

**NEW**

**Semester - II**

**Engineering Mechanics**

UNIT

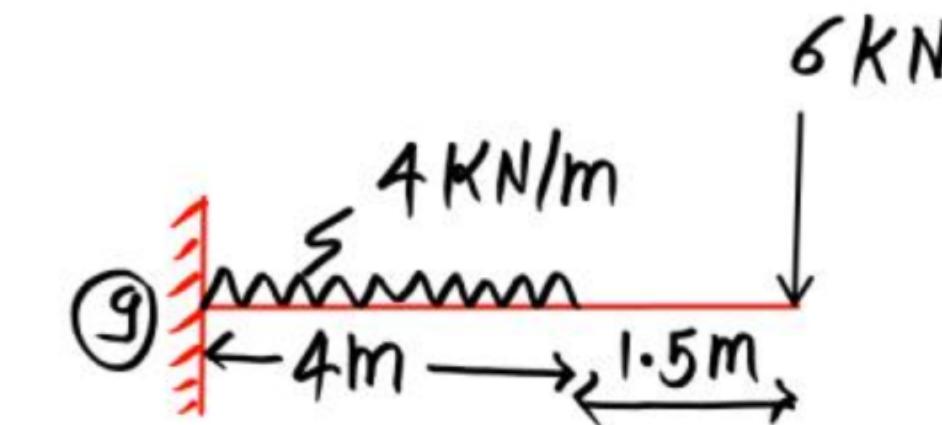
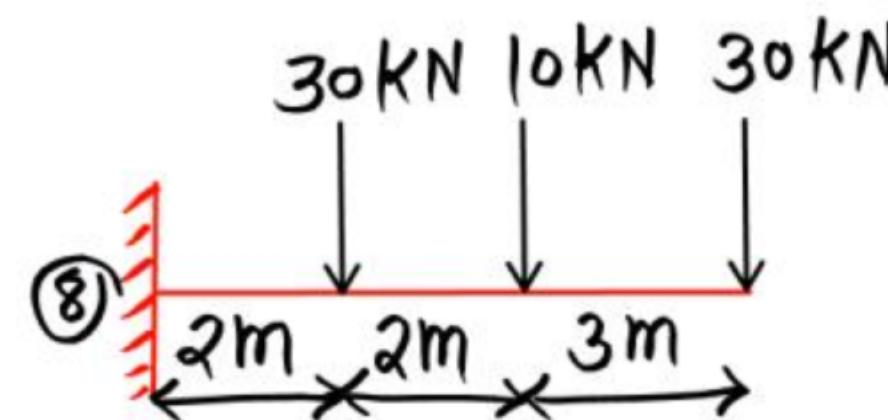
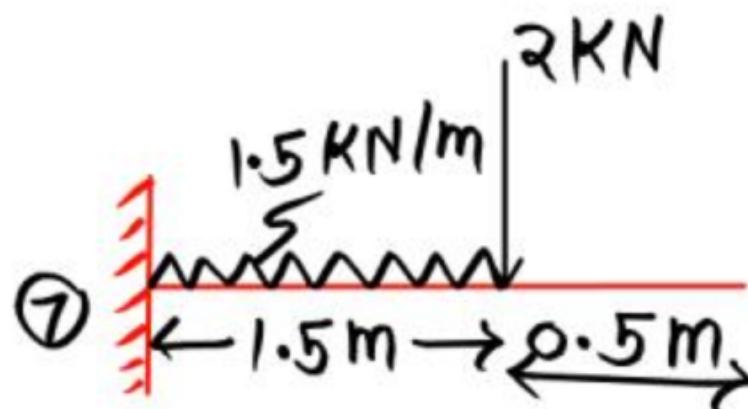
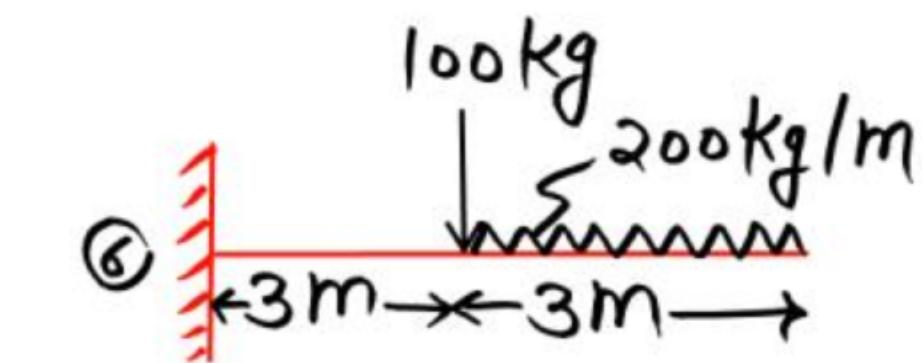
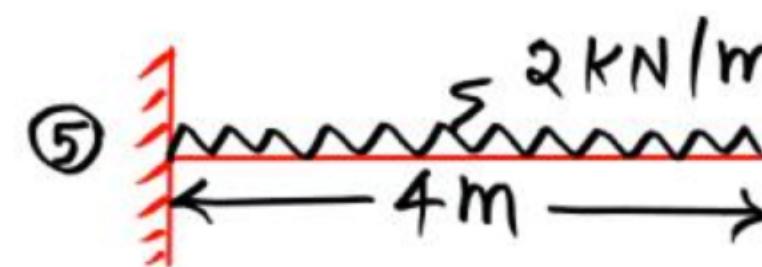
