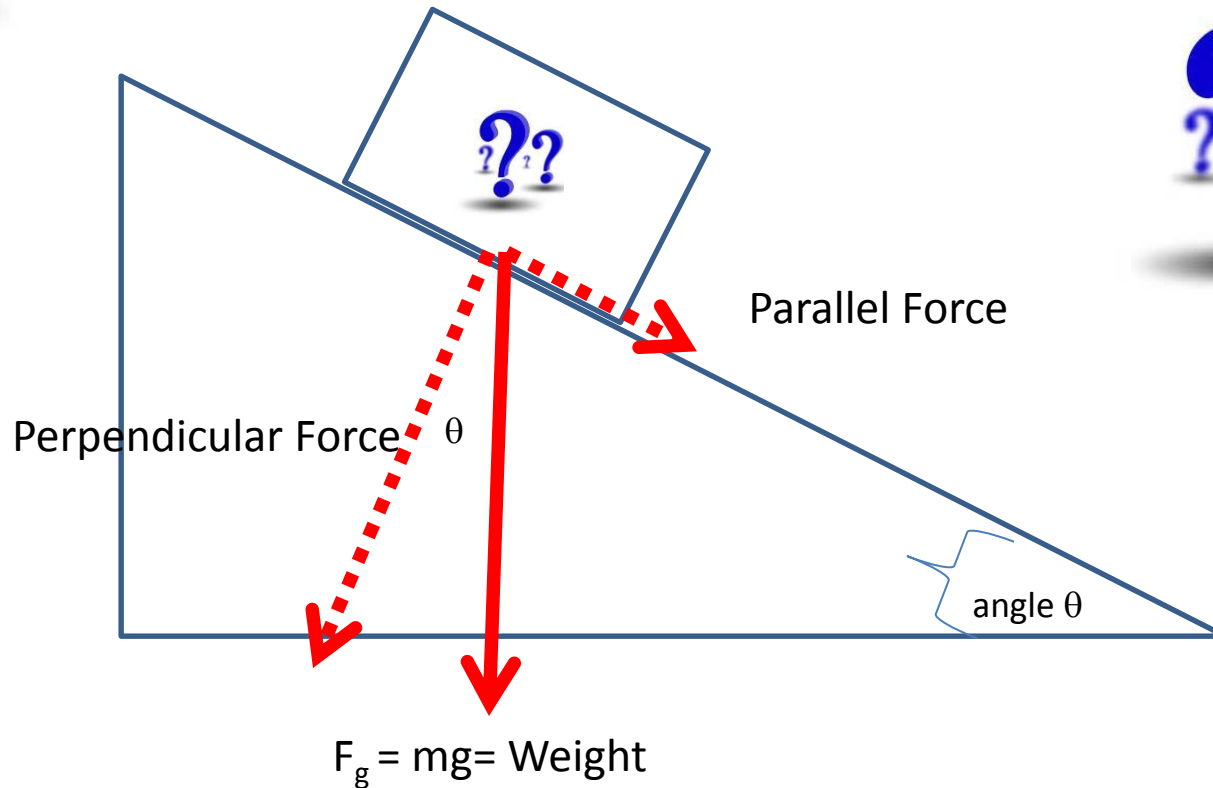




Inclined Plane Notes



Inclined Planes

- Weight always acts vertically
- Weight = $mg = F_g$
- Objects move in the direction of Net Force
- Objects on an angle have a force parallel to the surface and a force perpendicular to the surface.
- Normal Force F_N is always perpendicular to the surface.

Inclined Plane Questions

- What direction does weight act?

Straight down

- What force acts down the plane?

Parallel force

- What force acts against the parallel force?

Friction

- In what direction does the perpendicular force act?

Perpendicular to the Surface

- What force acts against the perpendicular force?

Normal Force

Inclined Plane Questions

- Which function is used to calculate the parallel force?
(sin,cos,tan)

Sin

- Which function is used to calculate normal force?

