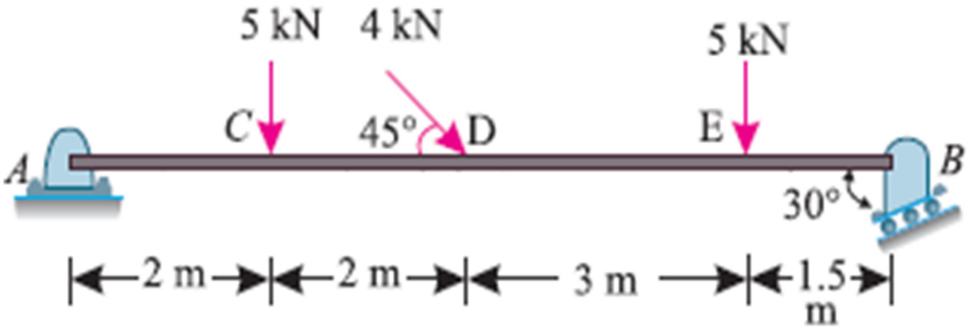
Q. A beam AB 8.5 m long is hinged at A and supported on rollers over a smooth surface inclined at 30° to the horizontal at B. The beam is loaded as shown in Fig. Determine the reactions at A and B.



Solution. Given: Span = 8.5 m
Let R_A = Reaction at A, and
R_B = Reactiion at B.
We know that as the beam is supported on rollers at B, therefore the reaction at this end will be normal to the support *i.e.* inclined at an angle of 30° with the vertical (because the support is inclined at 30° with the horizontal) as shown in Fig. 12.22. Moreover, as the beam is hinged at A, therefore the reaction at this end will be the resultant of vertical and horizontal forces, and thus will be inclined with the vertical.

Resolving the 4 kN load at D vertically

$$= 4 \sin 45° = 4 \times 0.707 = 2.83 \text{ kN}$$

and now resolving it horizontally

$$= 4 \cos 45° = 4 \times 0.707 = 2.83 \text{ kN}$$

We know vertical component of reaction R_B

$$= R_B \cos 30° = R_B \times 0.866 = 0.866\ R_B$$

and anticlockwise moment due to vertical component of reaction R_B about A

$$= 0.866\ R_B \times 8.5 = 7.361\ R_B \qquad ...(i)$$

We also know that sum of clockwise moments due to loads about A

$$= (5 \times 2) + (2.83 \times 4) + (5 \times 7) = 56.32 \text{ kN-m} \qquad ...(ii)$$

Now equating anticlockwise and clockwise moments given in (*i*) and (*ii*),

$$7.361\ R_B = 56.32$$

$$\boldsymbol{R_B = 7.65 \text{ kN}}$$

We know that vertical component of the reaction R_B

$$= 0.866\ R_B = 0.866 \times 7.65 = 6.625 \text{ kN}$$

and horizontal component of reaction R_B

$$= R_B \sin 30° = 7.65 \times 0.5 = 3.825 \text{ kN}$$

4 Vertical component of reaction R_A

$$= (5 + 2.83 + 5) - 6.625 = 6.205 \text{ kN}$$

and horizontal component of reaction R_A

$$= 3.825 - 2.83 = 0.995 \text{ kN}$$

$$(R_A)^2 = (6.205)^2 + (0.995)^2$$

$$\boldsymbol{R_A = 6.28 \text{ kN}}$$