the case, and a proctor will help you. Also raise your hand during the exam if you have a question.
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10. If needed, the acceleration due to gravity on earth may be take as $g = 9.81\ m/s^2$.

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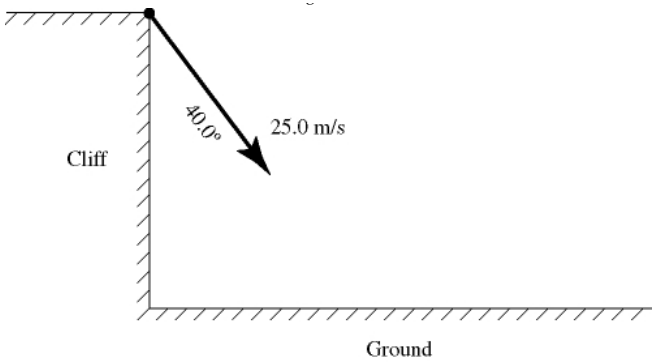
1. A hiker throws a stone from the upper edge of a vertical cliff. The stones initial velocity is 25.0 m/s directed at 40.0° with the face of the cliff, as shown in the figure. The stone hits the ground 3.75 s after being thrown and feels no appreciable air resistance as it falls. The height (in m) of the cliff is closest to




a) 129
b) 163
c) 141
d) 60.3
e) 71.8

2. A 50-kg child riding a Ferris wheel (radius = 10 m) travels in a vertical circle. The wheel completes one revolution every 10 s. The magnitude of the force on the child by the seat at the highest point on the circular path is closest to:

a) 290 N
b) 490 N
c) 690 N
d) 200 N
e) 400 N

3. A 0.20-km wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank and heads in such a way that it crosses to a point directly north of its departure point. How long does it take the boat to cross the river?

a) 23 s
b) 27 s
c) 29 s
d) 25 s
e) 17 s

4. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

a) You are able to spring up because the earth exerts a force upward on you that is stronger than the downward force you exert on the earth.
b) It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.
c) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.
d) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself that propels the body into the air.
e) When you jump up the earth exerts a force $\mathbf{F}_1$ on you and you exert a force $\mathbf{F}_2$ on the earth. You go up because $|\mathbf{F}_1| > |\mathbf{F}_2|$.

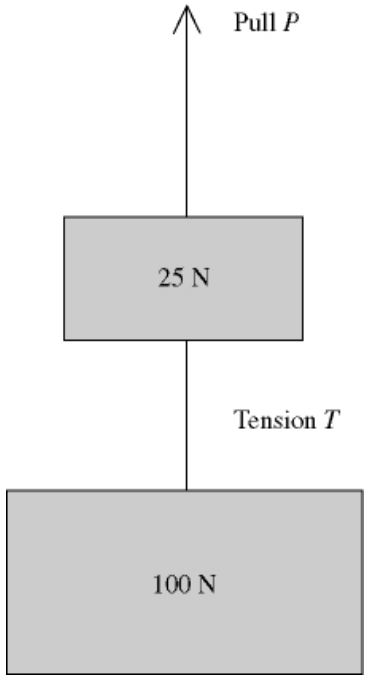
5. A plastic ball in a liquid is acted upon by its weight and by a buoyant force. The weight of the ball is 2.5 N. The buoyant force has a magnitude of 4.4 N and acts vertically upward. At a given instant, the ball is released from rest. The acceleration of the ball at that instant, including direction, is closest to:

a) zero
b) 3.7 m/s$^2$, upward
c) 7.4 m/s$^2$, downward
d) 7.4 m/s$^2$, upward
e) 3.7 m/s$^2$, downward

6. A 50.0-N box is sliding on a rough horizontal floor, and the only horizontal force acting on it is friction. You observe that at one instant the box is sliding to the right at 1.75 m/s and that it stops in 2.25 s with uniform acceleration. The magnitude of the force (in N) that friction exerts on this box is closest to:

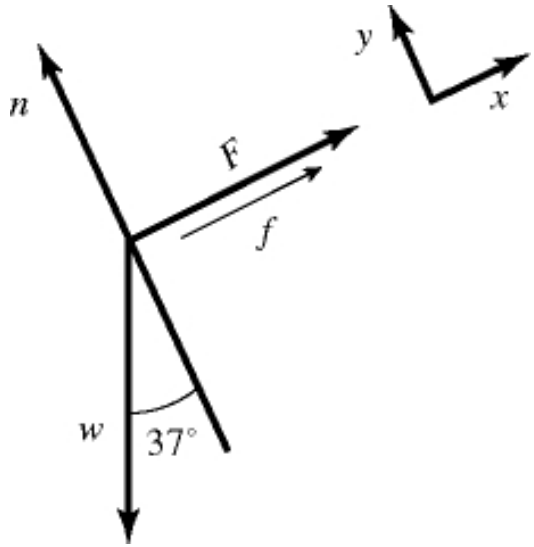
a) 38.9
b) 50.0
c) 490
d) 8.93
e) 3.97

7. Two weights are connected by a massless wire and pulled upward with an upward force with magnitude $P$ such that they move at a constant speed of 1.50 m/s. The magnitude of the tension in the wire is $T$. What is the correction relationship between $P$ and $T$?



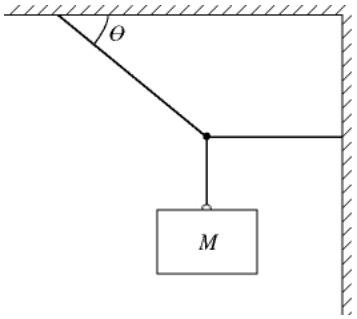

a) $P = T + 100$ N
b) $P = T + 25$ N
c) $T > P$
d) $P + T = 125$ N
e) $T = P$

8. A box with weight $w = 990$ N is on a rough surface, inclined at an angle of 37°. The box is kept from sliding down (in equilibrium) by means of an external force $F$. The other forces acting on the box are the normal and friction forces, denoted by $n$ and $f$. A force diagram, showing the four forces that act on the box, is shown in the figure. The magnitude of $f$ is 270 N. The magnitude of the normal force $n$ is closest to:



