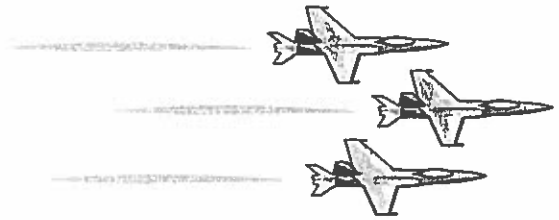
FORCES & MOTION UNIT PACKET



Ms. S. Pace – 205

Make-up labs will be scheduled during Tutoring Time if you miss a lab. Make sure you come to these make up days!

Name: _____

Period: _____

Being absent does not excuse you from missing work! It is your responsibility to get caught up!

	Lessons/Worksheets/Labs:	
Every Day	Starter Questions (1 box/day)	/12
Every Day	WS: Forces & Motion Unit Vocabulary	/50
10/29	**Lesson: Velocity**	
	WS: Bill Nye Motion	/26
	WS: Motion Graphs	/20
11/2	**Lesson: Acceleration**	
	Lab: Car Constant Speed	/45
	Lab: Marble Acceleration	/45
11/4	**Lesson: Forces**	
	Lab: Balloon Rocket	/40
11/6	**Lesson: Unbalanced Forces**	
	Lab: Balanced Forces	/40
	Lab: Friction	/30
11/10	Quiz: Forces & Motion	/24
	WS: Forces & Motion WA Review	/40
Total Unit Points Possible		372

If you miss a starter question day, the questions are posted to the unit page on the class website after the class is over.

/12

Starter Questions: (3 points each)

If you are missing any part of this worksheet, the answer key will be posted on the unit page of the class website after the review day (before the test)

/50

Forces & Motion Unit Vocabulary

(1 point each written item)

Main Principals of Forces & Motion

1) Physics is the _____.

2) Basically, _____ are _____ some amount, _____.

3) We _____ the motion of the object that _____ to a _____ object.

4) Objects _____, or change motion, because of _____ acting upon them.

5) The _____ mass an object has, the _____ is needed to move the object.

6) Friction _____ down.

Newton's "3 Laws of Motion":

1) An _____ will stay at rest unless an _____ _____ acts upon it. And the opposite is true; and object in motion _____ _____ unless an _____ acts upon it.

Also known as: The Law of _____

2) To move a _____ you need a _____.
Write the formula for Force:

3) For _____ there is an opposite _____ reaction.

Words you need to know for the test:

1) **Point of Reference:**
Definition:

2) **Stationary Object:**
Definition:

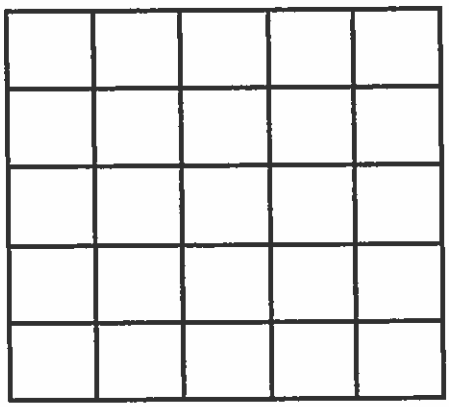
3) **Speed:**
Definition:

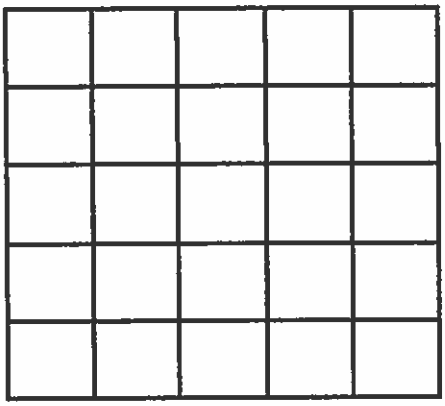
4) **Velocity:**

Definition:

Write the formula for Velocity (speed):

Speed & Velocity Graphs: (draw the graphs and describe what the lines mean)



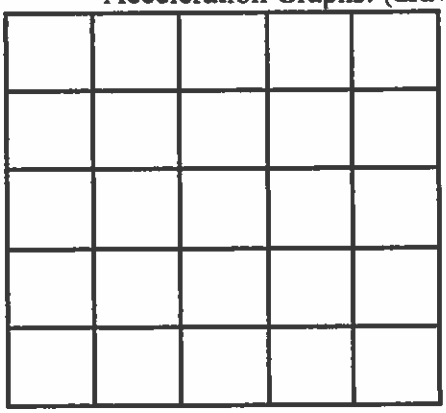


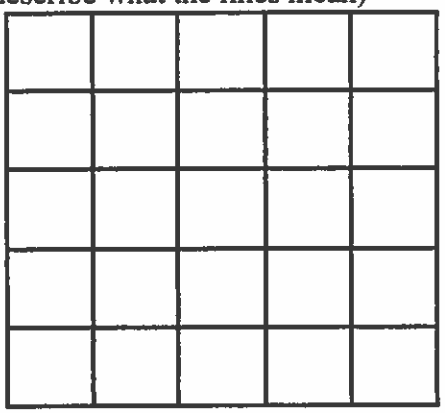
5) **Acceleration:**

Definition:

Write the formula for Acceleration:

Acceleration Graphs: (draw the graphs and describe what the lines mean)





6) **Force:**
Definition:

Forces will usually be either a _____ or a _____
Write the formula for Force:

Forces will cause all what? _____

What is the "unit" for force measurements? _____

7) **Mass:**
Definition:

What is the "stuff"? _____

8) **Inertia:**
Definition:

The _____ mass something has, the _____ force needed to move it.

9) **Balanced Forces:**
Definition:

10) **Unbalanced Forces:**
Definition:

Show an example of forces adding together:

Show an example of forces subtracting from each other:

11) **Friction:**
Definition:

What does friction do to motion? _____

If you miss a Bill Nye Video, you can either find them on You Tube or check them out during a Pride Time session from the school library to watch.

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Bill Nye: Motion

(2 points each question. Yes, they are in order)

1) What puts things in motion?

2) What are two examples of forces?

3) When something is at rest, what does it do?

4) When something is in motion, what will it do?

5) What must happen in order to make an object at rest move or a moving object stop?

6) What do we call how hard it is to move something?

7) What is Newton's first law of motion?

8) What is Newton's second law of motion?

9) What is Newton's third law of motion?

10) When the plane drops, how much weight does an apple have?

11) An object at rest will stay at rest until what?

12) According to the "hillbilly girl", what do we call it when it appears as if nothing is moving?

13) Dancers! If Mrs. Grace asks you to hold a position perfectly still...gravity is pulling down on you. In order for you to not fall over, you must generate a force that acts opposite of gravity. Where does this force come from?

/20

Motion Graphs

(2 points per question)

Part 1: Use the speed equation to solve the following problems:

1. Write the equation for Speed here:

   Speed =

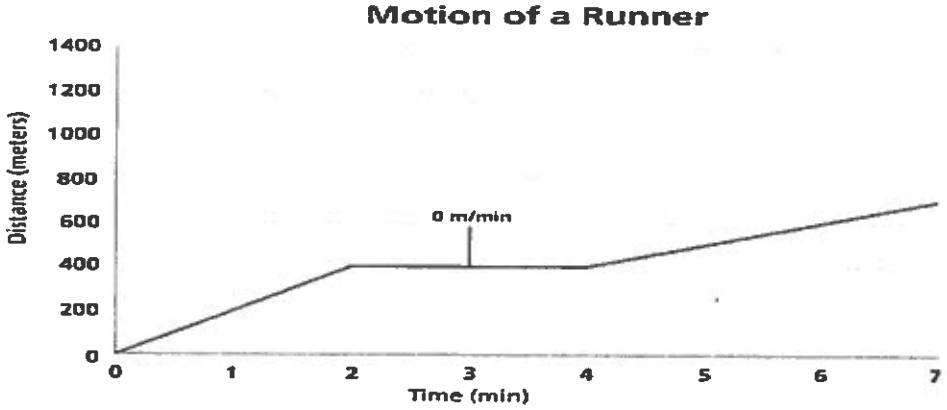
2. A truck traveled from Salt Lake City to Provo which is a distance of 45 miles. He made the drive in 30 minutes. How fast was the driver moving in order to travel this distance that fast?

3. If the speed limit on the freeway is 65 mph; should the driver in question 2 receive a speeding ticket?

4. If an airplane leaves Salt Lake City, Utah at noon, and arrives in Denver in 1.5 hours (371.27 miles) how fast was the plane flying?

Part II: Graphing Exercise

Use the following graph to answer the following questions.

