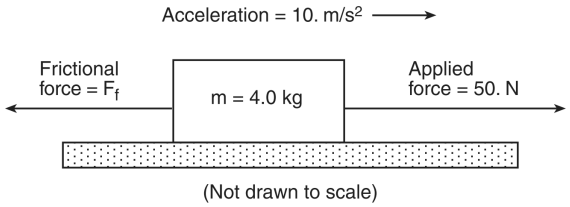
Friction, Inclined Planes, Forces Practice

Name: _____ **Date:** _____

1. The diagram below shows a 4.0-kilogram object accelerating at 10. meters per second^2 on a rough horizontal surface.



What is the magnitude of the frictional force F_f acting on the object?

A. 5.0 N B. 10. N C. 20. N D. 40. N

2. What is the magnitude of the force needed to keep a 60.-newton rubber block moving across level, dry asphalt in a straight line at a constant speed of 2.0 meters per second?

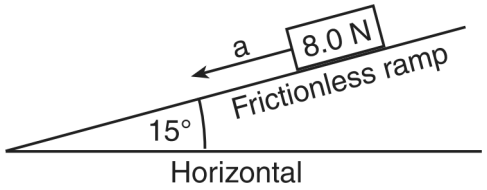
A. 40. N B. 51 N C. 60. N D. 120 N

3. A car's performance is tested on various horizontal road surfaces. The brakes are applied, causing the rubber tires of the car to slide along the road without rolling. The tires encounter the greatest force of friction to stop the car on

A. dry concrete B. dry asphalt

C. wet concrete D. wet asphalt

4. An 8.0-newton block is accelerating down a frictionless ramp inclined at 15° to the horizontal, as shown in the diagram below.



What is the magnitude of the net force causing the block's acceleration?

A. 0 N B. 2.1 N C. 7.7 N D. 8.0 N

5. A 60-kilogram skydiver is falling at a constant speed near the surface of Earth. The magnitude of the force of air friction acting on the skydiver is approximately

A. 0 N B. 6 N C. 60 N D. 600 N

6. Sand is often placed on an icy road because the sand

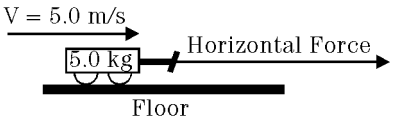
A. decreases the coefficient of friction between the tires of a car and the road

B. increases the coefficient of friction between the tires of a car and the road

C. decreases the gravitational force on a car

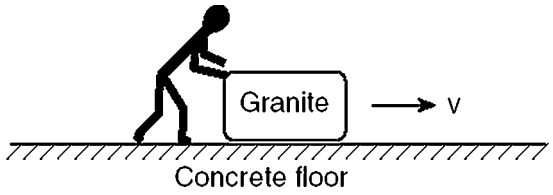
D. increases the normal force of a car on the road

7. A horizontal force is used to pull a 5.0-kilogram cart at a constant speed of 5.0 meters per second across the floor, as shown in the diagram. If the force of friction between the cart and the floor is 10 newtons, the magnitude of the horizontal force along the handle of the cart is



A. 5.0 N B. 10 N C. 25 N D. 50 N

8. The accompanying diagram shows a granite block being slid at constant speed across a horizontal concrete floor by a force parallel to the floor.



Which pair of quantities could be used to determine the coefficient of friction for the granite on the concrete?

A. mass and speed of the block

B. mass and normal force on the block

C. frictional force and speed of the block

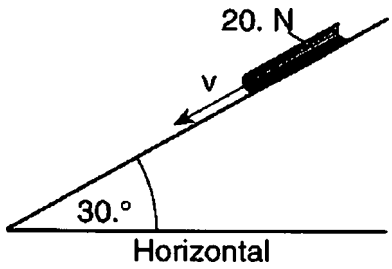
D. frictional force and normal force on the block

9. While taking off from an aircraft carrier, a jet starting from rest accelerates uniformly to a final speed of 40. meters per second on a runway that is 70. meters long. What is the magnitude of the acceleration of the jet?