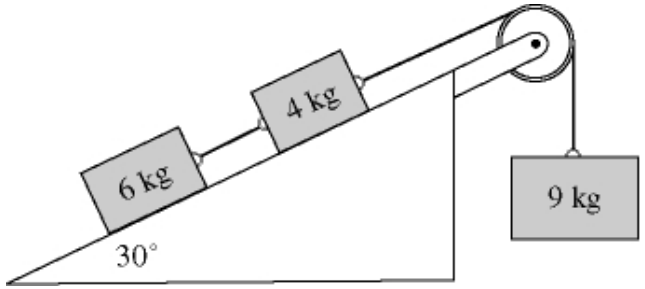

a) 791 N
b) 644 N
c) 742 N
d) 693 N
e) 594

9. In the figure, a block of mass M hangs in equilibrium. The rope that is fastened to the wall is horizontal and has a tension of 55 N. The rope that is fastened to the ceiling has a tension of 63 N and makes an angle $\theta$ with the ceiling. The angle $\theta$ is:



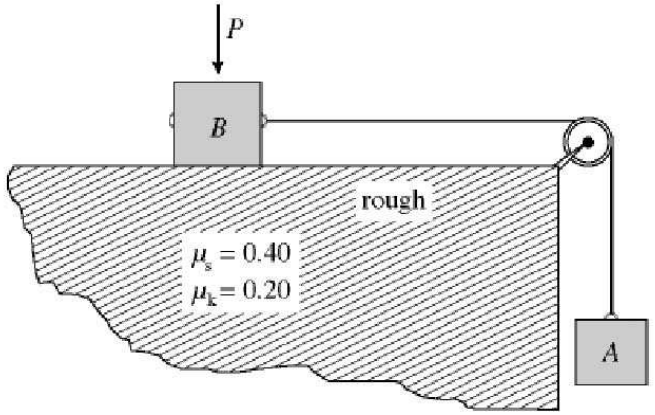

a) 61°
b) 29°
c) 76°
d) 45°
e) 41°

10. A system comprising blocks, a light frictionless pulley, a frictionless incline, and connecting ropes is shown. The 9 kg block accelerates downward when the system is released from rest. The acceleration (in $m/s^2$) of the system is closest to:



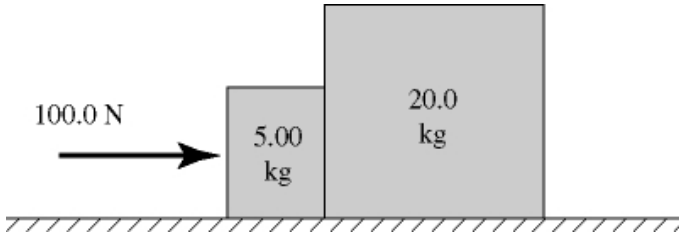

a) 1.9
b) 1.7
c) 2.1
d) 1.5
e) 2.3

11. Blocks A and B of masses 11 kg and 12 kg, respectively, are connected by a rope, which passes over a light frictionless pulley, as shown in the figure. The horizontal surface is rough. The coefficients of static and kinetic friction are 0.40 and 0.20, respectively. External force P acts on block B, as shown. The force P, for which block B is on the verge of moving, is closest to:



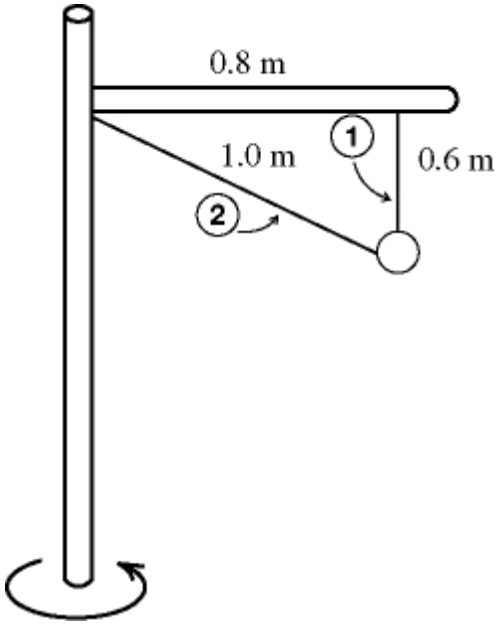

a) 420 N
b) 960 N
c) 310 N
d) 150 N
e) 240 N

12. Two boxes are next to each other on a horizontal frictionless floor. A person exerts a horizontal 100 N push on the lighter box, as shown in the figure. As a result, the push that the lighter box exerts on the larger box is closest to:




a) 25.0 N
b) 20.0 N
c) 75.0 N
d) 50.0 N
e) 80.0 N

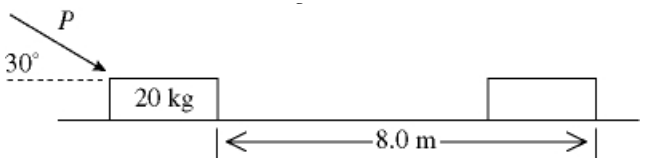
13. A ball of mass 3.0 kg is suspended by two wires from a horizontal arm, which is attached to a vertical shaft, as shown in the figure. The shaft is in uniform rotation about its axis such that the speed of the ball equals 2.5 m/s. The tension in wire 2 is closest to:




a) 44 N
b) 29 N
c) 34 N
d) 24 N
e) 39 N

14. In the figure, a constant external force P = 130 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 7.0 s, and the speed changes from $v_1$ = 0.60 m/s to $v_2$ = 3.2 m/s. The work done by the external force **P** is closest to:

a) 810 J
b) 720 J
c) 900 J
d) 620 J
e) 520 J




15. A 3.00-kg ball swings rapidly in a complete vertical circle of radius 2.00 m by a light string. The ball moves so fast that the string is always taut. As the ball swings from its lowest point to its highest point

a) The work done on it by gravity and the work done on it by the tension in the string are both equal to -118 J.
b) The work done on it by gravity and the work done on it by the tension in the string are both equal to zero.
c) The work done on it by gravity is -118 J and the work done on it by the tension in the string is +118 J.
d) The work done on it by gravity is -118 J and the work done on it by the tension in the string is zero.
e) The work done on it by gravity is +118 J and the work done on it by the tension in the string is -118 J.

