Worksheet: Static Friction

Question Video

Q1: A box is dropped onto a conveyor belt moving at 3.4 m/s. If the coefficient of friction between the box and the belt is 0.27, how long will it take before the box moves without slipping?

A 0.93 s

B 1.1 s

C 1.2 s

D 1.3 s

E 0.84 s

Q2: A box rests on the horizontal trailer of a truck. The coefficient of static friction between the box and the surface of the trailer is 0.24. The truck starts from rest and moves horizontally with constant acceleration. What maximum distance can the truck travel in 3.0 s without the box starting to slide?

A 9.7 m

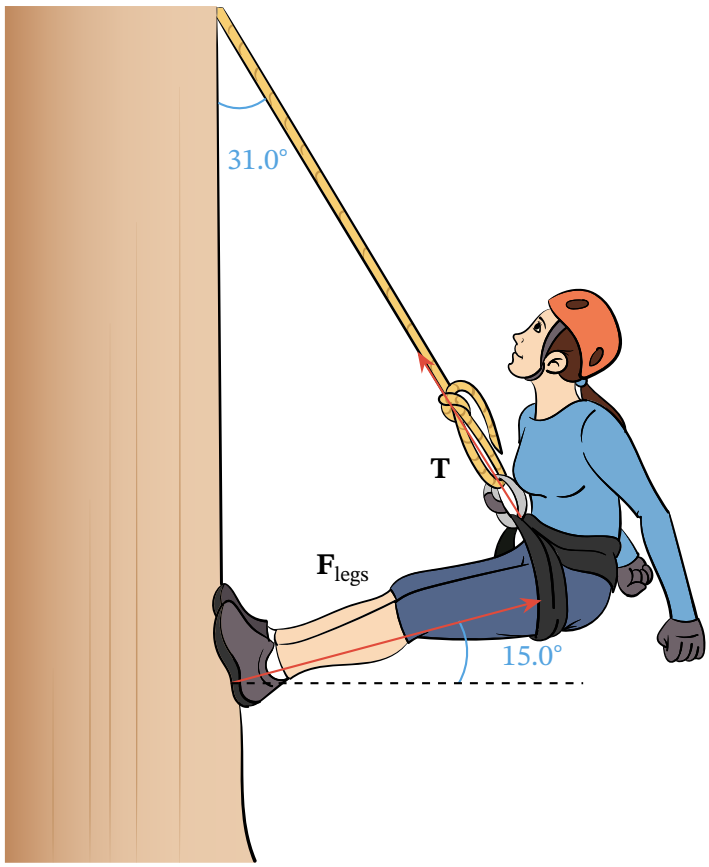
B 11 m

C 16 m

D 7.9 m

E 6.7 m

Q3: Consider the 52.0-kg mountain climber shown. Assume that the force that the mountain climber exerts with her feet on the vertical rock face is exerted parallel to her legs. Also, assume that negligible force is exerted by her arms.



Find the tension in the rope.

A 266 N

B 272 N

C 304 N

D 292 N

E 285 N

Find the force that the mountain climber must exert with her feet on the vertical rock face to remain stationary.

A 453 N

B 512 N

C 528 N

D 490 N

E 477 N

Find the minimum coefficient of friction between the climber's shoes and the cliff.

A 0.184

B 0.268

C 0.602

D 0.451

E 0.333

Q4: An automobile has a mass of 935 kg and its engine has a maximum power output of 97 kW. What is the maximum angle gradient above the horizontal that the automobile can climb at 45.0 km/h if the frictional retarding force on it the automobile is 280 N?

A 35°

B 45°

C 55°

D 75°

E 65°

Q5: When a force of 20 N is applied to a stationary box weighing 40 N, the box does not move. This means the coefficient of static friction ___.

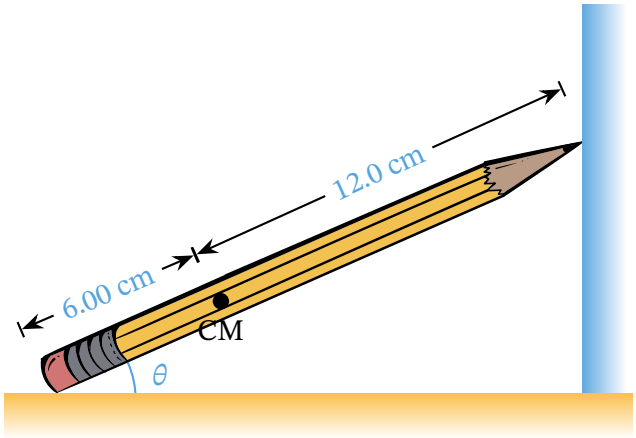
A is less than 0.5

B is greater than 0.5

C is equal to 0.5

D cannot be determined

Q6: A pencil is resting against a corner, as shown in the diagram. The sharpened end of the pencil is touching a smooth vertical surface and the eraser end is touching a rough horizontal floor. The coefficient of static friction between the eraser and the floor $\mu_s = 0.75$. The center of mass of the pencil is located 6.00 cm from the tip of the eraser and 12.0 cm from the tip of the pencil lead. Find the minimum angle θ for which the pencil does **not** slip.