A. $0.29\ m/s^2$ B. $0.57\ m/s^2$

C. $1.8\ m/s^2$ D. $11\ m/s^2$

10. A book weighing 20. newtons slides at constant velocity down a ramp inclined 30.° to the horizontal as shown in the accompanying diagram.



What is the force of friction between the book and the ramp?

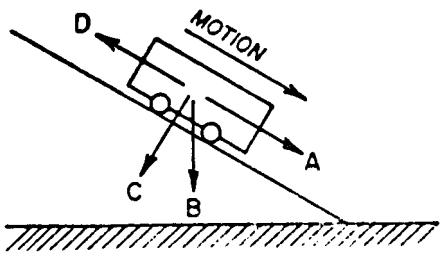
A. 10. N up the ramp

B. 17 N up the ramp

C. 10. N down the ramp

D. 17 N down the ramp

11. A cart rolls down an inclined plane with constant speed as shown in the diagram. Which arrow represents the direction of the frictional force?



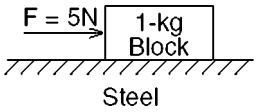
A. *A* B. *B* C. *C* D. *D*

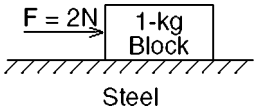
12. A 50.-newton horizontal force is needed to keep an object weighing 500. newtons moving at a constant velocity of 2.0 meters per second across a horizontal surface. The magnitude of the frictional force acting on the object is

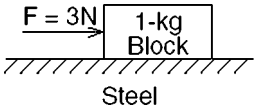
A. 500. N B. 450. N

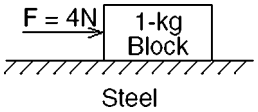
C. 50. N D. 0 N

13. A different force is applied to each of four 1-kilogram blocks to slide them across a uniform steel surface at constant speed as shown below. In which diagram is the coefficient of friction between the block and steel smallest?

A. 

B. 

C. 

D. 

14. A box decelerates as it moves to the right along a horizontal surface, as shown in the diagram. Which vector best represents the force of friction on the box?



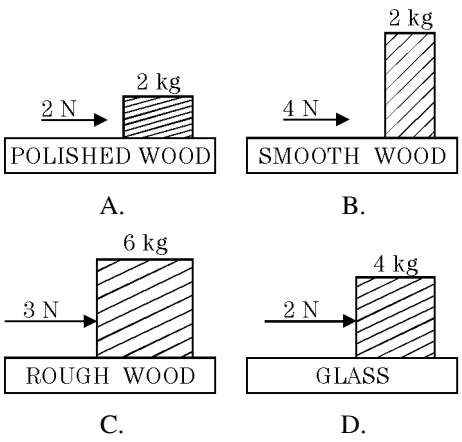
A. ↓ B. ↑

C. ⟶ D. ⟵

15. An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor?

A. 2.4 N B. 3.4 N C. 8.0 N D. 27 N

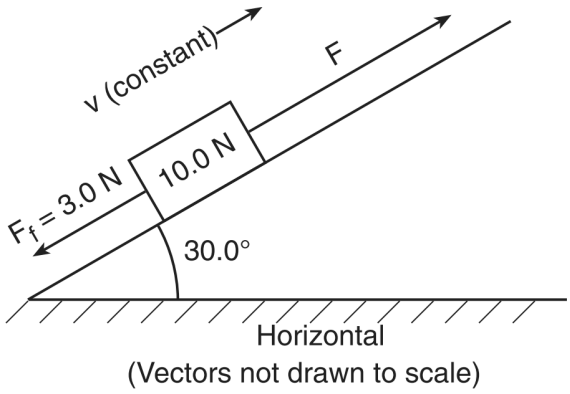
16. Each diagram shows a different block being punched by a force across a surface at a constant velocity. In which two diagrams is the force of friction the same?



