Unit 3: Interactions & Forces

Name: ______________________________ Period: _________ Date: ________________

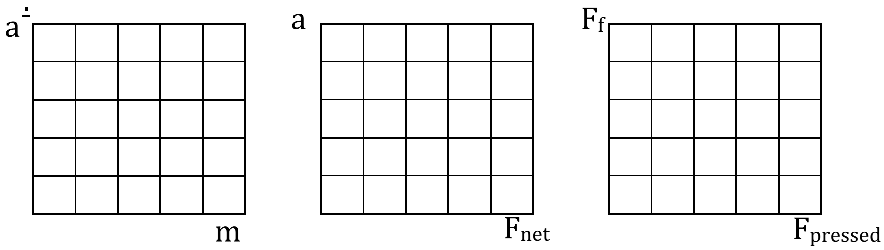
Homework from Physical Science Textbook:	Due Date
Read section 5.1, Questions on page 106: 4, 6, 7, 8, 9	
Read section 5.3, Questions on page 119: 2, 4, 5, 6, 9, 10	
Read section 6.1 and 6.2, Questions on page 135: 6, 7, 8, 10	
Read section 5.2, questions on page 122: 11-13	

Vocabulary	Sentence that correctly uses the word	Pattern, Diagram, or Equation
Force		
Interaction		
Vector		
Equilibrium		
Weight		
Net (Resultant)		
Inertia		

Patterns in Force and Interactions:

Force: Friction:

1. Graphically



2.Mathematically

a = a = F_f =

3. Data Tables: when *needed* assume a constant force of 5 N, a constant mass of 10 kg and stickiness factor of 0.5:

m	a
1	
2	
5	

In words:

F_{net}	a
1	
2	
5	

in words:

$F_{pressed}$	F_f
1	
2	
5	

in words:

Find 2 significant differences between the a vs F_{net} & the a vs m graphs above:

1.

2.

What does the slope in the F_f vs $F_{pressed}$ graph above stand for?

What does the slope in the a vs Fnet graph above stand for?

Lab Activity - Measuring Forces

For each of the following situations, predict all the forces that will be acting on the block and draw them in the prediction box. Then, experimentally measure all the forces that you are able to measure with the spring scale or weight scale for the situation and draw them in the experimental block. *Be sure to draw the length of your force arrows according to their strength.*

1. Hanging the block from the spring scale:

Prediction Experimental

2. Hanging the block from the spring scale but then lowering it onto the table, so that it half-rests on the table:

Prediction Experimental

3. Hanging the block from the spring scale but then lowering it onto the table, so that it completely rests on the table:

Prediction Experimental

4. Hanging the block from a spring scale and pulling down on the other side with a 2 N force using another spring scale:

Prediction Experimental

Continue on Back Side

For the remaining situations on the next page, rest the block on the table and **focus on only the horizontal forces** (that is, we will not be concerned with Earth's gravity pulling it down or the table equally pushing it back up vertically).

5. With a book placed on top of the block, pull on the block on just one side until it just begins to move. Stop! -- pull again until just before it moves (this is the max pull of friction – the force of friction):

Prediction ☐ ☐ Experimental

6. With a book placed on top of the block, pull on the block only half as hard as you did in situation 5:

Prediction ☐ ☐ Experimental

7. With a book placed on top of the block, pull on the block on just one side until it just begins to move and keep it just moving. Pull just enough to counteract the friction from situation 5.

Prediction ☐ ☐ Experimental

8. Remove the book, then pull on both sides of the block using the spring scales such that the right side spring scale reads 5 N and the block does not move:

Prediction ☐ ☐ Experimental

9. Pull on both sides of the block so that it doesn't move by using 1 spring scale on the right that reads 5 N and 2 springs scales on the left, where one of them on the left-side reads 2 N:

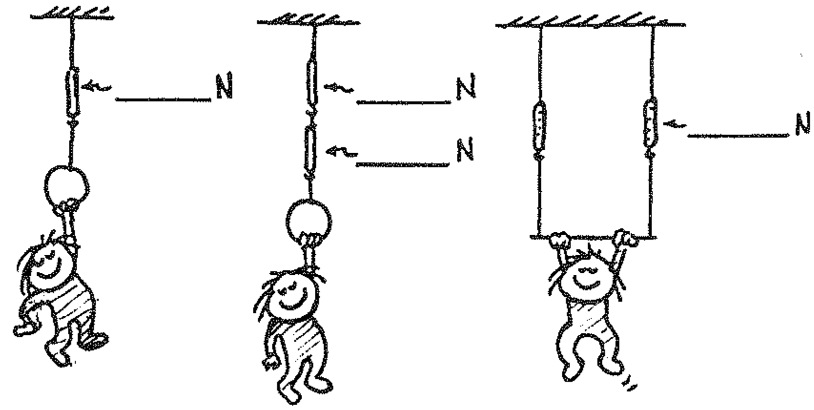
Prediction ☐ ☐ Experimental

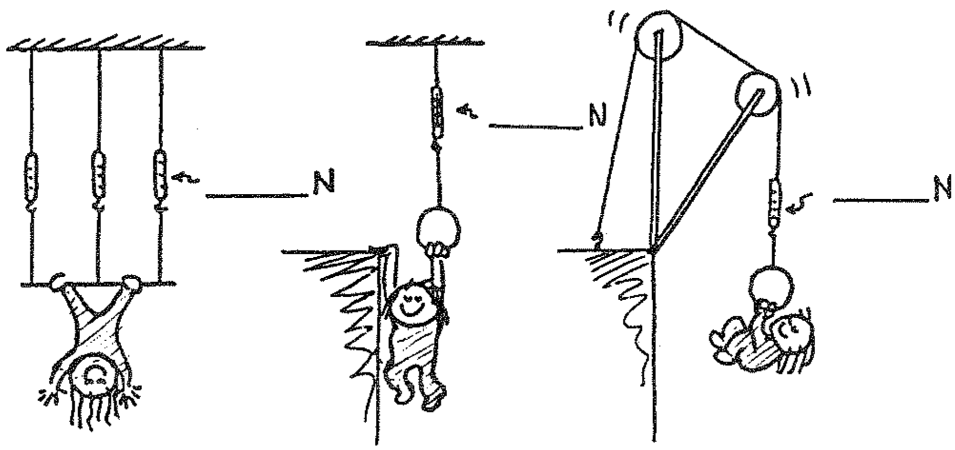
10. Pull on both sides of the block using the spring scales such that the right side spring scale reads 2 N and the left side reads 5 N:

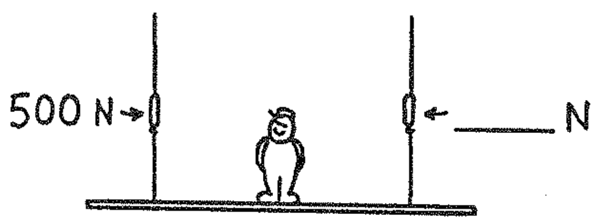
Prediction ☐ ☐ Experimental

Statics

1. Little Nellie Newton wishes to be a gymnast and hangs from a variety of positions as shown. Since she is not accelerating, the net force on her is zero. This means the upward pull of the rope(s) equals the downward pull of gravity. She weighs 300 N. Show the scale reading for each case.

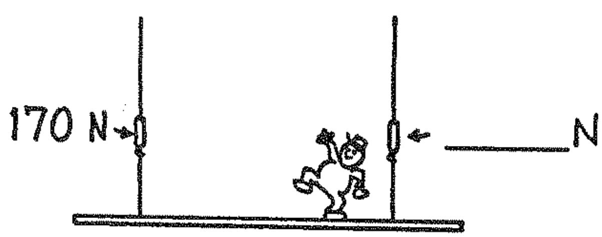




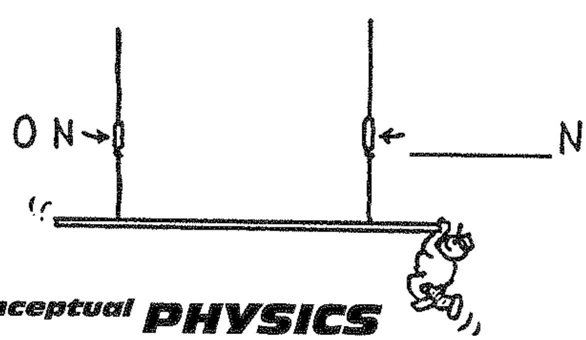


2. When Burl the painter stands in the exact middle of his staging, the left scale reads 500 N. Fill in the reading on the right scale. The total weight of Burl and staging must be

