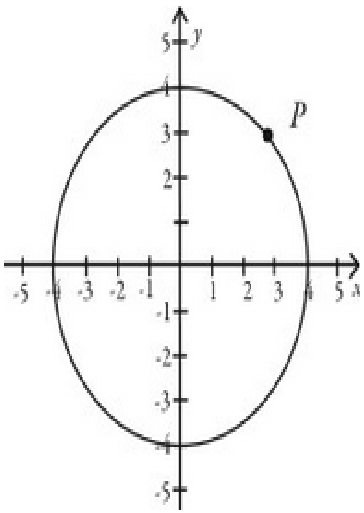
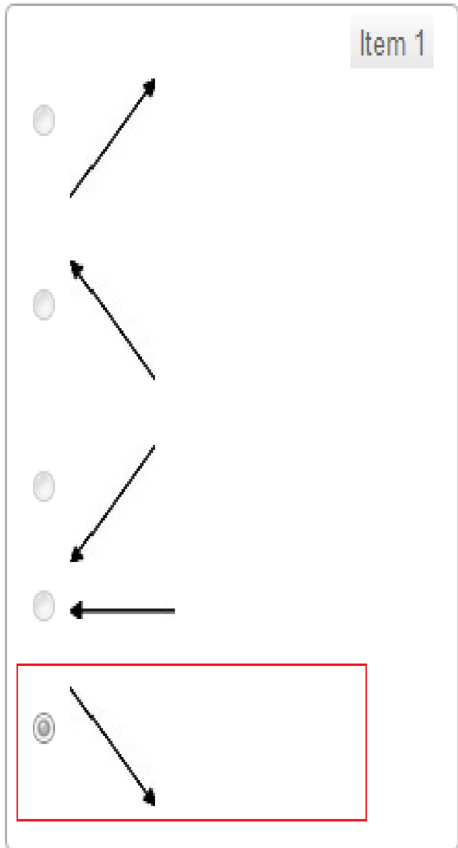
Test 3

Corrected

Point P in the figure indicates the position of an object traveling at constant speed clockwise around the circle.
Which arrow best represent the direction the object would travel if the net external force on it were suddenly reduced to zero?





Whenever an object moves in a circular path, there must be some force acting on that object, which is directed towards the center of the circular path. This force is called the centripetal force. If the centripetal force suddenly becomes zero, then the object will move in a direction tangent to the circular path, at its location.

So, if the external force which is responsible for the rotation of the object in the question, becomes zero, then the object will move along the tangent drawn to the circle at the point P. As the object is moving in clockwise direction, the tangent should be in that direction only.

Hence, the correct option is $\boxed{E}$.

A stalled car is being pushed up a hill at constant velocity by three people. The net force on the car is

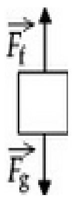
- down the hill and greater than the weight of the car.
- zero.
- down the hill and equal to the weight of the car.
- up the hill and equal to the weight of the car.
- up the hill and greater than the weight of the car.

Item 2

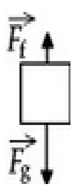
0 as it is moving with constant velocity v=constant

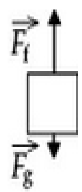
net force=ma=m (dv/dt)=0

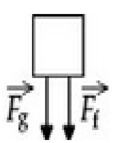
Which one of the following free-body diagrams best represents the free-body diagram, with correct relative force magnitudes, of a person in an elevator that is traveling upward with an unchanging velocity? $\vec{F}_f$ is the force of the floor on the person and $\vec{F}_g$ is the force of gravity on the person.

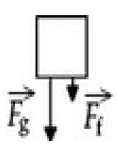


Item 3

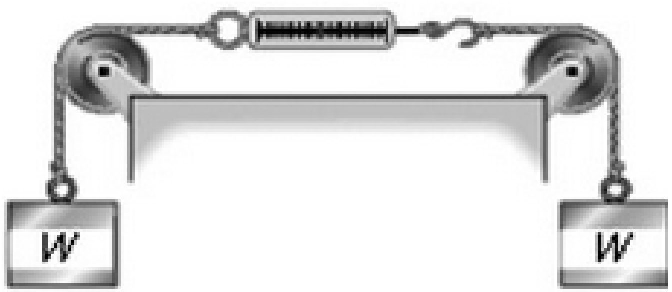








Two objects, each of weight W, hang vertically by spring scales as shown in the figure. The pulleys and the strings attached to the objects have negligible weight, and there is no appreciable friction in the pulleys. The reading in each scale is



- ☑ W.
- ○ more than W, but not quite twice as much.
- ○ less than W.
- ○ $2W$.
- ○ more than $2W$.

Item 4

Action - Reaction pair: Action side = W, Reaction side = W

Two objects have masses *m* and 5*m*, respectively. They both are placed side by side on a frictionless inclined plane and allowed to slide down from rest.