A. *A* and *B* B. *B* and *D*

C. *A* and *D* D. *C* and *D*

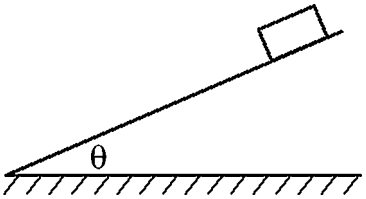
17. A block weighing 10.0 newtons is on a ramp inclined at 30.0° to the horizontal. A 3.0-newton force of friction, F_f, acts on the block as it is pulled up the ramp at constant velocity with force *F*, which is parallel to the ramp, as shown in the diagram below.



What is the magnitude of force *F*?

A. 7.0 N B. 8.0 N C. 10. N D. 13 N

18. The accompanying diagram shows a block sliding down a plane inclined at angle θ with the horizontal.



As angle θ is increased, the coefficient of kinetic friction between the bottom surface of the block and the surface of the incline will

A. decrease B. increase

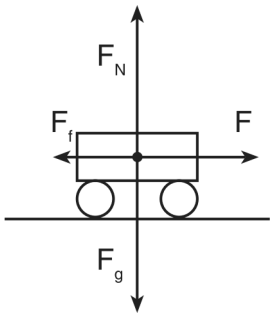
C. remain the same

19. A 0.50-kilogram puck sliding on a horizontal shuffleboard court is slowed to rest by a frictional force of 1.2 newtons. What is the coefficient of kinetic friction between the puck and the surface of the shuffleboard court?

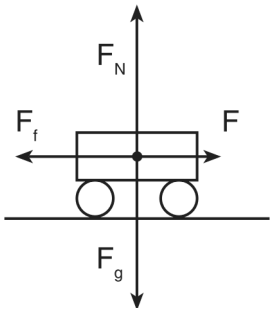
A. 0.24 B. 0.42 C. 0.60 D. 4.1

20. Which vector diagram best represents a cart slowing down as it travels to the right on a horizontal surface?

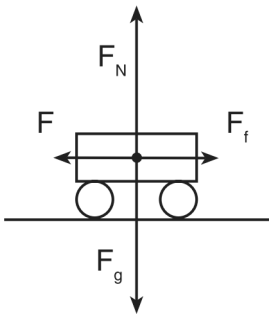
A.



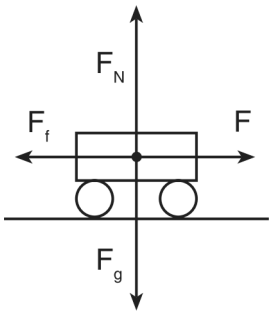
B.



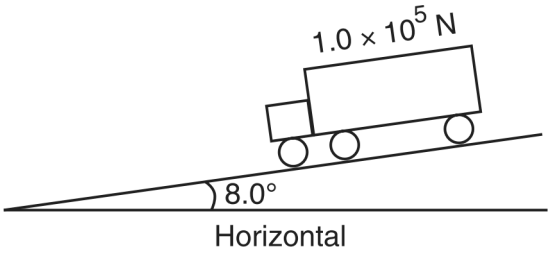
C.



D.



21. The diagram below shows a 1.0×10^5-newton truck at rest on a hill that makes an angle of 8.0° with the horizontal.

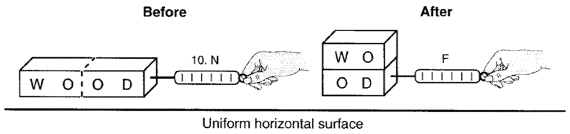


What is the component of the truck's weight parallel to the hill?

A. 1.4×10^3 N B. 1.0×10^4 N

C. 1.4×10^4 N D. 9.9×10^4 N

22. The diagram shows a student applying a 10-newton force to slide a piece of wood at constant speed across a horizontal surface. After the wood is cut in half, one piece is placed on top of the other, as shown.