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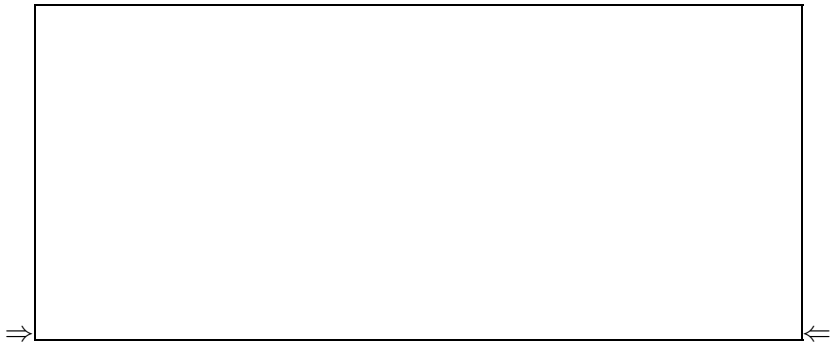

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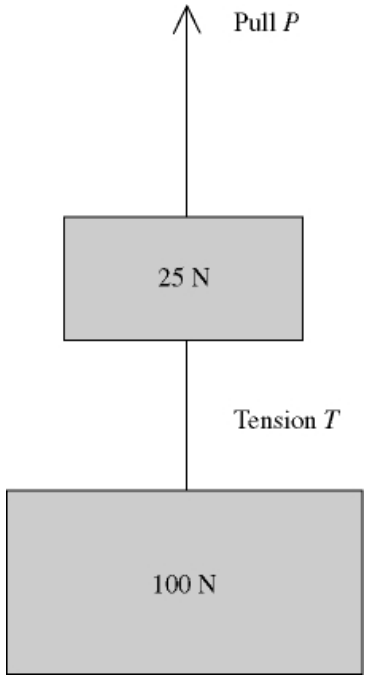
   a) 3.7 m/s$^2$, downward
   b) 7.4 m/s$^2$, downward
   c) zero
   d) 7.4 m/s$^2$, upward
   e) 3.7 m/s$^2$, upward

2. Two weights are connected by a massless wire and pulled upward with an upward force with magnitude $P$ such that they move at a constant speed of 1.50 m/s. The magnitude of the tension in the wire is $T$. What is the correction relationship between $P$ and $T$?




   a) $P = T + 100$ N
   b) $T > P$
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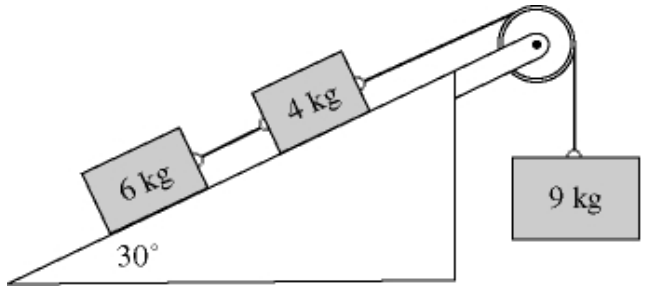
   d) $P + T = 125$ N
   e) $P = T + 25$ N

3. A system comprising blocks, a light frictionless pulley, a frictionless incline, and connecting ropes is shown. The 9 kg block accelerates downward when the system is released from rest. The acceleration (in m/s$^2$) of the system is closest to:




   a) 1.9
   b) 2.1
   c) 2.3
   d) 1.7
   e) 1.5

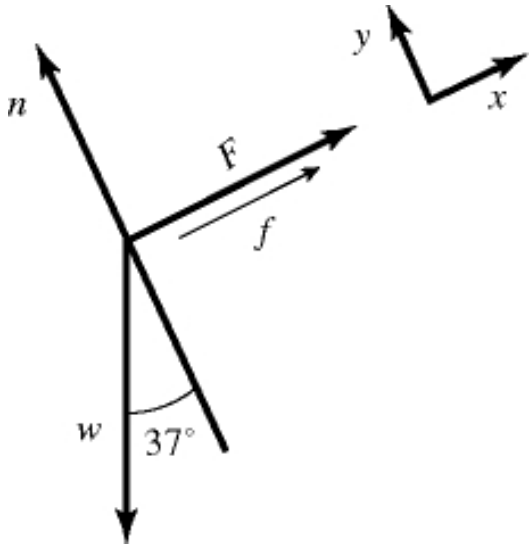
4. A 50.0-N box is sliding on a rough horizontal floor, and the only horizontal force acting on it is friction. You observe that at one instant the box is sliding to the right at 1.75 m/s and that it stops in 2.25 s with uniform acceleration. The magnitude of the force (in N) that friction exerts on this box is closest to:

   a) 3.97
   b) 50.0
   c) 490
   d) 38.9
   e) 8.93

5. A 50-kg child riding a Ferris wheel (radius = 10 m) travels in a vertical circle. The wheel completes one revolution every 10 s. The magnitude of the force on the child by the seat at the highest point on the circular path is closest to:

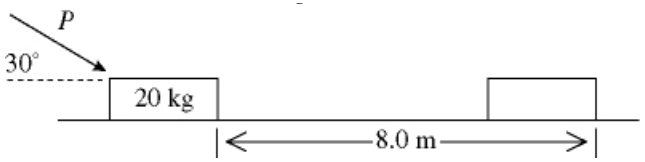
   a) 690 N
   b) 200 N
   c) 400 N
   d) 290 N
   e) 490 N

6. A box with weight $w = 990$ N is on a rough surface, inclined at an angle of 37°. The box is kept from sliding down (in equilibrium) by means of an external force $F$. The other forces acting on the box are the normal and friction forces, denoted by $n$ and $f$. A force diagram, showing the four forces that act on the box, is shown in the figure. The magnitude of $f$ is 270 N. The magnitude of the normal force $n$ is closest to:




a) 594
b) 791 N
c) 742 N
d) 693 N
e) 644 N

7. In the figure, a constant external force P = 130 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 7.0 s, and the speed changes from $v_1 = 0.60$ m/s to $v_2 = 3.2$ m/s. The work done by the external force **P** is closest to:




a) 620 J
b) 520 J
c) 810 J
d) 720 J
e) 900 J

8. A 3.00-kg ball swings rapidly in a complete vertical circle of radius 2.00 m by a light string. The ball moves so fast that the string is always taut. As the ball swings from its lowest point to its highest point

a) The work done on it by gravity is -118 J and the work done on it by the tension in the string is +118 J.
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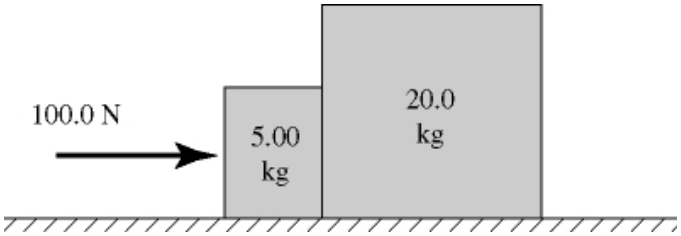
c) The work done on it by gravity and the work done on it by the tension in the string are both equal to zero.
d) The work done on it by gravity is +118 J and the work done on it by the tension in the string is -118 J.
e) The work done on it by gravity is -118 J and the work done on it by the tension in the string is zero.

9. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

a) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself that propels the body into the air.
b) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.
c) When you jump up the earth exerts a force $\mathbf{F}_1$ on you and you exert a force $\mathbf{F}_2$ on the earth. You go up because $|\mathbf{F}_1| > |\mathbf{F}_2|$.
d) You are able to spring up because the earth exerts a force upward on you that is stronger than the downward force you exert on the earth.
e) It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.

10. Two boxes are next to each other on a horizontal frictionless floor. A person exerts a horizontal 100 N push on the lighter box, as shown in the figure. As a result, the push that the lighter box exerts on the larger box is closest to:

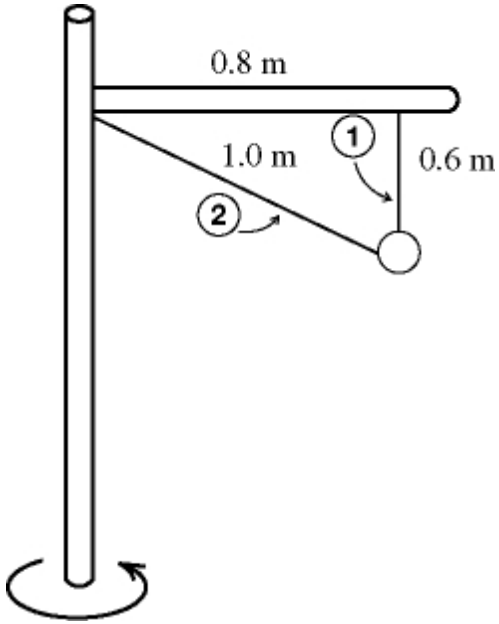



a) 50.0 N
b) 20.0 N
c) 75.0 N
d) 25.0 N
e) 80.0 N

11. A 0.20-km wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank and heads in such a way that it crosses to a point directly north of its departure point. How long does it take the boat to cross the river?

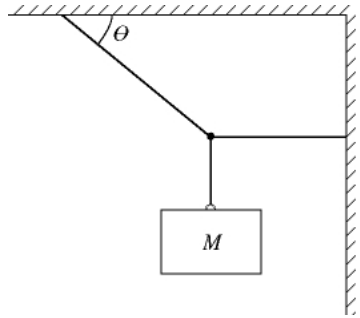
a) 29 s
b) 25 s
c) 23 s
d) 17 s
e) 27 s

12. A ball of mass 3.0 kg is suspended by two wires from a horizontal arm, which is attached to a vertical shaft, as shown in the figure. The shaft is in uniform rotation about its axis such that the speed of the ball equals 2.5 m/s. The tension in wire 2 is closest to:




a) 39 N
b) 34 N
c) 24 N
d) 44 N
e) 29 N

13. In the figure, a block of mass M hangs in equilibrium. The rope that is fastened to the wall is horizontal and has a tension of 55 N. The rope that is fastened to the ceiling has a tension of 63 N and makes an angle $\theta$ with the ceiling. The angle $\theta$ is:




a) 29°
b) 61°
c) 41°
d) 76°
e) 45°

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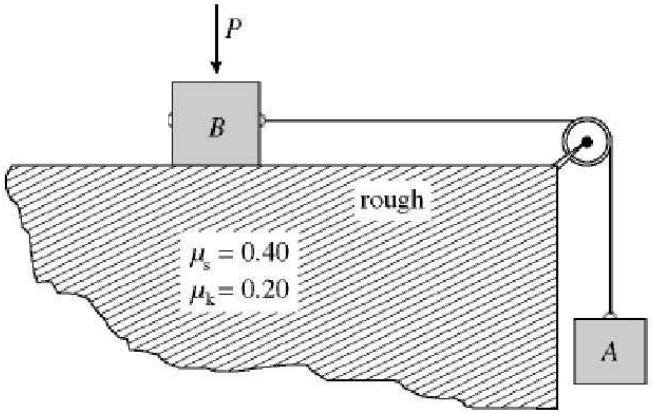
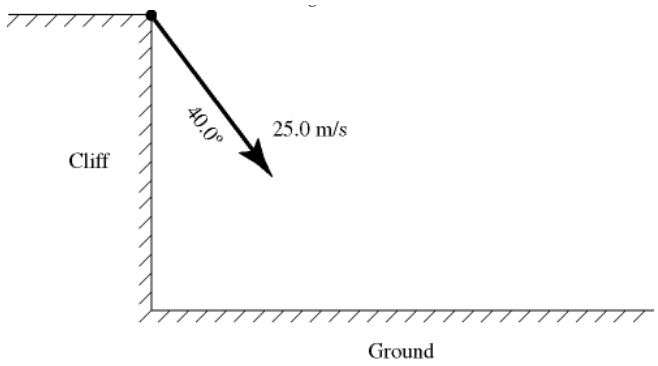
14. Blocks A and B of masses 11 kg and 12 kg, respectively, are connected by a rope, which passes over a light frictionless pulley, as shown in the figure. The horizontal surface is rough. The coefficients of static and kinetic friction are 0.40 and 0.20, respectively. External force P acts on block B, as shown. The force P, for which block B is on the verge of moving, is closest to:




a) 240 N
b) 150 N
c) 960 N
d) 310 N
e) 420 N

15. A hiker throws a stone from the upper edge of a vertical cliff. The stones initial velocity is 25.0 m/s directed at 40.0° with the face of the cliff, as shown in the figure. The stone hits the ground 3.75 s after being thrown and feels no appreciable air resistance as it falls. The height (in m) of the cliff is closest to




a) 60.3
b) 163
c) 71.8
d) 129
e) 141

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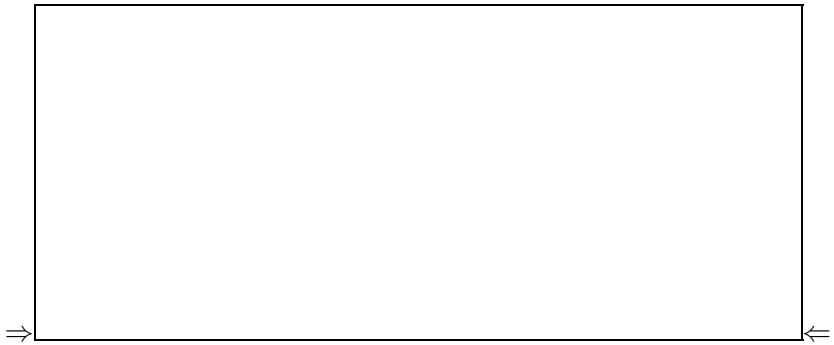

