

PROBLEM SET *THIS IS A PRACTICE ASSESSMENT. Show formulas, substitutions, answers and units!*

Topic 1.2 – Uncertainties and errors

15. What is the measured length of this line in mm? Use the amount of significant figures a wooden meter stick is capable of supplying.



16. What is the precision of this measurement?
17. If the above line is one side of a perfect square, what is the area of that square, taking into account the correct number of significant figures and the correct units?
18. What is the reading uncertainty in your answer from problem (15)?
19. A student measures a line to be $4.5 \text{ cm} \pm 0.1 \text{ cm}$. Find the absolute uncertainty in the measurement.
20. Find the instrument uncertainty in the measurement.
21. Find the fractional uncertainty in her measurement.
22. Find the percentage uncertainty in her measurement.
23. A flagpole is placed on the roof of a house. A student measures a flagpole to be $2.75 \text{ m} \pm 0.15 \text{ m}$. The same student measures the height from the ground to the base of the flagpole to be $3.8 \text{ m} \pm 0.4 \text{ m}$. If the flagpole is mounted vertically upward (straight up), how far is the tip of the flagpole above the ground. Be sure to use significant figures and include uncertainty with your answer.
24. A car travels $350 \text{ m} \pm 25 \text{ m}$ in $16.5 \text{ s} \pm 0.4 \text{ s}$. Calculate its speed. Be sure to use significant figures and include uncertainty with your answer.

25. Complete the table that shows data gathered by an IB student during an experiment in which a parachute was dropped from different heights.

Height H / m $\Delta H = \pm 0.1 \text{ m}$	Fall Time T_i / s $\Delta T_i = \pm 0.3 \text{ s}$			Average Fall Time T / s
	Trial 1	Trial 2	Trial 3	
1.4	1.5	1.8	1.6	
1.7	1.9	2.1	2.3	
2.0	2.4	2.9	2.8	
2.5	3.5	3.7	3.6	

26. Does it appear that the student has done the right number of trials and variations to satisfy the internal assessment requirements of the IBO? Be sure to explain very clearly your reasoning.
27. On a graph of your own making, plot *Height vs. Average Fall Time*. Be sure to label the graph properly.
28. On the same graph sketch the correctly-sized vertical error bars on each point.
29. On the same graph sketch in your line of best fit. Calculate its slope.
30. On the same graph sketch in the maximum and minimum slopes, using the first and last error bars as your guide. Calculate their slopes.
31. Calculate the uncertainty of the slope.
32. What are the x-intercepts of the lines representing the minimum and maximum slopes?
33. Calculate the uncertainty of the x-intercept.

