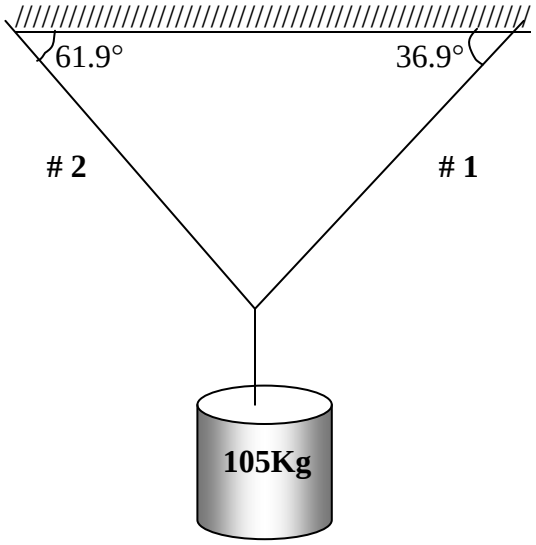
Physics Practice Test 15A Newton's Laws of Motion

Problem I



The two cables are used to suspend a 105 Kg object below the ceiling. Find the tension in each cable.

1. The horizontal tension in cable #2 is ___N
   A) 300 B) 400 C) 550 D) 750
2. The vertical tension in cable #1 is ___N.
   A) 300 B) 400 C) 550 D) 750
3. The total tension in cable #1 is ___N.
   A) 500 B) 625 C) 850 D) 975
4. The total tension in cable #2 is ___N.
   A) 500 B) 625 C) 850 D) 975

Problem 2

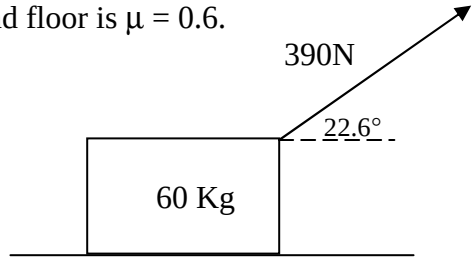
A net force of 24 N acts on a 60 N object. The net force is applied for 5 seconds starting the object from rest.

5. The object accelerates at ____ m/s^2.
   A) 3 B) 4 C) 5 D) 6 E) 7
6. The distance traveled during the 5 second interval is ___m.
   A) 37.5 B) 50 C) 62.5 D) 75
7. The object has a final speed of ___m/s.
   A) 20 B) 25 C) 30 D) 35

Use g = -10 m/s^2 as needed

Problem 3

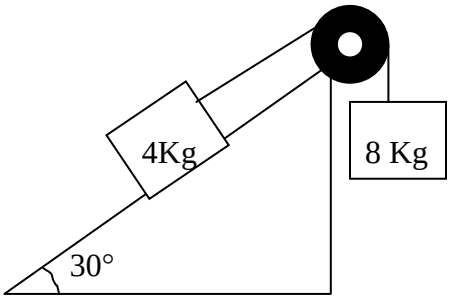
A 60 Kg crate is placed at rest on a level floor. An applied force of 390 N at 22.6° above the horizontal moves the crate from rest over a distance of 16.3 m. The coefficient of friction between crate and floor is $\mu = 0.6$.



8. The normal force acting on the block is ___N.
   A) 150 B) 300 C) 450 D) 600
9. The force of friction acting against the block is ___N.
   A) 180 B) 270 C) 360 D) 420
10. The object accelerates at ___ m/s^2.
    A) 1.5 B) 2.0 C) 2.5 D) 3.0
11. The final speed of the crate at the end of the 16.3 m distance is ___ m/s.
    A) 7 B) 8 C) 9 D) 10
12. If the applied force is removed the crate will begin to slide to rest at a rate of - ___ m/s^2.
    A) 3 B) 4 C) 6 D) 8

Problem 4

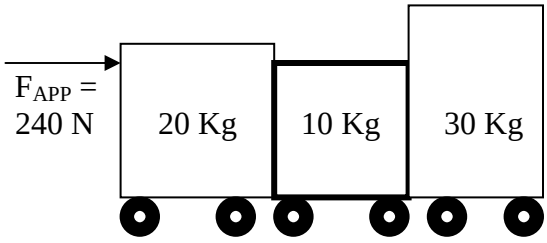
A lightweight, frictionless pulley is placed at the top of a frictionless, 30° incline. A 4 Kg is raised up the incline by means of a rope that simultaneously lowers an 8 Kg block.



