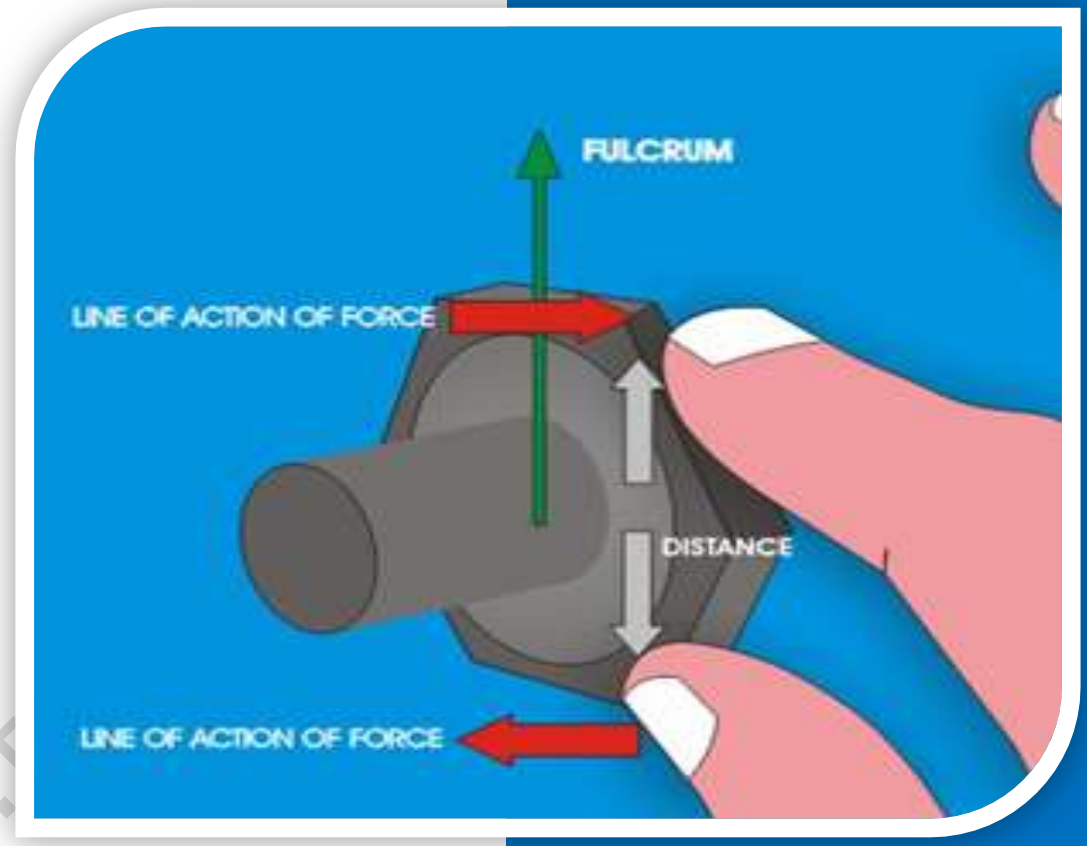
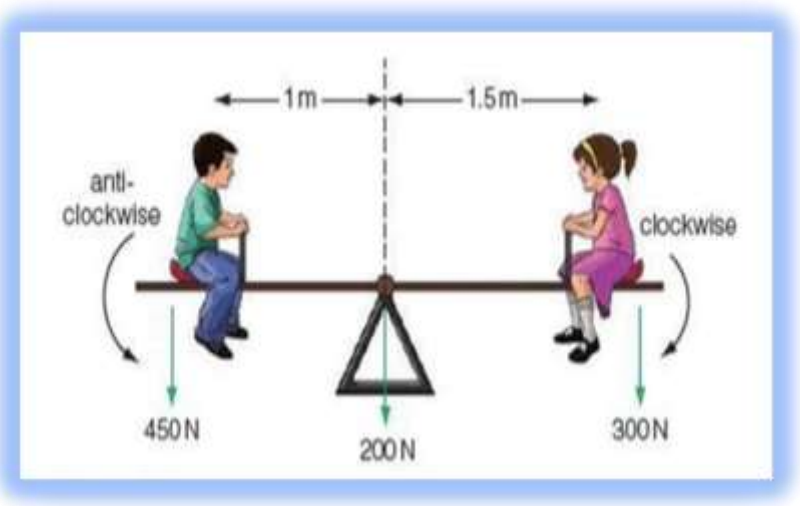
PHYSICS KNOWLEDGEBASE

2020

TURNING EFFECT OF A FORCE





TEACHERS OF PHYSICS
www.teachersofphysics.com
9/10/2020

1. Define the term moments.

✓ ***Is the turning effect of a force***

2. State the principle of moments.

✓ ***The principle of moments states that for a system in equilibrium, the sum of clockwise moments about a point must be equal to the sum of anticlockwise moments about the same point.***

3. Define the term moment of a force.

✓ ***Is the product of the force and the perpendicular distance between the point of support (pivot or fulcrum) and the line of action of the force.***

4. Name four activities which produce a turning effect

i ***Closing opening a door,***
ii ***Steering a car,***
iii ***Turning off a water tap,***
iv ***Cycling or riding on a see-saw,***
v ***Tightening a nut using a spanner***
vi ***Opening a soda bottle.***

5. Why is it very difficult to open a door from a point too close to hinges?

✓ ***This is because more force is applied near the hinges to produce the turning effect since the distance from the pivot is reduced***

6. **Explain** why it is difficult to steer a bicycle by gripping the centre of the handlebars. (2mks)

✓ ***Since the distance from the pivot is reduced, more force is required to steer the bicycle.***

7. A load of **900N** is placed **3m** from a pivot. Calculate the moment due to the load.

Moment of force=force x perpendicular distance from pivot

=900 x 3

=2700Nm

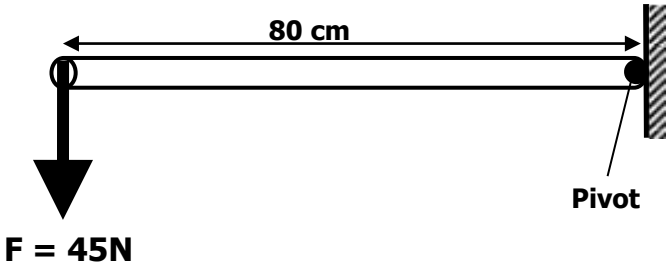
8. A girl of mass **60kg** sits **4m** from a pivot. Calculate the moment due to the girl.

Moment of force=F x d

=(60x10)x4

=2400Nm

9. Calculate the moment due to the force **F** below.

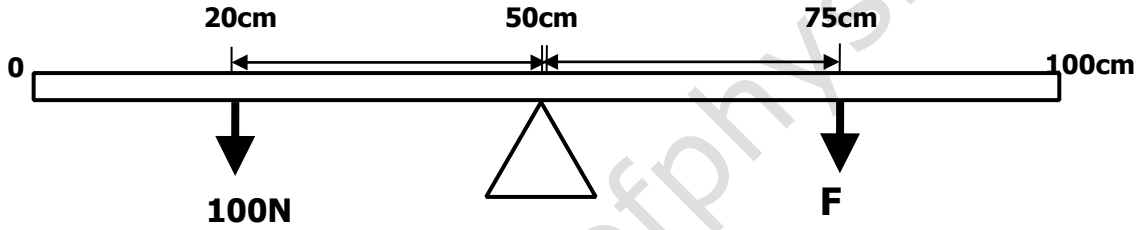


Moment of force=force x perpendicular distance from pivot

= 45x 0.80

=36Nm

10. A uniform meter rule pivoted at its centre is balanced by a force of **100N** at **20cm** and another force of **F** at the **75cm** mark.



(i) Calculate the force **F.**

Sum of Clockwise moments=sum of anticlockwise moments

$F_1d_1=F_2d_2$

$Fx25=100x30$

$F=\frac{100x30}{25}$

$=120N$

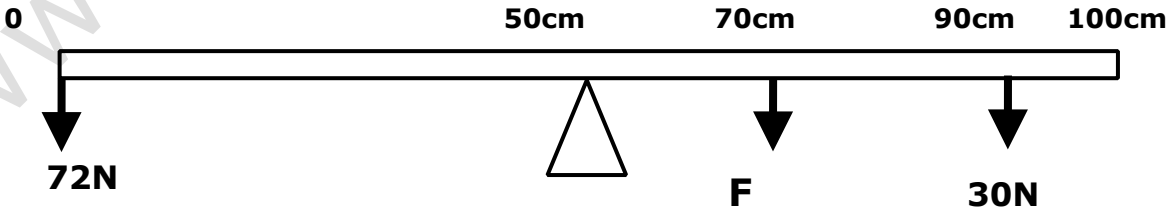
(ii) What is the reaction at the pivot?