Cos

- What determines the size of the angle you work with?

Angle of the hill

- What is the hypotenuse of the vector triangle?

Weight

- What is your favorite color?

Cyan

Name: _____

Label the diagram

1-5 are forces

6-8 are angles

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

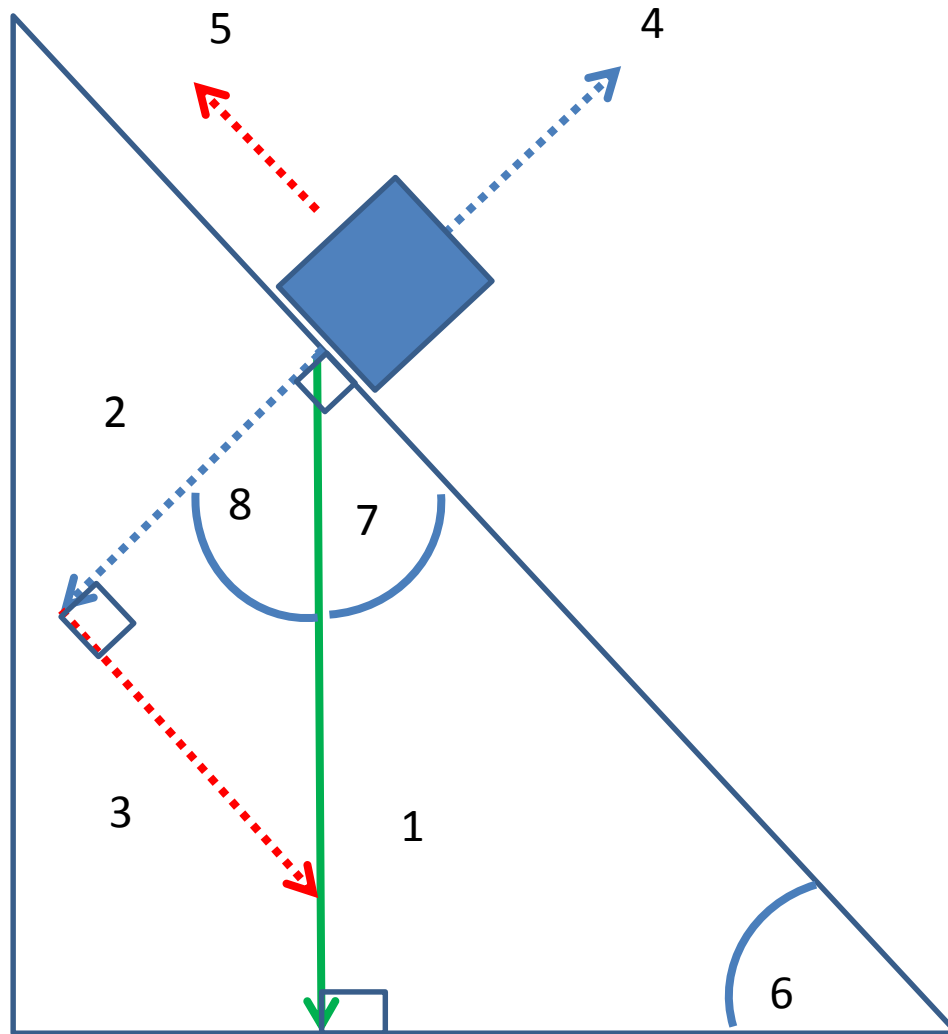
7 _____

8 _____

Assuming the object is at rest

Which forces are represented by $F_g \sin\theta$?

Which forces are represented by $F_g \cos\theta$?

