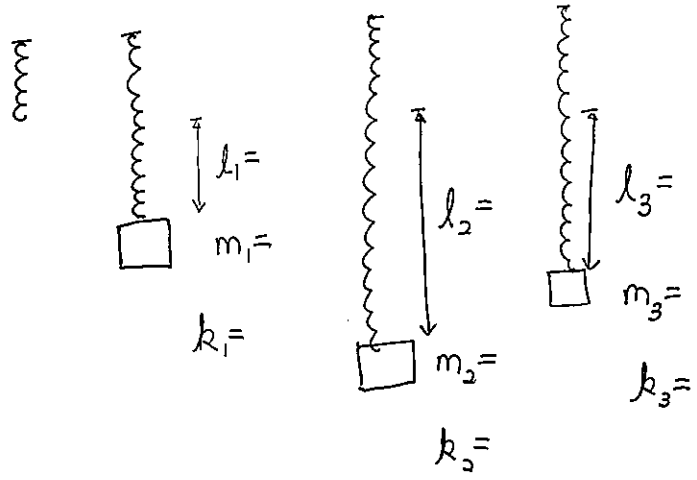
HS Physics Name:

Ch5 Lab: Springs, Energy, Machines

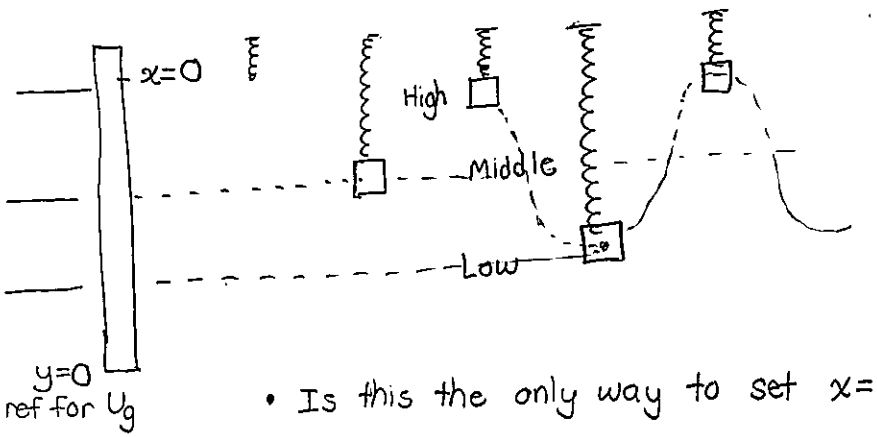
① a) Find the stiffness of a spring. Sketch the freebody diagram



k_{avg}=

- What is the shape of the scatterplot? Explain

b) Is Mechanical Energy Conserved?



- Is this the only way to set x=0? y=0?

Label your measurements

- k =
  m =

Indicate how you got the numbers

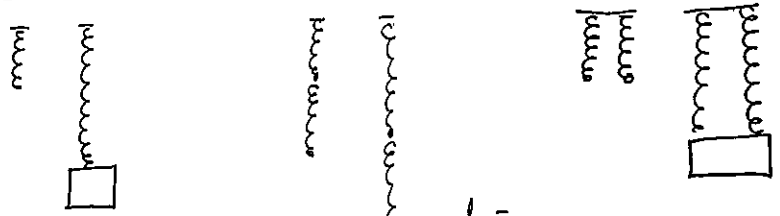
	U_s	U_g	K	Total energy
High				
Middle				
Low				

- Is the mechanical energy at the High and Low points the same? Explain.

- How do you estimate the speed of the mass in the Middle?

② Choose $m =$ _____. Keep it the same!

- Single Spring
- Series
- Parallel



$l_s =$

$l_1 =$

$l_p =$

$k =$

$k_s =$

$k_p =$

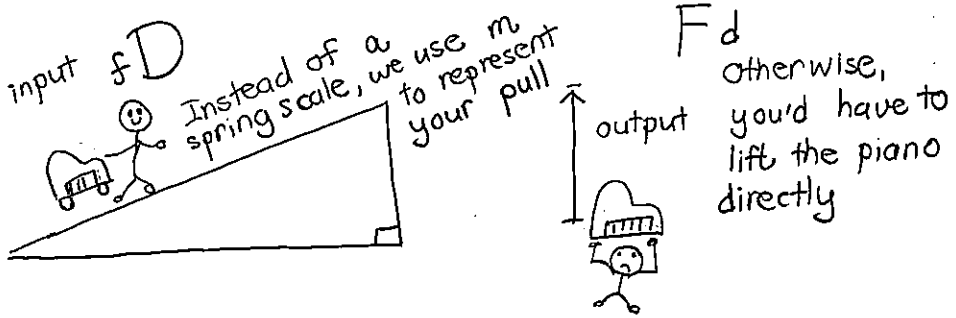
- Draw free body above

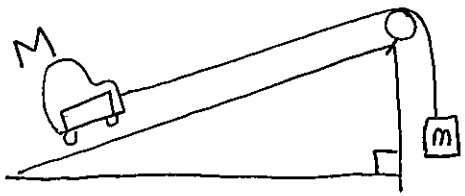
- Explain theoretically
- Derive the formulas for the new spring constants k_s and k_p in terms of k

- % error: for k_s from theory. Why different?
  " k_p "

③ Machine 1: Inclined Plane

Use a small mass m
to make a big mass M (piano) become elevated

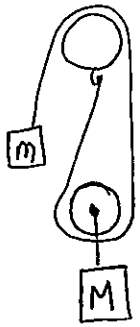




- Draw the free body for M and m
- Label f_{in}, D_{in}, F_{out}, d_{out}
- Also measure numbers for all the above
- Mechanical Advantage =
- % difference from theory =
- Mechanical Efficiency =
- E

- Explain why the machine is not 100% efficient, why not same as theoretical M.A.

④ Machine 2: Pulley (Choose one: Gears or Pulley)
Use a small mass to elevate a large mass.
It should go up at steady speed after a small tap.



- Explain theoretical M.A. with free-body.

- Collect data. Numerically Label f_{in}, D_{in}, F_{out}, d_{out}

M.A. =

M.E. =

- Explain variation from theory.

⑤ Machine 2B: Gears
(Choose one: Gears or Pulley)

Draw your gear box (or paste a picture)
Explain how it strengthens force (theory)
Find M.A. , M.E.
and why different from theory

1. **Calculate the gear ratio**

   * **Which side is faster? stronger?**

   * **By how many times?**

2. **If you want to use this gear train to**
   * **lift something heavy, which side should the motor be on? the book?**

   * **make a winning racecar, which side should the motor be on? the wheel?**

   * **win a tug of war, which side should the motor be on? the wheel?**