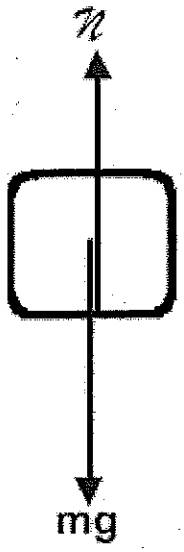
Physics online LAB

Worksheet
Freebody Diagrams #1

Refer to the following information for the next two questions.

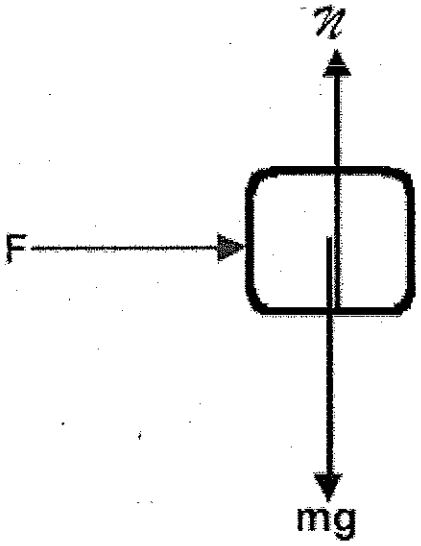


True or False: This freebody diagram would only apply to an object resting on a supporting surface.

○ True ○ False

If the mass of this object equals 5 kg, what is the magnitude of the normal force exerted on it by the supporting surface? _____

Refer to the following information for the next two questions.



True or False: According to this freebody diagram, the object is accelerating to the right on a frictionless, supporting surface.

○ True ○ False

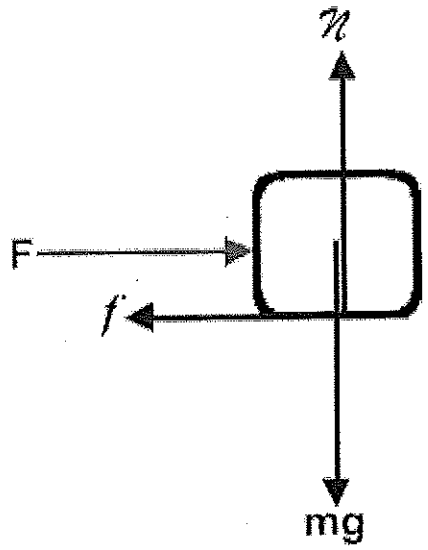
If this object weighs 49 N and the applied force equals 10 N, what is the magnitude of the resulting acceleration? _____

Refer to the following information for the next two questions.

True or False: According to this freebody diagram, the object is moving at a constant velocity, towards the left, across a supporting surface in the presence of friction.

C True C False

If this object weighs 49 N and the applied force equals 10 N, what is the magnitude of the frictional force present between the object and the supporting surface? _____



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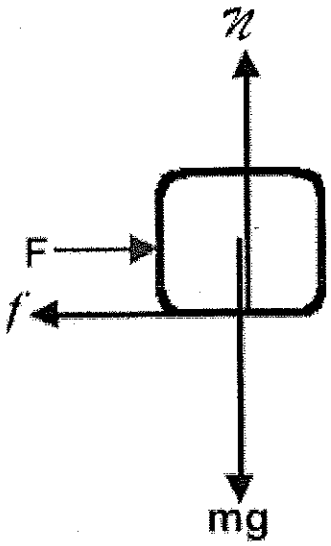
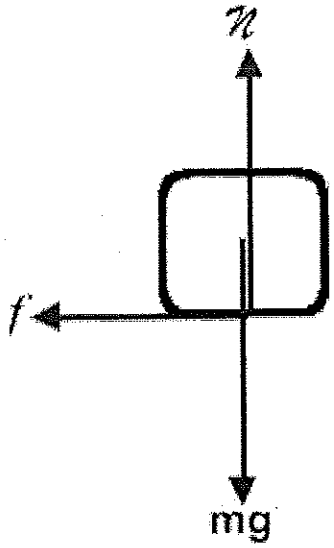


Which choice is correct? This object would be

- C losing speed
- C gaining speed
- C moving at a constant velocity
- C at rest

The object weighs 49 N and the frictional force between it and the supporting surface equals 10 N. If the applied force is reduced to 6 N, what is the magnitude of the resulting acceleration? _____

Refer to the following information for the next two questions.