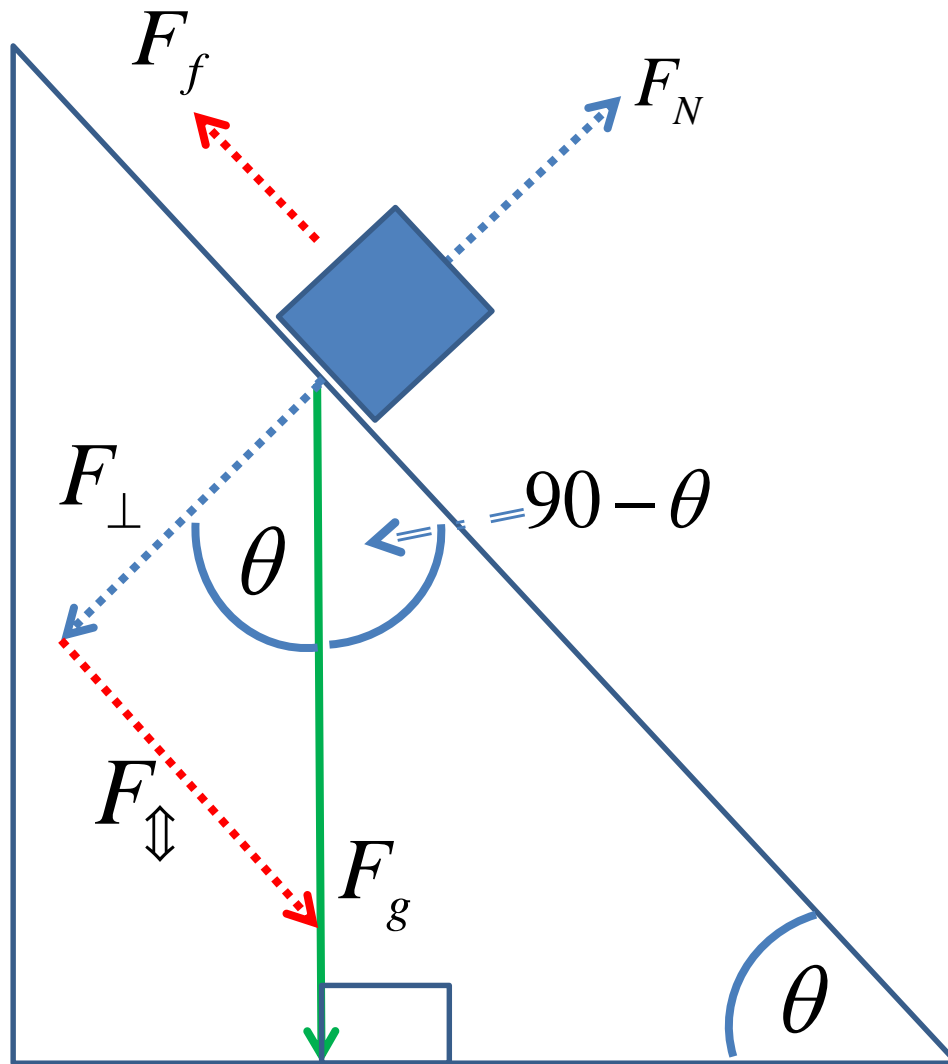


Name: _____

Label the diagram

1-5 are forces

6-8 are angles



Assuming the object is at rest

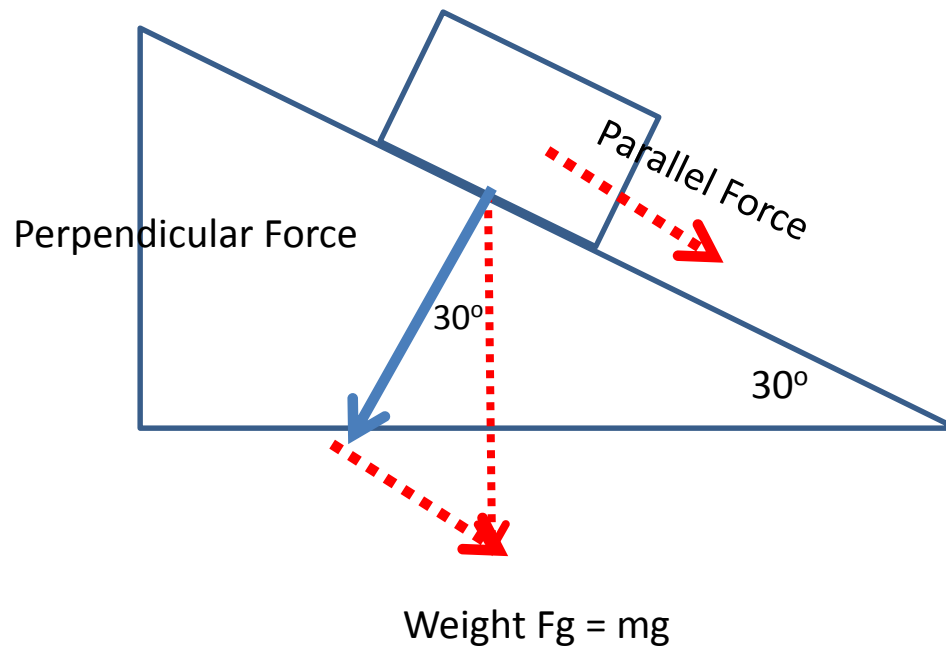
Which forces are represented by $F_g \sin \theta$?

Friction and parallel

Which forces are represented by $F_g \cos \theta$?

Normal and perpendicular

1. A 450 N trunk rests on a 30° inclined plane?
 - a) What is the force acting down the plane?
