



PHYSICS

Newton's Laws of Motion

Forces and Free-Body Diagrams

Learning Target

I will be able to determine all of the forces acting on a object and draw the corresponding free-body diagram.

[Force]

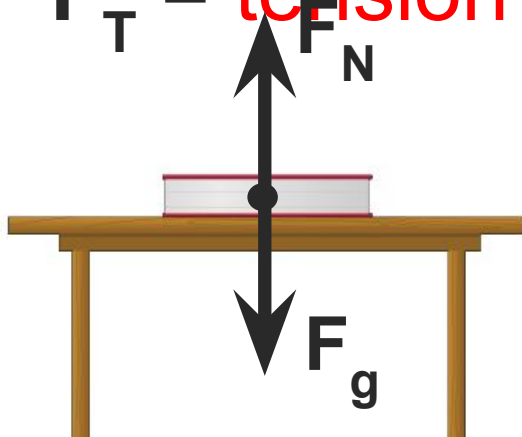
- Action that changes an object's state of motion
 - Push or a pull
 - Slow down
 - Speed up
 - Change direction
- } acceleration



Words	What They Mean	The forces should...
"at rest" or "constant velocity"	No acceleration	Be balanced Cancel one another out $F_{\text{net}}=0$
"accelerating" "speeding up" "slowing down"	Accelerating	Unbalanced Some of the forces cancel out, but not all of them $F_{\text{net}}=ma$

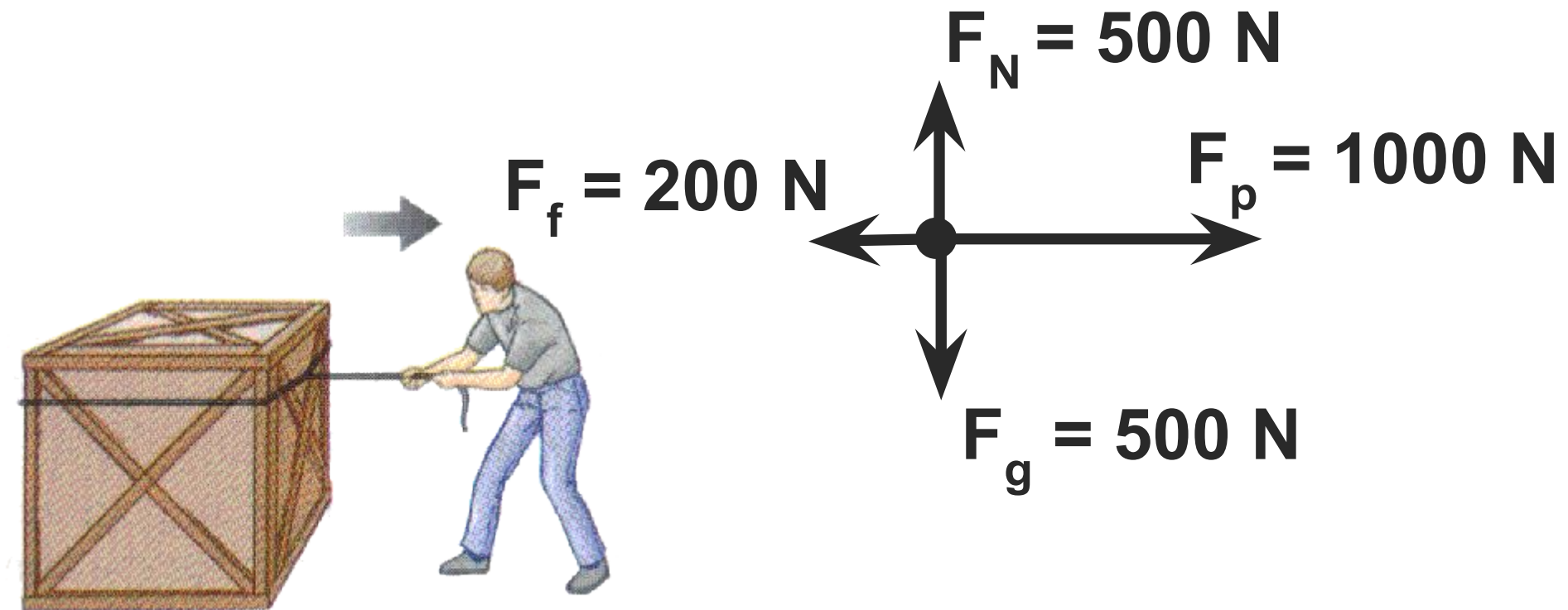
Common Forces

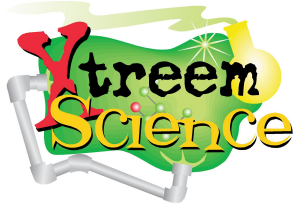
- F_g = weight \rightarrow downward
- F_N = normal \rightarrow perpendicular to surface (direct physical contact)
- F_f = friction (includes air) \rightarrow opposite to motion
- F_p = push/pull
- F_T = tension in string