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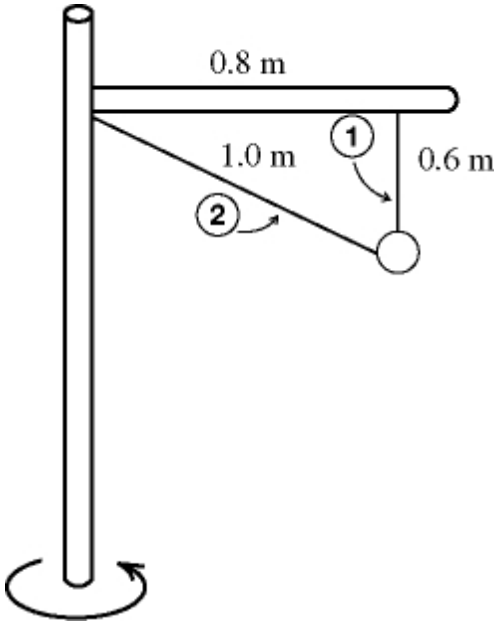
1. A ball of mass 3.0 kg is suspended by two wires from a horizontal arm, which is attached to a vertical shaft, as shown in the figure. The shaft is in uniform rotation about its axis such that the speed of the ball equals 2.5 m/s. The tension in wire 2 is closest to:

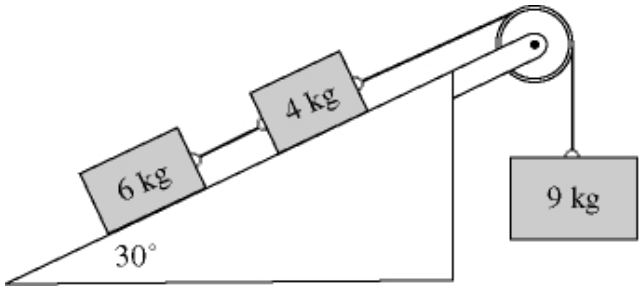



a) 39 N
b) 29 N
c) 44 N
d) 34 N
e) 24 N

2. A 50-kg child riding a Ferris wheel (radius = 10 m) travels in a vertical circle. The wheel completes one revolution every 10 s. The magnitude of the force on the child by the seat at the highest point on the circular path is closest to:

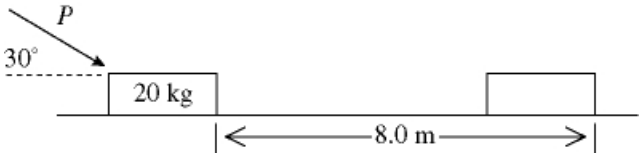
a) 490 N
b) 200 N
c) 690 N
d) 400 N
e) 290 N

3. A system comprising blocks, a light frictionless pulley, a frictionless incline, and connecting ropes is shown. The 9 kg block accelerates downward when the system is released from rest. The acceleration (in $m/s^2$) of the system is closest to:



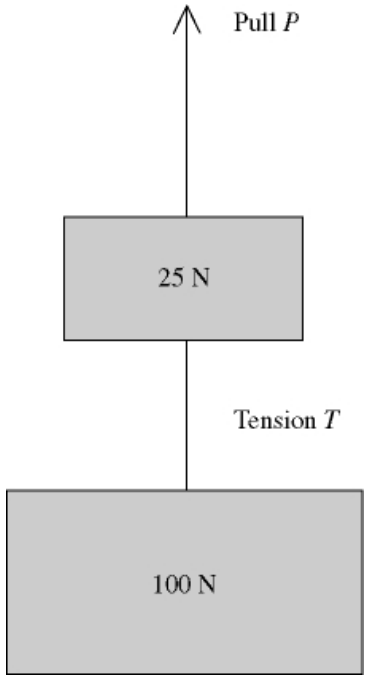

a) 2.3
b) 1.7
c) 1.9
d) 2.1
e) 1.5

4. In the figure, a constant external force P = 130 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 7.0 s, and the speed changes from $v_1 = 0.60$ m/s to $v_2 = 3.2$ m/s. The work done by the external force **P** is closest to:



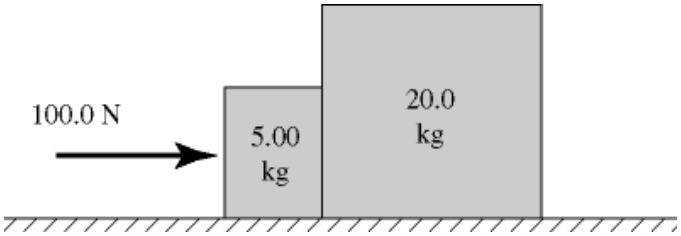

a) 520 J
b) 810 J
c) 900 J
d) 620 J
e) 720 J

5. Two weights are connected by a massless wire and pulled upward with an upward force with magnitude $P$ such that they move at a constant speed of 1.50 m/s. The magnitude of the tension in the wire is $T$. What is the correction relationship between $P$ and $T$?




a) $T = P$
b) $P = T + 25$ N
c) $P + T = 125$ N
d) $P = T + 100$ N
e) $T > P$

6. Two boxes are next to each other on a horizontal frictionless floor. A person exerts a horizontal 100 N push on the lighter box, as shown in the figure. As a result, the push that the lighter box exerts on the larger box is closest to:

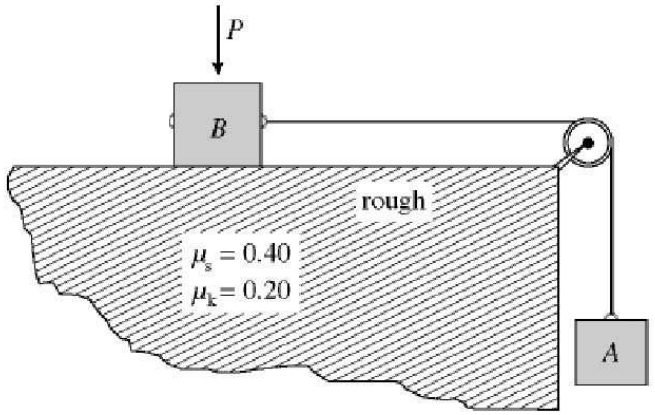



a) 50.0 N
b) 20.0 N
c) 75.0 N
d) 80.0 N
e) 25.0 N

7. A 3.00-kg ball swings rapidly in a complete vertical circle of radius 2.00 m by a light string. The ball moves so fast that the string is always taut. As the ball swings from its lowest point to its highest point

a) The work done on it by gravity is -118 J and the work done on it by the tension in the string is +118 J.
b) The work done on it by gravity is -118 J and the work done on it by the tension in the string is zero.
c) The work done on it by gravity and the work done on it by the tension in the string are both equal to zero.
d) The work done on it by gravity is +118 J and the work done on it by the tension in the string is -118 J.
e) The work done on it by gravity and the work done on it by the tension in the string are both equal to -118 J.

