

## Teacher Friendly Physics

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# Free-Body Diagram Cut-and-Paste



#### This lab adapted from:

Original lab written by colleague, Carey Munoz. Lab was never published.

## Lab: Free-Body Diagram Cut-and-Paste Lab TEACHER NOTES

#### Introduction:

Carey Munoz, the author of <u>Teacher Friendly ICP</u> (ICP=Integrated Chemistry Physics) had a similar activity that I "stole" this idea from. (Thanks Carey!) It's such a great way to have students "play" with free-body diagrams. I tell students to do their best and try it on their own first, then we come together as a class and discuss our results. Every time they are able to get the correct answers without any "lecture" from me! That's VERY teacher friendly!

### Notes on Setup:

Each student (or lab group) will need scissors and glue sticks to complete this activity.

There is no "dummy data" provided for this lab activity since making the lab up requires no teacher setup and most students have scissors and glue sticks at home.

Students now will understand "balanced" versus "unbalanced" forces in horizontal/vertical directions. They will also realize that unbalanced forces result in acceleration.

## Free Body Diagrams-Cut and Paste Physics 1

## CUT THIS PAGE OUT!

#### Instructions:

- Cut out <u>both</u> the word descriptions and the pictures (called "free body diagrams") below
- Match the word description number with the number on the chart <u>first</u>.
- Next, match the pictures ("free body diagrams") with the correct word descriptions.
- Paste them on the answer sheet and complete the chart by filling in all columns.

1-Falling on the	2-At rest on the	<u>3</u> -Falling on	4-Falling on	<u>5</u> -A book is at
moon-no air drag	table-no horizontal	Earth at	Earth, but	rest on a
	forces	terminal	terminal velocity	tabletop
		velocity	not yet reached	
<u>6</u> -Rolling along a	<u>7</u> -Rolling along a	<u>8</u> -True free	<u>9</u> -A girl is	10-A college
surface with	surface with applied	fall-no force	suspended	student rests
applied force	force and friction	opposes the	motionless from	a backpack
and friction at	with one greater	weight	a bar which hangs	upon one
constant	than the other		from the ceiling	shoulder
velocity			by two ropes	
<u>11</u> -A car is	12-A flying squirrel	13-A football	<b>14</b> -A horizontal	<b>15</b> -A force is
coasting to the	is gliding (no wing	is moving up	force is applied	applied to an
right and	flaps) to the ground	towards its	to an object in	object in
slowing down	at constant velocity	peak after	order to	order to move
		having been	accelerate it	it at a
		kicked		constant
				velocity
Fair drag	F <sub>air drag</sub>	$F_f$ $F_{app}$	F <sub>w</sub>	$F_f$ $F_{app}$
F <sub>W</sub>	F <sub>W</sub>	↓ F <sub>W</sub>	<b>.</b> "	↓ F <sub>W</sub>
F <sub>N</sub>	F <sub>W</sub>	F <sub>N</sub> F <sub>W</sub>	F <sub>air drag</sub>	$F_f$ $F_W$
F <sub>f</sub> F <sub>app</sub>	F <sub>T</sub>	F <sub>T</sub> F <sub>T</sub>	F <sub>f</sub> F <sub>app</sub>	F <sub>air drag</sub>

## PASTE ANSWERS HERE AND FILL IN ENTIRE CHART!

Word Description	Free Body Diagram (Picture)	Are the forces all balanced? aka (Is the object in equilibrium?)	Is the object accelerating? If yes, in which direction?
1			
2			
3			
4			
5			

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6			
7			
8			
9			
10			

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12			
13			
14			
15			

## Free Body Diagrams-Cut and Paste Physics 1

"ANSWER KEY"

## PASTE ANSWERS HERE AND FILL IN ENTIRE CHART!

Word Description	Free Body	Are the forces all balanced? aka (Is	Is the object accelerating? If
	Diagram (Picture)	the object in equilibrium?)	yes, in which direction?
<u>1</u> -Falling on the moon-no air drag	Fw	No	Yes-down
<u>2</u> -At rest on the table-no horizontal forces	F <sub>N</sub> F <sub>w</sub>	Yes	No
<u>3</u> -Falling on Earth at terminal velocity	Fair drag	Yes	No
<u>4</u> -Falling on Earth, but terminal velocity not yet reached	Fair drag	No	Yes-down
<u>5</u> -A book is at rest on a tabletop	F <sub>N</sub>	Yes	No

Word Description	Free Body Diagram (Picture)	Are the forces all balanced? aka (Is the object in equilibrium?)	Is the object accelerating? If yes, in which direction?
6-Rolling along a surface with applied force and friction at constant velocity	F <sub>f</sub> F <sub>app</sub> F <sub>w</sub>	Yes	No
7-Rolling along a surface with applied force and friction with one greater than the other	F <sub>f</sub> F <sub>app</sub>	No	Yes-right
<b>8</b> -True free fall-no force opposes the weight	<b>₽</b> F <sub>W</sub>	No	Yes-down
9-A girl is suspended motionless from a bar which hangs from the ceiling by two ropes	F <sub>T</sub> F <sub>T</sub> F <sub>W</sub>	Yes	No
10-A college student rests a backpack upon one shoulder	F <sub>T</sub> F <sub>w</sub>	Yes	No

Word Description	Free Body Diagram (Picture)	Are the forces all balanced? aka (Is the object in equilibrium?)	Is the object accelerating? If yes, in which direction?
11-A car is coasting to the right and slowing down	F <sub>f</sub> F <sub>N</sub>	No	Yes-left
12-A flying squirrel is gliding (no wing flaps) to the ground at constant velocity	Fair drag Fw	Yes	No
13-A football is moving up towards its peak after having been kicked	Fair drag	No	Yes-down
14-A horizontal force is applied to an object in order to accelerate it	F <sub>f</sub> F <sub>app</sub> F <sub>w</sub>	No	Yes-right
15-A force is applied to an object in order to move it at a constant velocity	F <sub>f</sub> F <sub>app</sub> F <sub>w</sub>	Yes	No