AP Physics 1 *Name:* _____

Mods: _____ *Date:* _____

After all the time his class spent on the pendulum lab, Phil Physics suspects that the angle of release of a pendulum actually does affect the time per swing for angles above 30° from vertical. Specifically, he hypothesizes that as the angle increases the time per swing will increase.

(a) Design an experiment for determining the relationship between angle and time. Assume you have access to equipment normally available in a physics classroom.

(i) Draw a diagram of the experimental setup for the pendulum. In your diagram, indicate each quantity that would be measured and draw or state what equipment would be used to measure each quantity. (3 pts)

(ii) Describe the overall procedure to be used, including any steps necessary to reduce experimental uncertainty. Give enough detail so that another student could replicate the experiment. (3 pts)

In the class, four lab groups decide to test the hypothesis mentioned earlier. The groups average their trials for each angle, and those averages are recorded below. Finally, the average times for all the groups are shown as a class average.

Angle from vertical (degrees)	GROUP 1 Time per swing (s)	GROUP 2 Time per swing (s)	GROUP 3 Time per swing (s)	GROUP 4 Time per swing (s)	CLASS AVG Time per swing (s)
10	2.00	2.13	2.85	1.97	2.24
20	2.02	2.06	2.70	2.06	2.21
30	2.05	2.12	2.61	2.10	2.22
40	2.26	2.22	2.55	2.20	2.31
50	2.44	2.37	2.45	2.39	2.41
60	2.50	2.47	2.25	2.55	2.44
70	2.67	2.51	2.04	2.59	2.45
80	2.74	2.67	2.04	2.71	2.54
90	2.80	2.72	1.99	2.88	2.60

(b) Based on the data, what conclusion should the students make about the hypothesis that the time per swing increases when the angle from vertical is above 30°. (2 pts)

_____ Increasing the angle above 30° does increase the time per swing

_____ Increasing the angle above 30° does not increase the time per swing

Briefly justify your reasoning

(c) Upon looking closely at the data for each group, you notice an inconsistency between groups. Which group had the inconsistency, and what is a plausible reason for it? (2 pts)

(d) Student A claims the inconsistent data is because that group used a different mass than everyone else. Student B claims the inconsistent data is due to the group using a different string length than everyone else.

Refute either Student A's claim or Student B's claim based on the data in the table and the data and information you learned in class from this lab. Make sure to support your choice with supporting details. (2 pts)