E5.13 A material is required for the blade of a rotary lawn-mower. Cost is a consideration. For safety reasons, the designer specified a minimum fracture toughness for the blade: it is K_{1c} > 30 MPa $m^{1/2}$. The other mechanical requirement is for high hardness, *H*, to minimize blade wear. Hardness, in applications like this one, is related to strength:

$$H \approx 3\sigma_y$$

where σ_f is the strength (Chapter 4 gives a fuller definition). Use the $K_{1c} - \sigma_f$ chart of Figure 4.8 to identify three materials that have K_{1c} > 30 MPa $m^{1/2}$ and the highest possible strength. To do this, position a "K_{1c}" selection line at 30 MPa $m^{1/2}$ and then adjust a "strength" selection line such that it just admits three candidates. Use the Cost chart of Figure 4.19 to rank your selection by material cost, hence making a final selection.