Objects on a Ramp

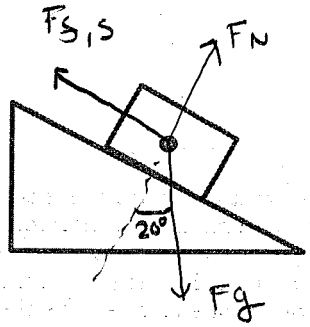
A 40.0 kg crate rests on a 20.0 degree incline. Complete the following:

A) Draw a free-body diagram ✓

B) Determine the weight of crate F_g=

C) Determine normal force

D) Determine force of friction



B) $F_g = mg = (40\text{kg})(9.81\text{m/s}^2) = 392\text{N}$

C) $F_N = F_{gy(\perp)} = F_g \cos\theta = (392\text{N})\cos 20° = 369\text{N}$

D) $F_f = F_{gx(\parallel)} = F_g \sin\theta = (392\text{N})\sin 20° = 134\text{N}$

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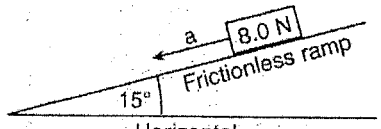
1. An 8.0-newton block is accelerating down a frictionless ramp inclined at 15° to the horizontal, as shown in the diagram below.

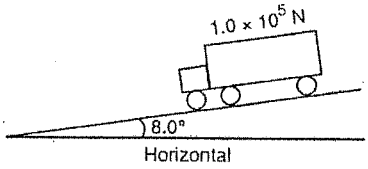


$F_{NET} = F_{gx} = F_g \sin\theta = (8\text{N})\sin 15°$

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

2. The diagram below shows a 1.0×10^5-newton truck at rest on a hill that makes an angle of 8.0° with the horizontal.



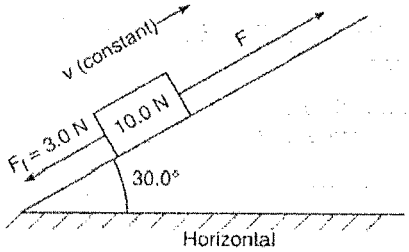
What is the component of the truck's weight parallel to the hill?

A) 1.4×10^3 N B) 1.0×10^4 N
~~C) 1.4×10^4 N~~ D) 9.9×10^4 N

$F_{gx(\parallel)} = F_g \sin\theta$

$= (1 \times 10^5\text{N})(\sin 8.0°)$

3. 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)

$a = 0$

$F_{NET} = 0$

$F_{NET,x} = F + (-F_f) + (-F_{gx})$

$F = F_f + F_{gx}$

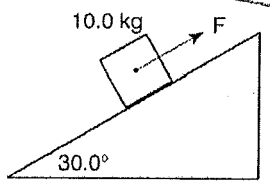
$= 3\text{N} + 10\text{N}\sin 30°$

$= 8\text{N}$

What is the magnitude of force F?

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

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



$F_{NET} = 0$

$F = F_{gx(\parallel)}$

$= mg \sin\theta$

$= (10\text{kg})(9.81\text{m/s}^2)\sin 30°$

$= 49.1\text{N}$

What is the approximate magnitude of force F?

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

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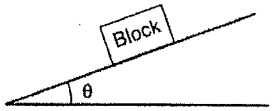
5. In the diagram below, a block rests on a ramp, making angle θ with the horizontal.



If angle θ is increased, what will occur?

A) The block's ~~mass will decrease~~. ← const

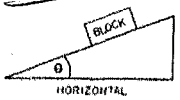
B) The block's ~~weight will increase~~. ← $F_g = mg$

C) The block's component of weight parallel to the ramp will decrease. $F_{gx} = F_g \sin\theta$

~~D)~~ The block's component of weight parallel to the ramp will increase.

$\uparrow\theta, \sin\theta\uparrow$

6. A block is at rest on an inclined plane as shown in the diagram at the right. As angle θ is increased, the component of the block's weight parallel to the plane



A) decreases ~~B) increases~~
C) remains the same

$F_{gx(\parallel)} = F_g \sin\theta$

$\theta\uparrow$

$F_{gx}\uparrow$