 - b) What is the force acting perpendicular to the plane?

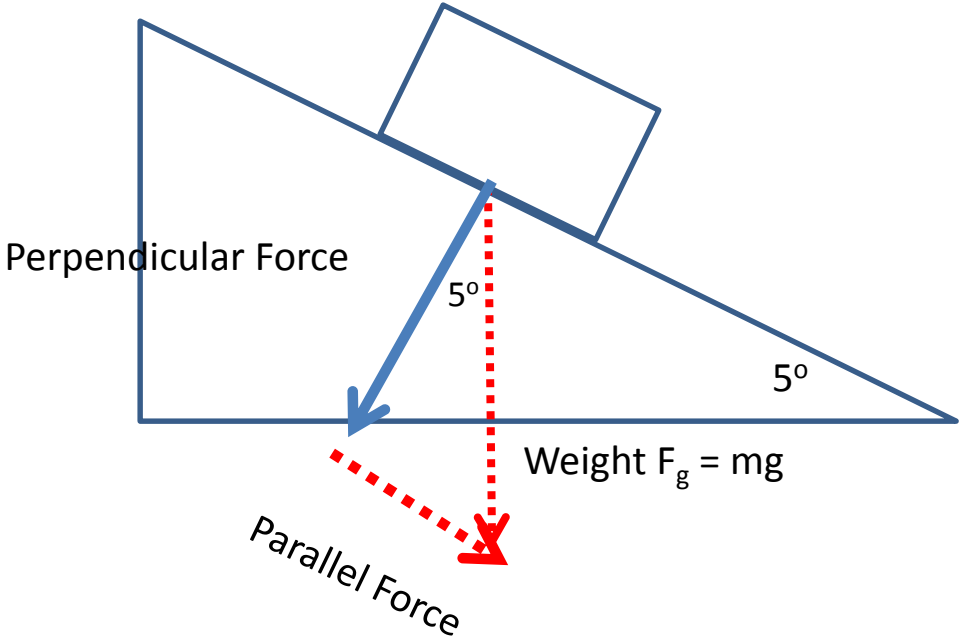


- A 450 N trunk rests on a 30° inclined plane?
- What is the force acting down the plane?
- **Opp= hyp (sinθ)= 450(sin30)= 225 N**
- What is the force acting perpendicular to the plane?
- **adj= hyp (cosθ)= 450(cos30)= 390 N**

2. A 54.7 kg box is resting on a 5° inclined plane?

- A what is the normal force?
- What is the friction force holding the box?