What is the magnitude of the force, *F*, required to slide the stacked wood at constant speed across the surface?

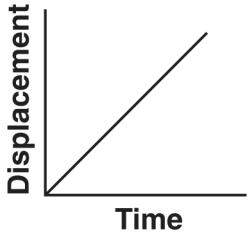
A. 40 N B. 20 N C. 10 N D. 5.0 N

23. An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor?

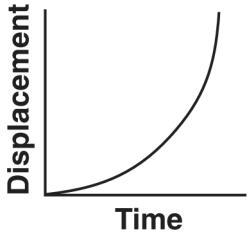
A. 2.4 N B. 3.4 N C. 8.0 N D. 27 N

24. Which graph best represents the motion of an object in equilibrium?

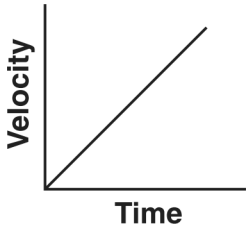
A.



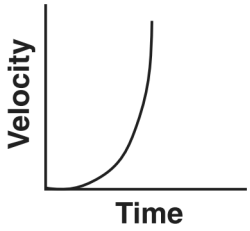
B.



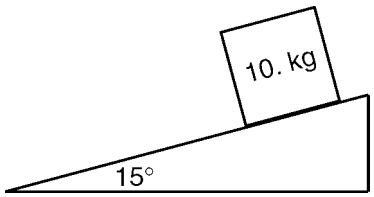
C.



D.



25. In the diagram below, a 10.-kilogram block is at rest on a plane inclined at 15° to the horizontal.

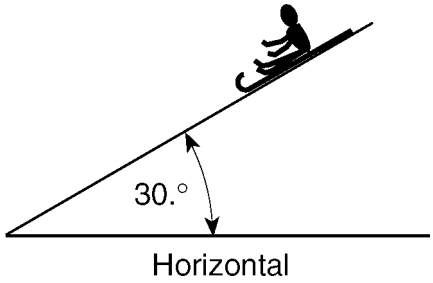


As the angle of the incline is increased to 30.°, the mass of the block will

A. decrease B. increase

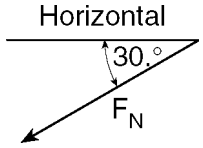
C. remain the same

26. The diagram below shows a sled and rider sliding down a snow-covered hill that makes an angle of 30.° with the horizontal.

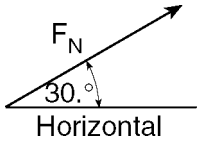


Which vector best represents the direction of the normal force, F_N, exerted by the hill on the sled?

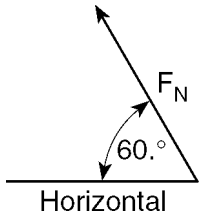
A.



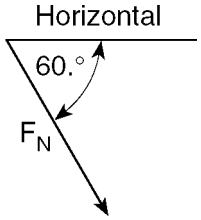
B.



C.



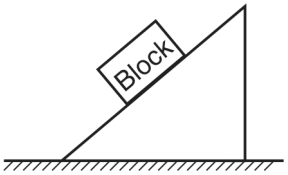
D.



27. A mosquito flying over a highway strikes the windshield of a moving truck. Compared to the magnitude of the force of the truck on the mosquito during the collision, the magnitude of the force of the mosquito on the truck is

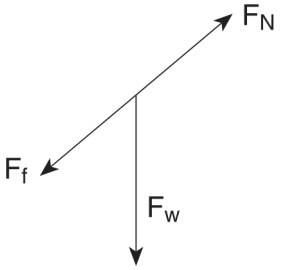
A. smaller B. larger C. the same

28. The diagram below represents a block at rest on an incline.

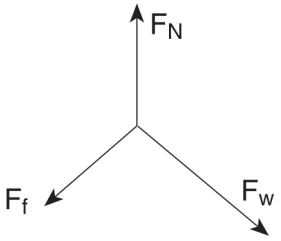


Which diagram best represents the forces acting on the block? (F_f = frictional force, F_N = normal force, and F_w = weight.)

