1.

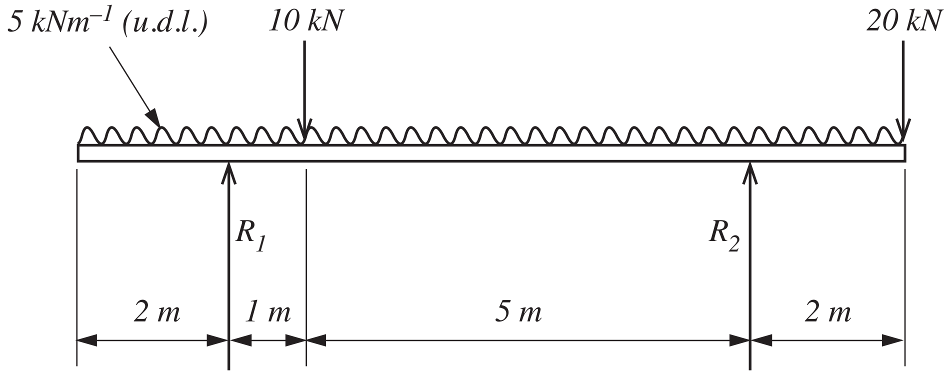


FIG. 1

For the loaded beam shown in FIGURE 1 :

(a) Determine the vertical reactions at the supports.

(b) Sketch the shear force diagram for the beam.

(c) Calculate the bending moment at 1m intervals along the beam.

(d) Sketch the bending moment diagram for the beam.

(e) State the position and magnitude of the maximum bending moment in the beam.

2. A beam of rectangular cross section 200 mm deep and 100 mm wide. If the beam is 3m long, simply supported at either end and carries point loads as shown in FIGURE 2 (on page 4).

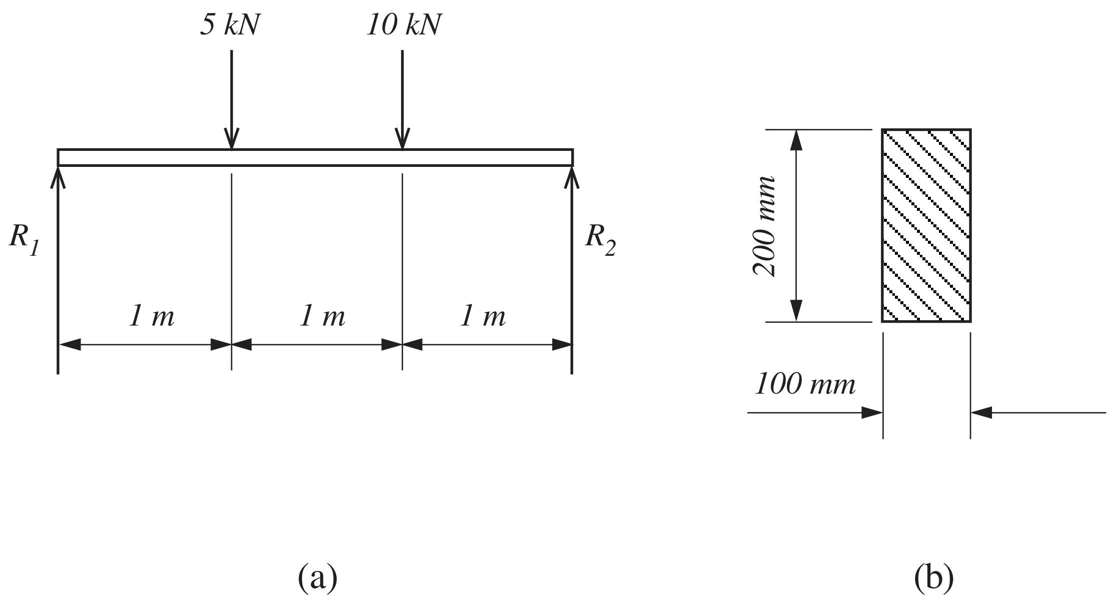


FIG. 2

(a) Calculate the maximum bending moment

(b) Calculate the maximum stress in the beam

(c) At the point of maximum stress sketch a graph of the stress distribution through the thickness of the beam, indicating which are tensile and compressive stresses.