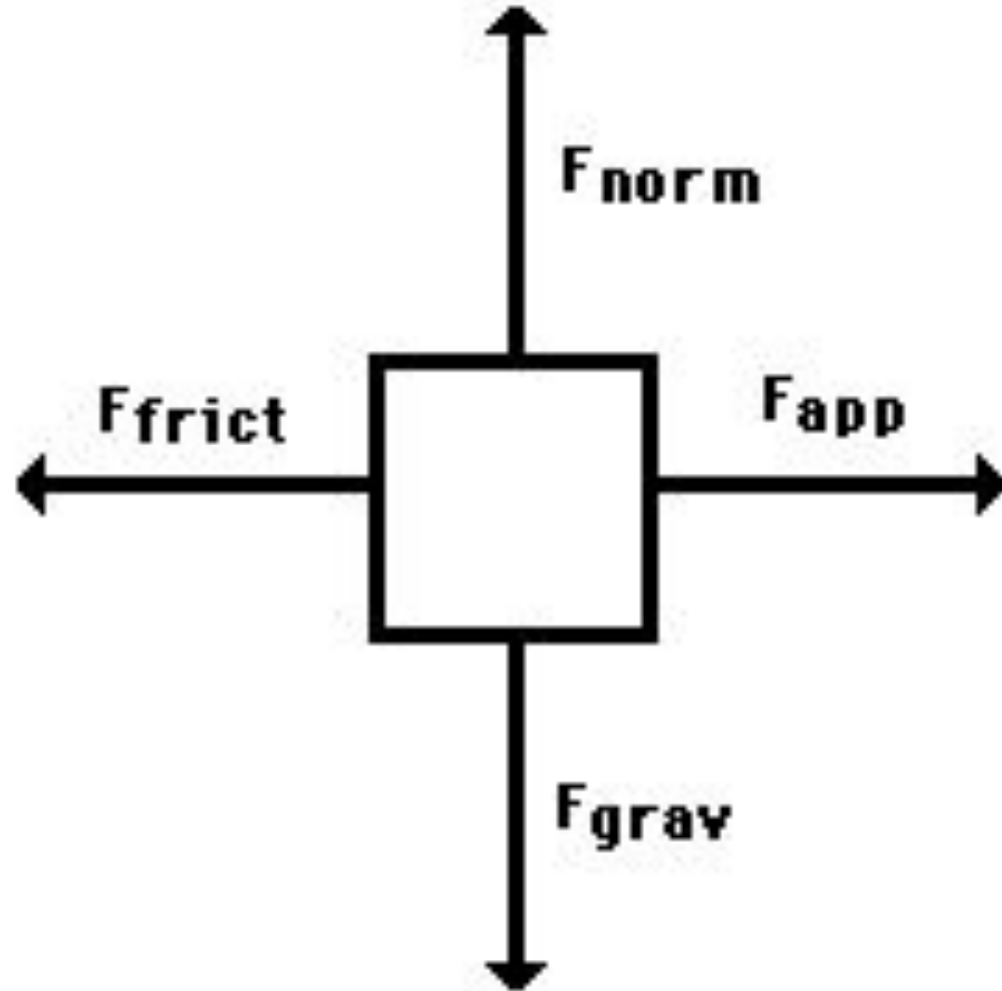
[Free Body Diagram]

- Shows all forces (vector) acting on an object
- Unit for force = N (Newton)



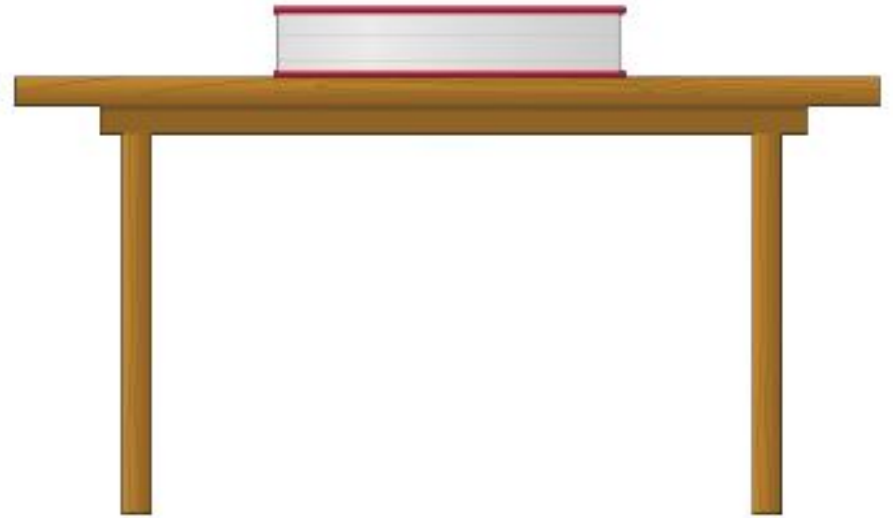


This diagram shows four forces acting upon an object. There aren't always four forces, For example, there could be one, two, or three forces.

