Skill 22: Types of Forces

75. On the surface of Earth, a spacecraft has a mass of 2.00 x 10^4 kilograms. What is the mass of the spacecraft at a distance of one Earth radius above Earth's surface?

doesn't change

A) 5.00×10^3 kg
B) 2.00×10^4 kg
C) 4.90×10^4 kg
D) 1.96×10^5 kg

76. A person weighing 785 newtons on the surface of Earth would weigh 298 newtons on the surface of Mars. What is the magnitude of the gravitational field strength on the surface of Mars?

Mars	Earth
$F_g = 298N$	$F_g = 785N$
$g = ?$	$g = 9.8 m/s^2$
$m = ?$	

A) 2.63 N/kg
B) 3.72 N/kg
C) 6.09 N/kg
D) 9.81 N/kg

77. What is the weight of a 2.00-kilogram object on the surface of Earth?

$g = 9.8 m/s^2$

A) 4.91 N
B) 2.00 N
C) 9.81 N
D) 19.6 N

$F_g = mg$

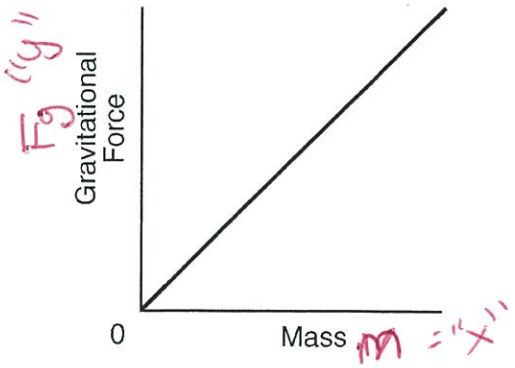
78. What is the acceleration due to gravity at a location where a 15.0-kilogram mass weighs 45.0 newtons?

$F_g = 45N$
$m = 15kg$
$g = ?$

$g = \frac{F_g}{m} = \frac{45N}{15kg} = 3 m/s$

A) 675 m/s^2
B) 9.81 m/s^2
C) 3.00 m/s^2
D) 0.333 m/s^2

79. Base your answer to the following question on The graph below represents the relationship between gravitational force and mass for objects near the surface of Earth.



F_g "y"

m = "x"

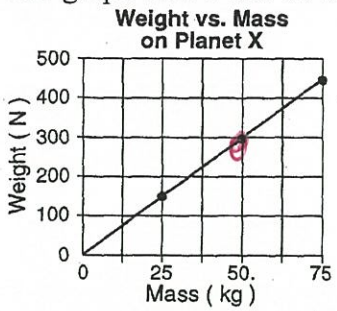
$g = \frac{F_g}{m}$

The slope of the graph represents the

A) gravitational field strength
B) universal gravitational constant
C) momentum of objects
D) weight of objects

Skill 22: Types of Forces

80. The graph below shows the weight of three objects on planet X as a function of their mass.



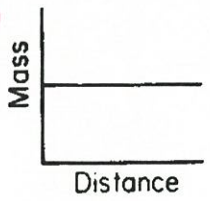
$F_g = 300N$
$m = 50kg$

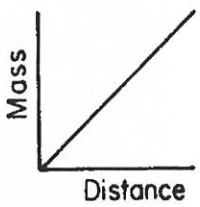
$g = \frac{F_g}{m} = 6 m/s^2$ or $\frac{6N}{kg}$

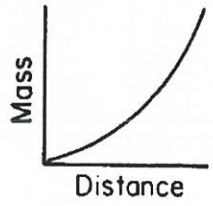
The acceleration due to gravity on planet X is

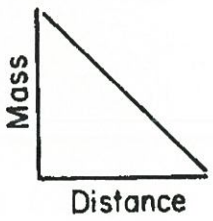
A) 0.17 m/s^2 B) 6.0 m/s^2 C) 9.8 m/s^2 D) 50. m/s^2

81. Which graph represents the relationship between the mass of an object and its distance from the Earth's surface?

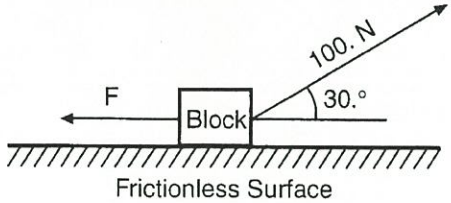
A)


B)


C)


D)


82. The diagram below shows a 25 kg block on a horizontal frictionless surface. A 100.- newton force acts on the block at an angle of 30.° above the horizontal.