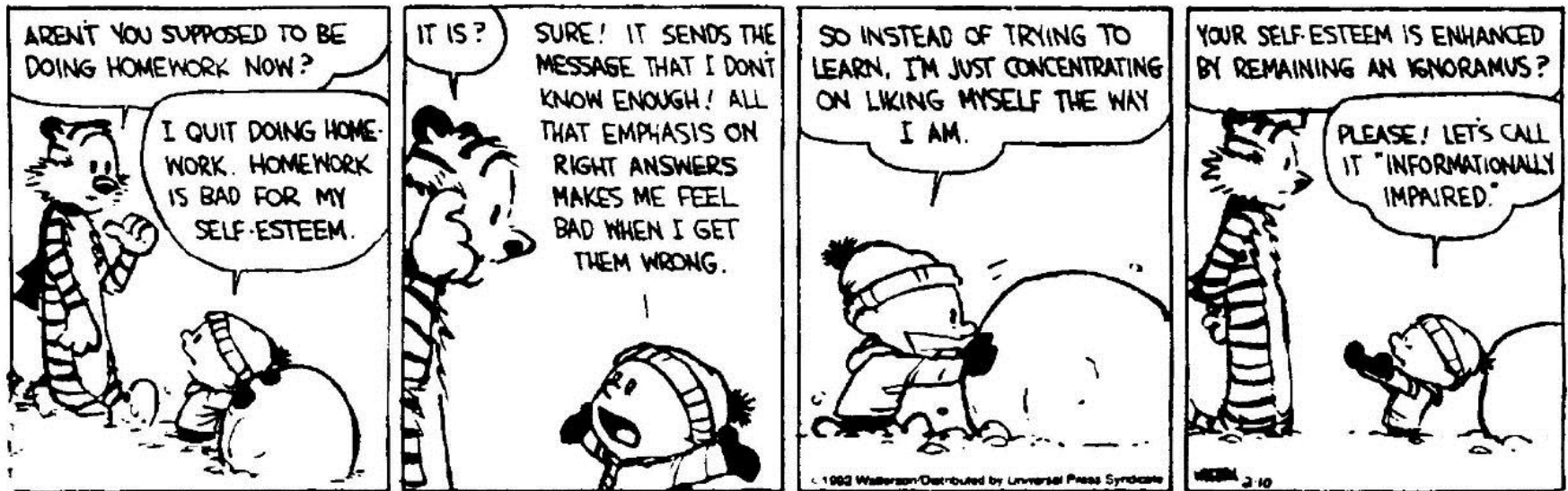
Diagram



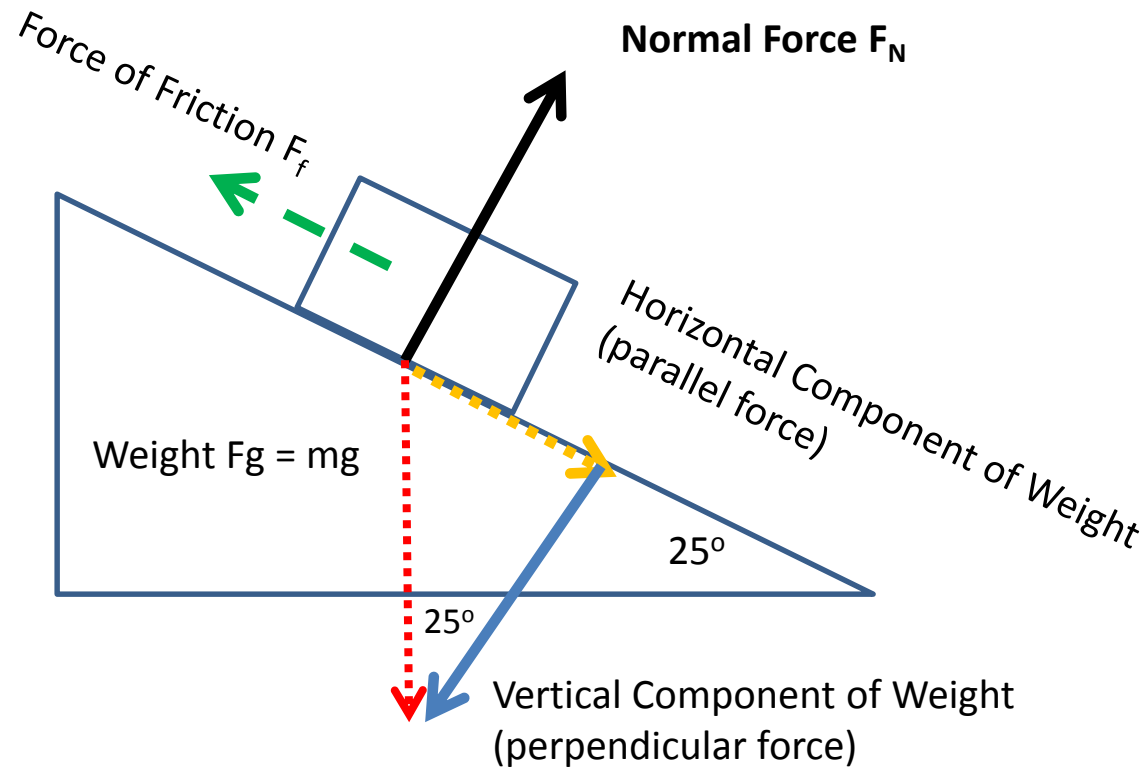
Solution

- Mass = 54.7 kg
- Weight = $F_g = mg = 54.7 \times 9.81 = 537 \text{ N}$
- Normal force is adjacent side
- Use $\cos \theta = \text{adj}/\text{hyp}$
- $\text{Adj} = \text{hyp} (\cos \theta) = 537 (\cos 5) = 46.8 \text{ N}$