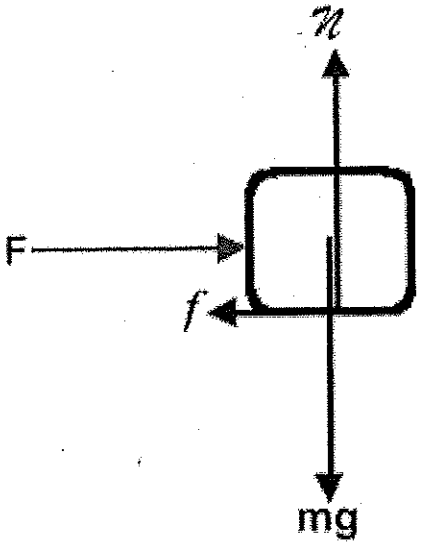


Which choice is correct? This object is

- C moving to the left and gaining speed.
- C moving to the left and losing speed.
- C moving to the right and gaining speed.
- C moving to the right and losing speed.

The object weighs 49 N and the frictional force between it and the supporting surface equals 10 N. If the applied force is removed, what is the magnitude of the resulting acceleration? [ ]

Refer to the following information for the next two questions.



Which choice is correct? This object is

- C moving to the right and losing speed.
- C moving to the right and gaining speed.
- C moving to the left and losing speed.
- C moving to the left and gaining speed.

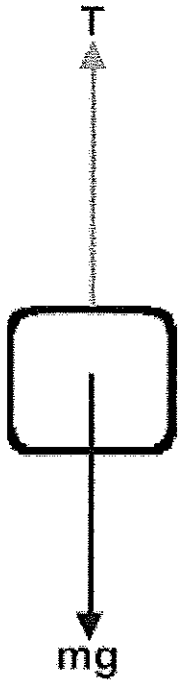
A second object weighing 29.4 N replaces the original 5 kg mass. As a direct consequence of the reduced mass, the retarding frictional force is now 6 N. Once again a horizontal force equaling 10 N is applied. What is the magnitude of the resulting acceleration? [ ]

Refer to the following information for the next two questions.

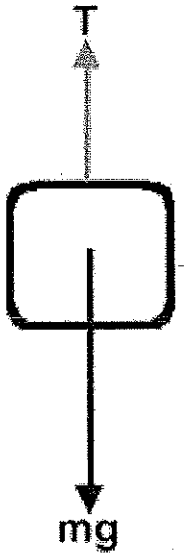
True or False: This freebody diagram would only apply to an object being raised vertically at a constant velocity.

○ True ○ False

If the mass of this object equals 3 kg, what is the magnitude of the tension in the string? [ ]



Refer to the following information for the next two questions.



Which choice is correct? This object could be

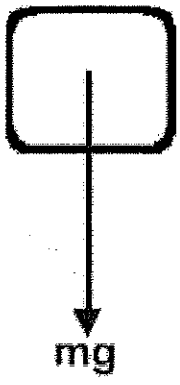
- ☐ rising and losing speed.
- ☐ rising and gaining speed.
- ☐ falling and losing speed.
- ☐ falling and gaining speed.

The 3 kg object now experiences an acceleration of - 4 m/sec^2. What is the tension in the string? [ ]

Refer to the following information for the next question.

True or False: This freebody diagram could apply to an object in freefall only while it is descending.