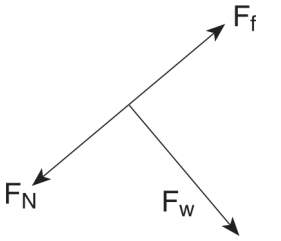
A.



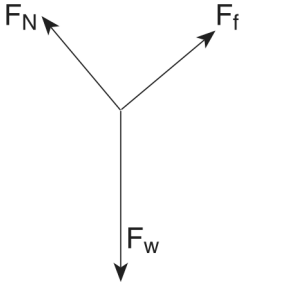
B.



C.



D.



29. A 12.0-kilogram cart is moving at a speed of 0.25 meter per second. After the speed of the cart is tripled, the inertia of the cart will be

A. unchanged
B. one-third as great
C. three times greater
D. nine times greater

30. Which statement best explains why a "wet saw" used to cut through fine optical crystals is constantly lubricated with oil?

A. Lubrication decreases friction and minimizes the increase of internal energy.
B. Lubrication decreases friction and maximizes the increase of internal energy.
C. Lubrication increases friction and minimizes the increase of internal energy.
D. Lubrication increases friction and maximizes the increase of internal energy.

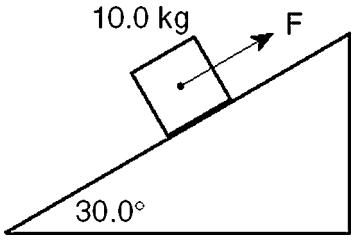
31. The force required to start an object sliding across a uniform horizontal surface is larger than the force required to keep the object sliding at a constant velocity. The magnitudes of the required forces are different in these situations because the force of kinetic friction

A. is greater than the force of static friction
B. is less than the force of static friction
C. increases as the speed of the object relative to the surface increases
D. decreases as the speed of the object relative to the surface increases

32. A box is pushed toward the right across a classroom floor. The force of friction on the box is directed toward the

A. left
B. right
C. ceiling
D. floor

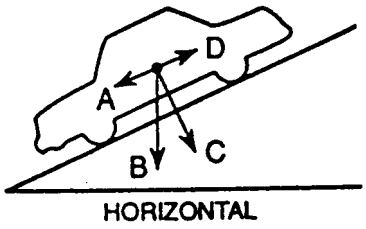
33. The accompanying diagram shows a 10.0-kilogram mass held at rest on a frictionless 30.0° incline by force *F*.



What is the approximate magnitude of force *F*?

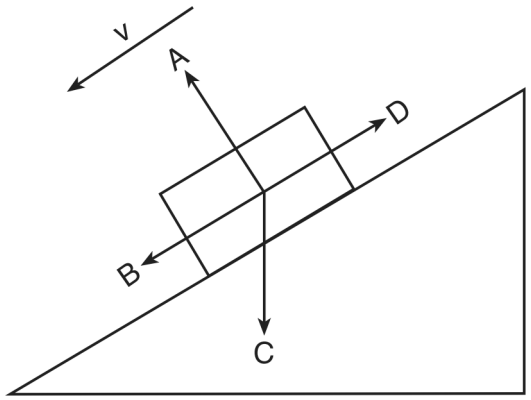
A. 9.81 N
B. 49.1 N
C. 85.0 N
D. 98.1 N

34. The diagram represents a car resting on a hill. Which vector best represents the weight of the car?



A. *A*
B. *B*
C. *C*
D. *D*

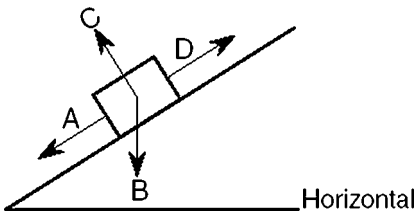
35. The diagram below represents a box sliding down an incline at constant velocity.