A 18°

B 76°

C 21°

D 24°

E 45°

Q7: The coefficient of static friction between a belt and a circular pulley is 0.57. The contact length between the belt and the pulley subtends an angle of 150 degrees. What is the ratio of belt tensions on the tight side (the side that pulls) to the loose side of the pulley that can be accommodated without the belt slipping?

A 3.5

B 2.6

C 0.57

D 4.4

E 7.1

Q8: The coefficient of static friction between a belt and a circular pulley is 0.62. The contact length between the belt and the pulley subtends an angle of 130 degrees. What is the ratio of belt tensions on the tight side of the pulley (the side that pulls) to the loose side of the pulley that can be accommodated without the belt slipping?

A 3.5

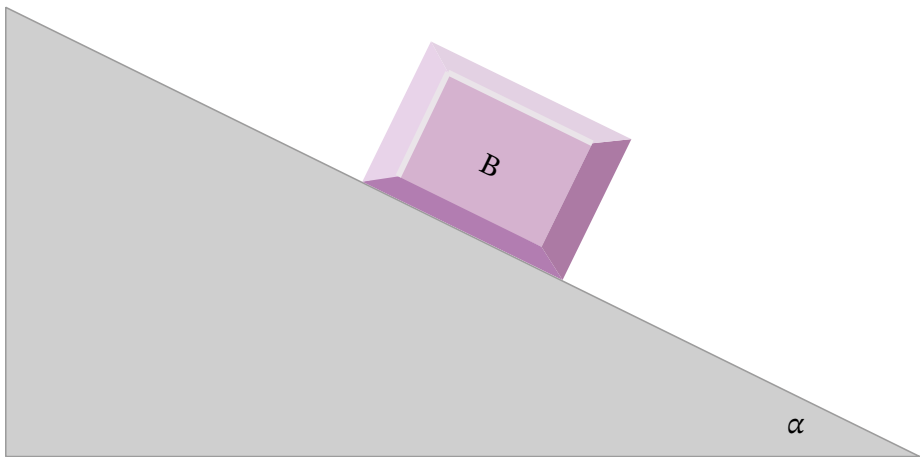
B 0.62

C 4.1

D 6.4

E 2.2

Q9: A block, B, is on an incline, as shown in the accompanying diagram. The static coefficient of friction between the block and the incline's surface is 0.488. At what value of the angle α will the block begin to slide downward along the incline?



A 2.07 degrees

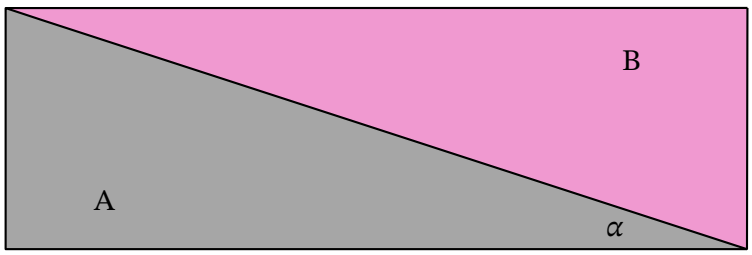
B 32.4 degrees

C 19.0 degrees

D 21.3 degrees

E 26.0 degrees

Q10: Two identical right-triangular prisms are placed so that their longest-sided faces completely cover each other, as shown in the accompanying diagram. The angle $\alpha = 18.0°$. The block B has a mass of 10.0 kg and is subject to a vertically downward gravitational acceleration of 9.80 m/s^2. Block A is held in place by external forces. If the coefficient of static friction between the block's surfaces is 0.0500, what magnitude horizontal force is required to just start block B moving to the left?



