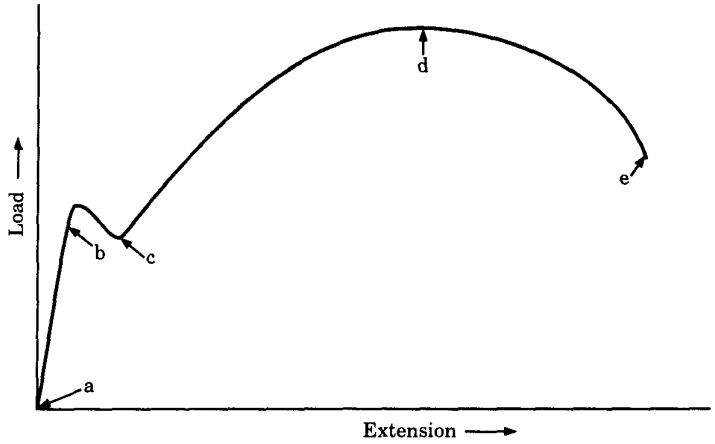

Loads/extension curve for low carbon steels

- From ***a*** **to** ***b*** the extension is proportional to the load. Also, if the load is removed the specimen returns to its original length. Under these lightly loaded conditions the material is said to be exhibiting the property of ***elasticity***.
- From ***b*** **to c** it will be seen that the metal suddenly extends with no increase in load: lithe load is removed the metal will not spring back to its original length. It is said to have taken a permanent set. This is the ***yield*** point. The **yield stress**, which is the stress at the yield point, is the load at *b* divided by the original cross-section area of the specimen.
- From **c to *d*** the extension is no longer proportional to the load and if the load is removed little or no spring-back will occur. Under these loads the material is said to exhibit the property of ***plasticity***.
- The point ***d*** is referred to as the ***ultimate tensile stress*** (UTS) for the material. This is determined by dividing the load at *d* by the original cross-sectional area of the specimen. Although a useful means of comparing the strengths of materials, it has little practical value since engineering equipment is not usually operated at breaking point. From *d* to e the specimen appears to continue stretching under a reduced load. In fact the specimen is thinning out (necking) so that the load per unit area or stresses is in fact still increasing. The specimen finally breaks at the point e.

Engineering Stress, Engineering Strain, True Stress and True Strain

In order to study the plastic flow of materials it is preferred to use the concepts of true stress and true strain. In tensile test for any engineering material one region of the specimen begins to deform much quicker than the rest as the test progresses. The reduction in area therefore raises a question, which area should be considered for calculating stress, the *original* area or the *actual* area of the specimen at any instant of the load.

When we calculate the stress on the basis of the original area, it is called the *engineering* or *nominal stress*. If we calculate the stress based upon the instantaneous area at any instant of load it is then termed as *true stress*. If we use the original length to calculate the strain, then it is called the *engineering strain*.