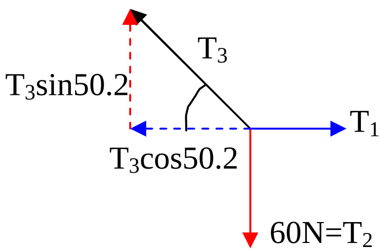
Solutions to Physics Practice Test 14 A

Problem #1

The answer to item #2 can be found using W = mg = (6Kg)(10m/s^2) = 60 N. The tension in rope #2 must exactly cancel the weight of the hanging object. Now, a free-body diagram of the ropes at the junction can be drawn.



From ΣF_Y: $T_3\sin50.2 - 60 = 0$

$T_3 = 60/\sin(50.2) = 78.1$ N

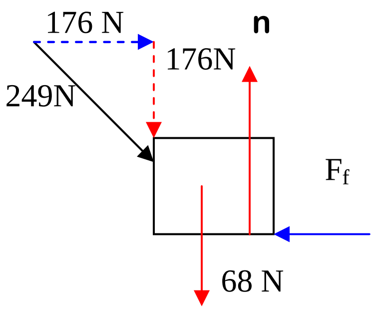
From ΣF_X: $T_1 - T_3\cos(50.2) = 0$

$T_1 - \{78.1\}\cos(50.2) = 0$

$T_1 = 50$ N

Problem #2

The following free-body diagram can be constructed from the given information.



From ΣF_Y: **n** – 68N – 176 N = 0

n = 244 N

From ΣF_X: 176N – F_f = 0

F_f = 176 N

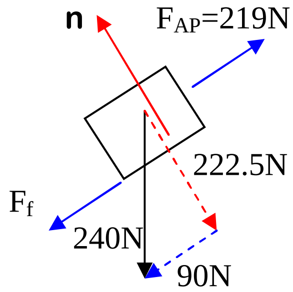
From $F_f = \mu$**n** we can substitute values-

$\mu = F_f$ / **n** = 176~~N~~ / 244 ~~N~~ = 0.721

When the initial applied force is removed and a horizontal applied force is used the normal force will change to a value of **n**=68N but μ=0.721 as before. Now using $F_f = \mu$**n** = 0.721(68N) = 49 N

Problem #3

Since the block slides "up" the incline then force of friction points "down" the ramp as shown in free-body diagram.



From $\Sigma F_{\perp}$: $\mathbf{n} - 222.5\text{N} = 0$ $\therefore \mathbf{n} = 222.5\text{N}$

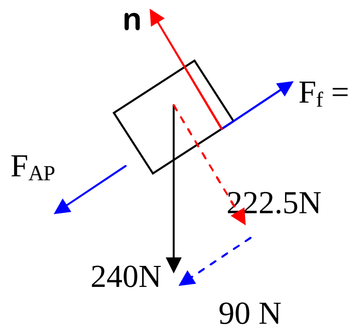
From $\Sigma F_{\parallel}$: $219\text{N} - 90\text{ N} - F_f = 0$

$\therefore F_f = 129\text{ N}$

From $F_f = \mu\mathbf{n}$ and substitution we get

$\mu = F_f / \mathbf{n}$ = 129~~N~~ / 222.5 ~~N~~ = 0.580

If the block moves down the incline at constant speed the 90 N part of the weight is pulling down on the block. The force of friction would reverse direction however. Since the normal force is still the same then the amount of friction is also still the same, 129 N. The 90 N part of the weight cannot compensate for all of the friction. You would have to supply an additional 39 N of force. See the figure below:

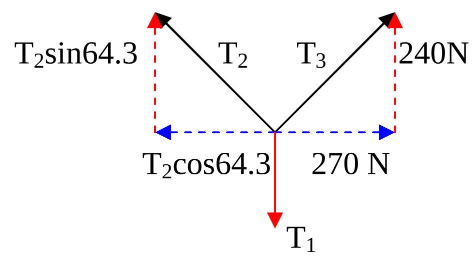


From $\Sigma F_{\parallel}$: $F_{AP} + 90\text{ N} - 129\text{N} = 0$

$\therefore F_{AP} = 39\text{ N}$ down the ramp

Problem #4

The free-body diagram of the intersection of cables can be constructed from the given information. Note that the tension in cable #3 is given. The x and y parts of that tension are also shown.



Items #14 and #15 can be answered directly from the diagram. The tension in cable #2 can be found from the horizontal forces equation.