$\Sigma F_y = F_g + F_N + F_{Ay}$
$0 = mg + F_N + F_A \sin\theta$
$(25kg)(9.8 m/s^2) + F_N + 100N \sin 30°$
$0 = -245N + F_N + 50N$

What is the magnitude of *normal force acting on the block*?

A) 50.0 N B) 195 N C) 86.6. N D) 245 N

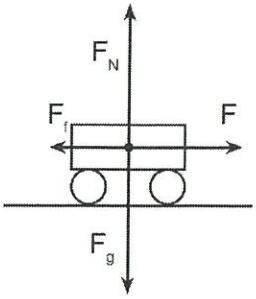
83. The force required to accelerate a 2.0-kilogram mass at 4.0 meters per second^2 is

A) 6.0 N B) 2.0 N C) 8.0 N D) 16 N

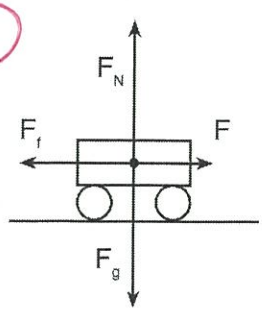
$F_{net} = ma$
$= (2kg)(4 m/s^2)$
$= 8N$

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

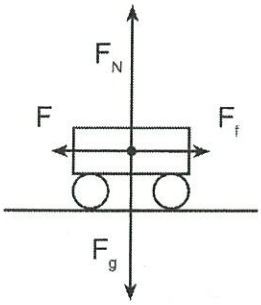
A)



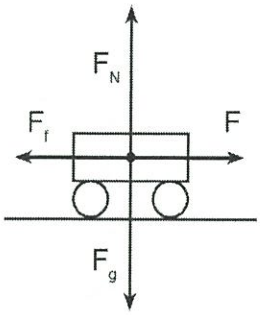
B)



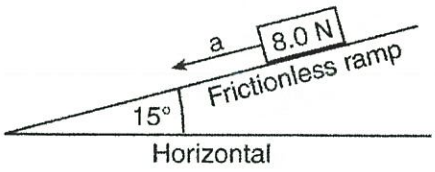
C)



D)



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



$\Sigma F_{\parallel} = F_{g\parallel}$

$F_{g\parallel} = F_g \sin\theta$
$= 8N \sin 15°$
$= 2.07N$

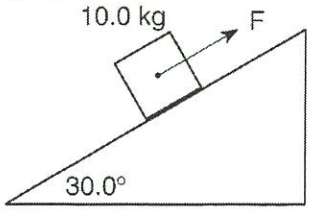
$? \; F_{g\parallel}$

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

$\Sigma F = 0$

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



$\Sigma F_{\parallel} = F_{g\parallel} + F$

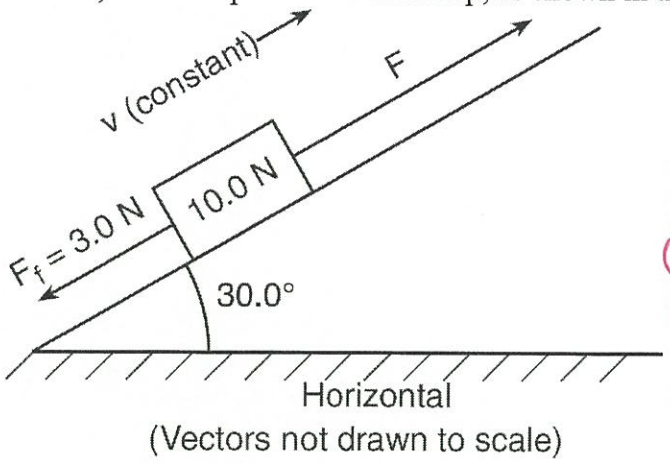
$0 = mg\sin\theta + F$

$0 = (10kg)(9.8m/s^2)\sin 30° + F$

What is the approximate magnitude of force *F*?

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

87. 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.



