

India's Number 1 Education App

## PHYSICS

# BOOKS - PRINCETON PHYSICS (ENGLISH)

## **NEWTON'S LAW**

Solved Example

What net force is required to maintain a
 5,000 kg object moving at a constant velocity



2. How much force is required to cause an object of mass 2 kg to have an acceleration of  $4m/s^2$  ?

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**3.** An object feels two forces : one of magnitude 8 N pulling to the left and one of

magnitude 20 N pulling to the right. If the

object's mass is 4 kg what is its acceleration ?



**4.** A woman riding a bicycle collides headon with a parked school bus. Which object feels greater force ?



**5.** The sun has a mass of  $2 \times 10^{30} kg$  and Mars has a mass of  $6 \times 10^{23} kg$ . How does the acceleration of the sun due to Mars compare to the acceleration of Mars due to the sun ?



**6.** If M is the mass of Earth, then the mass of the moon is about M/80 and the mass of the sun is about 330,000 M. If R is the distance between Earth and the moon, then the

distance between Earth and the sun is about 400R. So, which exerts a greater gravitational force on the Earth : the moon or the sun ?

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7. An artifical satellite of mass m travels at a constant speed in a circular orbit of radius R around Earth (mass M). What is the speed of the satellite ?



**8.** A communications satellite of mass m is orbiting the Earth at constant speed in a circular orbit of radius R. If R is increased by a factor of 4, what happens to T, the satellite's orbit period (the time it takes to complete one orbit) ?



9. What is the mass of an object that weights

500 N on Earth?

**10.** A person weight 200 pounds on Earth. Given that a pound is a unit of weight equal to 4.45 N, what is this person's mass ?

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**11.** A can of paint with a mass of 6 kg hangs from a rope. If the can is to be pulled up to a rooftop with an acceleration of  $1m/s^2$ , what must be the tension in the rope ?



12. A can of paint with a mass of 6 kg hangs from a rope. If the can is to be pulled up to a rooftop with an acceleration of 1m/s, what must be the tension in the rope ?

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**13.** A book whose mass is 2 kg rests on a table. Find the magnitude of the force exerted by the table on the book.



**15.** A crate of mass 20 kg is sliding across a wooden floor. The coefficient of kinetic friction

between the crate and the floor is 0.3.

Determine the magnitude of the friction force

acting on the crate.

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**16.** A crate of mass 20 kg is sliding across a wooden floor. The coefficient of kinetic friction between the crate and the floor is 0.3. If the crate is being pulled by a force of 90 N (parallel to the floor), find the acceleration of the crate.





**17.** A crate of mass 100 kg rests on the floor. The coefficient of static friction is 0.4. If a force of 250 N(parallel to the floor) is applied to the create, what's the magnitude of the force of static friction on the crate ?

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**18.** In the figure below, how much force would we need to exert on the free end of the cord in

order to lift the plank (mass m= 300 kg) with

#### constant velocity?



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**19.** In the diagram above, assume that the tabletop is frictionless. Determine the acceleration of the blocks once they're released from rest.



**20.** Using the diagram from the previous example, assurme that m=2 kg, M= 10 kg, and the coefficient of kinetic friction between the small block and the tabletop is 0.5. What is the acceleration of the blocks ?

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**21.** In the previous example, calculate the magnitude of the tension in the cord.

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22. A block slides down a frictionless, inclined plane that makes a  $30^{\circ}$  angle with the horizontal. Find the acceleration of this block.



**23.** A block slides down an inclined plane that makes an angle  $\theta$  with the horizontal. If the coefficient of kinetic friction is  $\mu$ , find the acceleration of the block.



1. A person standing on a horizontal floor feels two forces : the downward pull of gravity and the upward supporting force from the floor. These two forces

A. have equal magnitudes and form an

action / reaction pair

B. have equal magnitudes but do not form

an action / reaction pair

C. have unequal magnitudes and form an

action / reaction pair

D. have unequal magnitudes and do not

form an action / reaction pair

Answer: B

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**2.** A person who weight 800 N steps ontoa scale that is on the floor of an elevator car. If

the elevator acelerates upward at a rate of

 $5m/s^2$ , what will the scale read ?

A. 400 N

B. 800 N

C. 1000 N

D. 1200 N

Answer: D



**3.** A frictionless inclined plane of length 20 m has a maximum vertical height of 5 m. If an object of mass 2 kg is placed on the plane, which of the following best approximates the net force it feels ?