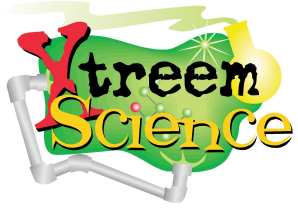


[In-Class Problem #1]

A 9 N book sits at rest on a table.



$$\Sigma F = 0 \text{ N}$$



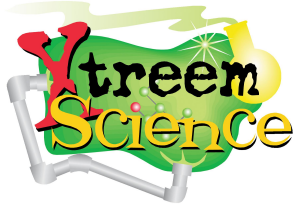
Problem 1

Question 1: Is the object accelerating?

Question 2: Should the forces be balanced or unbalanced?

Question 3: What forces are on the object?
(look at list)

Question 4: What are the direction of these forces?



Problem 1

A book is at rest on a table top. Draw the free body diagram of the book.

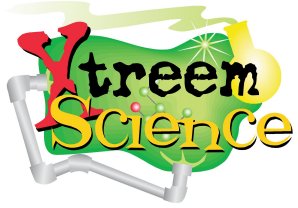
Question 1: Is the object accelerating?

NO

Question 2:

Should the forces be balanced or unbalanced?

Since the object is not accelerating, the forces would be balanced.



Question 3: What forces are on the book? (look at list)

Weight and Normal Force

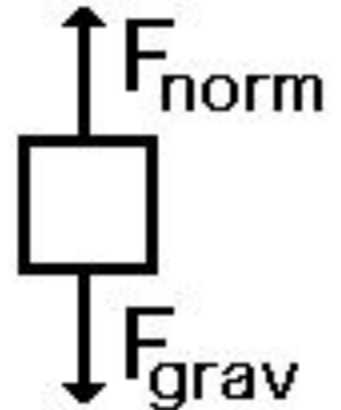
Question 4: What are the direction of these forces?

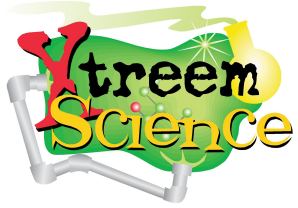
Weight - Down

Normal Force - up

Since we know that the forces are balanced, all of the forces should cancel one another out.

On our free diagram - we indicate this by drawing the force vectors of equal size.





Problem 2

Draw the free body diagram of a ball falling through the air. (Ignore air resistance)

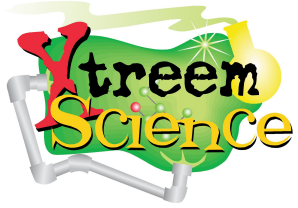
Question 1: Is the object accelerating?

yes

Question 2:

Should the forces be balanced or unbalanced?

Since the object is accelerating, the forces would be unbalanced.