A 37.3 N

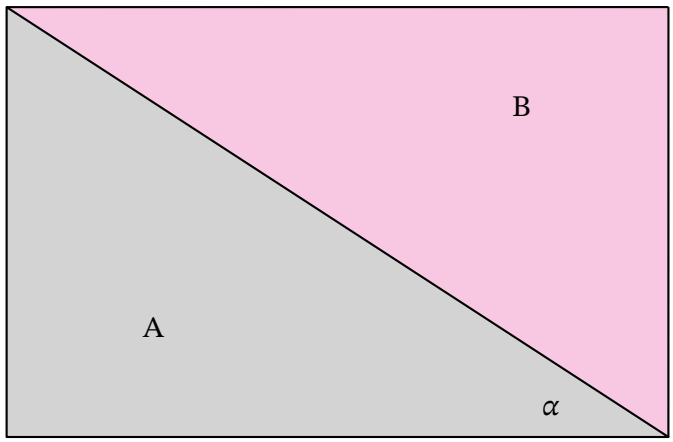
B 42.8 N

C 34.9 N

D 4.70 N

E 30.3 N

Q11: Two identical right-triangular prisms are placed so that their longest-sided faces completely cover each other, as shown in the accompanying diagram. The angle $\alpha = 33.0°$. The block B has a mass of 10.0 kg and is subject to a vertically downward gravitational acceleration of 9.80 m/s^2. Block A is held in place by external forces. If the coefficient of static friction between the block's surfaces is 0.0500, what magnitude horizontal force is required to just start block B moving to the left?



A 37.4 N

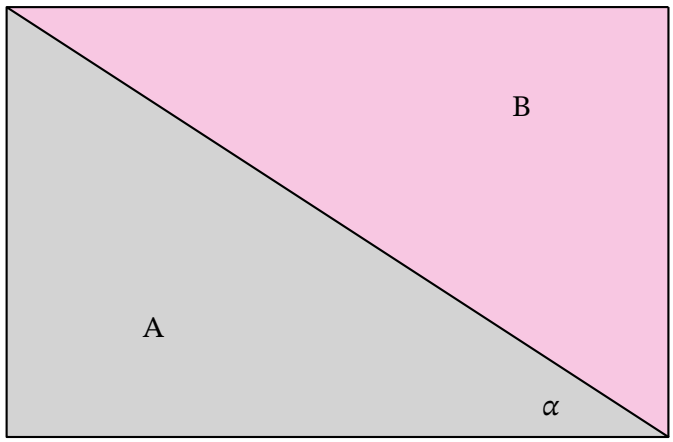
B 30.7 N

C 70.8 N

D 98.0 N

E 0.570 N

Q12: Two identical right-triangular prisms are placed so that their longest-sided faces completely cover each other, as shown in the accompanying diagram. The angle $\alpha = 33.0°$. The block B has a mass of 10.0 kg and is subject to a vertically downward gravitational acceleration of 9.80 m/s^2. Block A is held in place by external forces. If the coefficient of static friction between the block's surfaces is 0.0700, what magnitude horizontal force is required to just start block B moving to the left?



A 98.0 N

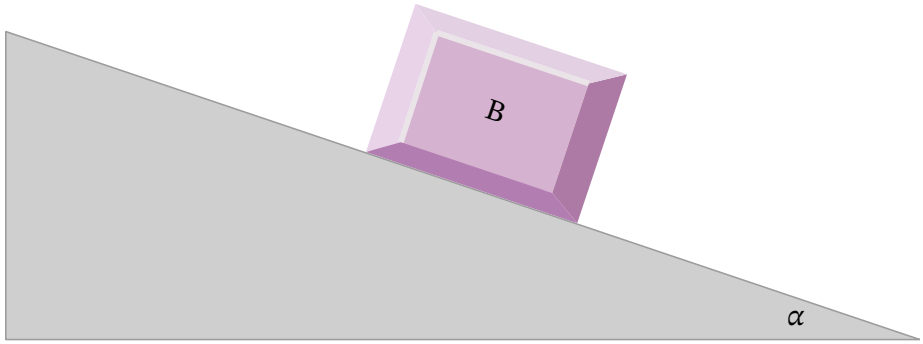
B 70.8 N

C 33.7 N

D 75.8 N

E 73.9 N

Q13: A block, B, is on an incline, as shown in the accompanying diagram. The static coefficient of friction between the block and the incline's surface is 0.343. At what value of the angle α will the block begin to slide downward along the incline?



A 19.0°

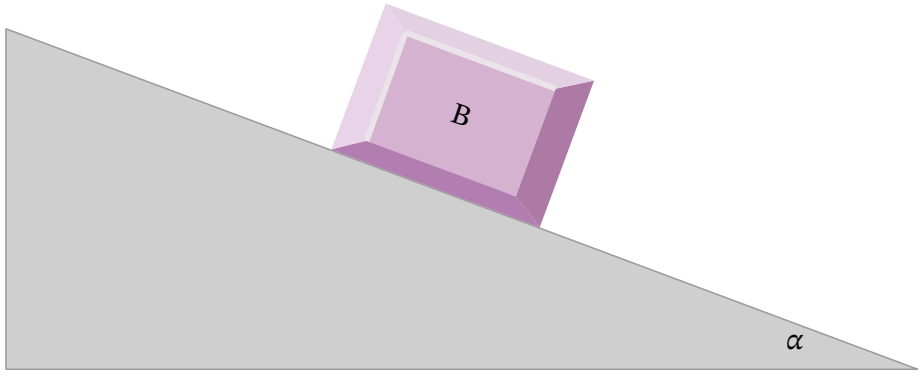
B 32.0°

C 21.0°

D 2.00°

E 26.0°

Q14: A block, B, is on an incline, as shown in the accompanying diagram. The static coefficient of friction between the block and the incline's surface is 0.38. At what value of the angle α will the block begin to slide downward along the incline?