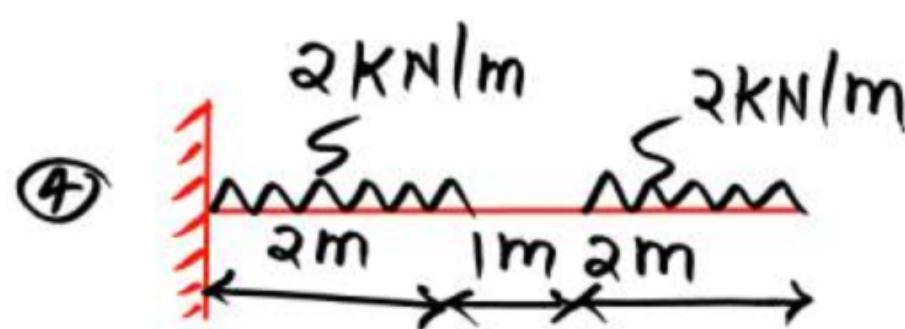
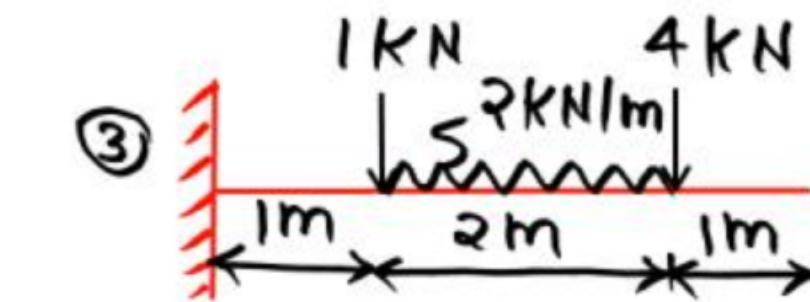
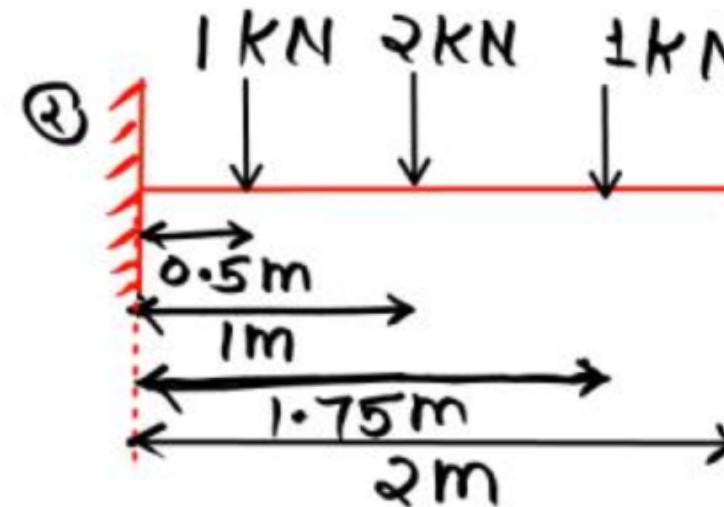
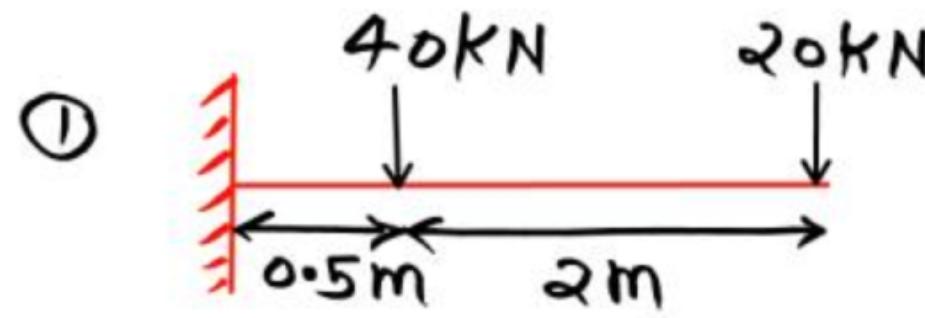
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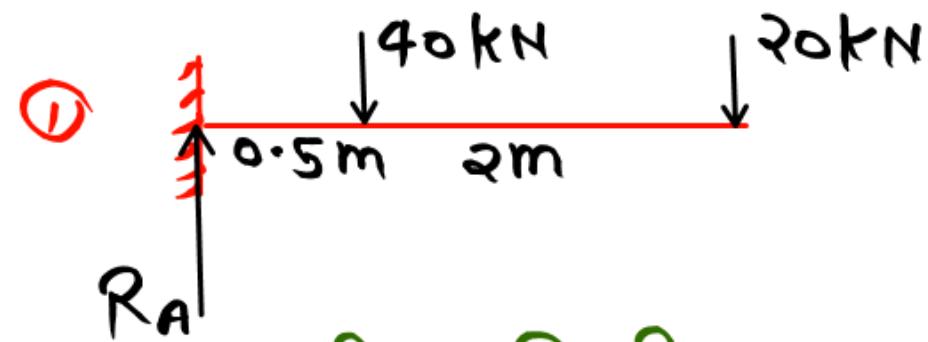
Equilibrium (संतुलन)