(d) Determine the dimensions of the cross section which will minimise the maximum stress value if:

- the cross sectional area of the beam can be increased by 20%
- the beam section is to remain a solid rectangle
- neither the breadth or depth of the beam section can be reduced below their original dimensions.

Show the dimensions of the proposed beam cross section with the aid of a sketch.

(e) Determine the percentage reduction of the maximum stress value when the new cross section is used.

3. A column has the dimensions shown in the diagram below.

(a) What is the minimum length of the column at which buckling is likely to occur?

(b) If the column is the length determined in (a),

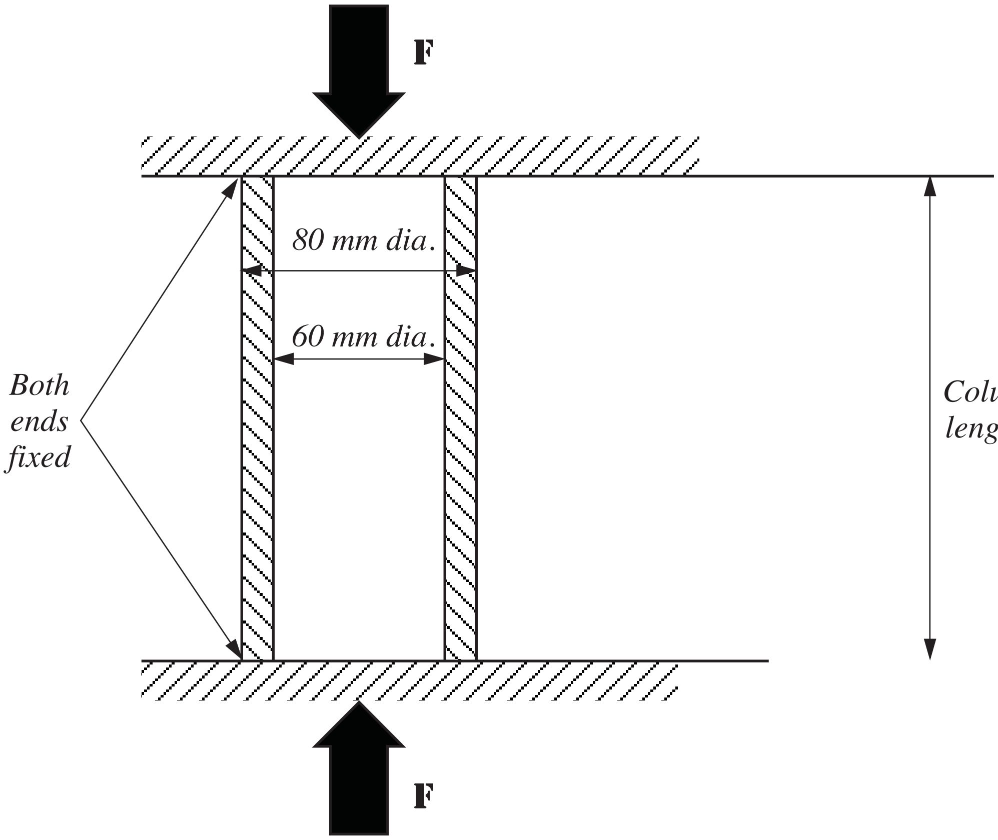
(i) What will be the mode of failure?

(ii) At what load would you expect failure to occur?

(c) If the column is half the length determined in (a) :

(i) What will be the mode of failure?

(ii) At what load would you expect failure to occur?



COLUMN MATERIAL PROPERTIES

Young's Modulus $E = 200$ GN m^{-2}

Yield stress $\sigma_y = 140$ MN m^{-2}

FIG. 3