Sum of upward forces (reaction)= sum of downward forces

Reaction= 100+120

=220N

11. Three forces are applied on a meter-ruler as shown.



(i) Calculate the force **F.**

$F_1d_1+F_2d_2=F_3d_3$

$20x30+Fx40=72x50$

$600+40F=3600$

$F=\frac{3600-600}{40}$

$=75N$

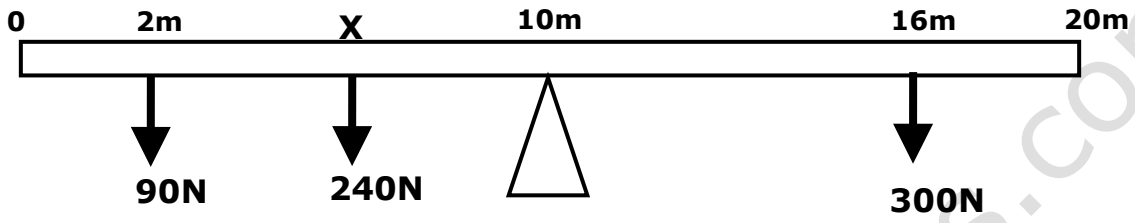
(ii) What is the reaction at the pivot?

Sum of upward forces (reaction)= sum of downward forces (weight)

Reaction=72+30+75

=177N

12. The figure below shows three forces applied on a uniform metal rod of length **20m**.



Calculate the position **X** where the force of **240N** is placed**.**

$F_1d_1+F_2d_2=F_3d_3$

$90x8+240xd_2=300x6$

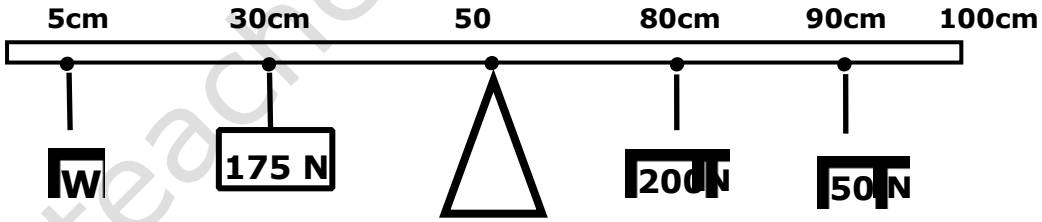
$720+240d_2=1800$

$d_2=4.5m$

$X=10-4.5$

$=5.5m$ ***mark.***

13. The figure below shows a meter rule balanced by four forces at its centre.



(i) Determine the weight **W**.

Sum of clockwise moments=sum of anticlockwise moments

$F_1d_1+F_2d_2=F_3d_3+F_4d_4$

$Wx45+175x20=200x30+50x40$

$45W+3500=6000+2000$

$W=100N$

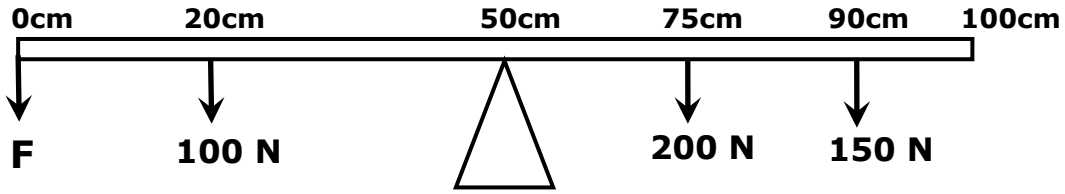
(ii) What is the reaction at the pivot?

Sum of upward forces (reaction)= sum of downward forces (weight)

Reaction=100+175+200+50

=525N

14. The figure below shows a uniform balanced by four forces at its centre. Determine the value of force **F**.



Sum of clockwise moments=sum of anticlockwise moments

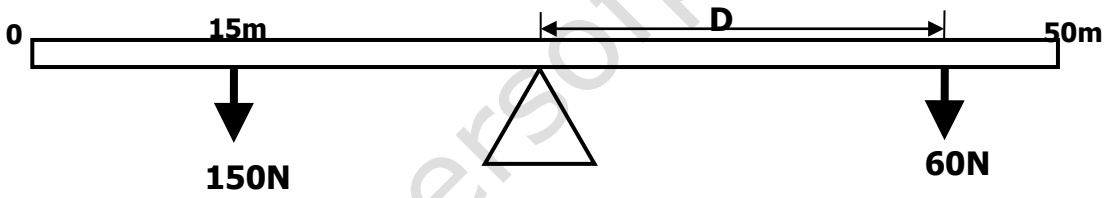
$$F_1d_1+F_2d_2=F_3d_3+F_4d_4$$

$$Fx50+100x30=200x25+150x40$$

$$50F+3000=5000+6000$$

$$F= 160N$$

15. A uniform wooden plank of length **50m** is pivoted at its centre and balanced by a force of **150N** at **15m** mark and another force of **60N** on the other side at a distance **D** from the pivot.



Determine the distance **D**

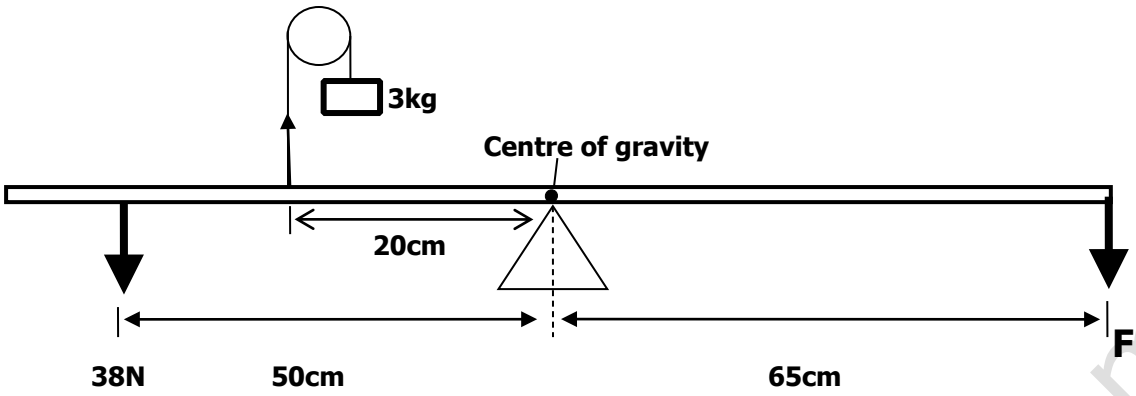
Sum of Clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$60xD=150x10$$

$$D=25m$$

16. The diagram in figure represents a system in equilibrium.



Determine the force, **F** needed to keep the system in equilibrium.

Sum of Clockwise moments=sum of anticlockwise moments

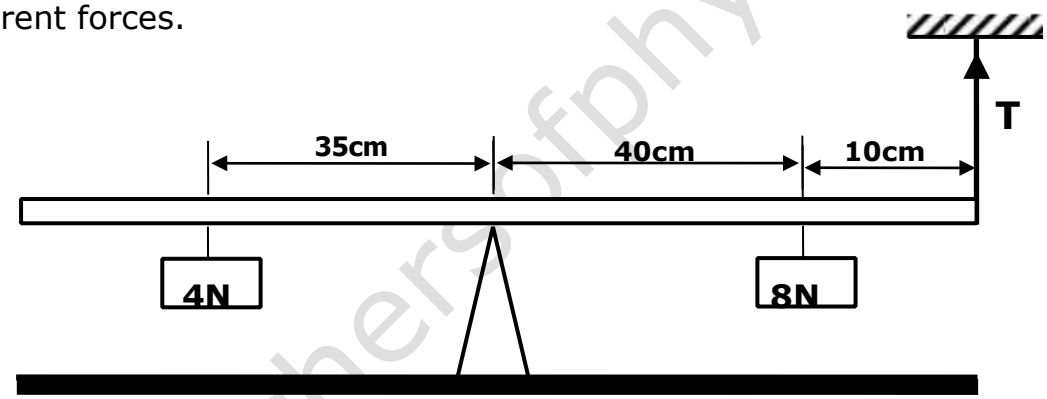
$$F_1d_1+F_2d_2=F_3d_3$$

$$Fx65+30x20=38x50$$

$$65F+600=1900$$

$$F=20N$$

17. The figure below shows a uniform metal rod balanced at the centre by different forces.



Determine the value of **T.** (3mk)

Sum of Clockwise moments=sum of anticlockwise moments

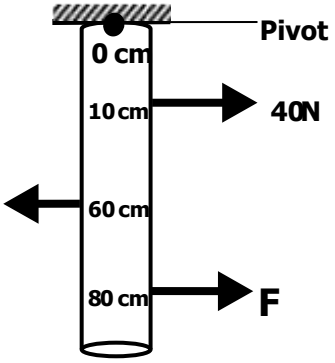
$$F_1d_1=F_2d_2+F_3d_3$$

$$8x40=Tx50+4x35$$

$$320=50T+140$$

$$T=3.6N$$

18. A uniform meter ruler is suspended vertically form a pivot at the **0cm** mark and maintained vertically by three horizontal forces acting at the **10cm** **60cm** and **80cm** as shown below. Calculate the force F acting at the **80cm** mark.