○ True ○ False



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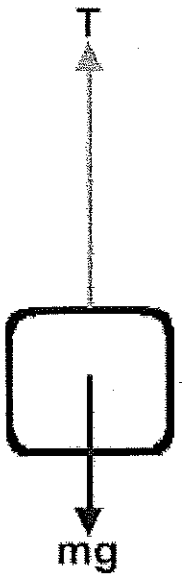


Which choice is correct? This object would be

- ☐ rising and losing speed.
- ☐ rising and gaining speed.
- ☐ falling and losing speed.
- ☐ falling and gaining speed.

The 3 kg object now experiences an acceleration of 4 m/sec^2. What is the tension in the string? ☐

Refer to the following information for the next four questions.

True or False: The magnitude of the normal, $\mathcal{N}$, is smaller than the object's weight.

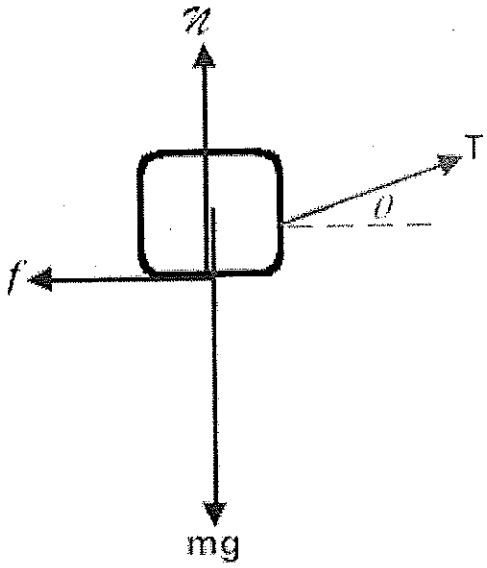
○ True ○ False

H A 5 kg mass is being pulled by a string, acting at an angle θ to the horizontal, across a rough table at a constant velocity. If the tension is 15 N and θ equals 37°, what is the magnitude of the frictional force?

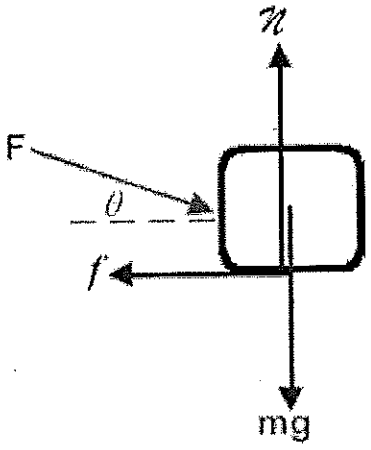
The numerical value of the normal equals

○ 37 N ○ 40 N ○ 49 N ○ 58 N

What is the coefficient of friction between the mass and the surface?



Refer to the following information for the next four questions.



True or False: The magnitude of the normal, $\mathcal{N}$, is smaller than the object's weight.

○ True ○ False

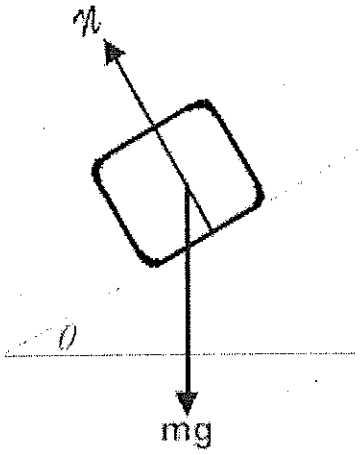
A 5 kg mass is being pushed across a rough table at a constant velocity by a constant force, F = 15 N, which acts at an angle θ = 37° to the horizontal. What is the magnitude of the frictional force?

The numerical value of the normal now equals

○ 40 N ○ 49 N ○ 58 N ○ 61 N

What is the coefficient of friction between the mass and the surface?

Refer to the following information for the next six questions.



True or False: The magnitude of the normal, $\mathcal{N}$, is smaller than the object's weight.