Which arrow represents the direction of the frictional force acting on the box?

A. *A* B. *B* C. *C* D. *D*

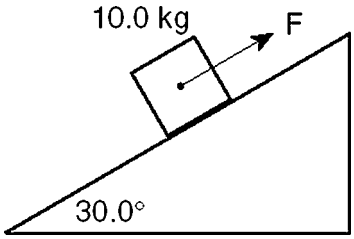
36. In the accompanying diagram, a box is at rest on an inclined plane.



Which vector best represents the direction of the normal force acting on the box?

A. A B. B C. C D. D

37. The accompanying diagram shows a 10.0-kilogram mass held at rest on a frictionless 30.0° incline by force *F*.

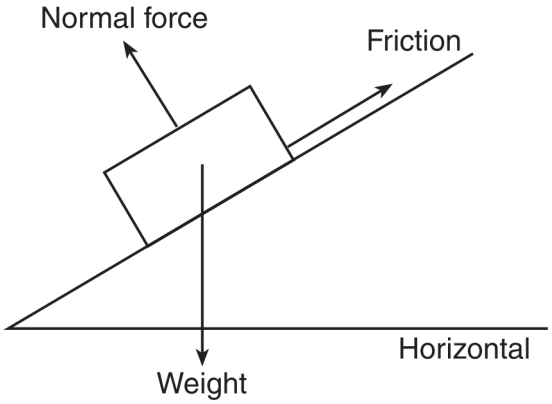


What is the approximate magnitude of force *F*?

A. 9.81 N B. 49.1 N

C. 85.0 N D. 98.1 N

38. Three forces act on a box on an inclined plane as shown in the diagram. [Vectors are not drawn to scale.]



If the box is at rest, the net force acting on it is equal to

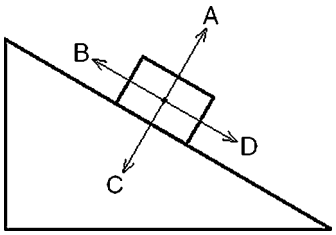
A. the weight B. the normal force

C. friction D. zero

39. If a 30-newton force is required to accelerate a 2-kilogram object at 10 meters per second^2, over a level floor, then the magnitude of the frictional force acting on the object is

A. 0 N B. 10 N C. 20 N D. 30 N

40. The accompanying diagram represents a block sliding down an incline.



Which vector best represents the frictional force acting on the block?

A. A B. B C. C D. D

41. A 100-newton box rests on a horizontal surface. A force of 10 newtons parallel to the surface is required to start the box moving. What is the maximum coefficient of static friction between the box and the surface?

A. 0.1 B. 10 C. 0.5 D. 1000

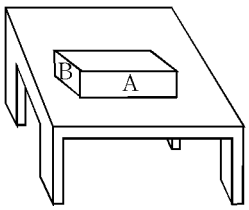
42. A box weighing 46 newtons rests on an incline that makes an angle of 25° with the horizontal. What is the magnitude of the component of the box's weight perpendicular to the incline?

A. 19 N B. 21 N C. 42 N D. 46 N

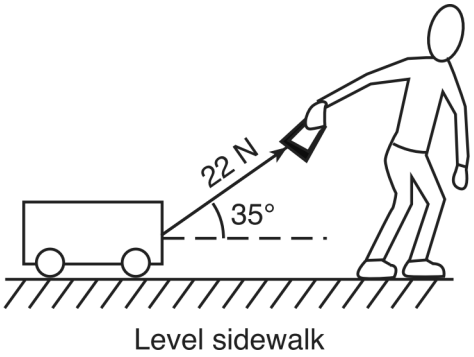
43. In the diagram shown, surface *A* of the wooden block has twice the area of surface *B*. If it takes *F* newtons to keep the block moving at constant speed across the table when it slides on surface *A*, what force is needed to keep the block moving at constant speed when it slides on surface *B*?