__________N.



3. Burl stands farther from the left. Fill in the reading on the right scale.



4. In a silly mood, Burl dangles from the right end. Fill in the reading on the right scale.

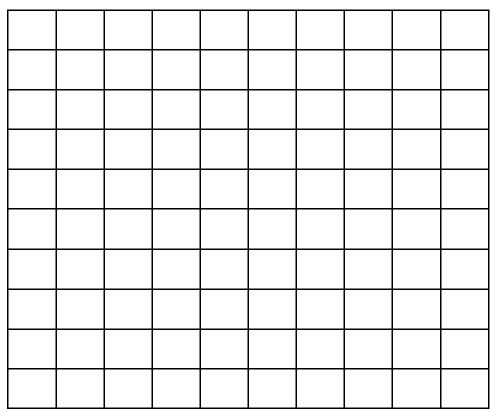
Generating and Analyzing Graphs of F_{net}

Using the information provided in each problem fill out the data table, graph the data on the graphs provided, and then sketch in your simplest best-fit line.

1. A stunt airplane (mass = 2000 kg) fires its engine at max force of 32000 N, in order to take off; as it speeds up it reaches speeds that incur significant air resistance as it takes-off as shown below.

Time (s) +/- 0.5	Force of Engine (N) +/- 100	Force of Air Resistance (N) +/- 100	F_{net} (N) +/- _____	Acceleration (m/s^2) +/- 1
0.0	32000	0		
5.0		- 2000		
10.0		- 8000		
15.0		- 18000		
20.0		- 32000		

a



F_{net}

a) Write the equation that represents the graph.

a =

*b) When the air resistance is equal in size to the thrust of the stunt airplane, the plane reaches its highest speed – also called, terminal velocity. At what time did the stunt airplane reach terminal velocity?

t = ___________

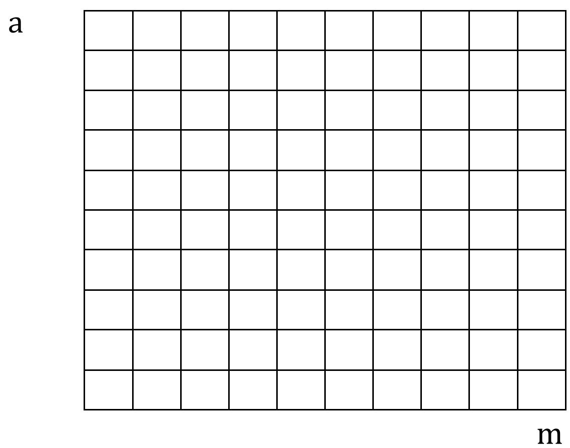
*c) Using your understanding of motion, acceleration, and forces, sketch what the velocity vs time graph would look like for the stunt plane for the first thirty seconds of flight:

v

t

2. A rocket during take-off actually burns and expels enough of its fuel to significantly change the rocket's overall mass. So while the force of the rocket (called thrust) stays roughly the same the rocket's mass drops each second.

Time (s) +/- 0.5	Total Force on Rocket (N) +/- 100	Mass of Rocket (kg)	Acceleration (m/s^2) +/- 1
0.0	45000	10000	
3.0		8000	
6.0		6000	
9.0		4000	
12.0	45000	2000	



a) What is the pattern in the acceleration vs mass graph.

b) Write the equation that represents the graph.

a =

c) Now you may have notice a slight over-simplification in our data table, if the mass is dropping, so then is the force of gravity pulling it down. If the thrust of the rocket stays roughly constant but the force of gravity lessens, how would this change the acceleration? Circle one:

Make it bigger   No change   Make it smaller

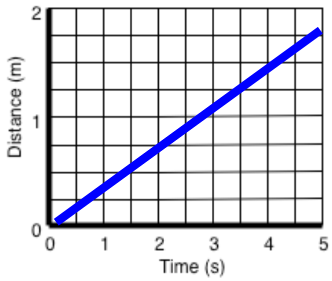
d) Write a high school level conclusion without a prediction for the acceleration vs mass graph.