13. The normal force acting on the 4 Kg block is ___N.
    A) 10 B) 20 C) 35 D) 40
14. The blocks will accelerate at ___m/s^2.
    A) 2.5 B) 3.3 C) 5.0 D) 6.7
15. The tension while accelerating is ___N.
    A) 10 B) 20 C) 40 D) 80
16. If the coefficient of friction between 4Kg block and incline is μ=0.52 the blocks will accelerate at ___ m/s^2.
    A) 2.0 B) 3.5 C) 5.0 D) 6.5
17. With the friction mentioned in item #16 the tension in the line is ___N.
    A) 14 B) 28 C) 42 D) 52

Problem 5

A forklift pushes horizontally with 240N on three carts. The masses of the carts are shown in the figure below.

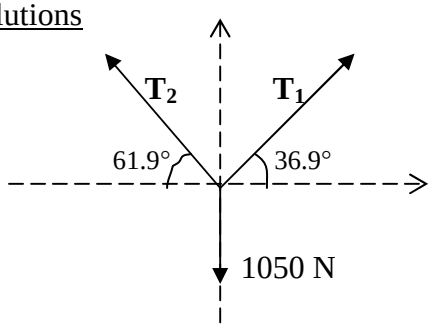


18. The carts will accelerate at ___ m/s^2.
    A) 2 B) 3 C) 4 D) 6
19. The 10 K cart pushes on the 30 Kg with a force of ___N.
    A) 40 B) 60 C) 80 D) 120
20. The 20Kg cart pushes on the 10 Kg cart with a force of ___N.
    A) 100 B) 120 C) 140 D) 160

Answers

1. B
2. A
3. A
4. C
5. B
6. B
7. A
8. C
9. B
10. A
11. A
12. C
13. C
14. C
15. C
16. B
17. D
18. C
19. D
20. D

Solutions

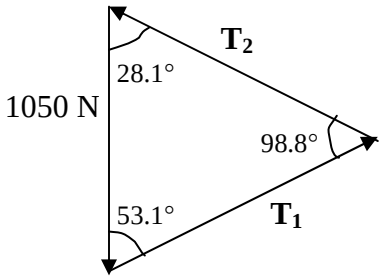


$\sum F_X$: $\mathbf{T_1}\cos(36.9) - \mathbf{T_2}\cos(61.9) = 0$

$\sum F_Y$: $\mathbf{T_1}\sin(36.9) + \mathbf{T_2}\sin(61.9) - 1050 = 0$

Solving equations using matrices or algebra yields values of $\mathbf{T_1}$ = 500N and $\mathbf{T_2}$ = 850 N. Using these values for the hypotenuse will lead to correct parts on sides.

Alternate Approach:



Now you can use the Law of Sines to find the opposite sides. ☺

Problem 2

Using $F_{NET} = ma$ or $(24N) = (6Kg)a$

$a = 4\ m/s^2$

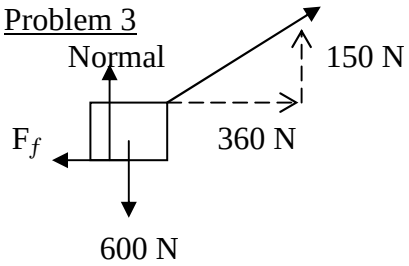
Using $d = \frac{1}{2} a t^2$ or $\frac{1}{2}(4m/s^2)(5sec)^2$

