

AP Physics – Unit 2 - Dynamics

Worksheet #2 Free Body or Force diagram

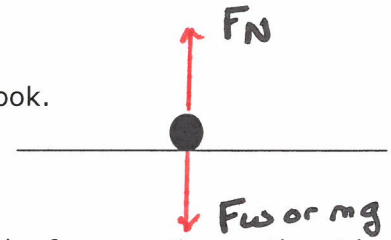
Construct free-body diagrams for the situations described below. Use the symbols we discussed in class. **Draw force vectors on the circle and label them.**

Write the Sum of Forces (ΣF_x and ΣF_y)

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

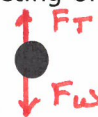
$$\Sigma F_x = 0 \quad \Sigma F_y = F_N - F_w = ma \uparrow 0$$

$$F_N = F_w$$



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. $v=0$

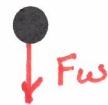
$$\Sigma F_x = 0 \quad \Sigma F_y = F_T - F_w = ma \uparrow 0$$



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}

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

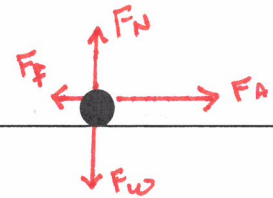
$$F_{air} - F_w = mg$$



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. $acc \rightarrow$

Since we have $Acc \rightarrow$ F_f $F_{air} \neq 0$

$$\Sigma F_x = F_A - F_f = ma \quad \Sigma F_y = F_N - F_w = ma \uparrow 0$$



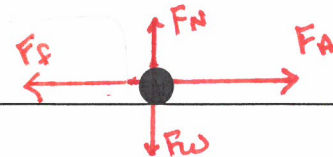
6. A rightward force is applied to a book in order to move it across a desk at constant velocity. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book. $a=0$

$F_A \rightarrow$ F_f $F_{air} = 0$

$$\Sigma F_x = F_A - F_f = ma \uparrow 0$$

$$\Sigma F_y = F_N - F_w = ma \uparrow 0$$

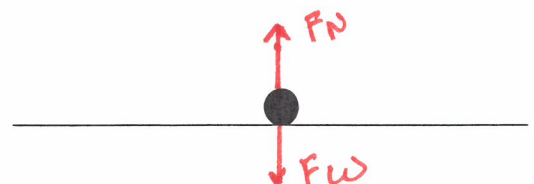
$$F_A = F_f \quad F_N = F_w$$



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

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

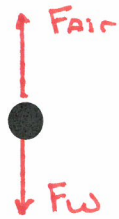
$$F_N = F_w$$



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}

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



9. A car is parked on a sloped street.

Rest $a=0$

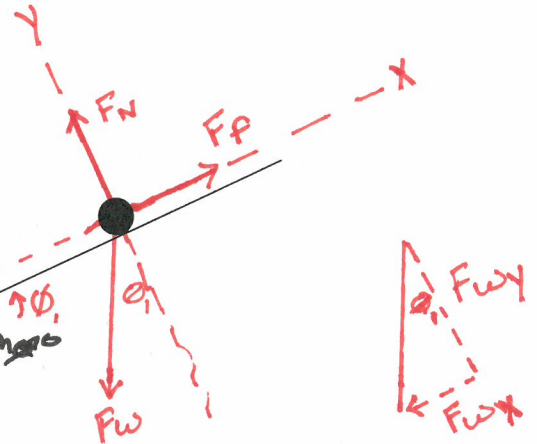
$$F_{wy} = F_w \sin \phi \quad F_{wx} = F_w \cos \phi$$

$$\Sigma F_x = F_f - F_w \cos \phi = ma \quad a=0$$

$$F_f = F_w \cos \phi$$

$$\Sigma F_y = F_N - F_w \sin \phi = ma \quad a=0$$

$$F_N = F_w \sin \phi$$

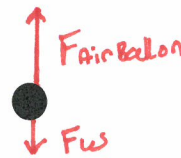


10. A hot air balloon is accelerating upward.

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

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

$$-F_f = ma$$

$$\Sigma F_y = F_N - F_w = ma \quad a=0$$

$$F_N = F_w$$