Identify the Net Force for the following d vs t and v vs t graphs of a ball

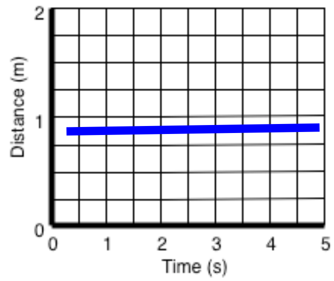
A -- Forces are Balanced ($F_{net} = 0$)

B -- Forces are Unbalanced ($F_{net} \neq 0$) and in the F_{net} is the direction of motion

C -- Forces are Unbalanced ($F_{net} \neq 0$) and in the F_{net} is the opposite direction of motion



Answer : ____________



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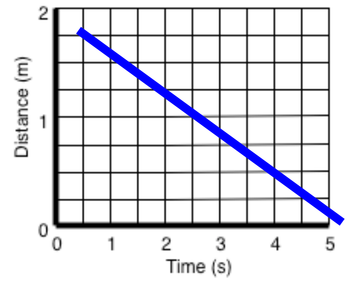

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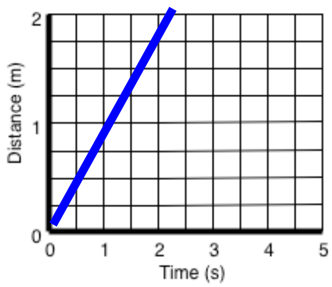

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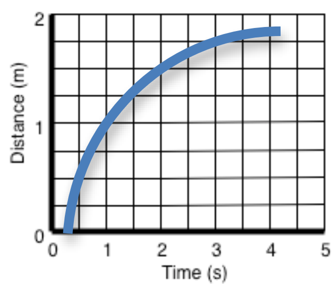

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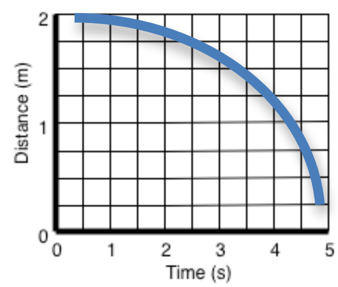

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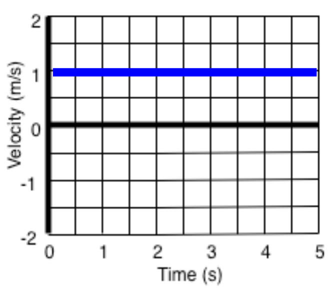

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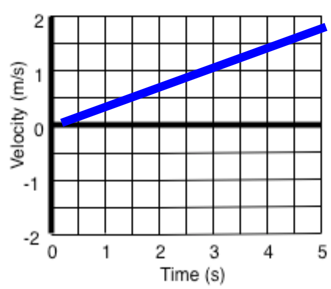

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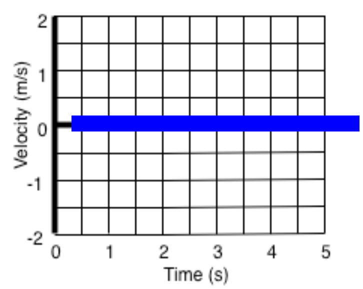

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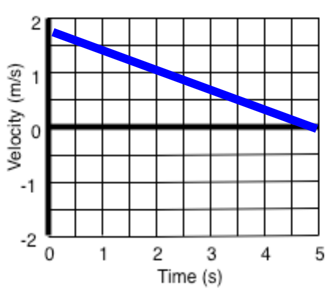

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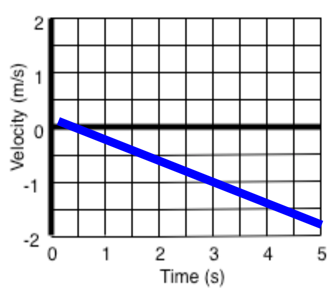

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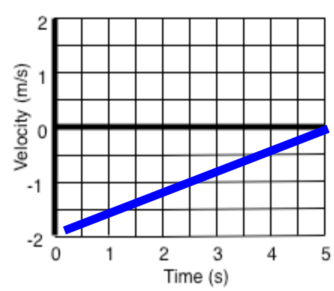

Answer : ____________

*****Ranking Task: order the graphs above from largest force to smallest force**