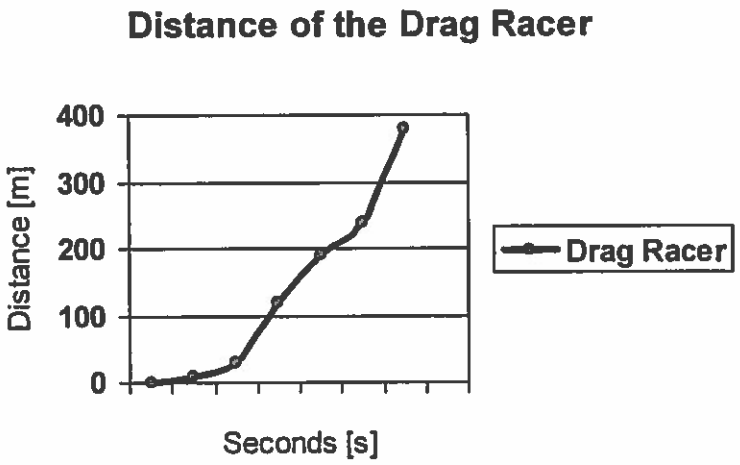


- What is the speed of the runner when he ran the first two minutes?
- What is the speed of the runner from minutes 2 through 4?
- What is the speed of the runner from minutes 4 through 7?

Part III: Interpret motion graphs

1) What is happening to the speed of this drag racer?

2) What about the shape of the line shows that the car is increasing its speed each second?



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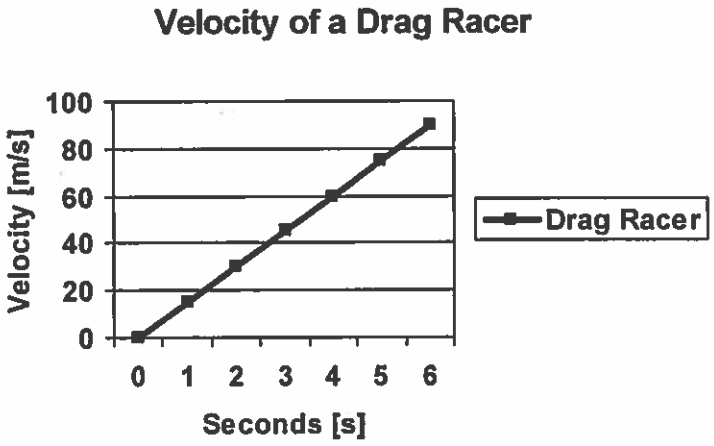
1) What is happening to the speed of this drag racer?

2) What about the shape of the line shows that the car is speeding up the same amount (constant rate) each second?



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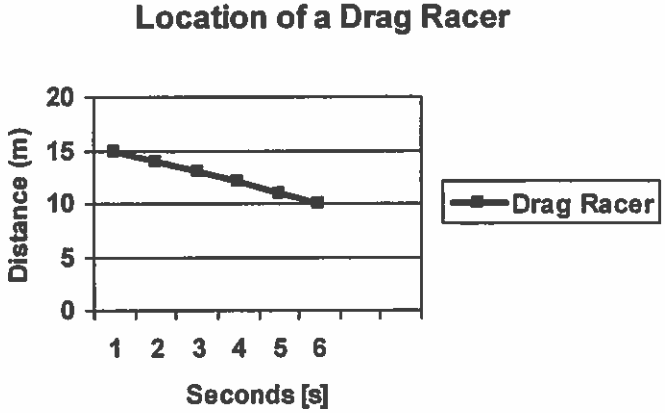
1) What is happening to the speed of this car?

2) Is the speed decreasing the same amount (constant rate) each second or is he slowing down faster and faster each second (increasing rate)?



If you miss this lab, there will be a Pride Time make up session scheduled. Watch on the schedule for times to have your planner stamped to attend.

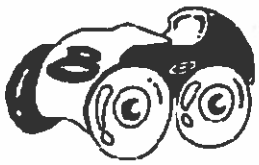
/45

Car Constant Motion Lab

Purpose: In this lab, you will examine and graph the velocity of a moving object.

Materials:

- Masking Tape
- Timer
- Meter Stick
- Calculator
- Test Car



Part I: 2 Toy Cars Trials **(1point each box; 11 total)**

Lab 1. Car Name: _____		
Distance [m]	**Time [s]**	**Speed = Distance/Time [m/s]**
1m		
2m		
3m		
4m		
5m		
X	Average Speed	