(Vectors not drawn to scale)

$F_{net} = 0$

down up down

$\Sigma F_{\parallel} = F_{g\parallel} + F + F_f$

$0 = mg\sin\theta + F + -3N$

$0 = -10N\sin 30° + F - 3N$

$0 = -5N + F + -3N$

$F = 8N$

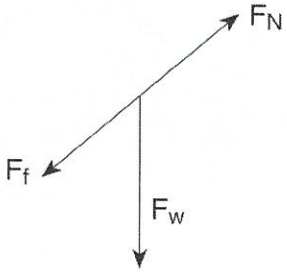
What is the magnitude of force F?

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

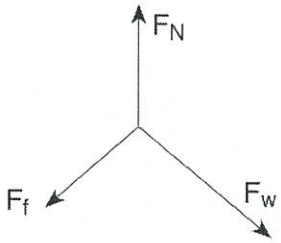
88. The diagram below represents a block at rest on an incline.

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

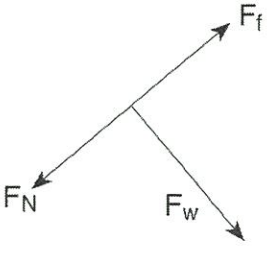
A)



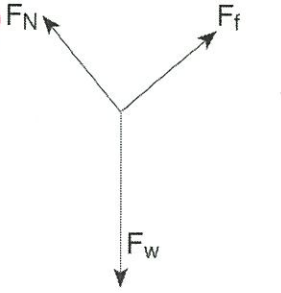
B)



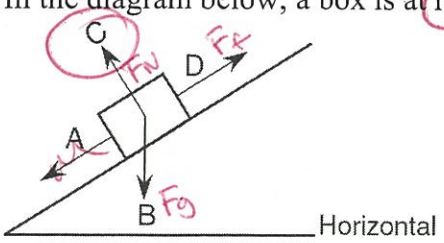
C)



D)



89. In the diagram below, a box is at rest on an inclined plane.



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

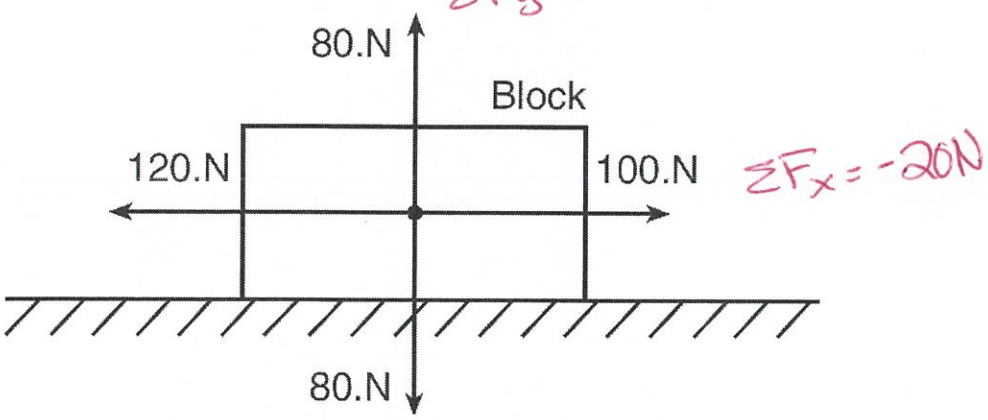
A) *A* B) *B* C) *C* D) *D*

90. At a certain location, a gravitational force with a magnitude of 350 newtons acts on a 70.-kilogram astronaut. What is the magnitude of the gravitational field strength at this location?

A) 0.20 kg/N B) 5.0 N/kg C) 9.8 m/s^2 D) 25 000 Nkg

$F_g = 350N$
$m = 70kg$
$g = ?$
$g = \frac{F_g}{m} = \frac{350N}{70kg} = 5N/kg$

91. Four forces act concurrently on a block on a horizontal surface as shown in the diagram below.



$\Sigma F_y = 0$

$\Sigma F_x = -20N$

As a result of these forces, the block

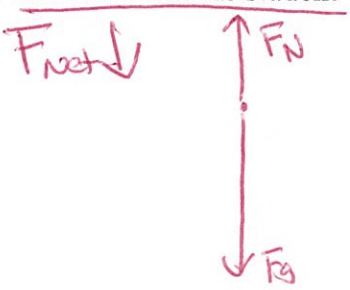
A) moves at constant speed to the right B) moves at constant speed to the left
C) accelerate to the right D) accelerate to the left

92. On a small planet, an astronaut uses a vertical force of 175 newtons to lift an 87.5-kilogram boulder at constant velocity to a height of 0.350 meter above the planet's surface. What is the magnitude of the gravitational field strength on the surface of the planet?