$d = 50\ m$

Using $v_f = v_o + at$ or $0 + (4m/s^2)(5sec)$

$v_f = 20\ m/s$

Problem 3



$\sum F_\perp$: Normal – 600 + 150 = 0 $\therefore$ N= 450N

Using $F_f = \mu$ (Normal) = 0.60(450)=270N

$\sum F_\parallel$: 360N – 270N = (60Kg)(a)

$\therefore a = 1.5\ m/s^2$

Using $v_f^2 = 2ad = 2(1.5)(16.3)$ $\therefore v_f = 7m/s$

When the applied force is removed the normal value changes to 600 N and friction changes to 0.6(600N) = -360N. Using $\sum F_\parallel$: 0 – 360N = (60Kg)(a) gives a resulting value of $-6\ m/s^2$. It is **not** coincidental that the acceleration of the free sliding object happens to be $a = -\mu g$.

Problem 4

$\sum F_8$: 80 – T = 8a
$\sum F_\parallel$: T – 20 = 4a
} Solving gives $a = 5\ m/s^2$ & T = 40N

For the last two questions use

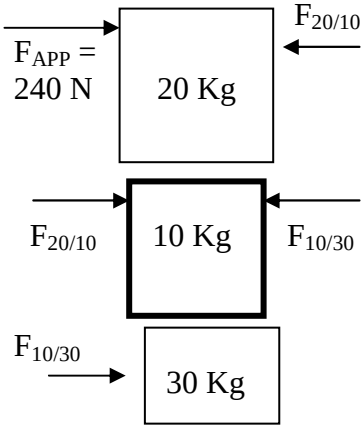
Normal = 40cos(30°) = 34.6 N

$F_f = \mu$ (Normal) = 0.52(34.6) = 18N

$\sum F_8$: 80 – T = 8a
$\sum F_\parallel$: T – 20 – 18 = 4a

Solving eqtns: $a = 3.5 m/s^2$ T = 52N

Problem 5



$\sum F_{\parallel 20}$: $240 - F_{20/10} = 20a$
$\sum F_{\parallel 10}$: $F_{20/10} - F_{10/30} = 10a$
$\sum F_{\parallel 30}$: $F_{10/30} - 0 = 30a$

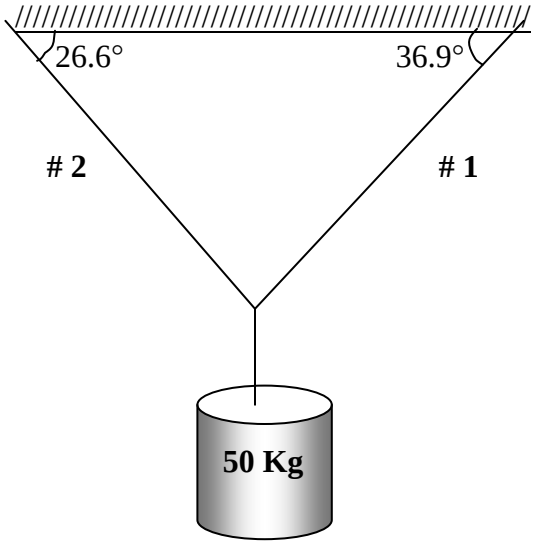
Solving above equations yields desired answers.

Physics Practice Test 15 B

Newton'Laws of Motion

Use g = -10 m/s^2

Problem I



The two cables are used to suspend a 50 Kg object below the ceiling. Find the tension in each cable.

21. The horizontal tension in cable #2 is ___N
    A) 300 B) 400 C) 550 D) 750
22. The vertical tension in cable #1 is ___N.
    A) 300 B) 400 C) 550 D) 750
23. The total tension in cable #1 is ___N.
    A) 500 B) 625 C) 850 D) 975
5. The total tension in cable #2 is ___N.
    A) 447 B) 603 C) 854 D) 975

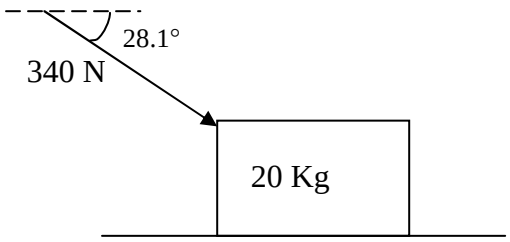
Problem 2

A net force of 24 N acts on a 80 N object. The net force is applied for 6 seconds starting the object from rest.

