Balance and Scale Encyclopedia Article

Balance and Scale

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Balance and Scale

One of the earliest known measuring devices, the equal-arm balance was used in Egypt during the fourth millennium B.C. to determine exact and relative weights. The Egyptians used the scale for measuring goods to be traded, as well as for weighing gold dust received in payment. This ancient balance consisted of a horizontal, pivoting beam from which were suspended a pan at each end, equidistant from the pivot. One pan held the item to be weighed; standard weights were added to the other. The weight of the item could be determined by adding or removing weights from the second pan until the two were equal. Though primitive, these two-pan balances were capable of accuracy as high as 99%. Probably the most significant improvement to the balance design was made by the Romans. They added a knife-edge, called a fulcrum, to the pivot point, which made the device much more sensitive and accurate, particularly when determining very small weights. For years agate was used as the fulcrum-piece, but many balances have since replaced these with fulcrums made of corundum (synthetic sapphire).

Most modern balances are of the *single-pan* variety. Instead of using two pans, this device replaces one pan with a large, heavy counterweight. The remaining pan is equipped with a number of smaller weights; when the item to be weighed is placed within the pan, these small weights make the pan heavier than the counterweight. The weight of the unknown can then be determined by removing enough small weights for the two sides to balance. Another balance, called the deflection balance, does not require the two sides to be balanced exactly. This type uses a vertical needle to make a more accurate measurement of the unknown's weight. When the two sides are nearly balanced the needle stands almost straight up, tilting slightly to one side or the other. The amount the needle is tilting can be measured to determine the exact weight of the item to several decimal points. The most accurate balance yet invented is the microbalance. Just a few inches long and weighing about 50 mg, the microbalance is ideal for determining extremely small weights to within a few millionths of a gram.