100N

Sum of Clockwise moments= sum of anticlockwise moments

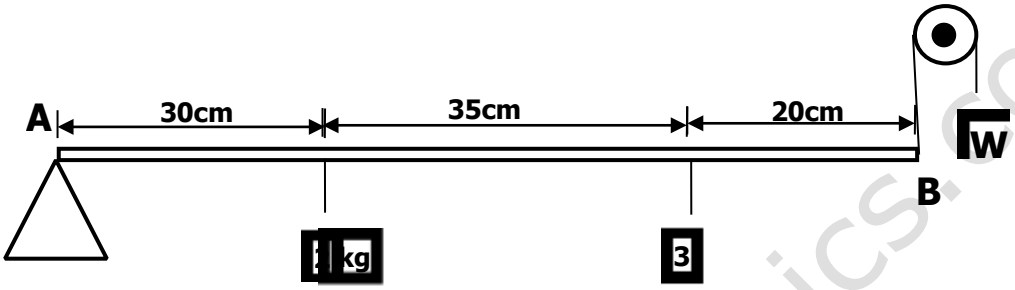
$$F_1d_1=F_2d_2+F_3d_3$$

$$100x60=40x10+Fx80$$

$$600=400+80F$$

$$F=2.5N$$

19. Figure below shows a uniform rod **AB** of negligible weight pivoted at **A**.



If the system is in equilibrium, determine the weight **W** shown in the diagram.

Sum of Clockwise moments=sum of anticlockwise moments

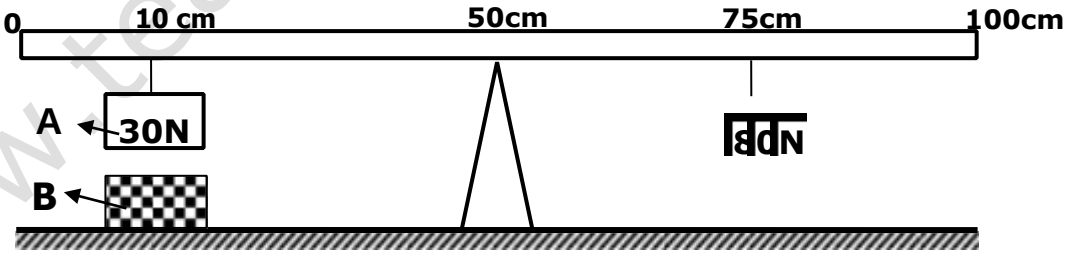
$$F_1d_1+F_2d_2=F_3d_3$$

$$20x30+30x65=Wx85$$

$$600+1950=85W$$

$$W=30N$$

20. The figure below shows a uniform ruler balanced at the centre due to action of some forces as shown. **A** is a magnet of weight **30N** and **B** is a permanent magnet fixed on to the bench.



(i) Determine the force between **A** and **B.**

Sum of Clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$80x25=40xF$$

$$F=50N$$

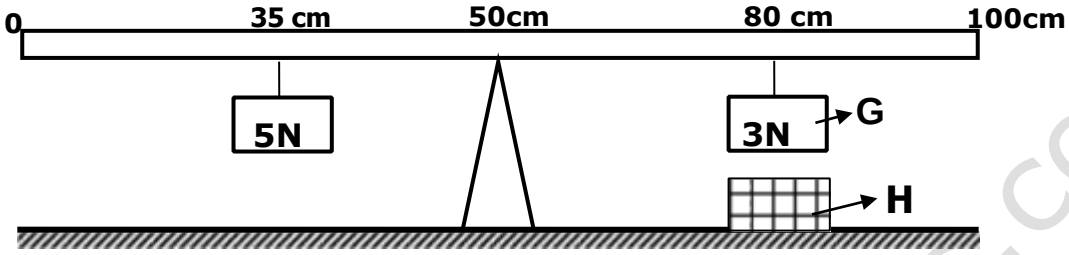
Force between A and B=50-30

=20N

(ii) State the nature of the magnetic force between **A** and **B**.

✓ ***Attraction force***

21. The figure below shows a uniform light rod balanced due to action of two forces shows. **G** is a magnet of weight **3N** and **H** is a permanent magnet fixed on to the bench.



(i) Determine the force between **G** and **H.**

Sum of Clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$Fx30=5x15$$

$$30F=75$$

$$F=2.5N$$

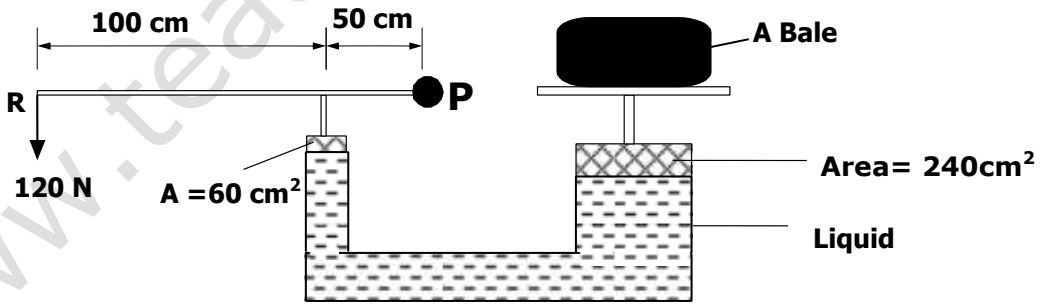
Force between G and H=3-2.5

=0.5N

(ii) State the nature of the magnetic force between **G** and **H**

✓ ***Repulsive force***

22. Figure shows a hydraulic press system using a lever of negligible mass on the side of a small piston pivoted at point **P**. A force of **120N** is applied at **R**.



(i) Calculate the force **F** exerted by small piston on the liquid.

Sum of Clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$Fx50=120x150$$

$$F=360N$$

(ii) Find the weight of the Bale supported by the large piston.

Pressure, P_s exerted on small piston=$\frac{force}{area}$

$$P_s=\frac{360}{0.006}$$

$$P_s=60000N/m^2$$

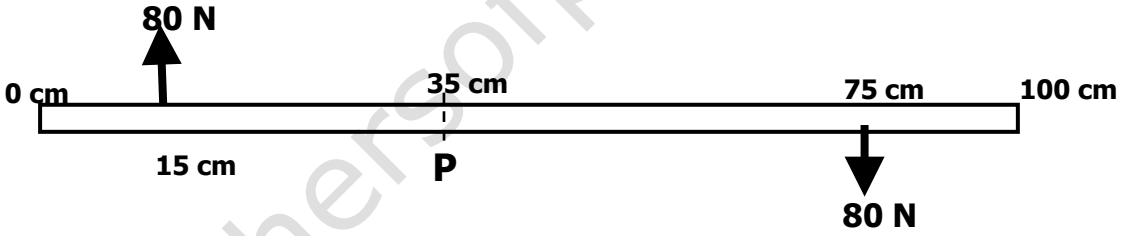
Pressure, P_s exerted on small piston=pressure, P_L exerted on large piston

$$P_L=\frac{weight\ of\ bale}{area\ of\ large\ piston}$$

$$60000=\frac{weight\ of\ bale}{0.024}$$

Weight of bale=1440Kg

23. The figure below shows two equal and opposite forces acting on a meter at the **15cm** mark and **75cm** marks respectively. If each of the forces has a magnitude of **80N**, calculate the moment on the meter rule about **35cm** mark.

