

**Chapter 5**  
**Short answer question**

Here are some data relevant to the strength of materials.

Material	Density kg m <sup>-2</sup>	Young modulus 10 <sup>9</sup> N m <sup>-2</sup>	Tensile strength 10 <sup>6</sup> N m <sup>-2</sup>	Compressive strength 10 <sup>6</sup> N m <sup>-2</sup>
Steel	7700	200	250*	250*
Aluminium	2700	70	100*	100*
Wood	600	16 along grain	18 along grain	15 along grain
Glass reinforced plastic	1500	6	500	400
Concrete	2200	40	low	30

*Tensile strength* is the *tensile stress* at which the material breaks, or, in the case of values marked \*, yields.

*Compressive strength* is the *compressive stress* at which the material fractures, is crushed, or, in the case of values marked \*, yields.

- (a) Why is it appropriate to give the tensile strengths for steel and aluminium (but not for the other materials) as the stresses at which they *yield*?

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- (b) Would you expect the tensile strength of wood across the grain to be larger, smaller, or much the same as its tensile strength along the grain? .....

Explain why.

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- (c) Explain why it is reasonable that the tensile and compressive strengths both have the same value for steel and aluminium, but not for wood and concrete.

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- (d) Calculate the cross-sectional area of a rod of aluminium which would just yield under tensile stress if it carried a load of 1 tonne ( $10^3$  kg).

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