## UNIT-II Equilibrium

**Equilibrium and Equilibrant, Free body and free body diagram, Analytical and graphical methods of analysing equilibrium. Lami's Theorem statement and explanation, Application for various engineering problems.**

**Beam-** Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang - subjected to combination of Point load and uniformly distributed load.

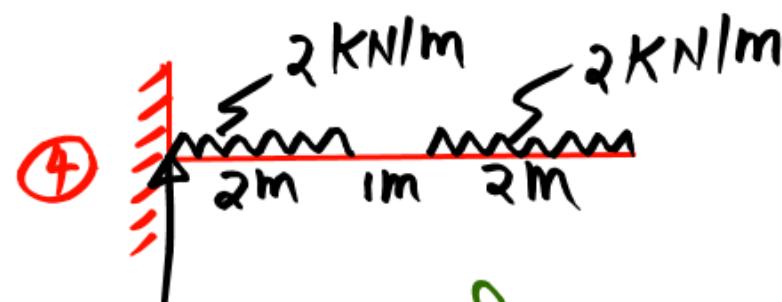




समूलन के समी० से  
 $\sum F_y = 0$  से

$$R_A - 40 - 20 = 0$$

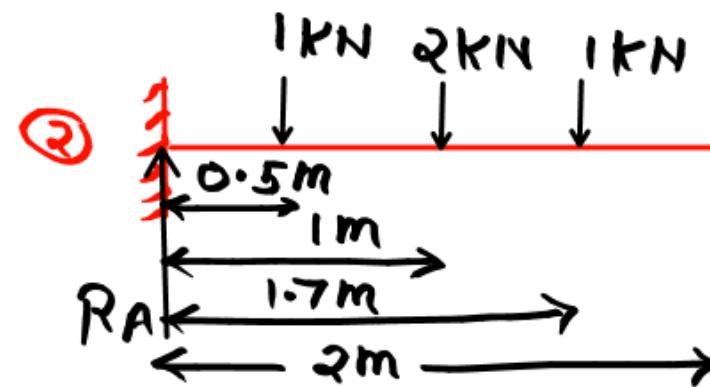
$$\boxed{R_A = 60 \text{ kN}} \quad \underline{\text{Ans}}$$