8. Blocks A and B of masses 11 kg and 12 kg, respectively, are connected by a rope, which passes over a light frictionless pulley, as shown in the figure. The horizontal surface is rough. The coefficients of static and kinetic friction are 0.40 and 0.20, respectively. External force P acts on block B, as shown. The force P, for which block B is on the verge of moving, is closest to:




a) 150 N
b) 240 N
c) 960 N
d) 310 N
e) 420 N

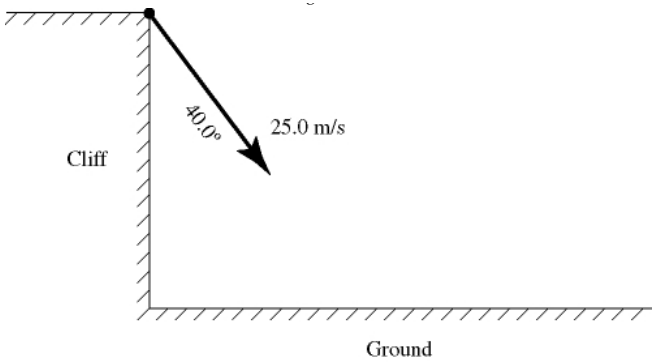
9. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

   a) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself that propels the body into the air.
   b) It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.
   c) You are able to spring up because the earth exerts a force upward on you that is stronger than the downward force you exert on the earth.
   d) When you jump up the earth exerts a force $\mathbf{F}_1$ on you and you exert a force $\mathbf{F}_2$ on the earth. You go up because $|\mathbf{F}_1| > |\mathbf{F}_2|$.
   e) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.

10. A 0.20-km wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank and heads in such a way that it crosses to a point directly north of its departure point. How long does it take the boat to cross the river?

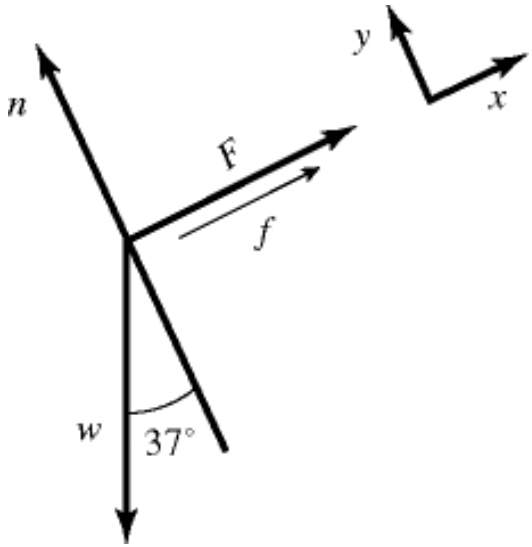
    a) 27 s
    b) 25 s
    c) 17 s
    d) 23 s
    e) 29 s

11. A hiker throws a stone from the upper edge of a vertical cliff. The stones initial velocity is 25.0 m/s directed at 40.0° with the face of the cliff, as shown in the figure. The stone hits the ground 3.75 s after being thrown and feels no appreciable air resistance as it falls. The height (in m) of the cliff is closest to



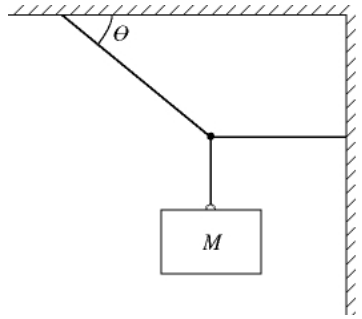

    a) 71.8
    b) 129
    c) 141
    d) 163
    e) 60.3

12. A box with weight $w = 990$ N is on a rough surface, inclined at an angle of 37°. The box is kept from sliding down (in equilibrium) by means of an external force $F$. The other forces acting on the box are the normal and friction forces, denoted by $n$ and $f$. A force diagram, showing the four forces that act on the box, is shown in the figure. The magnitude of $f$ is 270 N. The magnitude of the normal force $n$ is closest to:




a) 693 N
b) 644 N
c) 791 N
d) 742 N
e) 594

13. In the figure, a block of mass M hangs in equilibrium. The rope that is fastened to the wall is horizontal and has a tension of 55 N. The rope that is fastened to the ceiling has a tension of 63 N and makes an angle $\theta$ with the ceiling. The angle $\theta$ is:




a) 45°
b) 61°
c) 29°
d) 76°
e) 41°

14. A plastic ball in a liquid is acted upon by its weight and by a buoyant force. The weight of the ball is 2.5 N. The buoyant force has a magnitude of 4.4 N and acts vertically upward. At a given instant, the ball is released from rest. The acceleration of the ball at that instant, including direction, is closest to:

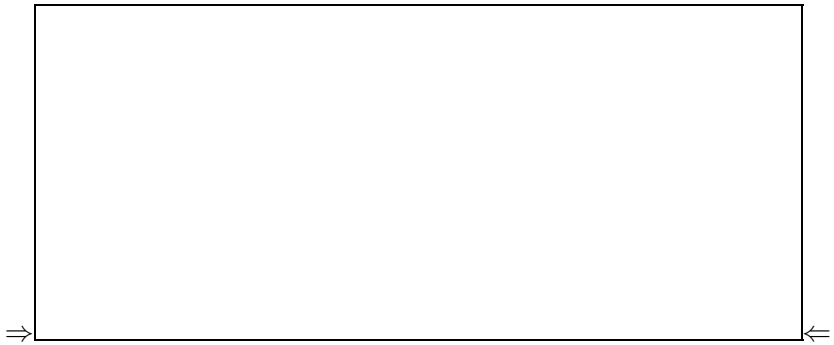
a) 7.4 m/s$^2$, upward
b) zero
c) 3.7 m/s$^2$, upward
d) 7.4 m/s$^2$, downward
e) 3.7 m/s$^2$, downward

15. A 50.0-N box is sliding on a rough horizontal floor, and the only horizontal force acting on it is friction. You observe that at one instant the box is sliding to the right at 1.75 m/s and that it stops in 2.25 s with uniform acceleration. The magnitude of the force (in N) that friction exerts on this box is closest to:

a) 50.0
b) 490
c) 38.9
d) 3.97
e) 8.93

NOTE: This file contains all four versions of the exam.