From ΣF_X: $270\text{N} - T_2\cos(64.3) = 0$

$270\text{ N} = T_2\cos(64.3)$

$T_2 = 270\text{N} / \cos(64.3) = 623\text{ N}$

The tension in the vertical cable can be found using the forces in the y-direction equation after you substitute the correct value for T_2.

From ΣF_Y: $240 + T_2\sin(64.3) - T_1 = 0$

$240 + \{623\}\sin(64.3) = T_1$

$801\text{ N} = T_1$

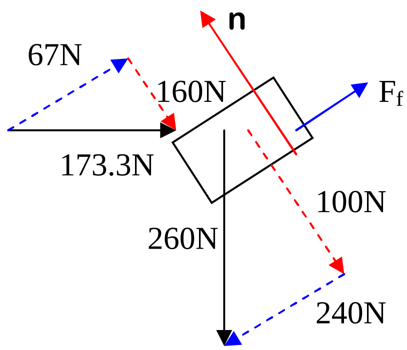
Since cable #1 is supporting the hanging mass, M?, then the tension in that cable must be exactly equal to the weight. Using W=mg we can determine mass.

$m = W/g = 801\text{N} / 10\text{ m/s}^2 = 8.01\text{ Kg}$

Note that on the test you will have one of these problems. I do not know if I will give you a tension and ask for the weight or if I will give you a weight and ask for tensions. Be prepared for either.

Problem #5

The first line indicates that the box is being "lowered". This is critical in recognizing that the friction force will act in a direction "up the ramp". In other words somebody is pushing on this object in order to prevent it from coming down the ramp too quickly. The diagram of the forces is shown below.



Item #19 can be answered directly from the diagram. Item #18 is found from summing the forces perpendicular to the surface.

From $\Sigma F_{\perp}$: $\mathbf{n} - 160N - 100N = 0$

$\mathbf{n} = 260\ N$

Item #17 is found by summing the forces parallel to the surface of the incline.

From $\Sigma F_{||}$: $240N - 67N - F_f = 0$

$F_f = 173\ N$

It is a coincidence that this is also the applied force.

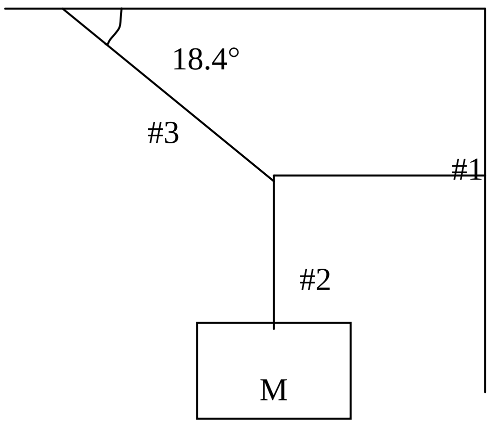
Item #20 is found from $F_f = \mu\mathbf{n}$.

$\mu = F_f / \mathbf{n} = 173\not{N} / 260\ \not{N} = 0.665$

To move the block up hill at constant speed by pushing parallel to the surface you would have to overcome a gravity force of 240N and a friction force of 66.5N or a total of 306.5N parallel and up the ramp. Note that friction changed here because we changed the direction of the push and reduced normal force to 100N.

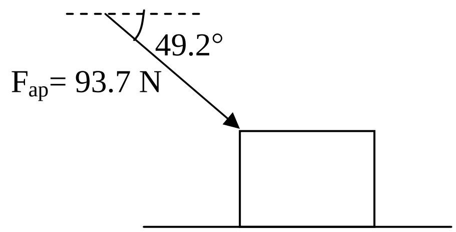
Physics Practice Test 14 B Name ________________________

A 3 Kg object is hung as shown in the diagram below. The string labeled as #3 forms a 18.4° angle with the horizontal.



1. The tension in line #1 is ___ N.
   a) 50
   b) 60
   c) 70
   d) 80
   e) 90
2. The tension in line #2 is ___ N.
   a) 30
   b) 40
   c) 50
   d) 60
   e) 70
3. The tension in line #3 is ___ N.
   a) 67.5
   b) 78.1
   c) 89.4
   d) 94.9
   e) 106.3

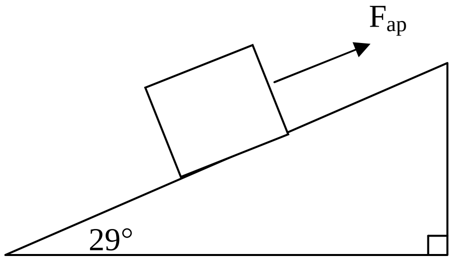
A 13.3 Kg block is placed on a level surface. An applied force of 93.7 N at 49.2° below the horizontal moves the block at constant speed.