$\sum F_y = 0$  से

$$R_A = 2 \times 2 + 2 \times 2$$

$$\boxed{R_A = 8 \text{ kN}} \quad \underline{\text{Ans}}$$

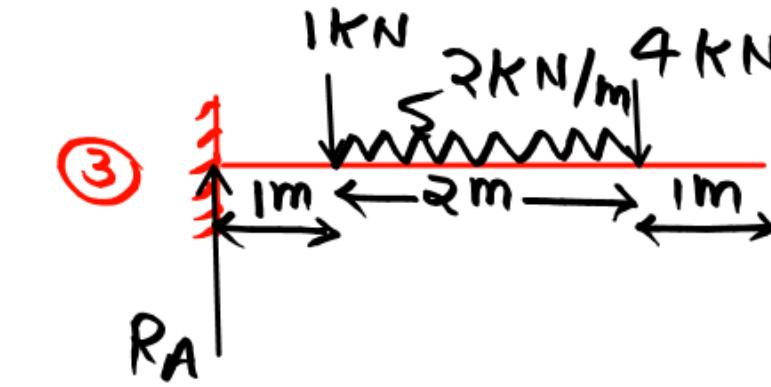


समूलन के समी० से  
 $\sum F_y = 0$  से

$$R_A - 1 - 2 - 1 = 0$$

$$R_A = 1 + 2 + 1$$

$$\boxed{R_A = 4 \text{ kN}} \quad \underline{\text{Ans}}$$

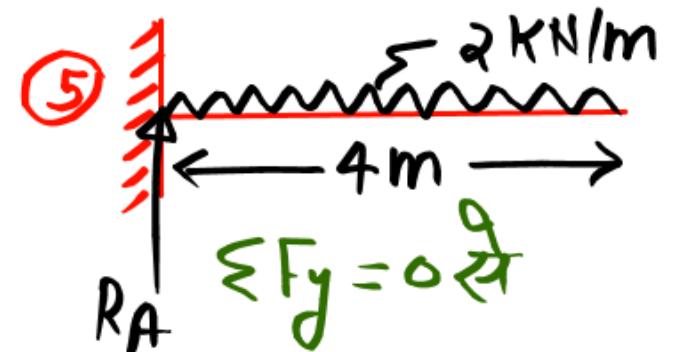


समूलन के समी० से  
 $\sum F_y = 0$  से

$$R_A = 1 + 2 \times 2 + 4$$

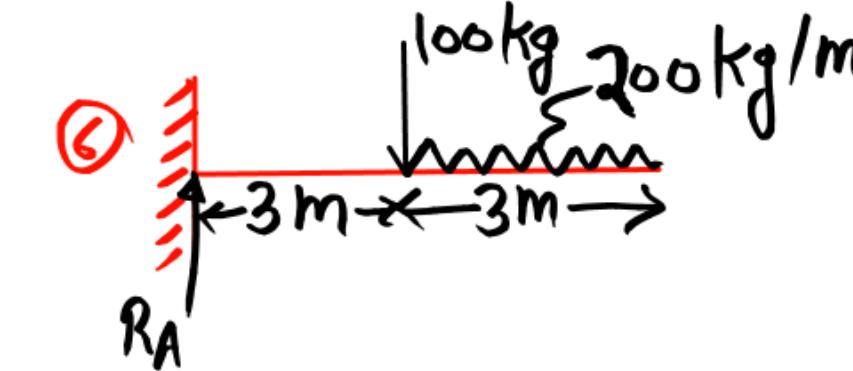
$$R_A = 1 + 4 + 4$$