25. The object accelerates at ____ m/s^2.
    A) 3 B) 4 C) 5 D) 6 E) 7
26. The distance traveled during the 6 second interval is ___m.
    A) 38 B) 54 C) 63 D) 75
27. The object has a final speed of ___m/s.
    A) 18 B) 24 C) 30 D) 36

Problem 3

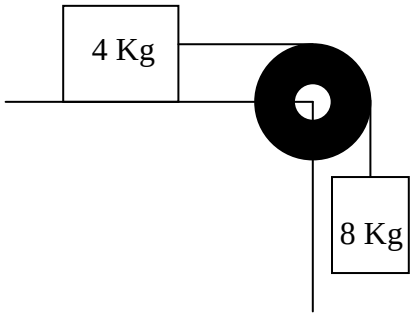
A 20 Kg crate is placed at rest on a level floor. An applied force of 340 N at 28.1° below the horizontal moves the crate from rest over a distance of 5.3 m. The coefficient of friction between crate and floor is $\mu = 0.5$.



28. The normal force acting on the block is ___N.
    A) 200 B) 250 C) 360 D) 420
29. The force of friction acting against the block is ___N.
    A) 180 B) 270 C) 360 D) 420
30. The object accelerates at ___ m/s^2.
    A) 3 B) 4 C) 5 D) 6
31. The final speed of the crate at the end of the 5.3 m distance is ___ m/s.
    A) 7 B) 8 C) 9 D) 10
32. If the applied force is removed the crate will begin to slide to rest at a rate of - ___ m/s^2.
    A) 3 B) 4 C) 5 D) 6

Problem 4

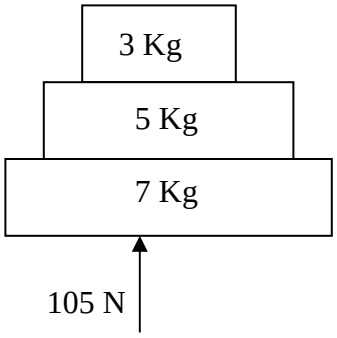
A lightweight, frictionless pulley is placed at the corner of a flat surface. A 4 Kg box is placed on the surface. An 8 Kg object is suspended under the pulley and connected to the box by string. The coefficient of friction between box and surface is $\mu = 0.8$.



33. The friction acting on the 4 Kg block is ___N.
    A) 10 B) 20 C) 32 D) 40
34. The objects will accelerate at ___m/s^2.
    A) 3 B) 4 C) 5 D) 6
35. The tension while accelerating is ___N.
    A) 24 B) 32 C) 48 D) 80
36. If the coefficient of friction between 4Kg block and incline is μ=0 the blocks will accelerate at ___ m/s^2.
    A) 2.0 B) 3.2 C) 5.0 D) 6.7
37. With the friction mentioned in item #16 the tension in the line is ___N.
    A) 14 B) 27 C) 42 D) 52

Problem 5

A 105 N force pushes up on the bottom of a stack of books as shown in the figure below.



38. The books will accelerate down at ___ m/s^2.
    A) 2 B) 3 C) 4 D) 6
39. The 7 Kg book pushes up on the 5 Kg book with a force of ___N.
    A) 56 B) 75 C) 80 D) 120
40. The 5Kg book pushes up on the 3 Kg book with a force of ___N.
    A) 9 B) 21 C) 30 D) 42

Answers

21. B
22. A
23. A
24. A
25. A
26. B
27. A
28. C
29. A
30. D
31. B
32. C
33. C
34. B
35. C
36. D
37. B
38. B
39. A
40. B