Exploring Mechanical Force

What's a FORCE?
Every time you push, pull or twist something, you exert a force on it. Almost every time you exert a force on an object, you change something about the object: its speed, its direction, or its shape.

Part 1 – The Force of Gravity
The force of gravity pulls on you all the time. It is the force of attraction between the planet Earth and you that keeps you from floating aimlessly off into space. All massive bodies (objects that have mass) in the universe exert gravitational force on each other. The amount of force depends on how massive the bodies are and on how far apart they are. Gravity is always an attractive force, never repulsive.

a) If two objects of different mass are dropped from the same height at the same time, which do you think will hit the ground first? _____

b) Now do it – drop **a pen** and **a book** from the same height at the same time. Watch and listen carefully. In what order do they land? _____

c) If a **flat piece of paper** and **a book** are dropped from the same height at the same time, predict which will hit the ground first. _____

d) Now do it – in what order did they hit the ground? Explain why the result in (c) is different from the result in (b). _____
_____

e) Now **crumple the paper** into a ball and repeat part (d). Are your results different from (c)? If they are different, explain why are they different? _____
_____

f) If you could put a coin and a feather in a container and remove all the air (creating a vacuum), and then drop the coin and feather, in what order would they hit the ground? Explain. _____
_____

g) Take a **20 N spring scale** and hang a **100g (0.100kg) mass** from the scale. Copy the chart below into your notebook and complete the chart by recording the force of gravity (F_g) on as many masses as you can. You may have to hang several masses at the same time to get the correct mass.

Mass (g)	Mass (kg)	Force (N)	Force(N) ÷ mass (kg)
100g	0.1 kg		
200g	0.2 kg		
250g	0.25kg		
300g	0.3 kg		
400g	0.4 kg		
500g	0.5 kg		
700g	0.7 kg		
1000g	1. kg		

h) **Draw a graph** (on graph paper!) of the data with **Force** on the *y axis* and **mass** on *x axis*.
   a. From the graph, predict the force of gravity on a 600g mass. _____
   b. Calculate the slope of the graph, and write the equation of the graph. _____
      Slope: _____ *Equation of graph:* _____

Part 2 - Pulling force

a) Use a **spring scale** to pull a **wheeled cart** across your desk. How much force is required to pull the cart at a constant speed? _____

b) **Place your text book on the cart** so that the mass is increased significantly. Now, how much force is required to pull the cart at a constant speed? _____

c) Are the forces from (a) and (b) different? By how much? _____

d) Pull the **empty cart** across the desk again, but this time try to read the force while the cart is **accelerating** (speeding up). How much force is required to accelerate the cart?

_____

e) Now place the **books back on the cart**, and record the force when **accelerating** the cart.

_____

f) Are the forces from (d) and (e) different? By how much? _____

g) Are the forces from (a) and (d) different? By how much? _____

h) **Summarize** what you learned about pulling forces. _____

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Part 3 - Frictional force

a) Use a **spring scale to pull a book or block of wood across your desk**. How much force is required to pull at a constant speed? _____

b) Place another book or some blocks on the first one so that the **mass is increased significantly**. Now, how much force is required to pull the cart at a constant speed? _____

c) Now place everything that you used in (b) on a cart. How much force is required to pull at a constant speed? Why is the force reduced? _____

d) Find something that you think will have a lot of friction. How much force is required to pull it across the desk? _____

e) What properties of an object make it higher in friction? _____

_____

_____

_____

Part 4 - Elastic Force

a) Use a **spring scale** to record the force required to stretch a **spring or elastic band** to different lengths. Complete the data table.

Force (N)	0.0	?	?	?	?
length (cm)	0.0	1.0	2.0	3.0	4.0 etc ….

b) What happens to the force as the spring stretches further? _____

_____

c) Graph the data with **force (F)** on the *y axis* and **length (l)** on the *x axis*.

d) Calculate the slope write the equation of the straight portion of graph.

Slope: _____ *equation:* _____