○ True ○ False

If the angle of the incline equals 37° and the mass remains 5 kg, what is the numerical value of the normal?

True or False: The mass will accelerate down the incline with an acceleration equal to g sin(θ).

○ True ○ False

If the mass starts from rest, how long will it take to slide down an incline 40 cm long?

If instead the 5 kg block slid down the 37° incline at a constant velocity, what would be the coefficient of friction between the two surfaces?

○ 0.6 ○ 0.75 ○ 0.8 ○ cannot be determined without more information

How large an applied force, F, would be required to slide the mass up the incline at a constant velocity?

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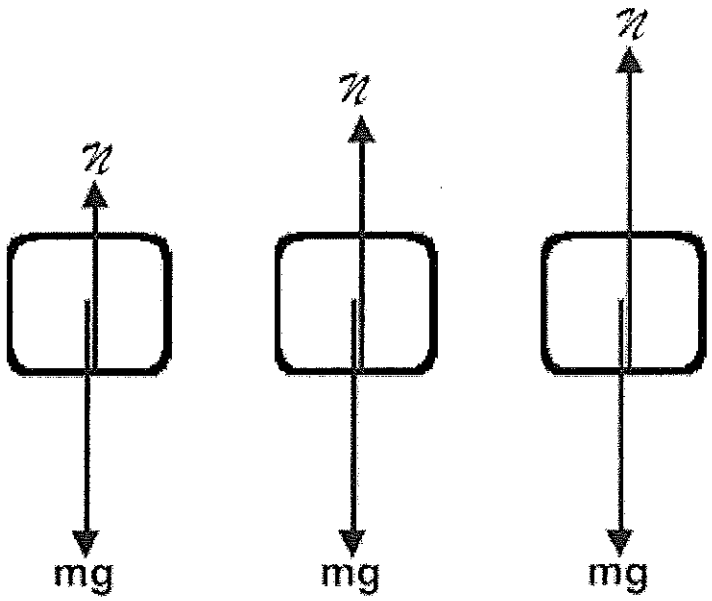
Worksheet
Freebody Diagrams #3

Refer to the following information for the next four questions.



A B C

H Which freebody diagram could represent a block sitting on the floor of an elevator that is in a state of equilibrium: that is,
either at rest, or
ascending/descending at a constant velocity?

○ A ○ B ○ C

H Which freebody diagram shown above would match the equation

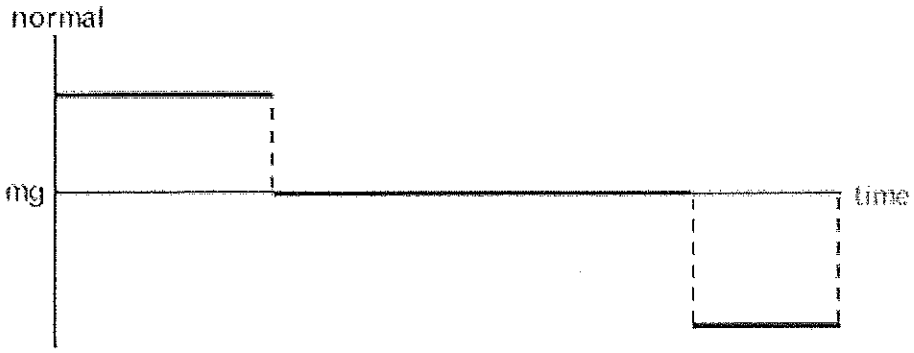
$$net\ F = ma$$
$$N - mg = ma$$

indicating that the block is sitting on the floor of an elevator that is accelerating upward?

○ A ○ B ○ C ○ cannot be determined without more information

H What would be the apparent weight of the block (or net force normal), expressed in terms of mg (its true weight), while the elevator is accelerating upwards if the elevator starts from rest and takes 0.6 meters to attain its final "cruising" velocity of 2 m/sec?