A. F B. $2F$

C. $\frac{1}{2}F$ D. $4F$



44. A child pulls a wagon at a constant velocity along a level sidewalk. The child does this by applying a 22-newton force to the wagon handle, which is inclined at 35° to the sidewalk as shown below.

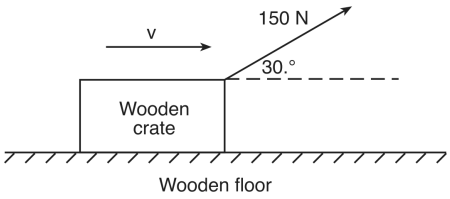


What is the magnitude of the force of friction on the wagon?

A. 11 N B. 13 N C. 18 N D. 22 N

45. Base your answer to the following question on the information and diagram below and on your knowledge of physics.

A 150-newton force, applied to a wooden crate at an angle of 30.° above the horizontal, causes the crate to travel at constant velocity across a horizontal wooden floor, as represented below.



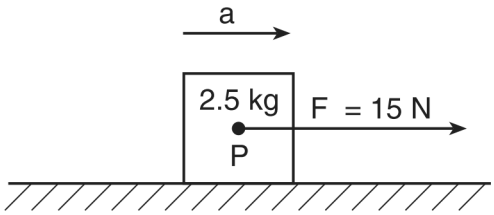
Calculate the magnitude of the horizontal component of the 150-newton force. [Show all work, including the equation and substitution with units.]

46. Determine the magnitude of the frictional force acting on the crate.

47. Calculate the magnitude of the normal force exerted by the floor on the crate. [Show all work, including the equation and substitution with units.]

Base your answer to the following question on the information and diagram below and on your knowledge of physics.

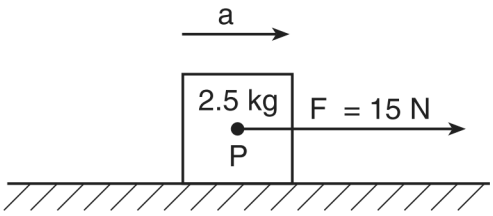
As represented in the diagram below, a constant 15-newton force, F, is applied to a 2.5-kilogram box, accelerating the box to the right at 2.0 meters per second squared across a rough horizontal surface.



48. Calculate the magnitude of the net force acting on the box.

49. Base your answer to the following question on the information and diagram below and on your knowledge of physics.

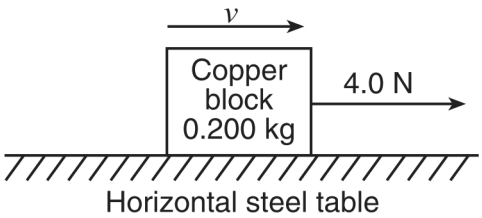
As represented in the diagram below, a constant 15-newton force, F, is applied to a 2.5-kilogram box, accelerating the box to the right at 2.0 meters per second squared across a rough horizontal surface.



Determine the magnitude of the force of friction on the box.

50. Base your answer(s) to the following question(s) on the information below and on your knowledge of physics.

The diagram below represents a 4.0-newton force applied to a 0.200-kilogram copper block sliding to the right on a horizontal steel table.



Determine the weight of the block.

51. Calculate the magnitude of the force of friction acting on the moving block. [Show all work, including the equation and substitution with units.]

52. Determine the magnitude of the net force acting on the moving block.

53. Describe what happens to the magnitude of the velocity of the block as the block slides across the table.

54. Base your answer(s) to the following question(s) on the information below.

A student and the waxed skis he is wearing have a combined weight of 850 newtons. The skier travels down a snow-covered hill and then glides to the east across a snow-covered, horizontal surface.

Determine the magnitude of the normal force exerted by the snow on the skis as the skier glides across the horizontal surface.