$$\boxed{R_A = 9} \quad \underline{\text{Ans}}$$



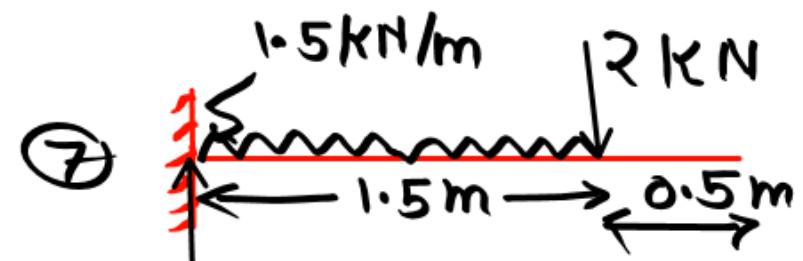
$\sum F_y = 0$  से

$$\boxed{R_A = 2 \times 4 = 8 \text{ kN}} \quad \underline{\text{Ans}}$$



$$R_A = 100 + 200 \times 3$$

$$\boxed{R_A = 700 \text{ kg}} \quad \underline{\text{Ans}}$$

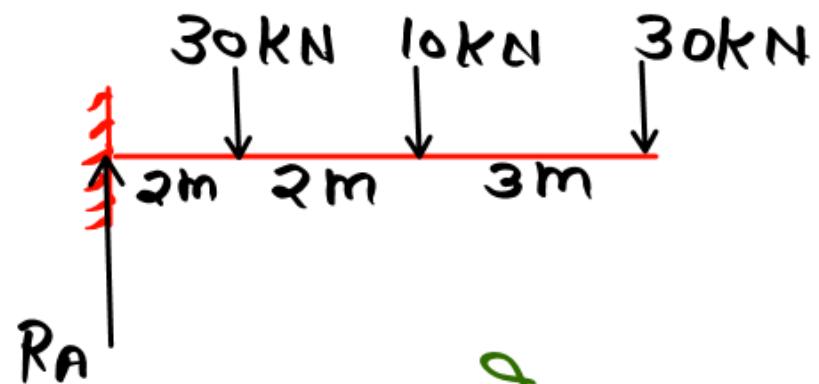


$$\sum F_y = 0 \text{ से}$$

$$R_A = 1.5 \times 1.5 + 2$$

$$R_A = 2.25 + 2$$

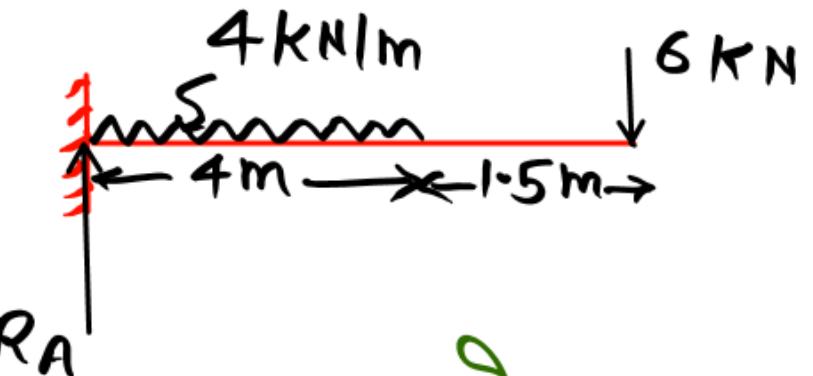
$$(R_A = 4.25 \text{ KN}) \underline{\underline{\text{Ans}}}$$