# Physics 123 - Analytical Physics
# SECOND COMMON HOUR EXAM
# Monday, November 9, 2009 9:40 - 11:00 PM
# Professor R.A. Bartynski

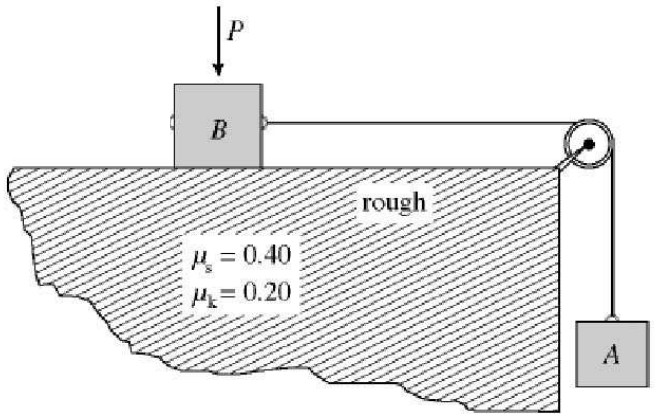


Your name sticker with **exam code. SIGN HERE:**

1. Use a #2 pencil to make entries on the answer sheet. Enter the following ID information now, before the exam starts..
2. In the section labeled NAME (Last, First, M.I.) enter your last name, then fill in the empty circle for a blank, then enter your first name, another blank, and finally your middle initial.
3. Under STUDENT # enter your 9-digit RUID Number.
4. Enter 123 under COURSE, and your section number (see label above) under SEC.
5. Under CODE enter the exam code given above.
6. During the exam, you may use pencils, a calculator, and one 8.5 x 11 inch sheet (both sides) with formulas and notes.
7. There are 15 multiple-choice questions on the exam. For each question, mark only one answer on the answer sheet. There is no deduction of points for an incorrect answer, so even if you cannot work out the answer to a question, you should make an educated guess. **At the end of the exam, hand in the answer sheet and the cover page.** Retain this question paper for future reference and study.
8. When you are asked to open the exam, make sure that your copy contains all 15 questions. Raise your hand if this is not the case, and a proctor will help you. Also raise your hand during the exam if you have a question.
9. Please SIGN the cover sheet under your name sticker and have your student ID ready to show to the proctor during the exam.
10. If needed, the acceleration due to gravity on earth may be take as $g = 9.81\ m/s^2$.

NOTE: This file contains all four versions of the exam.

1. Blocks A and B of masses 11 kg and 12 kg, respectively, are connected by a rope, which passes over a light frictionless pulley, as shown in the figure. The horizontal surface is rough. The coefficients of static and kinetic friction are 0.40 and 0.20, respectively. External force P acts on block B, as shown. The force P, for which block B is on the verge of moving, is closest to:




a) 310 N
b) 150 N
c) 960 N
d) 240 N
e) 420 N

2. A 50-kg child riding a Ferris wheel (radius = 10 m) travels in a vertical circle. The wheel completes one revolution every 10 s. The magnitude of the force on the child by the seat at the highest point on the circular path is closest to:

a) 490 N
b) 400 N
c) 290 N
d) 200 N
e) 690 N

3. Consider what happens when you jump up in the air. Which of the following is the most accurate statement?

a) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself that propels the body into the air.
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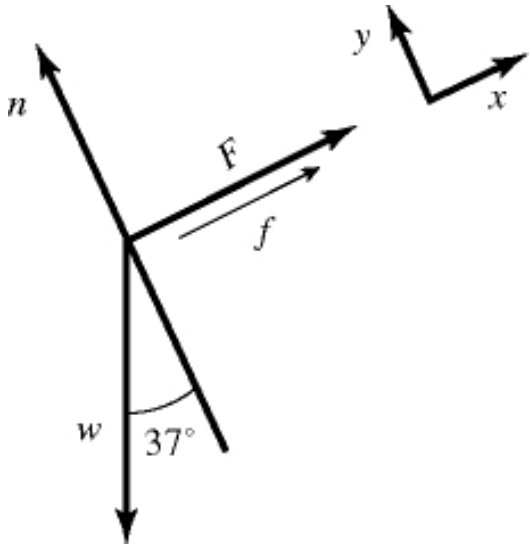
4. A box with weight $w$ = 990 N is on a rough surface, inclined at an angle of 37°. The box is kept from sliding down (in equilibrium) by means of an external force $F$. The other forces acting on the box are the normal and friction forces, denoted by $n$ and $f$. A force diagram, showing the four forces that act on the box, is shown in the figure. The magnitude of $f$ is 270 N. The magnitude of the normal force $n$ is closest to:

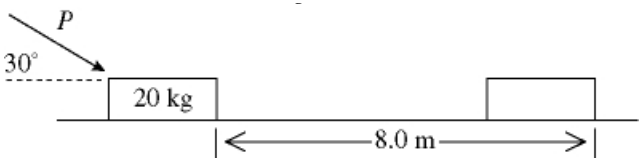



a) 594
b) 791 N
c) 693 N
d) 742 N
e) 644 N

5. A 50.0-N box is sliding on a rough horizontal floor, and the only horizontal force acting on it is friction. You observe that at one instant the box is sliding to the right at 1.75 m/s and that it stops in 2.25 s with uniform acceleration. The magnitude of the force (in N) that friction exerts on this box is closest to:

a) 50.0
b) 8.93
c) 38.9
d) 490
e) 3.97

6. In the figure, a constant external force P = 130 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 7.0 s, and the speed changes from $v_1$ = 0.60 m/s to $v_2$ = 3.2 m/s. The work done by the external force **P** is closest to:




a) 720 J
b) 620 J
c) 520 J
d) 900 J
e) 810 J

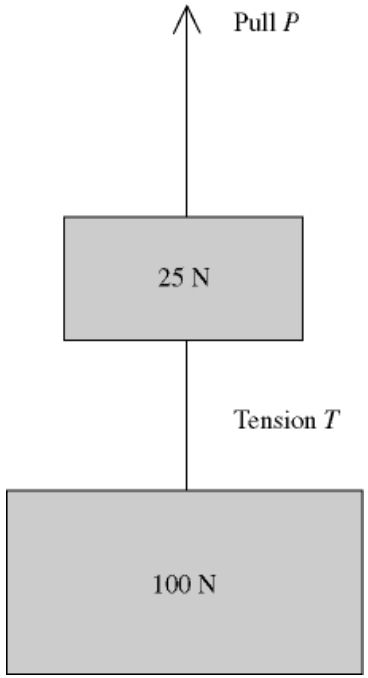
7. A 3.00-kg ball swings rapidly in a complete vertical circle of radius 2.00 m by a light string. The ball moves so fast that the string is always taut. As the ball swings from its lowest point to its highest point

a) The work done on it by gravity is -118 J and the work done on it by the tension in the string is zero.
b) The work done on it by gravity is +118 J and the work done on it by the tension in the string is -118 J.
c) The work done on it by gravity is -118 J and the work done on it by the tension in the string is +118 J.
d) The work done on it by gravity and the work done on it by the tension in the string are both equal to -118 J.
e) The work done on it by gravity and the work done on it by the tension in the string are both equal to zero.