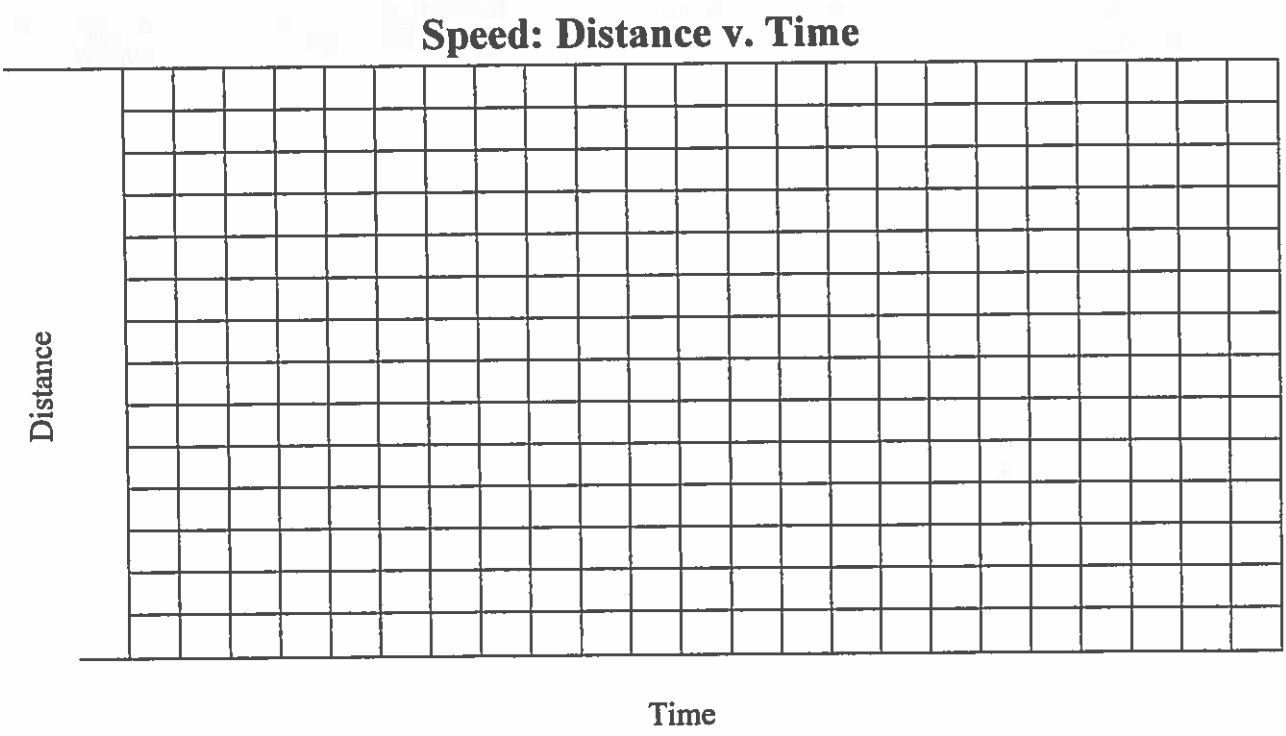
Repeat the test with a different car: **(1 point each box; 11 total)**

Lab 2. Car Name: _____		
Distance [m]	**Time [s]**	**Speed = Distance/Time [m/s]**
1m		
2m		
3m		
4m		
5m		
X	Average Speed	

Part II: Line Graph (5 points total)

In the graph below, set up your scale and plot your results of your two cars. Finally, draw a line of best fit.

***Use different colors to represent each different average lab test. Create a key to label each line that is graphed; so we can tell which car is shown by each line.



Questions (2 points each):

1. How long did it take for your car to reach 5 meters?

2. What was your average speed of to two cars together?

3. Was there any difference between the speeds of each car? – **What could explain the difference? (Please explain!)**

4. If you were to increase the speed of the car, what would the graph look like? Steeper or less steep?

5. What does a flat line mean on a graph?

6. What does a curved line mean on a graph?

If you miss this lab, there will be a Pride Time make up session scheduled.
Watch on the schedule for times to have your planner stamped to attend.

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Marble Acceleration Lab

Purpose: In this lab you will record and graph the velocity of an accelerating object (marble). So you can see the difference between an object moving with a constant speed (Car Lab) and an object accelerating (this lab).

Materials:

- Timer
- 3 meter long ramp
- Calculator
- 70 g Marble
- Cup (to catch the marble)

Part I Ramp Tests:

Place the marble at the top of the ramp for each test. Place the cup the indicated distance down the ramp. Roll the marble from the top into the cup and time how long it takes.

	Using 3 Books		Using 6 Books	
Distance (m)	Time (sec)	Speed (m/sec)	Time (sec)	Speed (m/sec)
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				

Part II Solve for Acceleration:

Use the data from the table above to solve for the acceleration of the 3 book and 6 book tests. We will compare the half way speed and the end speed to see this acceleration:

$A = (V_2 - V_1)/ (T_2 - T_1)$

1. 3 book test Acceleration:

A=

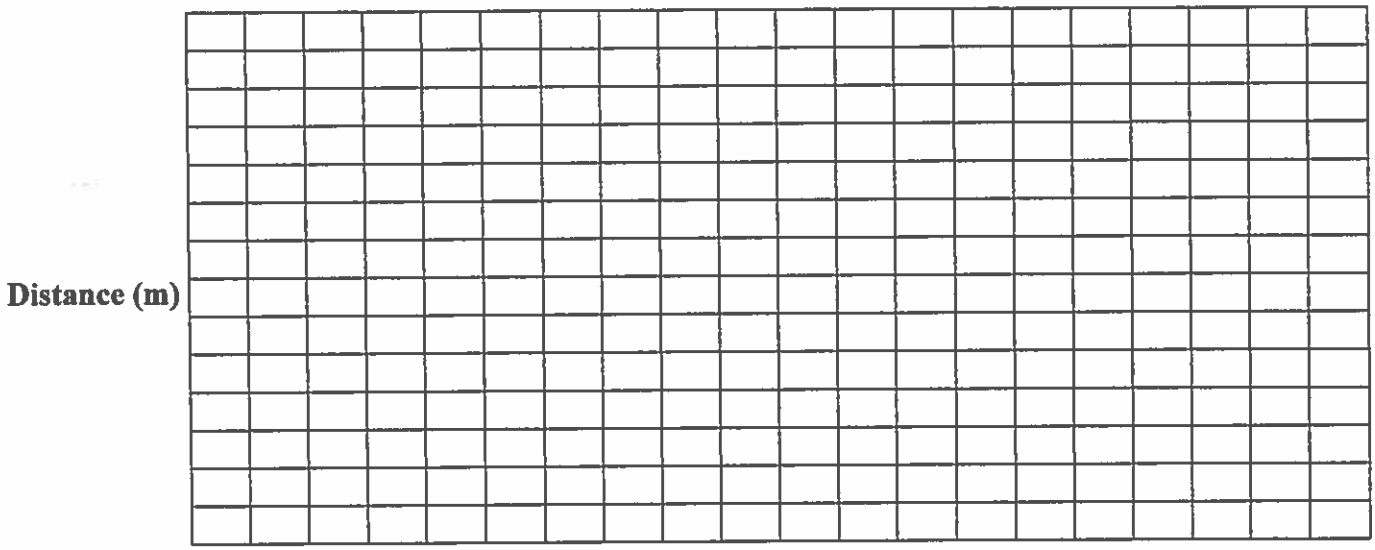
2. 6 book test Acceleration:

A=

Part III Multi-Line Graph:

In the graph below, show the lines for each test (3 book test and the 6 book test and compare the difference in the lines) Use the key given below to show the colors)

Title: _____



Key:

Line Color	Which test does the line color represent?

Part IV Questions:

1) How does the shape of the line show that the marble is speeding up (accelerating)?

2) If the speed of the marble was the same the entire time, what would the line look like?

3) How do the lines on the graph show that the marble for the 6 book test is accelerating more than the marble in the 3 book test?

4) When you did the math (part II), how did you know that the 6 book test had a marble accelerating more than in the 3 book test?

5) Why is the acceleration of the marble in both tests FASTER near the end of the ramp than near the top (think about energy transformation!)?

If you miss this lab, there is a "make-up lab" posted online on the Unit Page of the class website. Look down in the assignments section for this.

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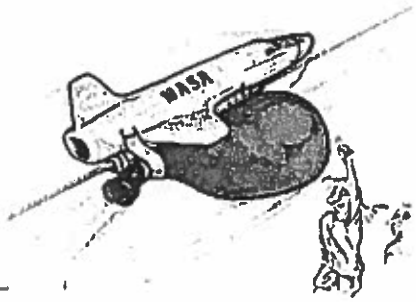
Balloon Jet Lab

(1 point for each blank; 2 points for each question' 5 points for the graph)

Purpose: Use Newton's Laws of Motion to explain the motion of the balloon jet.

Materials

- **String**
- **1 drinking straw**
- **1 long balloon**
- **Masking tape**
- **stopwatch**
- **meter stick**
- **6 Masses**
- **2 chairs**



Procedure

1. Measure the length of the room (in meters): _____
2. Blow up the balloon and hold the balloon's opening closed.
3. Have a classmate attach the balloon lengthwise to the straw, using tape (Make sure you tape it in the middle of the balloon not the front or back!)
4. Release the balloon. Measure the time & distance during which the balloon jet moves. Record the time and distance values in the data table for 0 masses.
5. Repeat Steps 1 and 2 with masses taped to the middle of the balloon and record your results to the data table. Make sure that the balloon is blown up to the exact same size as the previous balloon size.
6. Calculate and record the velocity for each trial. (V = Distance/Time)

Predict: How will the distance and speed change each time you add mass?

a) **Distance:** The _____ mass, the _____ distance the balloon should travel.