A) 0.500 N/kg B) 2.00 N/kg C) 9.81 N/kg D) 61.3 N/kg

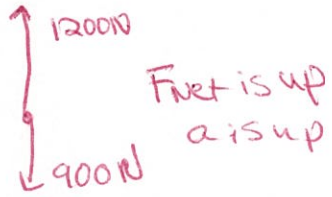
$g = \frac{F_g}{m} = \frac{175N}{87.5kg} = 2N/kg$

93. A student is standing in an elevator that is accelerating downward. The force that the student exerts on the floor of the elevator must be



A) less than the weight of the student when at rest
B) greater than the weight of the student when at rest
C) less than the force of the floor on the student
D) greater than the force of the floor on the student

94. A man weighs 900 Newtons standing on a scale in a stationary elevator. If some time later the reading on the scale is 1200 Newtons, the elevator must be moving with



A) constant acceleration downward
B) constant speed downward
C) constant acceleration upward
D) constant speed upward

95. An elevator containing a man weighing 800 Newtons is rising at a constant speed. The force exerted by the man on the floor of the elevator is

$F_N = F_g$ equilibrium

A) less than 80 N
B) between 80 and 800 N
C) 800 N
D) more than 800 N

96. If the magnitude of the gravitational force of Earth on the Moon is F, the magnitude of the gravitational force of the Moon on Earth is

3rd Law

A) smaller than F
B) larger than F
C) equal to F

97. A ball having mass m is struck by a bat having mass 9 m. Compared to the magnitude of the force exerted by the bat on the ball, the magnitude of the force exerted by the ball on the bat is

3rd Law

A) less
B) greater
C) the same

98. A rocket engine thrusts the rocket into space because

A) the exhaust pushes against the ground
B) the exhaust pushes against the air
C) every action produces an equal and opposite reaction
D) matter and energy are conserved

99. A rock is thrown straight up into the air. At the highest point of the rock's path, the magnitude of the net force acting on the rock is known as weight F_g. (Actually along the entire path of the projectile.)

Skill 22: Types of Forces

100 A table exerts a 2.0-newton force on a book lying on the table. The force exerted by the book on the table is

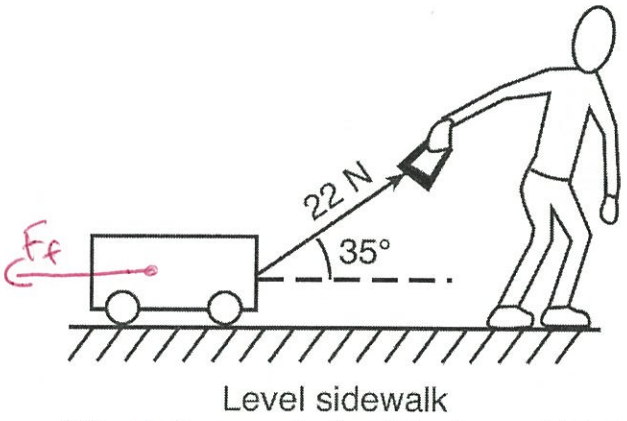
A) 20. N B) 2.0 N C) 0.20 N D) 0 N

101. A 30-kilogram boy exerts a force of 100 Newtons on a 50-kilogram object. The force that the object exerts on the boy is

A) 0 N B) 100 N C) 980 N D) 1,500 N

3rd Law

102. 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.