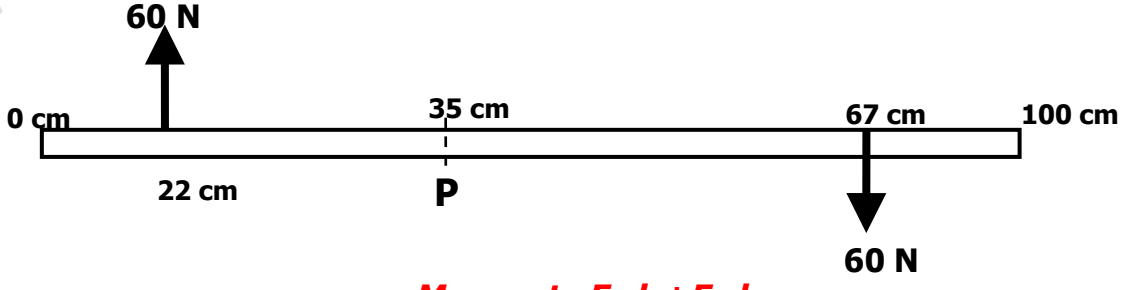


Moment=$F_1d_1+F_2d_2$

=80x0.2+80x0.4

=48Nm

24. The figure below shows two equal and opposite forces acting on a meter at the **22cm** mark and **67cm** marks respectively. If each of the forces has a magnitude of **60N**, calculate the moment on the meter rule about **35cm** mark.

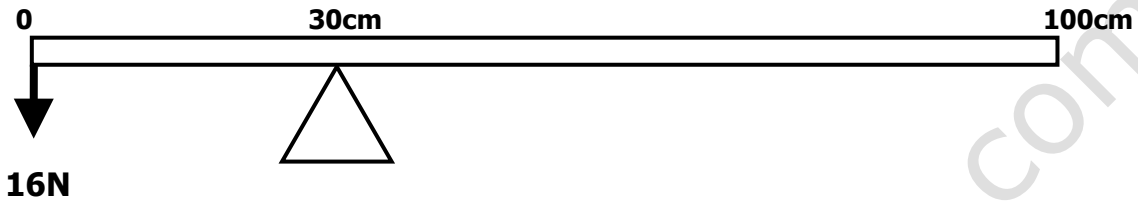


Moment=$F_1d_1+F_2d_2$

=60x0.13+60x0.32

=27Nm

25. A uniform meter rule is pivoted at the **30cm** mark by a force of **16N** placed at the **0cm** mark.



Calculate the weight of the meter rule**.**

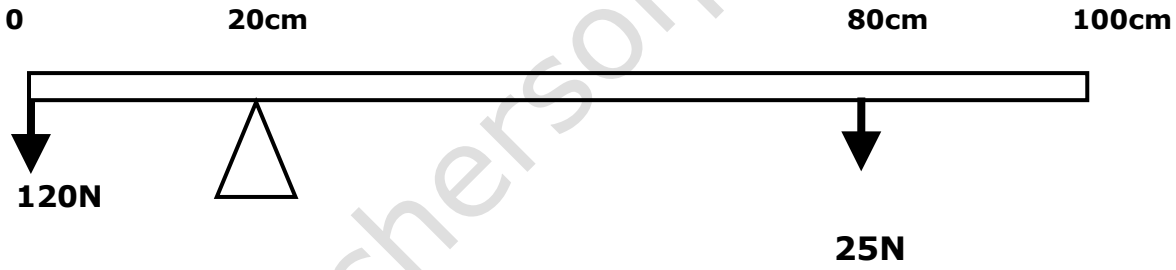
Clockwise moments=anticlockwise moments

F1d1=F2d2

Wx20=16x30

W=24N

26. The figure below shows a meter rule in equilibrium.



i) Calculate the weight of the meter rule**.**

Clockwise moments=anticlockwise moments

F1d1+F2d2=F3d3

Wx30+25x60=120x20

30W+1500=2400

W=30N

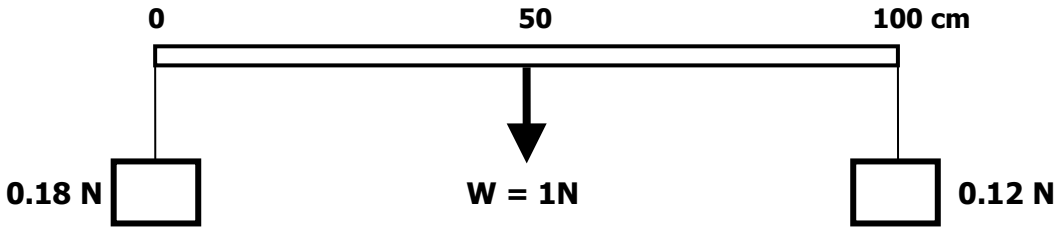
ii) What is the reaction at the pivot?

Sum of upward forces (reaction) = sun of downward forces

Reaction=120+30+25

=175N

27. The figure below shows a uniform meter rule of weight 1N with two weights of weight **0.18N** and **0.12N** suspend from its ends.



Determine how far from the 0.18 N weight a pivot should be placed in order to balance meter rule. (3mk)

Clockwise moments=anticlockwise moments

Clockwise moments=anticlockwise moments

$$F_1d_1+F2d_2=F_3d_3$$

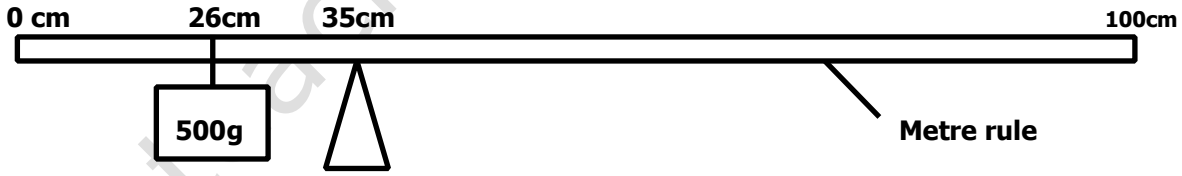
$$0.12(100-d)+1(50-d)=0.18d$$

$$12-0.12d+50-d=0.18d$$

$$1.3d=62$$

D=47.69cm from the 0.18N weight.

28. A metre rule whose centre of gravity is at the **50cm** mark balances at the **35cm** mark when a mass of **500g** is placed at the **26cm** mark as shown the below



Determine the mass of the metre rule.

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$F_1x15=5x9$$

$$F_1=3N$$

$$\text{Mass of metre rule}={}^{3}/_{10}$$

$$=0.3Kg$$

29. The figure below shows a uniform wooden plank of length **80m** and weight **40N** balanced at the **30m** mark as shown. Determine the reading at position **X** where the **60N** weight is placed.

Sum of Clockwise moments=sum of anticlockwise moments

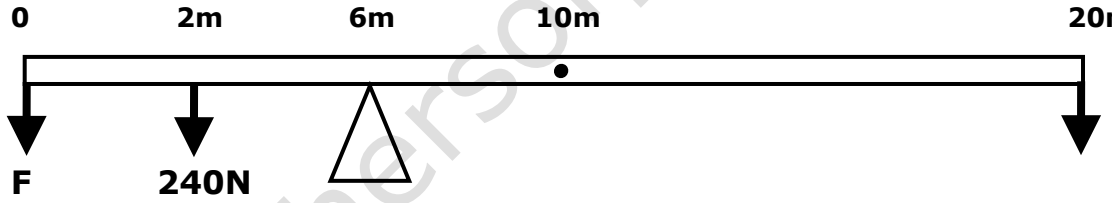
F1d1+F2d2= F3d3

40x10+60(x-30)=160x20

400+60x-1800=3200

X=76.67m mark

30. The figure below shows a uniform metal rod of length **20m** and weight **25N** in equilibrium.



Calculate the force **F.**

Sum of clockwise moments=sum of anticlockwise moments

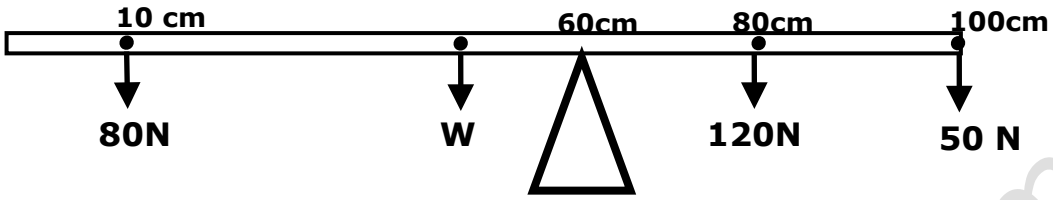
F_1d_1+F2d2=F3d3+F_4d_4

25x4+100x14=240x4+Fx6

100+1400=960+6F

F=90N

31. The figure below shows a meter rule balanced by four forces at its centre.



Determine the weight **W** of the ruler

Sum of clockwise moments=sum of anticlockwise moments

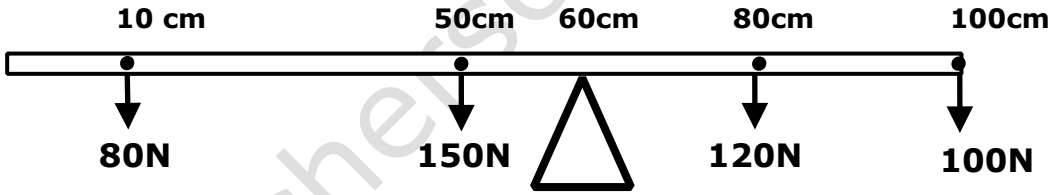
$$F_1d_1+F_2d_2=F_3d_3+F_4d_4$$

$$80x50+Wx10=120x20+50x40$$

$$4000+10W=2400+2000$$

$$W=40N$$

32. The figure below shows a meter rule balanced by four forces of **80N, 150N, 120N,** and **50N**. Determine the weight of the ruler.