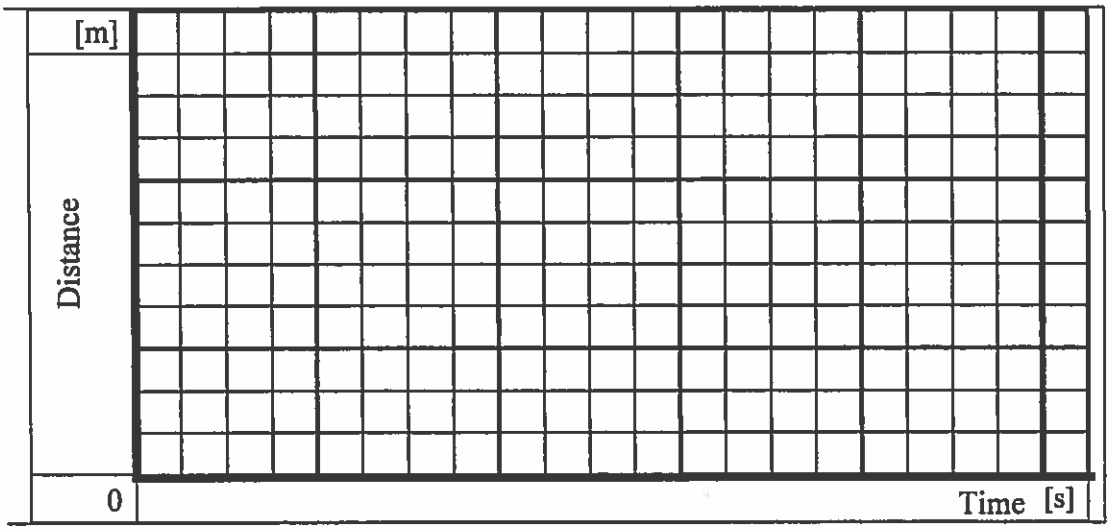
b) **Speed:** The _____ mass, the _____ speed the balloon should have.

Record your data:

Test Number	Number of masses used	Time (sec)	Distance (m)	Speed
1 (control)	0			
2	2			
3	4			
4	6			

Part 2 Graphing and Analysis:

Graph the speeds on the graph below (one line for each test)



1) What was the independent (manipulated) variable in this lab?

2) What was the dependent (responding) variable in this lab?

3) Why did we have to do a control balloon without any added mass?

4) How can you tell which balloon travelled the fastest just by looking at the graph?

5) Q: What does this lab show you about mass and how it affects motion?

A: The _____ mass an object has, the _____ force needed to move it.

6) What do we call the resistance to change in motion due to the mass of an object?

7) Sometimes your balloon would "spin" around the string instead of flying straight. What might be causing the balloon to spin around the string?

8) If Newton's 1st law says: "Objects in motion will stay in motion unless a force interferes". What forces (more than one) are making the balloon slow down and stop if you are not touching it?

Force one: _____ Force two: _____

If you miss this lab, there will be a Pride Time make up session scheduled. Watch on the schedule for times to have your planner stamped to attend.

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Unbalanced Forces Lab

Purpose: The purpose of this lab is to examine a basic unbalanced force set up. First confirm that forces really are equal when you push or pull with the force meters. Then using the meter sticks examine the effects of unbalanced forces and try to balance them out.

Part 1: Spring to Spring

In this part, gently attach your spring meter to another spring meter. Gently tug your spring meter with the other spring meter then read both readings.

Trial	Spring 1 Force Measurement (Don't forget your units)	Spring 2 Force Measurement (Don't forget your units)
1		
2		
3		

Questions:

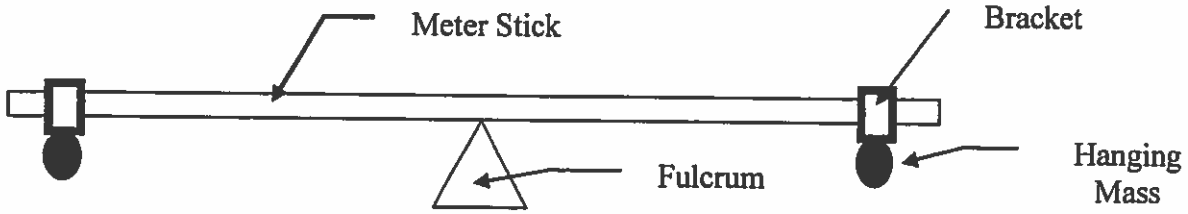
1. What did you notice about your spring in comparison with the other person's spring? Were your readings the same? Why do you think so?

