Strength of materials under the action of forces

tension – stretching: being stretched to stiffness

2 Strength of materials under the action of forces

In Grade 7 Term 1, in Structures, you learned about a variety of strengthening methods such as tubing, folding and triangular webs. All structures in the world, man-made as well as natural, are subjected to forces such as tension, compression, bending and torsion. Revise this information if you have forgotten.

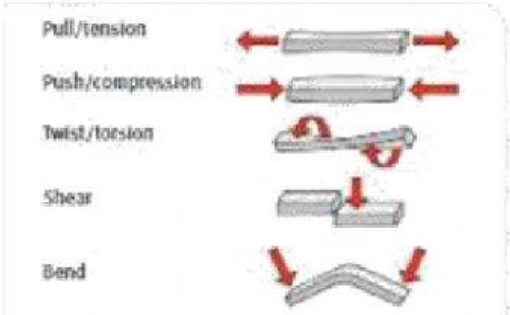


FIGURE 23 Engineering terms for different forces

When you design a structure, you need to ensure that the materials you use will be able to withstand the action of forces that act on the structure. We will look at the action of the following forces: tension (pulling), compression (pushing), bending of beams (compression and tension) and torsion (twisting). We will also look at the purpose of metal cross-sections. FIGURE 23 shows these different forces and how they act on structural members.

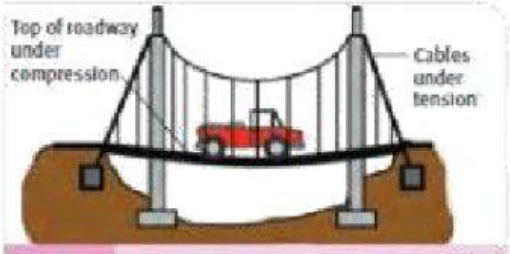


FIGURE 24 Compression and tension in the beams of a structure

FIGURE 24 shows a suspension bridge. The various parts of the bridge are under compression and tension. Can you explain why?

The deflection or bending of a beam under a load depends not only on the load, but also on the planes and shape of the beam's cross-section. This is why beams with wide flanges, such as I-beams, are often seen in building construction as opposed to other beams with the same area.

Look at the illustration of an I-beam in FIGURE 25. Investigate the cross-section and the additional flanges that make it stronger.

No matter how strong we build structures, they can topple over in strong winds. Think of the damage caused to buildings by hurricanes, tornadoes, floods and earthquakes.



FIGURE 25 Cross-sections of I-beams

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Activity 3 Understanding forces

Look at **FIGURES 26** and **27**. Complete the questions in your workbook.

1. Name the force exerted at A in **FIGURE 26**.
2. Name the force exerted at B in **FIGURE 26**.
3. Beam: Name the types of forces exerted at A and at B in **FIGURE 27**.
4. Arch: Name the types of forces exerted at A in **FIGURE 27**.
5. Suspension bridge: Name the types of forces exerted at A and B in **FIGURE 27**.
6. Cable-stayed bridge: Name the forces exerted at A and B in **FIGURE 27**.

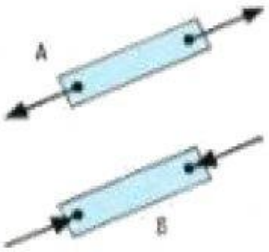
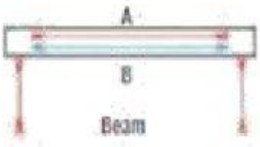


FIGURE 26 Pull and push forces on a structure









Answers.

1.

2.

3.

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4.

5.

6.

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