$$\sum F_y = 0 \text{ से}$$

$$R_A = 30 + 10 + 30$$

$$(R_A = 70 \text{ KN}) \underline{\underline{\text{Ans}}}$$



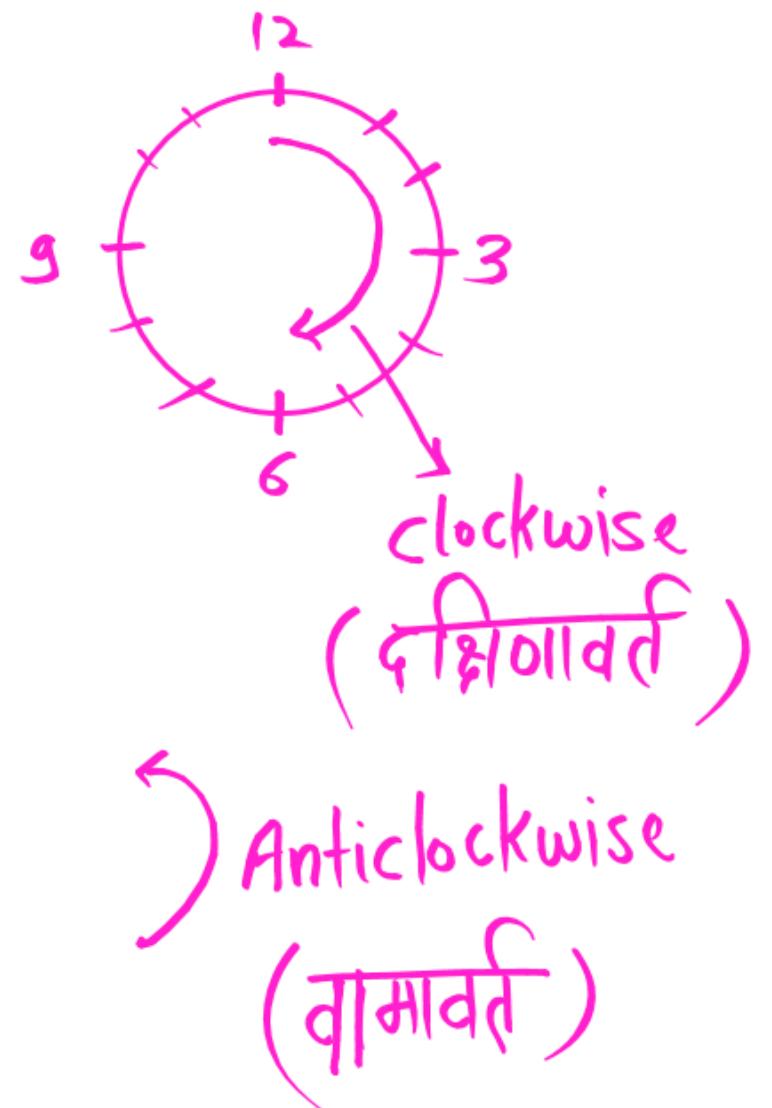
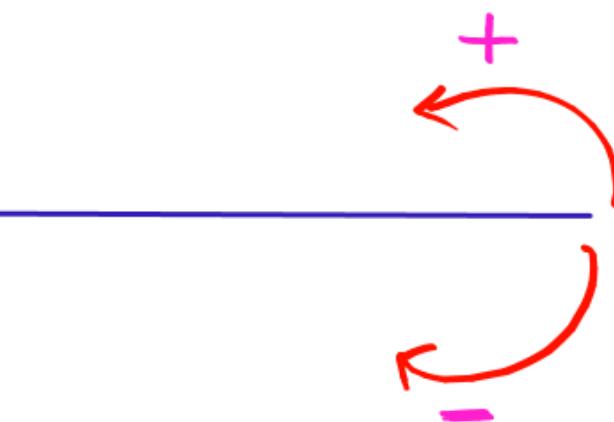
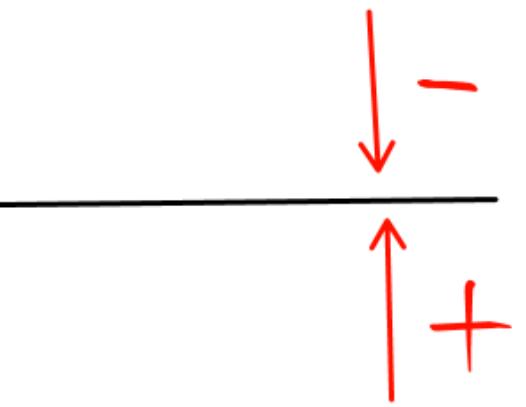
$$\sum F_y = 0 \text{ से}$$

$$R_A = 4 \times 4 + 6$$

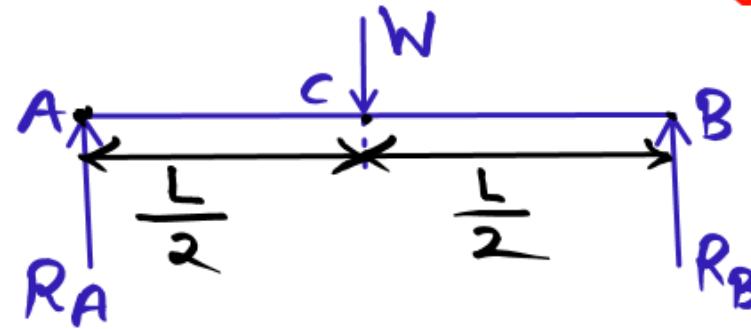
$$R_A = 16 + 6$$

$$(R_A = 22 \text{ KN}) \underline{\underline{\text{Ans}}}$$

## Sign Conversion (चिन्ह परिवर्ती)



कानूनी आलंबित धरत के लिए प्रतिक्रिया, जब मध्य बिन्दु पर संकेन्द्रीय भार लगा है।  
 ( Reaction for Simply supported beam subjected to concentrated Load at mid Point )