$F_{net} = 0$

$\Sigma F_x = F_{Ax} + F_f$

$0 = F_A \cos\theta + F_f$

$0 = 22N \cos 35° + F_f$

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

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

103. A 750-newton person stands in an elevator that is accelerating downward. The upward force of the elevator floor on the person must be

F_g

A) equal to 0 N
B) less than 750 N
C) equal to 750 N
D) greater than 750 N

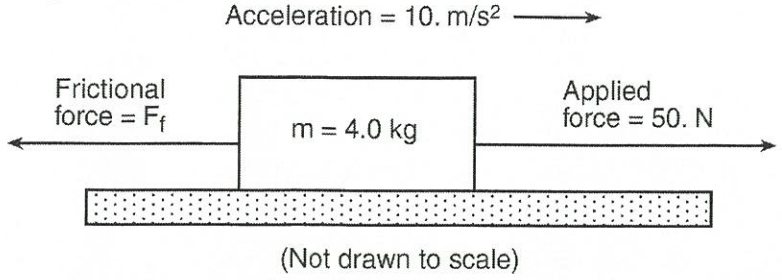
$F_g > F_N$
$= 750N$

104. An 800-newton person is standing in an elevator. If the upward force of the elevator on the person is 600 Newtons, the person is

A) at rest
B) accelerating upward
C) accelerating downward
D) moving downward at constant speed

$F_g > F_N$
down wins

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



$\Sigma F = F_A + F_f$
$ma = 50N + F_f$
$(4kg)(10m/s^2) = 50N + F_f$
$40N = 50N + F_f$
$F_f = -10N$

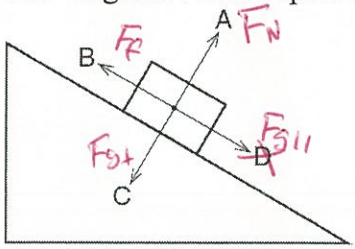
What is the magnitude of the frictional force F_f acting on the object?

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

106. 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

107. The diagram below represents a block sliding down an incline.

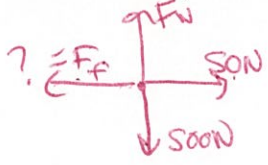


Which vector best represents the frictional force acting on the block?

A) *A* B) *B* C) *C* D) *D*

108. 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

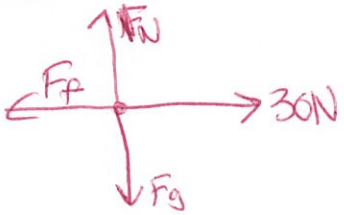
A) 500. N B) 450. N C) 50. N D) 0 N



$\Sigma F_x = F_A + F_f$
$0 = 50N + F_f$

109. 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

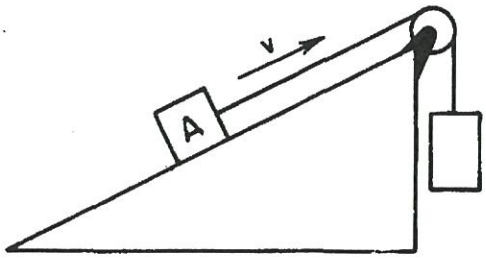
A) 0 N B) 10 N C) 20 N D) 30 N



$\Sigma F_x = F_A + F_f$
$ma = 30N + F_f$
$20N = 30N + F_f$

Skill 22: Types of Forces

110. Block *A* is pulled with constant velocity up an incline as shown in the diagram below.

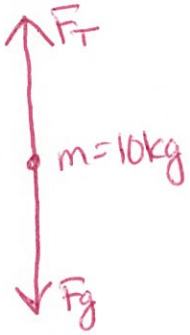


object moving up
friction moving down

Which arrow best represents the direction of the force of friction acting on block *A*?

A)  B)  C)  D) 

111. A monkey with a mass of 10 kg hangs from a rope.



a. What is the magnitude of the tension force supporting the monkey?

$\Sigma F_y = F_T + F_g$ $F_T = 98N$

$0 = F_T + mg$

$0 = F_T + (10kg)(-9.8 m/s^2) = 98N$

b. Determine the acceleration of the monkey if it were pulled upward from rest to a speed of 1 m/s in a time of 0.5s.

$a = \frac{\Delta v}{t}$ $v_f = v_i + at$

$1 m/s = 0 + a(.5s)$

$a = 2 m/s^2$

c. During the acceleration phase, what is the magnitude of the tension force?

$\Sigma F_y = F_T + F_g$

$ma = F_T + mg$

$(10kg)(2 m/s^2) = F_T + (10kg)(-9.8 m/s^2)$

$20N = F_T + (-98N)$

$F_T = 118N$

d. The monkey continues to be pulled upward at 1 m/s. What is the magnitude of the tension force at this point?

$F_T = 98N$ ↘ equilibrium