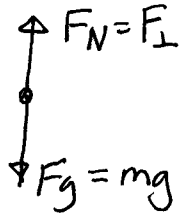


Physics 11 Unit 1 – Worksheet #2 – Normal Force and Friction

Name: _____

Solutions

1. A 4.3 kg block is sitting on a flat table. Find the normal force.

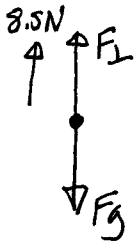


$$F_{\text{up}} = F_{\text{down}} \text{ (as accel} = 0\text{)}$$

$$F_{\perp} = F_g$$

$$F_g = mg = (4.3)(9.8) = 42.1 \text{ N}$$

2. A 2.3 kg box is sitting on a desk. A string is pulling the box straight up with a force of 8.5 N. Find the normal force.




$$F_g = F_{\perp} + 8.5 \text{ N}$$

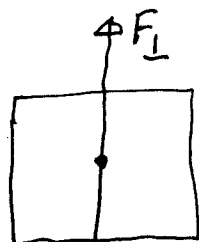
$$22.54 = F_{\perp} + 8.5$$

$$F_{\perp} = 14.04 \text{ N}$$

3. A book is being pulled across a smooth table at a steady speed. The book has a mass of 1.2 kg. The coefficient of friction between the table and the book is 0.31. Find the friction force on the book.

as no other forces up/down

$$F_g = F_{\perp}$$


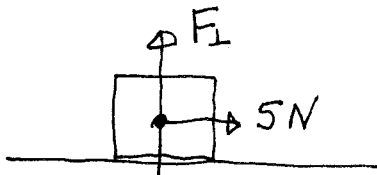


① $F_g = mg = (1.2)(9.8) = 11.76 \text{ N} = F_{\perp}$

② $F_f = \mu F_{\perp} = (0.31)(11.76) = 3.6456 \text{ N}$

(as book is moving)
 $F_f = F_{f \text{ MAX}}$

4. A 2.3 kg box is sitting on a table. The coefficient of friction between the table and the box is 0.4. The box is being pulled to the right with a 5 N force. Find the force of friction on the box. Will the box move?



① $F_g = mg = (2.3)(9.8) = 22.54 = F_L$

② $F_{f_{max}} = \mu F_L = (0.4)(22.54) = 9.016 N$

③ $F_{applied} < F_{f_{max}}$ so block does not move.

④ $F_f = F_{applied} = 5 N$
actual

5. A 36 kg sofa is being pulled with a 200 N force to the right. The coefficient of friction between the sofa and the floor is 0.48. What is the friction force on the sofa? Will the sofa move?



① $F_g = mg = (36)(9.8) = 352.8 N = F_L$

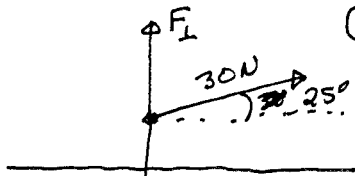
② $F_{f_{max}} = \mu F_L = (0.48)(352.8) = 169 N$

③ $F_{applied} > F_{f_{max}}$ so couch moves

④ $F_f = F_{f_{max}}$ as couch is sliding
 \downarrow
169 N.

Harder Problems

6. A 4.5 kg box is being pulled to the right by a 30 N force at 25 degrees above the horizontal. The coefficient of friction is 0.6. Will the block move?



① $F_y = 30 \sin 25 = 12.678 N$

$F_x = 30 \cos 25 = 27.189 N$

② $F_g = mg = (4.5)(9.8) = 44.1 N$

③ $F_L = ?$ $F_{up} = F_{down}$

$F_L + F_y = F_g$

$F_L = F_g - F_y = (44.1) - (12.678) =$

$F_L = 31.421 N$

④ $F_f = \mu F_L$
 $= (0.6)(31.421) = 18.852 N$ ($F_{f_{max}}$)

$F_{applied} = F_x > F_{f_{max}}$, box moves

$F_f = F_{f_{max}}$