Sum of clockwise moments=sum of anticlockwise moments

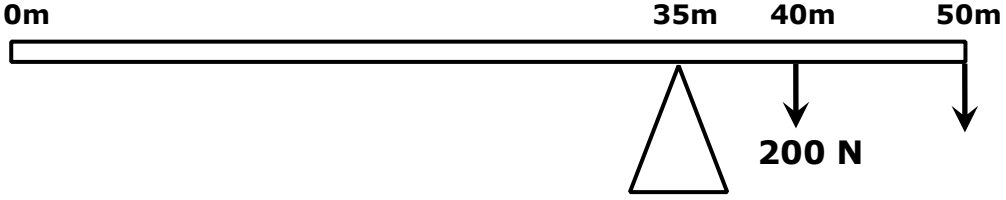
$$F_1d_1+F_2d_2=F_3d_3+F_4d_4$$

$$80x50+10(150+W)=120x20+100x40$$

$$4000+1500+10W=2400+4000$$

$$W=90N$$

33. The figure below shows a uniform metal bar of length 50m in a balanced condition. Determine the weight of the bar.



100 **N**

Sum of clockwise moments=sum of anticlockwise moments

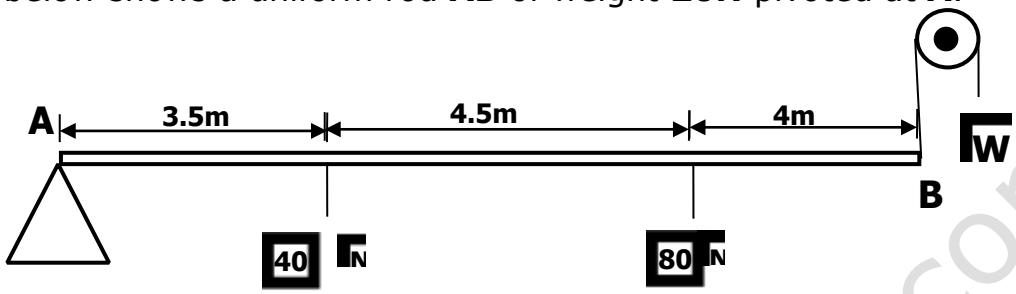
$$F_1d_1=F_2d_2+F_3d_3$$

$$Wx10=200x5+100x15$$

10W=1000+1500

W=250N

34. Figure below shows a uniform rod **AB** of weight **20N** pivoted at **A**.



If the system is in equilibrium, determine the weight **W** shown.

Sum of clockwise moments=sum of anticlockwise moments

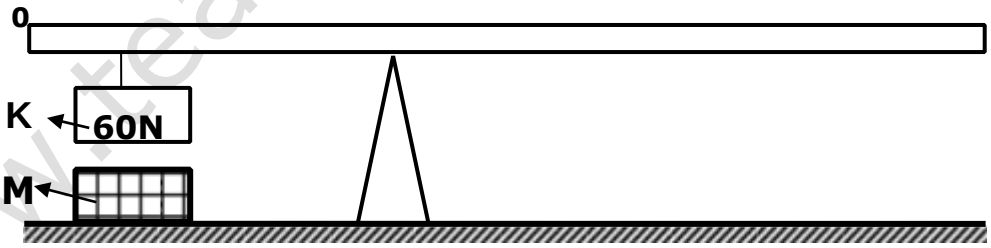
$$F_1d_1+F_2d_2=F_3d_3$$

$$40x3.5+80x8=Wx12$$

$$140+640=12W$$

$$W=65N$$

35. The figure below shows a uniform half meter rule of weight **24N** balanced at the **15cm** mark. **K** is a magnet of weight **60N** and **M** is a permanent magnet fixed on to the bench.



(iii) Determine the force between magnets **K** and **M.**

Sum of clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$Wx6=24x10$$

$$W=40N$$

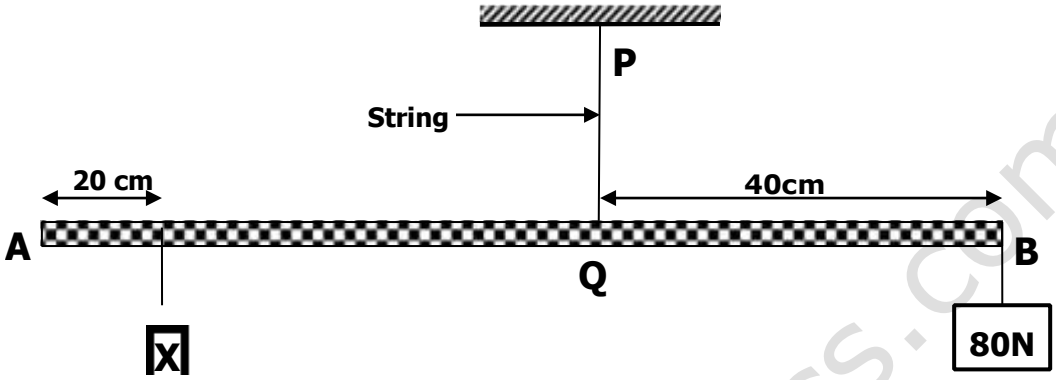
Force between K and M=60-40

=20N

(iv) State the nature of the magnetic force between **K** and **M**.

✓ ***Repulsive force***

36. Fig shows a system in equilibrium with the horizontal rate.



AB is a uniform rule of length **1.0m** and weight **20N**. Calculate the

(i) Weight of block **X**

Sum of clockwise moments=sum of anticlockwise moments

$$F_1d_1+F_2d_2=F_3d_3$$

$$Xx40+20x10=80x40$$

$$40x+200=3200$$

$$X=75N$$

(ii) Tension in the string **PQ**.

Tension=sum of downward forces

$$=75+20+80$$

$$=175N$$

37. A uniform metallic bar of length **100cm** and mass **40kg** is supported horizontally by two vertical spring balances A and B as shown below.

Balance **A** is **20cm** from one end while balance **B** is **30cm** from the other end. Find the reading of each individual balance.

Taking moments about A

Sum of clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

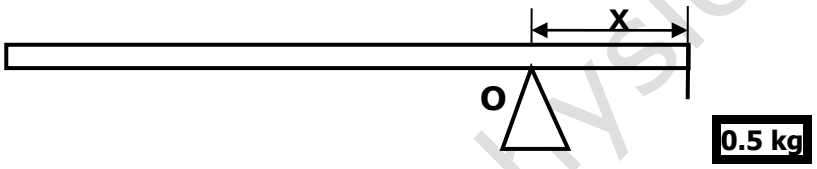
$$400x30=T_Bx50 \text{ where } T_B \text{ is the reading on spring B}$$

$$T_B=240N$$

$$T_A+T_B=400 \text{ where } T_A \text{ is the reading on balance A}$$

$$T_A=160N$$

38. The figure below shows a uniform plank of weight **20N** and length **6m** balanced by a **0.5kg** mass at a distance **X** from the pivot point **O**.