2. Do you think this was a balance of forces or do you think this was an imbalance of forces? Why?

3. Why are these measurements in Newton's and not grams?

Part 5: Balanced Forces

Work out a balanced force for each situation. First determine where to place the mass to balance, then determine which mass will balance out the forces at the given location. Set up the apparatus as illustrated:



Lab Test	Mass A (Control)	Location of mass A [cm]	Mass B	Location of mass B [cm]
1	50 g	25 cm	50 g	
2	50 g	10 cm	50 g	
3	50 g	25 cm	100 g	
4	50 g	40 cm		80 cm
5	50 g	10 cm		80 cm
6	20 g	10 cm		80 cm

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Questions:

1. What is the Independent (manipulated) Variable for this lab (part 2 specifically)?

2. What is the Dependent (responding) Variable for this lab (part 2 specifically)?

3. What indicates to you that the forces are unbalanced on either side of the fulcrum?

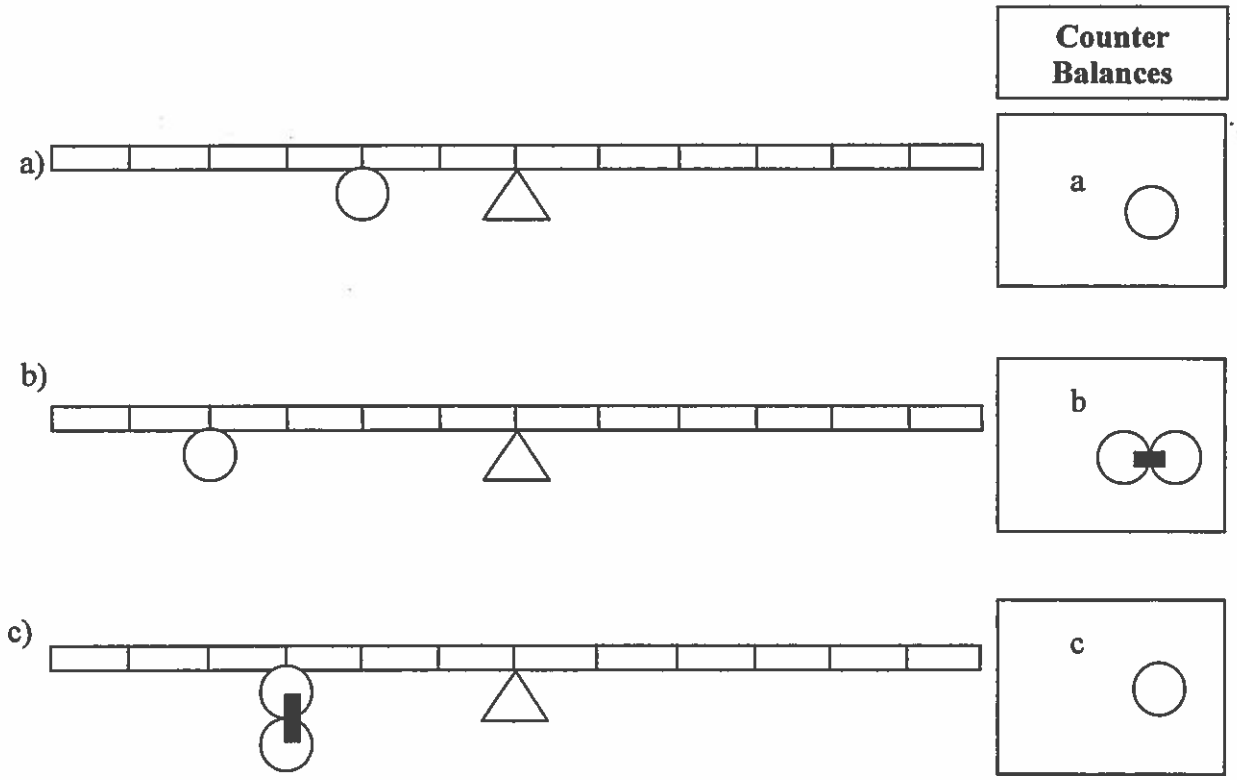
4. What indicates to you that the forces are in balance on either side of the fulcrum?

5. What force is trying to pull down on the masses on either side of the fulcrum?

6. How can I tell that the Fulcrum is pushing up with equal force of the gravity pulling down on the meter stick/

7. **Let's do an inference activity:**

Each letter diagram has a basic, unbalanced set up. Use the "counter balances indicated on the right to balance out each example. Balance out the following diagrams using the counter balances on the right:



If you miss this lab, there will be a Pride Time make up session scheduled. Watch on the schedule for times to have your planner stamped to attend.

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Friction Lab

Purpose: In this lab we will observe the ability of a surface to create friction and slow down the motion of an object. We will also observe the extra force required to move an object against friction.

Part 1: Basic Friction of a block on 4 different flat surfaces

Use the force meter to slowly pull the block across the different **flat** test surfaces.