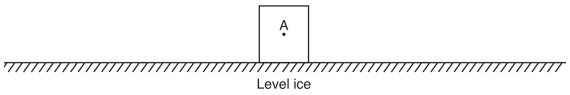
55. Calculate the magnitude of the force of friction acting on the skis as the skier glides across the snow-covered, horizontal surface. [Show all work, including the equation and substitution with units.]

56. Base your answer(s) to the following question(s) on the information below.

An ice skater applies a horizontal force to a 20.-kilogram block on frictionless, level ice, causing the block to accelerate uniformly at 1.4 meters per second^2 to the right. After the skater stops pushing the block, it slides onto a region of ice that is covered with a thin layer of sand. The coefficient of kinetic friction between the block and the sand-covered ice is 0.28.

Calculate the magnitude of the force applied to the block by the skater. [Show all work, including the equation and substitution with units.]

57. On the diagram provided, starting at point A, draw a vector to represent the force applied to the block by the skater. Begin the vector at point A and use a scale of 1.0 centimeter = 5.0 newtons.



58. Determine the magnitude of the normal force acting on the block.

59. Calculate the magnitude of the force of friction acting on the block as it slides over the sand-covered ice. [Show all work, including the equation and substitution with units.]

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Friction, Inclined Planes, Forces Practice 11/4/2018

1.
Answer: B

2.
Answer: A

3.
Answer: A

4.
Answer: B

5.
Answer: D

6.
Answer: B

7.
Answer: B

8.
Answer: D

9.
Answer: D

10.
Answer: A

11.
Answer: D

12.
Answer: C

13.
Answer: B

14.
Answer: D

15.
Answer: A

16.
Answer: C

17.
Answer: B

18.
Answer: C

19.
Answer: A

20.
Answer: B

21.
Answer: C

22.
Answer: C

23.
Answer: A

24.
Answer: A

25.
Answer: C

26.
Answer: C

27.
Answer: C

28.
Answer: D

29.
Answer: A

30.
Answer: A

31.
Answer: B

32.
Answer: A

33.
Answer: B

34.
Answer: B

35.
Answer: D

36.
Answer: C

37.
Answer: B

38.
Answer: D

39.
Answer: B

40.
Answer: B

41.
Answer: A

42.
Answer: C

43.
Answer: A

44.
Answer: C

45.
Answer: $n_2 = 1.46$

46.
Answer: $E_{photon} = \frac{hc}{\lambda}$

$$E_{photon} = \frac{(6.63 \times 10^{-34}\ \mathrm{J \cdot s})(3.00 \times 10^{8}\ \mathrm{m/s})}{4.88 \times 10^{-7}\ \mathrm{m}}$$

47.
Answer: $E_{photon} = 4.08 \times 10^{-19} J$

48.
Answer: $F_{net} = 5.0\,\mathrm{N}$

49.
Answer: $F_{net} = 10.\,\mathrm{N}$

50.
Answer: 1.96 N or 2.0 N or 1.9 N

51.
Answer: $F_f = \mu F_N$

$F_f = (0.36)(1.96\,\mathrm{N})$

$F_f = 0.71\,\mathrm{N}$ or $0.70\,\mathrm{N}$

52.
Answer: 3.3 N

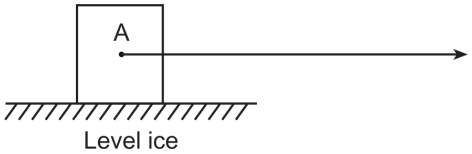
53.
Answer: the magnitude of the veolcity increases; the block speeds up

54.
Answer: 850 N

55.
Answer: $F_\mathrm{f} = \mu F_\mathrm{N}$, $F_\mathrm{f} = (0.05)(850\,\mathrm{N})$, $F_\mathrm{f} = 40\,\mathrm{N}$

56.
Answer: 28 N

57.
Answer: Vector should be 5.6 cm long, parallel to the surface, and point to the right.



58.
Answer: 196 N

59.
Answer: 56 N