Determine the value of **X**

Sum of clockwise moments=sum of anticlockwise moments

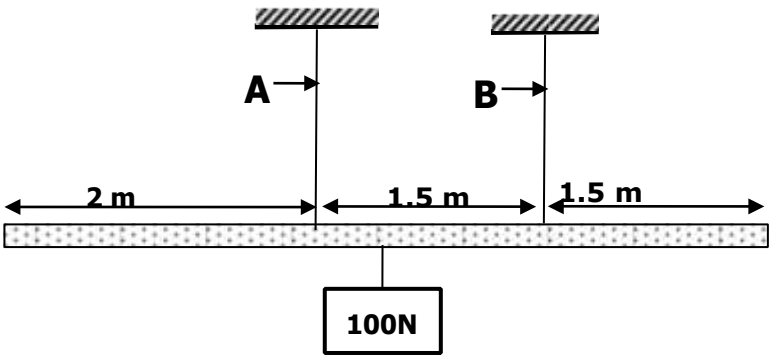
$$F_1d_1=F_2d_2$$

$$20(3-x)=5xx$$

$$60-20x=5x$$

$$X=2.4m$$

39. A uniform plunk of wood weighing **50N** and of length **5m** is suspended by two ropes, **A** and **B. A** is at **2m** from one end while B is at **1.5m** from the other end as shown below. A concrete block of weight **100N** is suspended from the centre of the plunk



Calculate the tension on the string **A**

Taking moments about string B

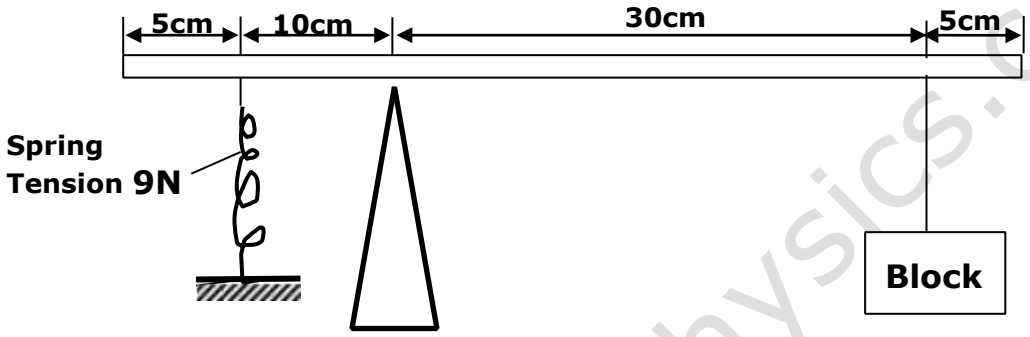
Sum of clockwise moments=sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$1.5xT_A=150x1 \text{ where } T_A \text{ is the tension on string A}$$

$$TA=100N$$

40. The figure shows a uniform half metre rod that is balanced over a pivot using a block of weight **2N** and a spring



Given that the tension in the spring is **9N**, determine the weight of the rod.

Sum of clockwise moments=sum of anticlockwise moments

$$F_1d_1+F_2d_2=F_3d_3$$

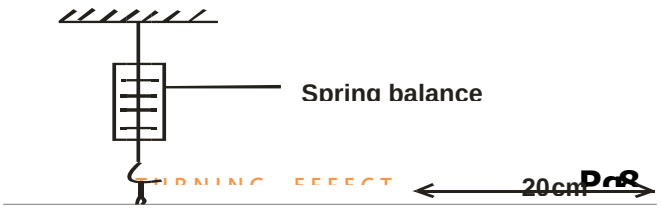
$$Wx10+2x30=10x9$$

$$10W+60=90$$

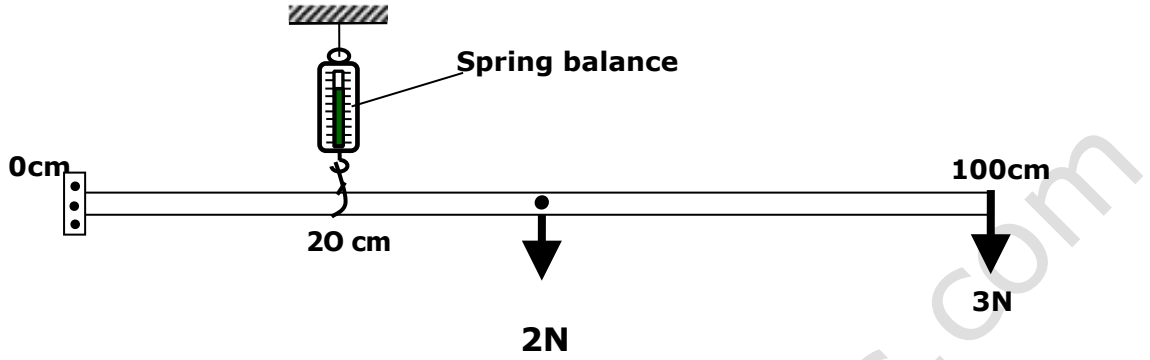
$$W=3N$$

41. Figure shows a uniform bar of length 1.0 m pivoted near one end. The bar is kept in equilibrium by a spring balance as shown:

Given that the reading of the spring balance is 0.6 N, determine the reaction force at the pivot.



42. The figure below shows a uniform meter rule of weight **2N** kept at equilibrium by a vertical spring balance hung at **20cm** mark. A weight of **3N** is hung at **100cm** mark and the other end pivoted by a hinge at **0 cm** as shown.



Calculate the reading of the spring balance.

Taking moments about 0cm mark

Sum of clockwise moments=sum of anticlockwise moments.

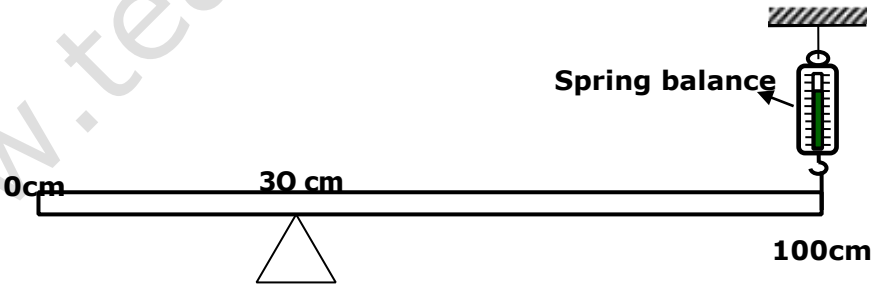
$F_1d_1+F_2d_2=F_3d_3$

2x50+3x100=F_3x20 where F_3 is the reading on the spring balance

$100+300=20F_3$

$F_3=20N$

43. The figure below shows a uniform metre rule which is pivoted at **30.0cm** mark. The spring balance is fastened at the **100cm** mark and it is at equilibrium when the spring balance records **1.2N**. Determine the weight of the metre rule.



Sum of clockwise moments=sum of anticlockwise moments

$F_1d_1=F_2d_2$

F_1x20=1.2x70 where F_1 is the weight of the metre rule

$20F_1=84$

$F_1=4.2N$

44. The figure below shows a uniform meter rule balanced at the 30cm mark by the forces shown. Determine the weight of the meter rule. **(4mk)**

Sum of clockwise moments=sum of anticlockwise moments.

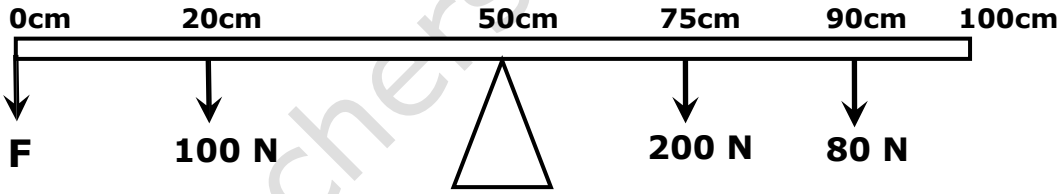
$$F_1d_1+F_2d_2=F_3d_3$$

$$F_1x20+30x50=120x20 \text{ where } F_1 \text{ is the weight of metre rule}$$

$$20F_1+1500=2400$$

$$F_1=45N$$

45. The figure below shows a meter rule balanced by four forces at its centre. Determine the value of force **F**. **(4mk)**



Sum of clockwise moments=sum of anticlockwise moments.

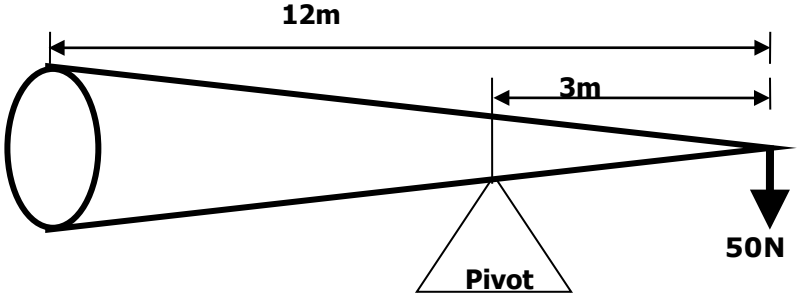
$$F_1d_1+F_2d_2=F_3d_3+F_4d_4$$

$$Fx50+100x30=200x25+80x40$$

$$50F+3000=5000+3200$$

$$F=104N$$

46. The figure shows a regular solid cone in equilibrium



Determine the weight of the cone.

