Guided Lesson Notes

Name:_____ **Date:**_____

Newton's Second Law

Directions: Complete this study guide as you move through the lesson. By taking notes, you are more likely to remember what you are learning. The completed study guide can be used for practice activities and to prepare for quizzes and exams. Be sure to save each study guide so you can access it when you need it.

Essential Vocabulary

As you encounter these scientific terms in the lesson, enter the meaning and an example (or two) for each. You can even draw a picture. If there are other unfamiliar words you find, enter them in the blank spaces provided.

Newton's Second Law	*weight*
net force	

Newton's Laws

What is Newton's first law — the law of inertia?

Mass and Weight

1. Fill in the blanks about mass and weight.

Mass is a _____ of the object's _____ to _____ _____, but it is also a measure of how much _____ is in that object. In other words, the more _____ an object contains, the more _____ it has.

Weight is a _____ of the _____ _____ on the _____.

2. Write the formula for weight and define each of the variables.

Equation:	
Variables:	

3. **What are two different ways to write the units of weight?**

Newton's First and Second Laws

1. **What is the Latin definition of *inertia*?**

2. **Fill in the blanks about mass and inertia.**

More _____ = more _____ = more _____to _____ in _____.

3. **Define equilibrium in terms of net force and motion.**

4. **Fill in the blanks about forces and acceleration.**

Forces _____ balanced ↔ Net _____ not equal to _____ ↔ _____ is present.

5. Fill in the blanks below about Newton's second law of motion

The _____ of an object is _____ _____ to the _____ _____ acting on the object and _____proportional to the object's _____.

6. Complete the following statements using the appropriate up or down arrows.

When net force _____, acceleration _____.

When mass _____, acceleration _____.

Using $\vec{F} = m\vec{a}$

For each of the problems shown, write Newton's second law as an equation that you can use to solve the problem. Then write the answer, including proper units (see the questions for units).

Question	F = ma applied to question	Solution, with units
A dog can drag a 40.0-kg sled at a rate of 2.00 m/s^2. How much force (in Newtons) is the dog exerting?		
What net external force (in Newtons) is required to give a 24.0-kg box an acceleration of 3.30 m/s^2 to the left?		

You are applying a force of 200 N to push a box that has a mass of 20.0 kg across the floor. What is the box's acceleration rate (in m/s^2)?		
What force (in Newtons) must be applied to push a 50.0-kg weight at 5.00 m/s^2?		
What is the acceleration (in m/s^2) of a 400-kg box that has an 800 N force applied to it?		
What mass is accelerated at 50.0 m/s^2 by a 200-Newton force?		

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Finding Net Force First

1. **For the paddleboarder problem:**

   Draw the free-body diagram for the paddleboarder problem.

   Use the free-body diagram to determine to net force.

   Apply Newton's second law to find the acceleration.

Net force:	
Acceleration:	

2. **Is the angle of the acceleration always the same as the angle of the net force?**

Net Force and Newton's Second Law Practice

Choose one problem from this page and complete the table for that problem. Select from: Stalled car or Chew toy.

Problem:	

Picture	Given/Find	Equation	Solution

Applying Kinematics to Force Problems

1. **Apply Newton's second law to the following kinematics problem.**

   A shopper in a supermarket pushes a 50.0-kg loaded card with a horizontal force of 17.5 N. The floor provides a frictional force of 2.4 N.

   a. What is the acceleration of the shopping cart?

   b. If the cart starts from rest, how long does it take the cart to reach a speed of 3.4 m/s?

c. How far does the cart roll as it accelerates from rest to 3.4 m/s?

Working Backwards

1. **What are the three steps involved in working backwards to find a resistance force?**

Step 1:	
Step 2:	
Step 3:	

2. **For the motorboat example, complete the table.**

Picture	Given/Find	Equation	Solution