A. 5 N

B. 10 N

C. 15 N

D. 20 N

Answer: A

**4.** A 20 N block is being pushed across a horizontal table by an 18 N force. If the coefficient of kinetic friction between the block and the table is 0.4, find the acceleration of the block.

A. 
$$0.5m\,/\,s^2$$

 $\mathsf{B.}\,1m\,/\,s^2$ 

 $\mathsf{C.}\,5m\,/\,s^2$ 

## D. $7.5m/s^2$

#### Answer: C

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5. The coefficient of static friction between a box and a ramp is 0.5. The ramp's incline angle is  $30^{\circ}$ . If the box is placed at rest on the ramp, the box will

A. accelerate down the ramp

B. accelerate briefly down the ramp but

then slow down and stop

C. move with constant velocity down the

ramp

D. not move

Answer: A

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Assuming a frictionless, massless pulley, determine the acceleration of the blocks once they are released from rest.

A. 
$$rac{m}{M+m}g$$
  
B.  $rac{M}{M+m}g$   
C.  $rac{M}{m}g$   
D.  $rac{M-m}{M+m}g$ 

#### Answer: D





**7.** If all of the forces acting on an object are balanced (net force is zero), then

A. the object must be at rest

B. the object's speed will decrease

C. the object will follow a parabolic

trajectory

D. the object is experiencing zero

#### Answer: D



8. A block of mass m is at rest on a frictionless, horizontal table placed in a laboratory on the surface of Earth. An identical block is at rest on a frictionless, horizontal table placed on the surface of the moon. Let F be the net force necessary to give the earthbound block an acceleration of a across the table. Given that  $g_{
m moon}$  is one sixth of  $g_{
m Earth}$ , the force necessary to give the moon-bound block the same

acceleration a across the table is

A. 
$$\frac{F}{12}$$
  
B.  $\frac{F}{6}$   
C.  $\frac{F}{3}$ 

#### Answer: D



**9.** A crate of mass 100 kg is at rest on a horizontal floor. The coefficient of static friction between the crate and the floor is 0.4, and the coefficient of kinetic friction is 0.3 . A force F of magnitude 344 N is then applied to the crate, parallel to the floor. Which of the following is true ?

A. The crate will accelerate across the floor

at  $0.5m/s^2$ .

B. The static friction force, which is the

reaction force to F as guaranteed by

Newton 's Third Law, will also have a

magnitude of 344 N.

C. The crate will slide across the floor at a

constant speed of 0.5m/s.

D. The crate will not move.

Answer: D

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10. Two crates are stacked on top of each other on a horizontal floor, crate #1 is on the bottom, and crate #2 is on the top. Both crates have the same mass. Compared with the strength of the force  $F_1$  necessary to push only crate #1 at a constant speed across the floor, the strength of the force  $F_2$  necessary to push the stack at the same constant speed across the floor is greater because

A. the force of the floor on crate #1 is greater because of the additional weight

being supplied by crate #2

B. the coefficient of kinetic friction between

crate #1 and the floor is greater

C. the force of kinetic friction, but not the

normal force, on crate #1 is greater

D. the coefficient of static friction between

crate #1 and the floor is greater

Answer: A

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**11.** If the distance between two point particles is doubled, then the gravitational force between them

A. decreases by a factor of 4

B. decreases by a factor of 2

C. increases by a factor of 2

D. increases by a factor of 4

Answer: A

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**12.** At the surface of the Earth, an object of mass m has weight w. If this object is transported to an altitude that's twice the radius of the Earth, then, at the new location,

A. its mass is 
$$\frac{m}{2}$$
 and its weight is  $\frac{w}{2}$   
B. its mass is m and its weight is  $\frac{w}{2}$   
C. its mass is  $\frac{m}{2}$  and its weight is  $\frac{w}{4}$   
D. its mass is m and its weight is  $\frac{w}{9}$ 

#### Answer: D

**13.** A moon of mass m orbits a planet of mass 100 m. Let the strength of the gravitational force exerted by the planet on the moon be denoted by  $F_1$ , and let the strength of the gravitational forc exerted by the moon on the planet be  $F_2$ . Which of the following is true ?

A. 
$$F_1=100F_2$$

B.  $F_1 = 10F_2$ 

 $C. F_1 = F_2$ 

D.  $F_2 = 10F_1$ 

#### Answer: C

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**14.** Pluto has 1/500 the mass and 1/15 the radius of Earth. What is the value of g on the surface of Pluto ?

A.  $0.3m/s^2$ 

B. 
$$1.6m/s^2$$

C. 
$$2.4m/s^2$$

D. 
$$4.5m/s^2$$

#### Answer: D