A 26°

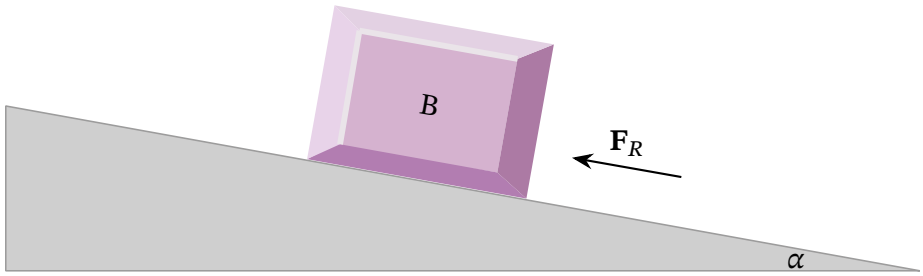
B 2.0°

C 21°

D 32°

E 7.0°

Q15: The block B is on an inclined slope, as shown in the accompanying diagram. The coefficient of static friction between the block and the ramp is 0.42 and the mass of block B is 25 kg. The angle α of the incline above the horizontal is 0.19 rad. A force $\mathbf{F}_R$ acts upward along the incline. What magnitude of $\mathbf{F}_R$ is required to maintain the block at rest on the incline under the influence of a vertically downward gravitational acceleration of 9.8 m^2/s?



A 240°

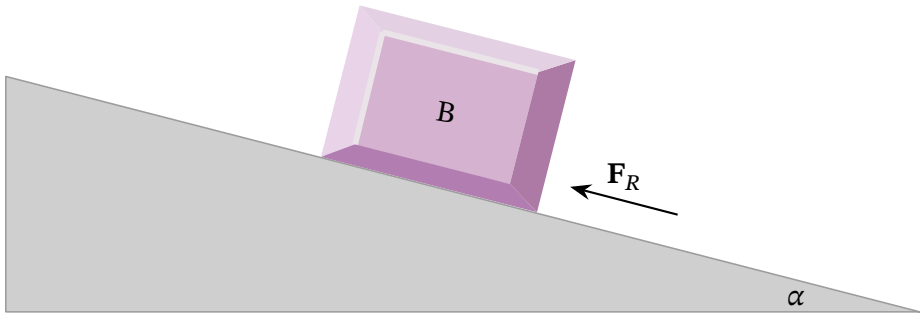
B 42°

C 250°

D 12°

E 46°

Q16: The block B is on an inclined slope, as shown in the accompanying diagram. The coefficient of static friction between the block and the ramp is 0.42 and the mass of block B is 18 kg. The angle α of the incline above the horizontal is 0.25 rad. A force $\mathbf{F}_R$ acts upward along the incline. What magnitude of $\mathbf{F}_R$ is required to maintain the block at rest on the incline under the influence of a vertically downward gravitational acceleration of 9.8 m^2/s?



A 250 N

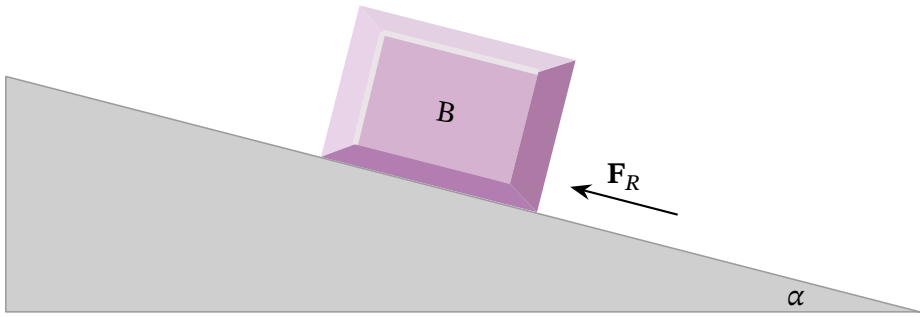
B 240 N

C 64 N

D 44 N

E 61 N

Q17: The block B is on an inclined slope, as shown in the accompanying diagram. The coefficient of static friction between the block and the ramp is 0.42 and the mass of block B is 25 kg. The angle α of the incline above the horizontal is 0.25 rad. A force $\mathbf{F}_R$ acts upward along the incline. What magnitude of $\mathbf{F}_R$ is required to maintain the block at rest on the incline under the influence of a vertically downward gravitational acceleration of 9.8 m^2/s?



A 44 N

B 250 N

C 46 N

D 240 N

E 61 N