सन्तुलन के समीक्षण से (from equilibrium equation)

$$\sum F_y = 0 \text{ से}$$

$$R_A + R_B - W = 0$$

$$R_A + R_B = W \quad \text{--- } ①$$

$$\sum M_A = 0 \text{ से}$$

बिन्दु A के परितः आघुर्फ लेने पर (Taking moment about Point A)

$$R_B \times L - W \times \frac{L}{2} + R_A \times 0 = 0$$

$$L \cdot R_B - \frac{WL}{2} = 0 \Rightarrow L \cdot R_B = \frac{WL}{2}$$

$$R_B = \frac{W}{2} \quad \text{समीक्षण } ① \text{ से उत्पन्न पर}$$

(Note:- Reaction सात करने के लिए Moment उस Point के परितः लेते हैं जिसपर Reaction लगती है।)

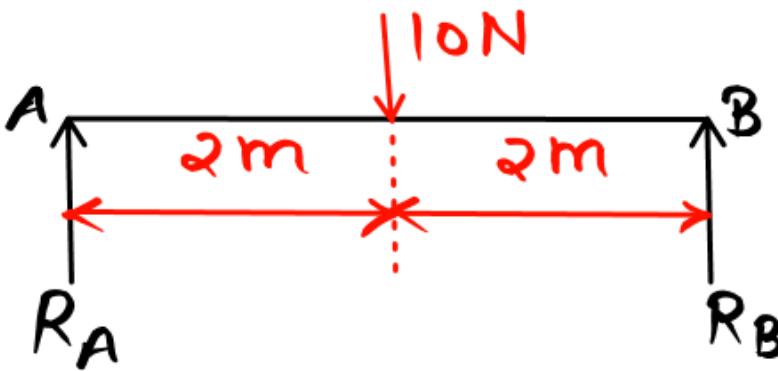
Moment  $M = F \times d$

$$R_A + \frac{W}{2} = W$$

$$R_A = \frac{W - W}{2}$$

$$R_A = \frac{W}{2}$$

Q.1 :-



सन्तुलन के समीक्षा से

$$\sum F_y = 0 \text{ से}$$

$$R_A + R_B - 10 = 0$$

$$R_A + R_B = 10 \text{ N} \quad \text{--- (1)}$$

$\sum M_A = 0$  से (Point A के about moment लेने पर)

$$R_B \times 4 - 10 \times 2 + R_A \times 0 = 0$$

$$4R_B - 20 = 0$$

$$4R_B = 20$$

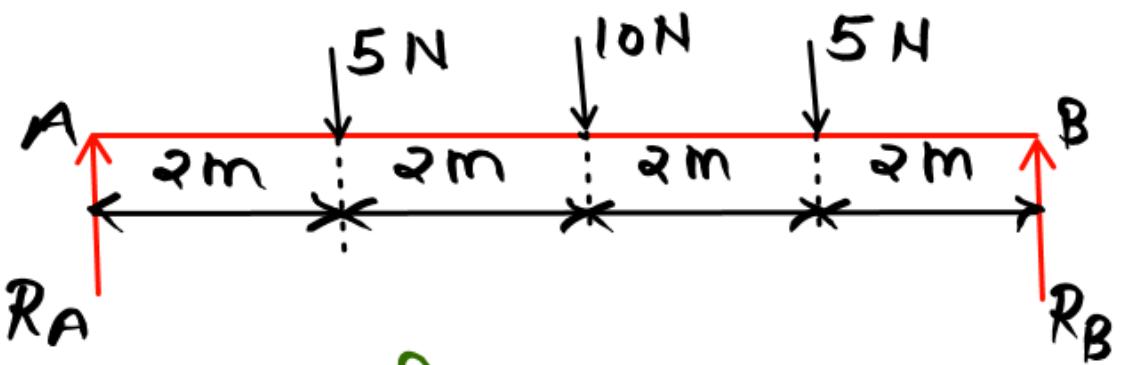
$$R_B = 5 \text{ N} \quad \text{समीक्षा (1) से दर्खता पर}$$

$$R_A + 5 = 10$$

$$R_A = 10 - 5$$

$$R_A = 5 \text{ N}$$

Q.



$$\sum F_y = 0 \text{ से}$$

$$R_A + R_B - 5 - 10 - 5 = 0$$

$$R_A + R_B = 20 \text{ N} \quad \text{--- } ①$$

$\sum M_A = 0$  से Taking moment about Point A

$$R_B \times 8 - 5 \times 6 - 10 \times 4 - 5 \times 2 + R_A \times 0 = 0$$

$$8R_B - 30 - 40 - 10 = 0$$

$$R_A + 10 = 20$$

$$8R_B = 80$$

$$R_A = 10 \text{ N}$$

$$R_B = 10 \text{ N}$$

Put in Eq. ①

Q.