Block mass:	
Surface Used	**Force Required to move it (Don't forget your units)**
Sandpaper	
Vinyl	
Flannel	
Felt	

Part 2: Friction of a block on an "incline" for 4 different surfaces

Stack 4 books on top of each other and place the edge of the test surface on the 4 books creating a slope. Again, pull the wood block up each slope slowly.

Block mass:	
Surface Used	**Force Required to move it (Don't forget your units)**
Sandpaper	
Vinyl	
Flannel	
Felt	

Part 3: "Static" Friction:

Place at one end of the slope. Slowly raise the height of your slope with the block at the top end. Use a meter stick to measure the height when the block slides:

Surface Used	Height that the block slips at (Don't forget your units)
Sandpaper	
Vinyl	
Flannel	
Felt	

Questions:

1. If left totally alone would a block move on its own?

2. If not what was required to move it?

3. Which fabric surface had the most friction?

4. Why does the spring stretch until the object gets moving? (Hint: think about mass & inertia)

5. Why does a steeper slope require more force to move the block than the less steep slope (hint: think about the forces involved)?

6. How does the force required to move the block up the slope differ from the amount of force it takes to move the object on a flat surface?

7. How does the blocks mass differ from the amount of force it takes to move the block straight up?

To make up the quiz, make honest attempts for each question. The check your answers on the PPT located on the Unit Page of the class website. Make a correction whenever you get an attempt wrong and you will still get full credit.

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Forces & Motion Quiz

1) What does Inertia really mean?

Attempt: _____

Correct: _____

2) I pull a cart with boxes across the floor. The surface changes from carpet to tile. Why do I have to pull/push harder on the carpet to move the same cart?

Attempt: _____

Correct: _____

3) Which graph shows an object moving slowly (when compared to the other)

Attempt: _____

Correct: _____

4) A change in direction or speed is known as _____

Attempt: _____

Correct: _____

5) If both of these football players have the same mass, why is the one on the right falling backwards?

Attempt: _____

Correct: _____

6) Which of Newton's 3 Laws of Motion explains why objects with mass don't just start moving by themselves?

Attempt: _____

Correct: _____

7) Which graph shows an object accelerating (when compared to the other)?

Attempt: _____

Correct: _____

8) If I want to accelerate an object with twice as much mass as another object, what do I have to do?

Attempt: _____

Correct: _____

9) If all the forces are in balance, what will the motion of an object be?

Attempt: _____

Correct: _____

10) What is the unit of measurement for Force?

Attempt: _____

Correct: _____

11) Which of Newton's 3 Laws of Motion explains why someone falls backward when punched really hard?

Attempt: _____

Correct: _____

12) Why does it take more force to pull a block up a slope than just along the ground?

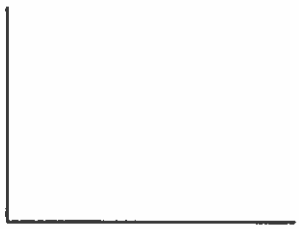
Attempt: _____

Correct: _____

/40

Forces & Motion WA Review

1. Draw a basic line graph that shows an increasing acceleration:



2. Draw a basic line graph that shows an object that is moving quickly:

3. Draw a basic line graph that shows an object that is moving slowly:

4. Draw a basic line graph of an object that is staying the exact same speed:

5. Why does it matter what variables you chose when making any of the above graphs?

6. Velocity is a combination of both speed and direction. Give an example where knowing the speed and direction of travel would be VERY important:

Balanced/Unbalanced Forces:

1) Two forces acting on the same object in the same direction will do what?

2) Give an actual example of forces adding together:

3) Two unbalanced forces acting on the same object in opposite directions will do what?

4) Give an actual example of forces subtracting from each other:

5) If forces acting on an object are in prefect balance, what will you observe the object do?

6) Give an actual example of forces that are in perfect balance:

7) True/False: It is possible to have an object in motion AND equal forces all acting at the same time all around it.

Friction:

1) A shooting star streaks across the night sky. As it does, a brilliant glowing "tail" of small debris flows from the back of the object. This is caused by a type of friction. Explain how this might occur:

2) What happens to the amount of force required to move an object when there is friction on a surface?

3) Friction always acts to _____ the current motion of an object

Newton's Laws:

1) We accelerated an object 4 feet with a force of 5 N. What would we need to do to accelerate an object with twice as much mass the same distance?

2) What explains why you can pull a table cloth out from under the plates on a table without moving the plates?

3) Chewbacca (from the star wars movies) is floating in outer space (yes, he has a space suit on). He sees that the Death Star (a man made planet created by the forces of the evil empire) is about to attack another planet. He decides to push the death star with all his might. What will the results of Chewbacca's efforts be and why?

4) The _____ mass an object has the _____harder it will be to accelerate the object with a force.