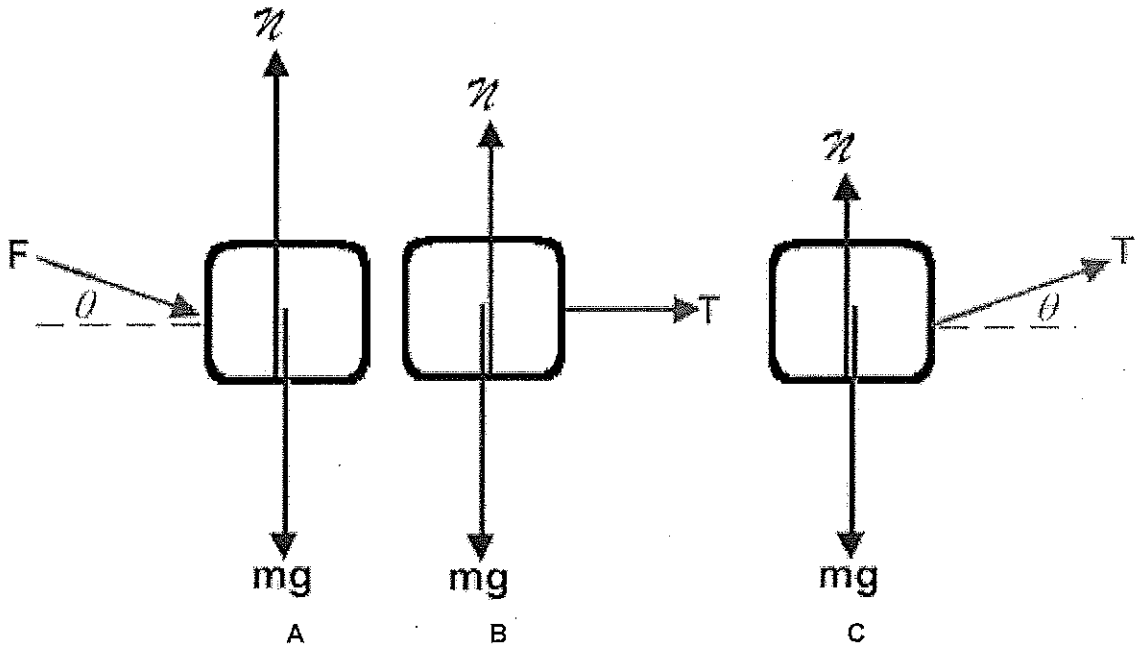
○ 0.34 mg ○ 0.48 mg ○ 1.00 mg ○ 1.34 mg ○ 1.48 mg



According to the graph shown above, does the elevator lose speed as it slows down to stop on the next floor faster or slower than it gained speed when it left the lower floor?

○ faster ○ slower ○ at the same rate

Refer to the following information for the next two questions.



These three freebody diagrams illustrate that the value of the normal is affected by the direction of the applied force. In which diagram does the normal equal the object's weight?

○ A ○ B ○ C ○ cannot be determined without more information

H Which of the following expressions correctly represents the value of the normal in diagram C?

○ $N = mg - T\sin\theta$

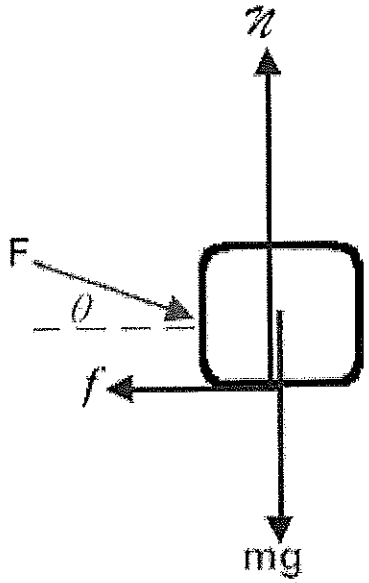
○ $N = mg - T\cos\theta$

○ $N = mg + T\sin\theta$

○ $N = mg + T\cos\theta$

Refer to the following information for the next question.