- Friction force is opposite side
- Use $\sin \theta = \text{opp}/\text{hyp}$
- $\text{Opp} = \text{hyp} (\sin \theta) = 537 (\sin 5) = 535 \text{ N}$

Now complete the worksheet on Inclined Plane Problems



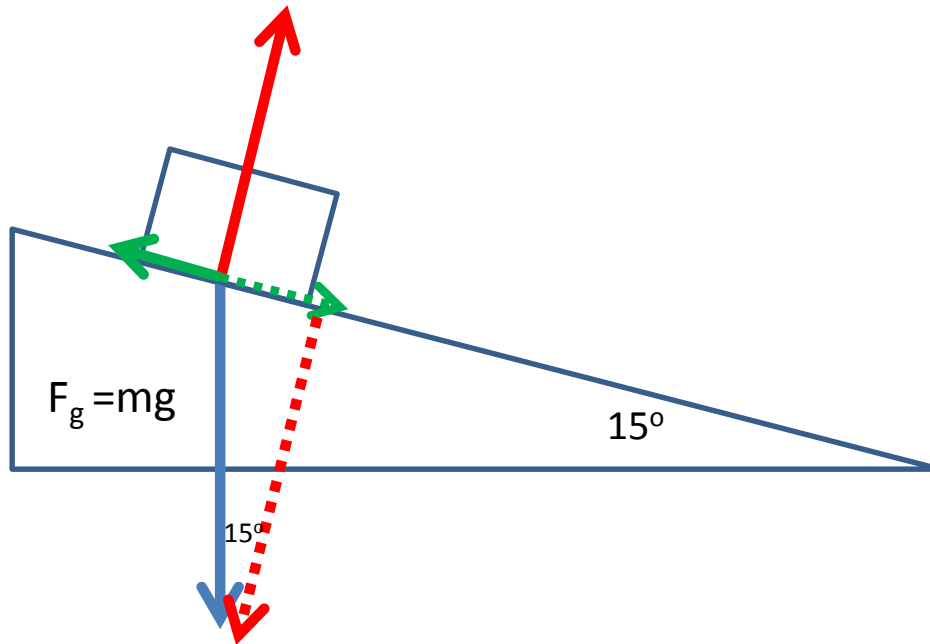
1. What is the force of friction holding a 225 kg box on a ramp that forms a 25° angle with the ground?



