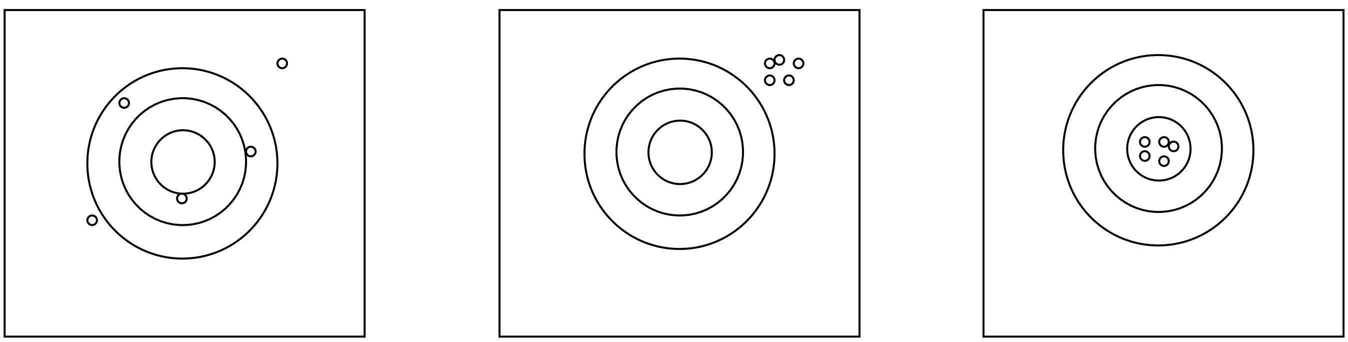
Precision and Accuracy

The terms precision and accuracy are widely used in any scientific work where quantitative measurements are made. Precision is a measure of the degree to which the results of a given experiment "check" or agree. A high precision is obtained when several results for the same experiment agree closely. The accuracy of a result is the degree to which the experimental value agrees with the true or accepted value. It is possible to have a high degree of precision with poor accuracy. This occurs if the same error is involved in repeated trials of the same experiment. It is unlikely to have a low degree of precision and good accuracy however. The difference between the two terms is illustrated by the results of target practice as shown below.



Shooting targets show the difference between precise and accurate.

a.) neither accurate nor precise (large random errors).

b.) precise but not accurate (small random errors, large systematic errors).

c.) both precise and accurate (small random errors, no systematic errors).

A high degree of accuracy can only be obtained with a high degree of precision and minimal error. Errors include systematic and random errors. A random error has an equal probability of being either high or low whereas a systematic error occurs in the same direction every time. If small random errors occur the average results become more accurate as the number of trials increases.

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Name - ____________________

Instructions – answer the following questions on a separate sheet of paper please.

1.) To check the accuracy of a graduated cylinder, a student filled the cylinder to the $25\ mL$ mark, poured the contents into a buret and read the volume. This was repeated four more times with the following results.

Trial	Volume Shown by Graduated Cylinder (mL)	Volume Shown by Buret (mL)
1	25	26.54
2	25	26.51
3	25	26.60
4	25	26.49
5	25	26.57
Average	**25**	**26.54**

What conclusion can be made with regards to the accuracy and precision of the graduated cylinder? Explain.

2.) A chemist, trying to identify the composition of a certain solvent finds that $25.00 \pm 0.03\ cm^3$ has a mass of $19.625 \pm 0.002\ g$ at $20°C$. What conclusions can you make about the identity of the fluid given the following densities:

Compound	Density ($\frac{g}{cm^3}$)
Chloroform	1.492
Diethyl ether	0.714
Ethanol	0.789
Isopropanol	0.785
Toluene	0.867

Explain why you were able to make that conclusion.

3.) How could you answer the question above if the volume is accurate to $\pm 0.20\ cm^3$ and the balance is accurate to $\pm 0.015\ g$? Explain and show your work.