Sum of clockwise moments=sum of anticlockwise moments.

$$F_1d_1=F_2d_2$$

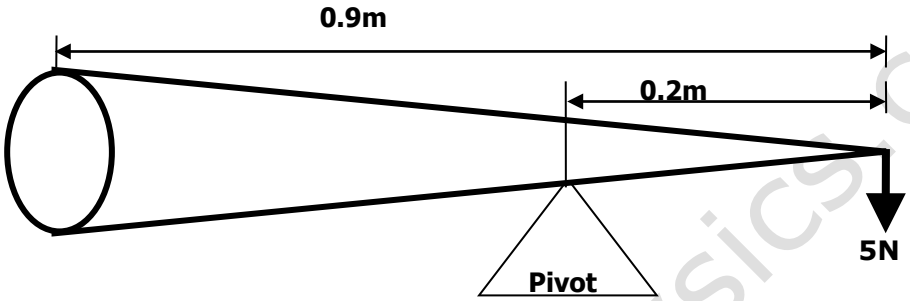
$$50x3=F_2x5 \text{ where } F_2 \text{ is the weight of cone}$$

NB: the cog of a cone is at a point 1/3 of its length

$$5F_2=150$$

$$F_2=30N$$

47. Figure 2 show a solid cone which has a uniform density in equilibrium



Determine the weight of the cone (3mk)

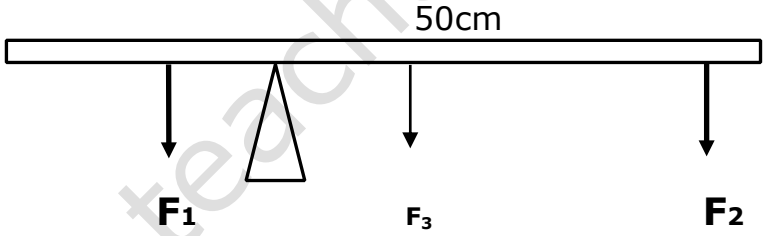
Sum of clockwise moments=sum of anticlockwise moments.

$$F_1d_1=F_2d_2$$

$$5x0.2=F2x0.4$$

$$F2=2.5N$$

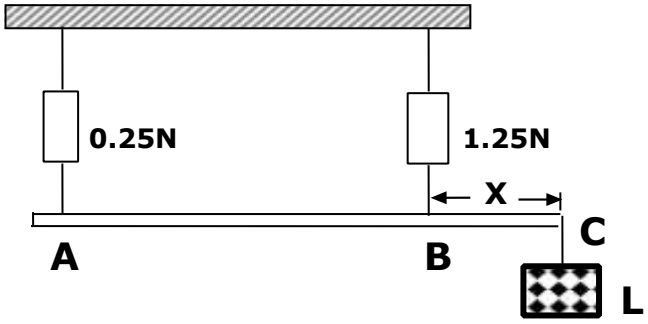
48. The figure below shows force $\mathbf{F_1}$ and $\mathbf{F_2}$ acting on a metre rule such that it is in equilibrium.



Mark on the figure a third force $\mathbf{F_3}$ acting on the rule such that the equilibrium is maintained.

✓ ***F_3 is the force due to the weight of metre that acts through the centre***

49. The figure below shows a uniform metre rule of weight **1.0N** suspended from spring balances. A load is attached to the extreme right hand end **C**. The spring balance attached to the extreme left hand end of the rule **(A)** reads **0.25N.** The spring balance attached at **B** a distance **X** from the right hand end reads **1.25N.**



(i) Calculate the weight of load **L** (2mks)

Sum of upward forces = sum of downward forces

Load L +1=0.25+1.25

Load L=0.5N

(ii) Determine the value of distance **X** by taking moments about **A** (3Mks)

Taking moments about A

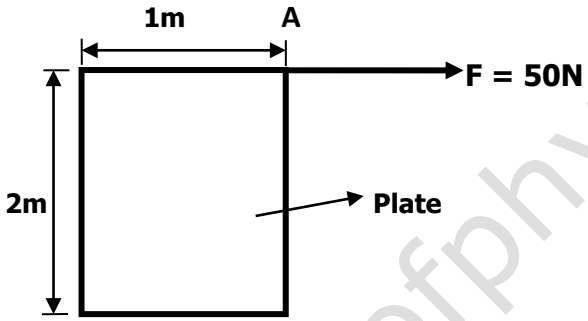
Sum of clockwise moments=sum of anticlockwise moments

1x50+0.5x100=1.25x(100-x)

50+50=125-1.25x

X=20cm

50. The figure below shows a metal plate 2 m long, 1m wide and negligible thickness. A horizontal force of 50 N applied at point 'A' Just makes the plate tilt.



Calculate the weight of the plate.

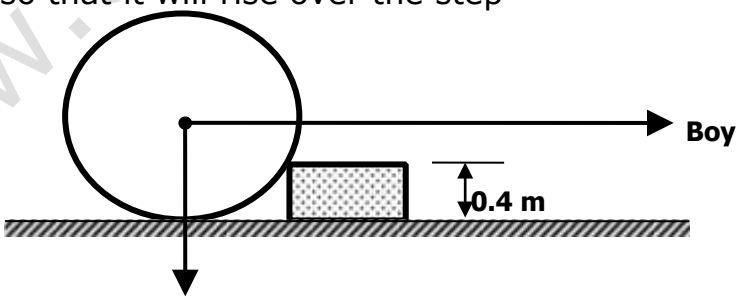
(3mk)

Sum of clockwise moments=sum of anticlockwise moments

50x2=Wx1 where W is the weight of the plate

W=100N

51. The figure below shows a wheel of mass **10kg** and radius **1 m** being pulled by a boy against a step **0.4 m** high. What force is just sufficient to turn the wheel so that it will rise over the step



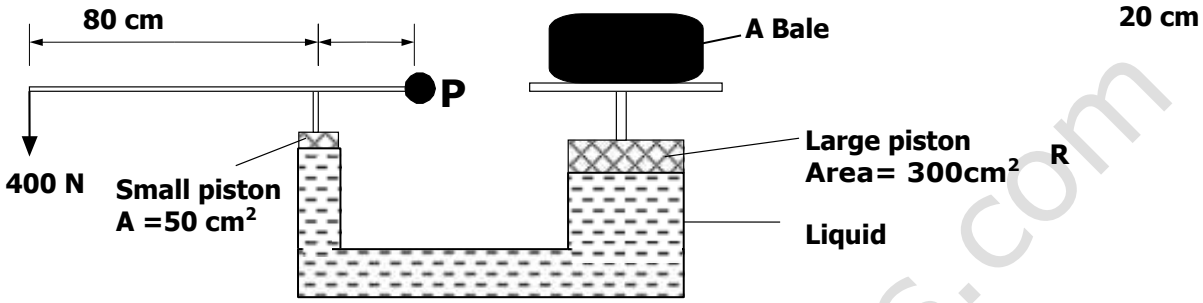
Sum of clockwise moments=sum of anticlockwise moments

Fx0.6=100x($\sqrt{(1^2-0.6^2)}$)

0.6F=100x0.8

F=133.33N

52. Figure shows a hydraulic press system using a lever of negligible mass on the side of a small piston pivoted at point **P**. A force of **400N** is applied at **R**.



(i) Calculate the force **F** exerted by small piston on the liquid due to the lever. (4mk)

Taking moments about p

Sum of clockwise moments= sum of anticlockwise moments

$F_1d_1=F_2d_2$

$Fx20=400x100$

$F=2000N$

(ii) Find the weight of the Bale supported by the large piston. (4mk)

Pressure exerted by the small piston

$P=\frac{F}{A}$

$=\frac{2000}{0.005}$

$=400000N/m^2$

Pressure exerted is equally transmitted

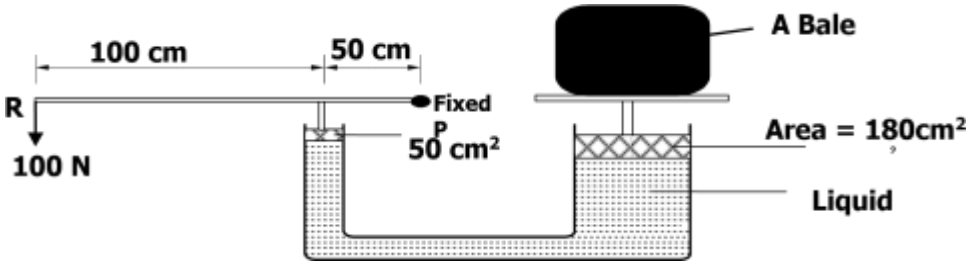
$400000=\frac{weight}{0.03}$

$Weight=12000N$

(iii) State two properties of the liquid used as the brake fluid (2mk)

- ✓ ***Should be incompressible***
- ✓ ***Should not corrode the parts of the system***
- ✓ ***Should have low freezing point and high boiling point***

53. Figure shows a hydraulic press system using a lever of negligible mass on the side of a small piston pivoted at point **P**. A force of 100N is applied at **R**.