Solution

- Mass = 225 kg
- Weight = $F_g = mg = 225 \times 9.81 = 2210 \text{ N}$
- Friction force is opposite side
- Use $\sin \theta = \text{opp/hyp}$
- $\text{Opp} = \text{hyp} (\sin \theta) = 2210 (\sin 25) = 934 \text{ N}$

2. What is the μ of between a 520 kg wooden crate and the concrete ramp (15°) that it is sitting on?



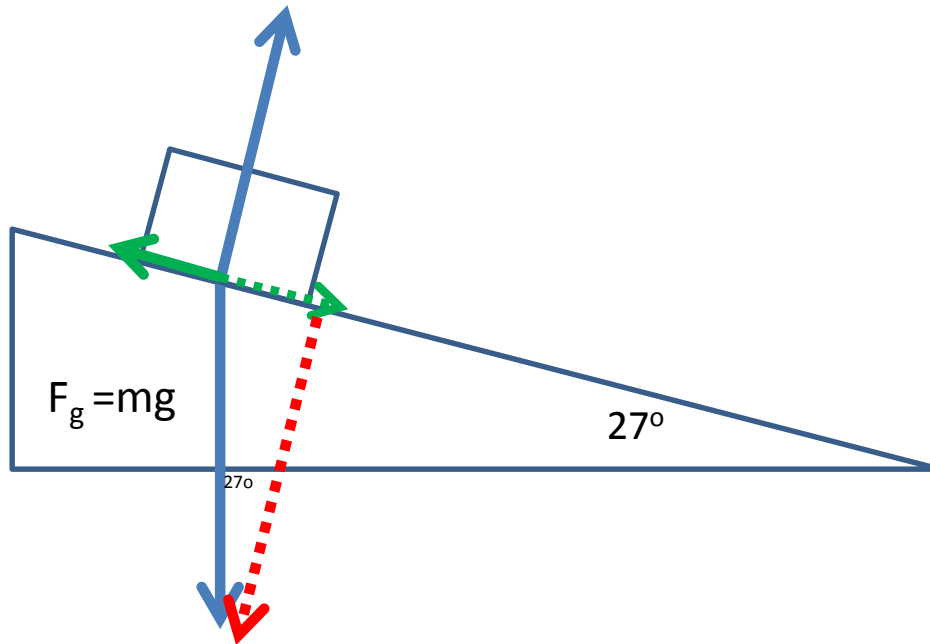
Solution

- Mass = 520 kg
- $\mu = F_f / F_N$
- F_f is the horizontal component of the weight
- F_N is the vertical component of the weight

Solution

- Weight= $F_g = mg = 520 \times 9.8 = 5100 \text{ N}$
- Opp= hyp(Sin θ) $F_f = 5100 (\sin 15) = 1320 \text{ N}$
- $F_N = \text{hyp}(\cos\theta)$ $F_N = 5100 (\cos 15) = 4930 \text{ N}$
- $F_f = \mu F_N$
- $\mu = F_f/F_N = 1320/4930 = 0.26$

3. A 125 kg box is sliding down a 27° ramp at a constant velocity of 1.12 m/s. What is the friction force acting on it?



Solution

- Mass = 125 kg
- Weight = $F_g = mg = 125 \times 9.81 = 1230 \text{ N}$
- Constant velocity means $F_{\text{NET}} = 0$
- Therefore $F_f = F_{\text{parallel}}$
- Opp = hyp (Sin θ) = $1230 (\sin 27) = 558 \text{ N}$
- $F_f = 558 \text{ N}$