8. A 0.20-km wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank and heads in such a way that it crosses to a point directly north of its departure point. How long does it take the boat to cross the river?

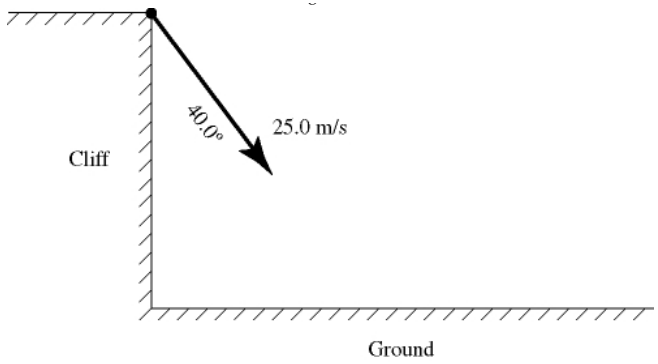
a) 17 s
b) 29 s
c) 25 s
d) 27 s
e) 23 s

9. Two weights are connected by a massless wire and pulled upward with an upward force with magnitude $P$ such that they move at a constant speed of 1.50 m/s. The magnitude of the tension in the wire is $T$. What is the correction relationship between $P$ and $T$?




a) $P = T + 100$ N
b) $T = P$
c) $T > P$
d) $P + T = 125$ N
e) $P = T + 25$ N

10. A hiker throws a stone from the upper edge of a vertical cliff. The stones initial velocity is 25.0 m/s directed at 40.0° with the face of the cliff, as shown in the figure. The stone hits the ground 3.75 s after being thrown and feels no appreciable air resistance as it falls. The height (in m) of the cliff is closest to

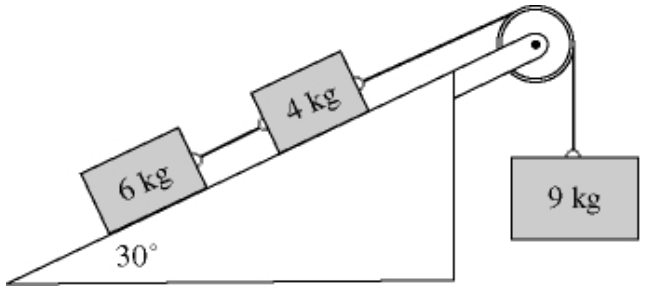



a) 60.3
b) 71.8
c) 129
d) 141
e) 163

11. A plastic ball in a liquid is acted upon by its weight and by a buoyant force. The weight of the ball is 2.5 N. The buoyant force has a magnitude of 4.4 N and acts vertically upward. At a given instant, the ball is released from rest. The acceleration of the ball at that instant, including direction, is closest to:

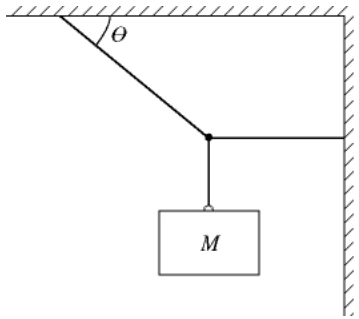
a) 7.4 m/s$^2$, upward
b) 3.7 m/s$^2$, upward
c) 7.4 m/s$^2$, downward
d) 3.7 m/s$^2$, downward
e) zero

12. A system comprising blocks, a light frictionless pulley, a frictionless incline, and connecting ropes is shown. The 9 kg block accelerates downward when the system is released from rest. The acceleration (in $m/s^2$) of the system is closest to:



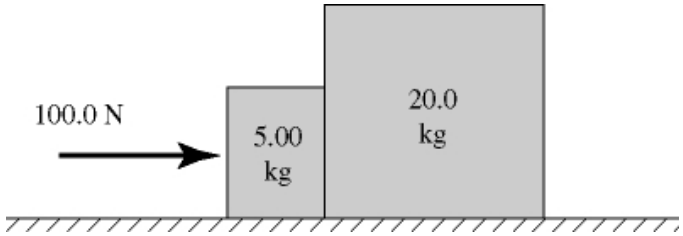

a) 1.9
b) 1.5
c) 2.1
d) 1.7
e) 2.3

13. In the figure, a block of mass M hangs in equilibrium. The rope that is fastened to the wall is horizontal and has a tension of 55 N. The rope that is fastened to the ceiling has a tension of 63 N and makes an angle $\theta$ with the ceiling. The angle $\theta$ is:



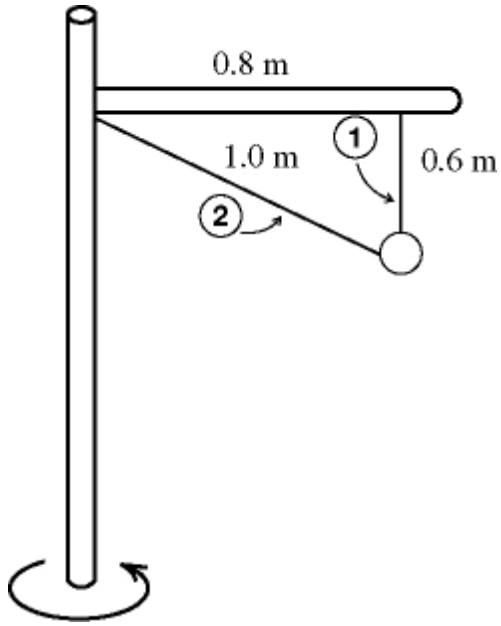

a) 76°
b) 41°
c) 29°
d) 45°
e) 61°

14. Two boxes are next to each other on a horizontal frictionless floor. A person exerts a horizontal 100 N push on the lighter box, as shown in the figure. As a result, the push that the lighter box exerts on the larger box is closest to:




a) 20.0 N
b) 75.0 N
c) 80.0 N
d) 25.0 N
e) 50.0 N

15. A ball of mass 3.0 kg is suspended by two wires from a horizontal arm, which is attached to a vertical shaft, as shown in the figure. The shaft is in uniform rotation about its axis such that the speed of the ball equals 2.5 m/s. The tension in wire 2 is closest to:




a) 29 N
b) 39 N
c) 24 N
d) 34 N
e) 44 N