

# Physics CH4 Forces - motion

KEY

## Worksheet #2 Free Body or Force diagram - w/eqns

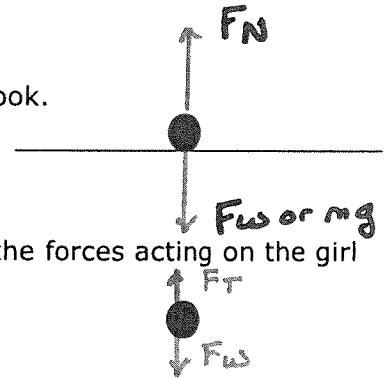
Construct free-body diagrams for the situations described below. Use the symbols we discussed in class. **Draw force vectors on the circle and label them.**

### Write the Sum of Forces ( $\Sigma F_x$ and $\Sigma F_y$ )

1. A book is at rest on a table top. Diagram the forces acting on the book.

$$\Sigma F_x = 0 \quad \Sigma F_y = F_N - F_w = ma \overset{0}{\uparrow}$$

$$F_N = F_w$$



2. A girl is suspended motionless from the ceiling by a rope. Diagram the forces acting on the girl as she holds onto the rope.  $v=0$

$$\Sigma F_x = 0 \quad \Sigma F_y = F_T - F_w = ma \overset{0}{\uparrow}$$



3. An egg is free-falling from a nest in a tree. Neglect air resistance. Diagram the forces acting on the egg as it falls.  $a=g$

$$\Sigma F_x = 0 \quad \Sigma F_y = -F_w = ma$$

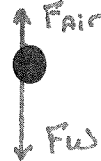
$$-F_w = mg$$



4. An egg is falling (not freely, do not neglect air resistance) from a nest in a tree. Diagram the forces acting on the egg as it falls.  $F_{air}$

$$\Sigma F_x = 0 \quad \Sigma F_y = F_{air} - F_w = ma \quad a=g$$

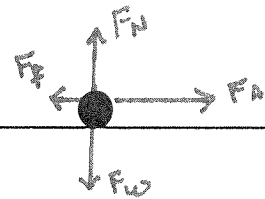
$$F_{air} - F_w = mg$$



5. A rightward force is applied to a book in order to move it across a desk with a rightward acceleration. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book.  $a > 0$

Since we have  $a > 0$   $F_a > F_f$

$$\Sigma F_x = F_a - F_f = ma \quad \Sigma F_y = F_N - F_w = m \overset{0}{\uparrow}$$

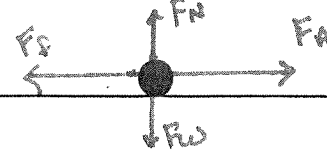


6. A rightward force is applied to a book in order to move it across a desk at constant velocity. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book.  $a=0$

$$\Sigma F_x = F_a - F_f = m \overset{0}{\uparrow} \quad \Sigma F_y = F_N - F_w = m \overset{0}{\uparrow}$$

$$F_a = F_f \quad F_N = F_w$$

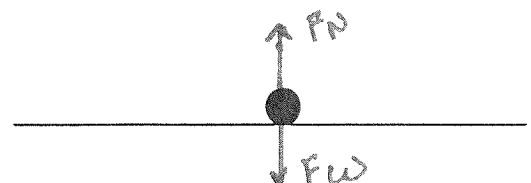
$\therefore$  vectors same length



7. A car is stopped at a stop light.  $a=0$   $v=0$

$$\Sigma F_x = 0 \quad \Sigma F_y = F_N - F_w = m \overset{0}{\uparrow}$$

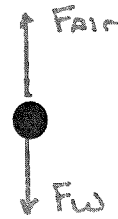
$$F_N = F_w$$



8. A skydiver is descending with a constant velocity. Consider air resistance. Diagram the forces acting upon the skydiver.

$a=0$  (Terminal V)  $F_{air}$

$$\Sigma F_x = 0 \quad \Sigma F_y = F_{air} - F_w = m \overset{\uparrow 0}{a} \quad a=g$$



9. A car is parked on a sloped street.

Rest  $a=0$

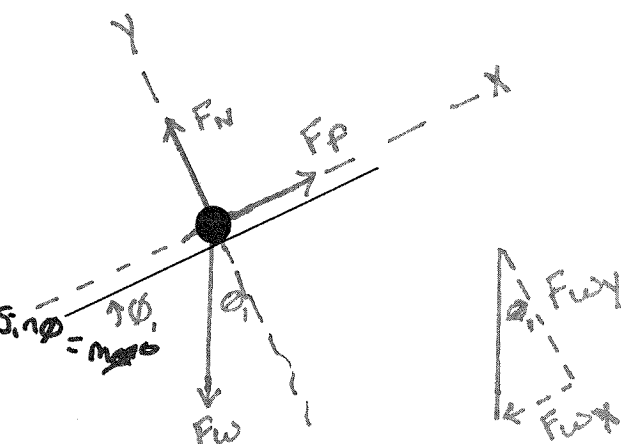
$$F_{wy} = F_w \sin \theta \quad F_{wx} = F_w \cos \theta$$

$$\Sigma F_x = F_f - F_w \cos \theta = m \overset{\uparrow 0}{a}$$

$$F_f = F_w \cos \theta$$

$$\Sigma F_y = F_N - F_w \sin \theta = m \overset{\uparrow 0}{a}$$

$$F_N = F_w \sin \theta$$

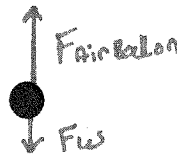


10. A hot air balloon is accelerating upward.

$a$

$$\Sigma F_x = 0 \quad \Sigma F_y = F_{AB} - F_w = ma$$

$$F_{AB} - F_w = ma$$



11. A car is coasting to the right and slowing down. Diagram the forces acting upon the car.

$\therefore$  No Applied force

$a$

$$\Sigma F_x = -F_f = ma$$

$$-F_f = ma$$

$$\Sigma F_y = F_N - F_w = m \overset{\uparrow 0}{a}$$

$$F_N = F_w$$