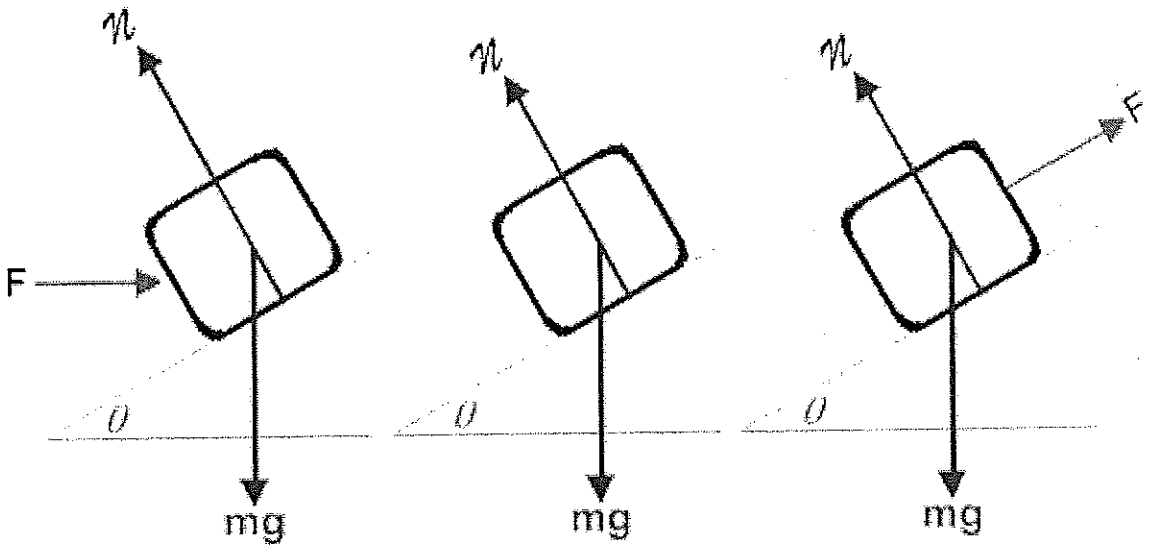
This block is being pushed at a constant velocity towards the right along a rough surface.



H Which expression correctly represents the value of the coefficient of friction between the block and the surface?

- $\mu = \frac{F\cos\theta}{mg - F\sin\theta}$
- $\mu = \frac{F\sin\theta}{mg + F\cos\theta}$
- $\mu = \frac{F\sin\theta}{mg - F\cos\theta}$
- $\mu = \frac{F\cos\theta}{mg + F\sin\theta}$

Refer to the following information for the next three questions.



H If the block in diagram A were to be moving up the incline at a constant velocity, the magnitude of the kinetic friction present would equal?

- $f = F\cos\theta + mg\cos\theta$
- $f = F\cos\theta - mg\sin\theta$
- $f = F\sin\theta - mg\cos\theta$
- $f = mg\sin\theta - F\sin\theta$
- $f = mg\cos\theta - F\cos\theta$

H If the block in diagram B were to move down the incline at a constant velocity, the coefficient of the kinetic friction present would equal?

- $\mu = \dfrac{mg\cos\theta}{mg\sin\theta} = \cot\theta$
- $\mu = \dfrac{mg\sin\theta}{mg\cos\theta} = \tan\theta$
- $\mu = \dfrac{mg\sin\theta}{N\cos\theta}$
- $\mu = \dfrac{mg\cos\theta}{N\sin\theta}$

H Which of the following expressions correctly represents the value of the normal in diagram C?

- $N = F\sin\theta - mg\cos\theta$
- $N = mg\sin\theta$
- $N = mg\cos\theta$
- $N = \dfrac{mg}{\sin\theta}$