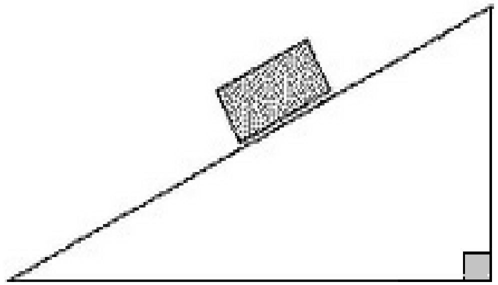
- It takes the heavier object 5 times longer to reach the bottom of the incline than the lighter object.
- It takes the lighter object 10 times longer to reach the bottom of the incline than the heavier object.
- It takes the lighter object 5 times longer to reach the bottom of the incline than the heavier object.
- The two objects reach the bottom of the incline at the same time.
- It takes the heavier object 10 times longer to reach the bottom of the incline than the lighter object.

Item 5

Same acceleration, same time.

Different accelerations, different time.

A brick is resting on a rough incline as shown in the figure. The friction force acting on the brick, along the incline, is



- equal to the weight of the brick.
- zero.
- less than the weight of the brick.
- greater than the weight of the brick.

$f < \mu_s \cdot N$

For the brick to remain at rest, the friction force f must be less than the weight of the brick.

A 60.0-kg person rides in an elevator while standing on a scale. The scale reads 400 N. The acceleration of the elevator is closest to

- [x] 3.13 m/s^2 downward.
- [ ] 9.80 m/s^2 downward.
- [ ] zero.
- [ ] 6.67 m/s^2 upward.
- [ ] 6.67 m/s^2 downward.

Item 7

weight = 60 * 9.8 = 588 N

$N = m(g - a)$

$400 = 60 \cdot (9.8 - a)$

$9.8 - a = 400/60 = 6.6666$

$a = 9.8 - 6.6666 = 3.1334$ m/s^2 nearly downward

A person is dragging a packing crate of mass 100 kg across a rough horizontal floor where the coefficient of kinetic friction is $\boxed{0.400}$. He exerts a force F sufficient to accelerate the crate forward. At what angle above horizontal should his pulling force be directed in order to achieve the maximum acceleration?

Item 8

- 34.5°
- 27.7°
- 30°
- 45°
- 21.8°

sum forces in the y

F sin theta + N - mg = 0

$N = mg - F \sin(\theta)$

sum forces in the x

$F \cos(\theta) - \text{friction} = ma$

$F \cos(\theta) - \boxed{\mu(mg - F \sin(\theta))} = ma$

$a = F/m \cos(\theta) - \mu g + \mu F/m \sin(\theta)$

$\frac{da}{d(\theta)} = -F/m \sin(\theta) + \mu \cdot F/m \cos(\theta) = 0$

$\sin(\theta) = \mu \cos(\theta)$

$\tan(\theta) = \mu$

$\theta = \arctan(u) = \arctan(0.40) = 21.8°$

A box is sliding down an incline tilted at a 12.9° angle above horizontal. The box is initially sliding down the incline at a speed of 1.60 m/s. The coefficient of kinetic friction between the box and the incline is 0.320. How far does the box slide down the incline before coming to rest?

Item 9

- ○ 1.77 m
- ○ 2.06 m
- ○ 1.18 m
- ◉ 1.47 m
- ○ The box does not stop. It accelerates down the plane.

$F_{net} = mg\sin(12.9°) - 0.320 \times mg\cos(12.9°) = m\,.\,(9.8)\,.\,(-0.088673) = -0.869\,.\,m$

$a = F/m = -0.869\ m/s^2$

acceleration is in upward direction.

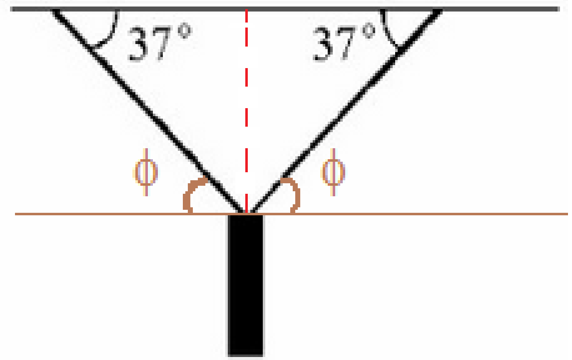
$v^2 - u^2 = 2as$

$0 - 1.60^2 = 2 \times -0.869 \times s$

$s = -1.473m$

(-) is downward

A traffic light weighing 100 N is supported by two ropes as shown in the figure. The tensions in the ropes are closest to



$$\phi = 90° - 37° = 53°$$

$$100\text{ N} = F.\cos(53°) + F.\cos(53°)$$

$$100\text{ N} = 2F \times \cos(53°)$$

$$\frac{100\text{ N}}{2 \times \cos(53°)} = 83.1\text{N}$$

- 50 N.
- $\boxed{83 \text{ N.}}$
- 56 N.
- 63 N.
- 66 N.

Item 10