

- 2 (a) State the *principle of moments*.

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[1]

- (b) Fig. 2.1 shows part of a cable-stayed bridge. Each section of the bridge is supported by eight equally spaced cables that pass through a central supporting pillar.

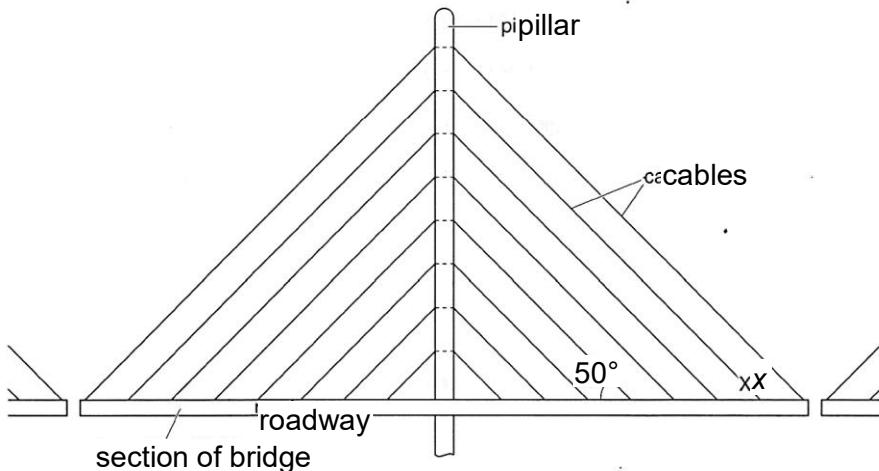


Fig. 2.1 (not to scale)

The cables are at an angle of  $50^\circ$  to the horizontal and the maximum tension allowed in each cable is  $7.8 \times 10^5$  N.

- (i) The mass of the roadway in this section is 350 tonnes (1 tonne = 1000 kg). Calculate the maximum mass of traffic that is allowed on this section of the roadway.

mass = ..... kg [2]

- (ii) Suggest a reason why the maximum tension allowed in each cable is well below the breaking tension.

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[1]

- (c) Fig. 2.2 shows a suspension bridge. The cables of the bridge are anchored into large free-standing anchor blocks of concrete.

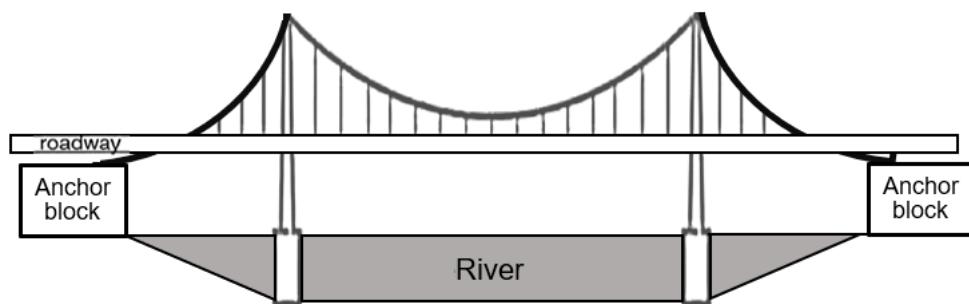


Fig. 2.2

The anchor block on the right is shown on a larger scale in Fig. 2.3. It has a length of 30.0 m and its cross-section and density are uniform.

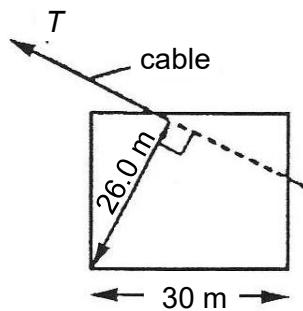


Fig. 2.3

This block is standing on the ground. The maximum force which the cables could exert on this block is  $5.50 \times 10^8$  N for a particular bridge. This force acts in the direction shown so that its line of action is 26.0 m from the point about which the block might possibly rotate.

- (i) Calculate the minimum mass of the block needed to prevent rotation, when the force exerted by the cable has its maximum value.

minimum mass = ..... kg [2]

- (ii) Draw on Fig. 2.4 the two other forces acting on the block under normal operating conditions (i.e. when the maximum force of the cable on the block is not at the maximum value). [3]

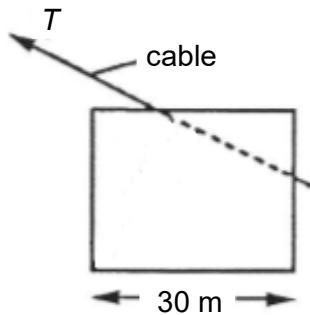


Fig. 2.4

[Total: 9]