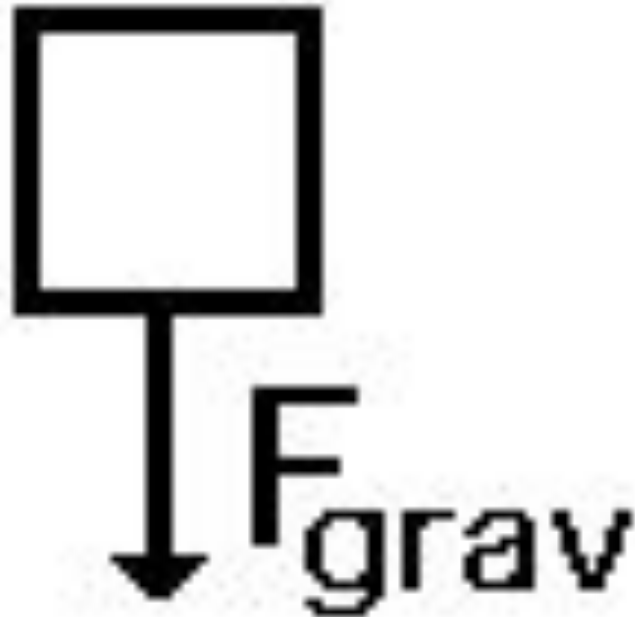


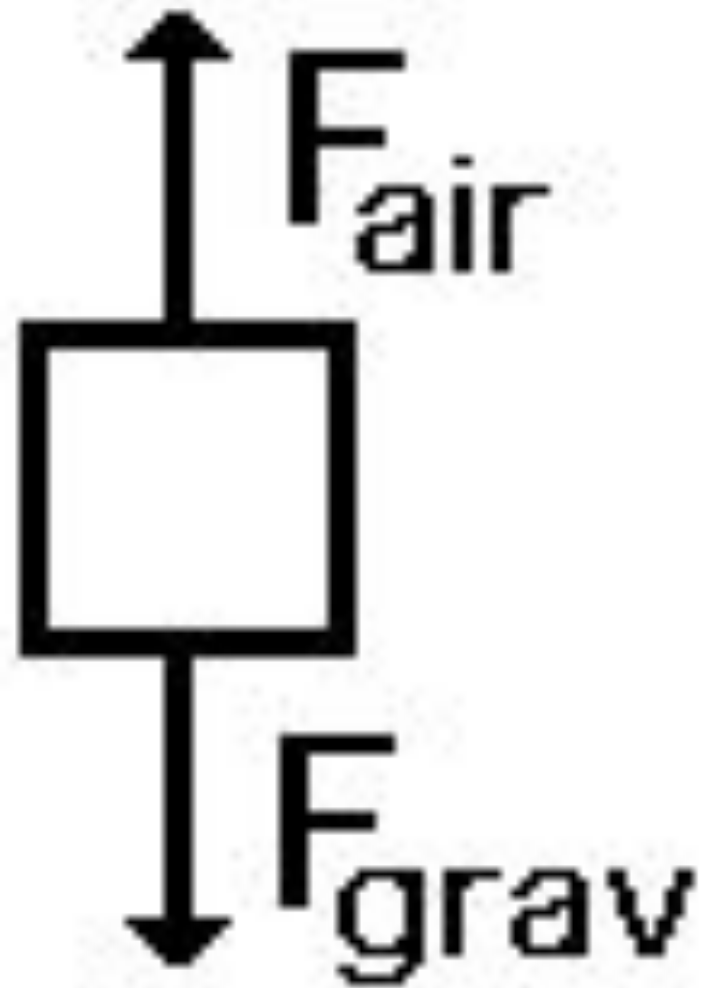
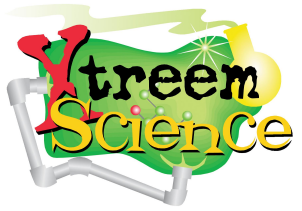
Question 3: What forces are on the book? (look at list)

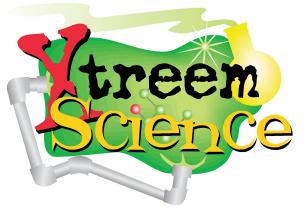
Weight

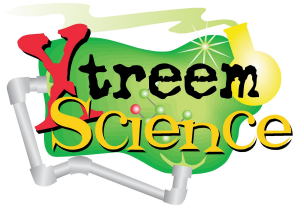
Question 4: What are the direction of these forces?

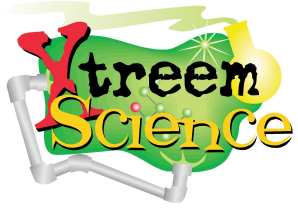
Weight - Down









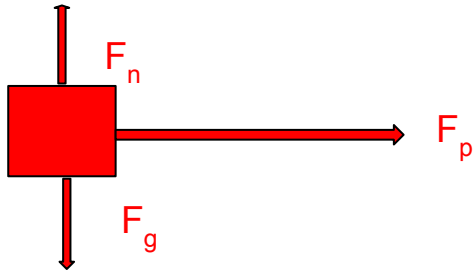


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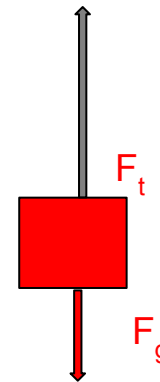
Drawing Free Body Diagrams.

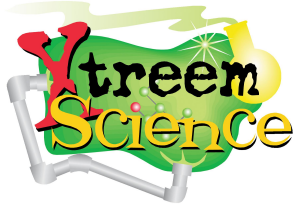
Draw a free body diagram for each description below.

Craig pushes his cart to the right.



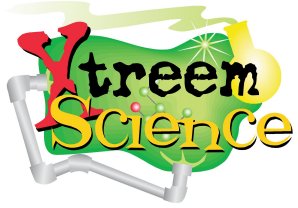
Emily holds up her backpack by the strap.





Explore Newton's laws

1. Get Chromebook. Use assigned number
2. Go to type Gizmo in Google Search.
3. Click Login MrsT726
4. password TOY726
5. Search "Fan Cart Physics"
6. Launch Gizmo
7. Complete study guide.
8. Due by end of the period.



Free Body Diagrams

Practice drawing free body diagrams.

12 practice descriptions. Be label all forces.