4. The coefficient of kinetic friction is
   a) 0.16
   b) 0.30
   c) 0.44
   d) 0.58
   e) 0.72
5. The normal force is ___N.
   a) 164
   b) 204
   c) 244
   d) 284
   e) 324
6. The force of friction is ____N.
   a) 35.8
   b) 61.2
   c) 95.1
   d) 125
   e) 176
7. To move the block sideways at constant speed over the <u>same surface</u> requires a horizontal applied force of ___ Newtons.
   a) 25
   b) 32
   c) 40
   d) 49
   e) 59

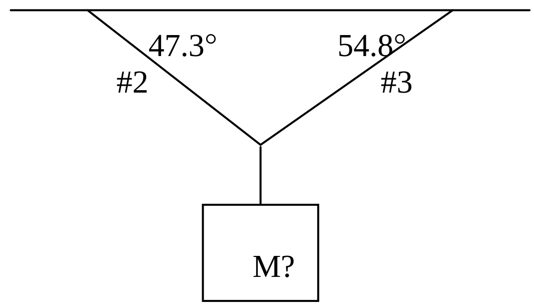
Test 104B (continued)

A 10.3 kg block is placed on a 29° inclined plane. A 113 N applied force parallel to the surface of the incline moves the block up at constant speed.



8. The normal force acting on the block is ___ N.
   a) 90.1
   b) 125.9
   c) 206.3
   d) 222.5
   e) 448.0
9. The coefficient of friction between block and incline is ___.
   a) 0.23
   b) 0.42
   c) 0.58
   d) 0.70
   e) 0.85
10. The force of friction is ___ N.
    a) 63.1
    b) 107.1
    c) 129.1
    d) 175.4
    e) 188.2
11. To move the block down the incline at constant speed would require a force of ___ N parallel to the incline.
    a) 13.2
    b) 25.5
    c) 39.2
    d) 52.6
    e) 68.2

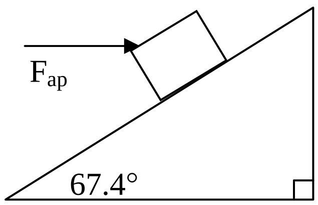
An unknown mass is hanging in the figure below. The tension in cable #3 is 416.2N. Cable #3 forms an angle of 54.8° with the horizontal. Cable #2 forms an angle of 47.3° with the horizontal.



12. The unknown mass is ___ Kg.
    a) 50 d) 80
    b) 60 e) 90
    c) 70
13. The tension in cable #2 is ___ N.
    a) 241
    b) 354
    c) 469
    d) 506
    e) 622
14. The horizontal component of the tension in cable #3 is ___ N.
    a) 180
    b) 210
    c) 240
    d) 270
    e) 300
15. The vertical part of the tension in cable #3 is ___ N.
    a) 140 d) 440
    b) 240 e) 540
    c) 340
16. Tension in the vertical cable is ___N.
    a) 500
    b) 600
    c) 700
    d) 800
    e) 900

Test 104 B (continued)

A 26 kg box is lowered from the top of an inclined plane. The incline has been raised 67.4° from the horizontal. An applied force of 130 N parallel to the ground and toward the incline acts to lower the box at constant speed.



17. The force of friction acting on the block is about ___ N.
    a) 100
    b) 148
    c) 173
    d) 182
    e) 190
18. The normal force acting on the block is about ___N.
    a) 200
    b) 220
    c) 240
    d) 260
    e) 280
19. The part of the applied force parallel to the incline is ___ N.
    a) 50
    b) 58
    c) 60
    d) 67
    e) 96
20. The kinetic coefficient of friction is
    a) 0.37
    b) 0.50
    c) 0.67
    d) 0.76
    e) 0.86

Answers to Practice Test 14B

1. e
2. a
3. d
4. b
5. b
6. b
7. c
8. a
9. d
10. a
11. a
12. b
13. b
14. c
15. c
16. b
17. e
18. b
19. a
20. e