(i) Calculate the force **F** exerted by small piston on the liquid.(2 mk)

Taking moments about p

Sum of clockwise moments= sum of anticlockwise moments

$F_1d_1=F_2d_2$

$Fx50=100x150$

$50F=15000$

$F=300N$

(ii) Find the weight of the Bale supported by the large piston.(2 mk)

Pressure exerted by small piston= $\frac{300}{0.005}$

$=60000N/m^2$

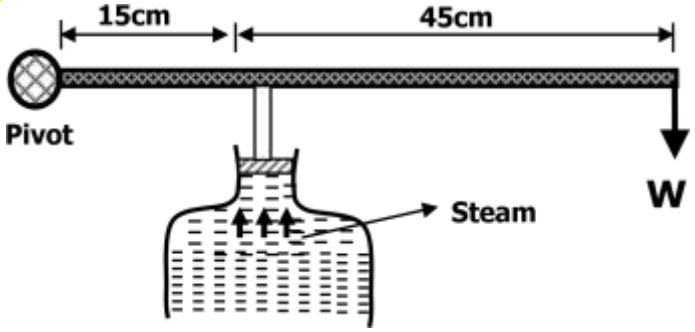
Pressure exerted at one point is equally transmitted

Pressure exerted by large piston= $60000N/m^2$

$60000=\frac{weight}{0.018}$

Weight=1080N

54. The figure shows a device for closing a steam outlet. The area of the piston is **$4.0 \times 10^{-4}m^2$** and the pressure of the steam in the boiler is **$2.0 \times 10^5Nm^{-2}$**. Determine the weight **W** that will just hold the bar in the horizontal position shown.



55. A see – saw of length **5m** is pivoted at the centre. A student of mass **50kg** sits at one end and is balanced by another student of mass 'm' sitting at a distance of **1m** from the other end. Calculate the value of **'m'**

Sum of clockwise moments= sum of anticlockwise moments

$$F_1d_1=F_2d_2$$
$$500x2.5=F_2x1.5$$
$$F_2=833.33N$$
$$M=833.33/10$$
$$=83.33Kg$$

56. A mass of **100g** is placed on a **20cm** mark and a mass of **50g** on a **40cm** mark of a uniform metre rule which is balanced at its centre. Where should a further **100g** mass be placed to balance the arrangement?

Sum of clockwise moments= sum of anticlockwise moments

$$F_1d_1+F_2d_2=F_3d_3$$
$$1x30+0.5x10=1xd_3$$
$$30+5=d_3$$
$$d_3=35cm$$

further 100g mass is placed at 50+35=85cm mark

57. A meter rule of negligible weight is balanced by masses of **24N** and **16N** suspended from its ends. Find the position of the pivot.

Sum of clockwise moments= sum of anticlockwise moments

$$F_1d_1=F_2d_2$$
$$24xX=16(100-X)$$
$$24X=1600-16X$$
$$40X=1600$$
$$X=40$$

Position of pivot=40cm mark

58. A half meter rule is balanced at the **15cm** mark when a load of **1.2N** is hung at the zero mark. Calculate the weight of the half meter rule. (3mk)

Sum of clockwise moments= sum of anticlockwise moments

$$F_1d_1=F_2d_2$$
$$1.2x15=F_2x10$$
$$F_2=1.8N$$

Weight of metre rule =1.8N

59. Two men **P** and **Q** carried a uniform ladder **3.6 m** long weighing **1200N**. **P** held the ladder from one end while **Q** supported the ladder at a point **0.4m** from the other end. Calculate the load supported by each man.

Taking moments about p

Sum of clockwise moments= sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$1200x1.8=3.2xL_Q \text{ where } L_Q \text{ is the load supported by Q}$$

$$L_Q=675N$$

$$L_P+L_Q=1200 \text{ where } L_P \text{ is the load supported by P}$$

$$L_P+675=1200$$

$$L_P=525N$$

60. A 20m uniform plank AB of mass 20Kg is put on a wedge such that it does not balance horizontally. Three pupils of mass 50Kg, 35Kg and 30Kg sit on the plank at a distance 3m, 7m and 18.5m respectively from A. How far must the wedge be placed from A for the arrangement to balance horizontally?

(3 mk)

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1+F_2d_2=F_3d_3+F_4d_4$$

$$500(4+x)+350xX=200(3-x)+300(11.5-x)$$

$$2000+500x+350x=600-200x+3450-300x$$

$$1350x=2050$$

$$X=1.52$$

Wedge position=7+1.52

=8.52m mark from A

61. A uniform half metre rule of mass **37.5g** is freely pivoted at **10cm** mark. At what mark should a body of mass **75g** be suspended for the system to balance

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$0.75xd_1=0.375x15$$

$$d_1= 7.5cm$$

75g mass is suspended at 10-7.5=2.5cm mark

62. A uniform metre rule is balanced at the 20cm mark when a load of 1.2N is hung at the zero mark. Calculate the weight and mass of the metre rule. (3mk)

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$F_1x30=1.2x20$$

$$F_1=0.8N$$

Mass of metre rule=0.8/10

=0.08Kg

63. A uniform metre rule pivoted at its **15cm** mark is balanced by a **200g** mass suspended at the **5cm** mark. Determine the weight of the metre rule.

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1=F_2d_2$$

$$2x10=F_2x35$$

$$F_2=0.571N$$

64. A mass of **100g** is placed on a **20cm** mark and a mass of **50g** on a **40cm** mark of a uniform metre rule which is balanced at its centre. Where should a further **100g** mass be placed to balance the arrangement? (3mk)

Sum of clockwise moments = sum of anticlockwise moments

$$F_1d_1+F_2d_2=F_3d_3$$

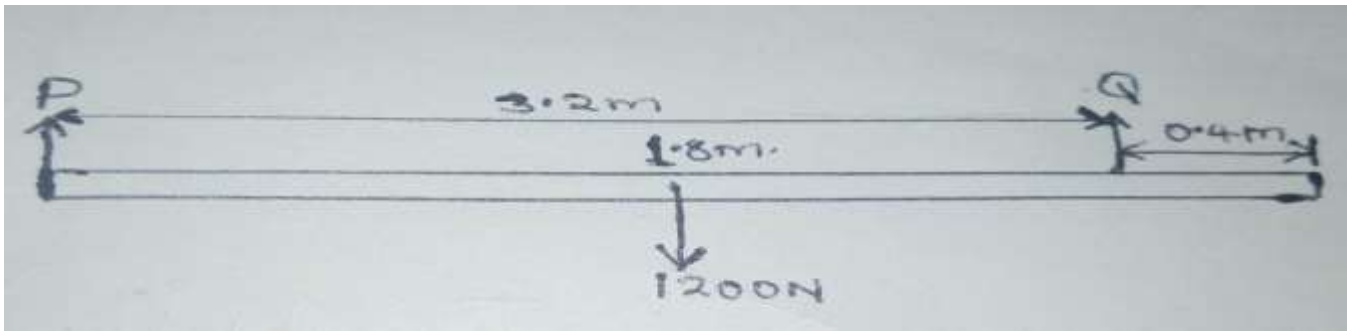
$$1x30+0.5x10=1\times x$$

X=35cm

Further 100g mass is placed at 85cm mark

65. Two men **P** and **Q** carried a uniform ladder **3.6 m** long weighing **1200N**. **P** held the ladder from one end while **Q** supported the ladder at a point **0.4m** from the other end.

(i) Sketch a diagram showing the forces acting on the ladder.



(ii) Calculate the load supported by each man.

Taking moments about p

Sum of clockwise moments= sum of anticlockwise moments

$F_1d_1=F_2d_2$

$1200x1.8=3.2xL_Q$ ***where*** L_Q ***is the load supported by Q***

$L_Q=675N$

$L_P+L_Q=1200$ ***where*** L_P ***is the load supported by P***

$L_P+675=1200$

$L_P=525N$

66. A uniform **half- metre** rod is balanced by a weight of **38N** at one end. If the pivot is placed **10cm** from the same end, calculate the weight of the rod.

Sum of clockwise moments=sum of anticlockwise moments

$F_1d_1=F_2d_2$

$38x10=F_2x15$

$F_2=25.33N$

Weight of rod=25.33N

67. With the metre rule remaining on the knife-edge at the 30 cm mark, a mass of 125g is suspended from the 70 cm mark. The mass of 500g is moved until the rule is balanced. Determine the new position of the 500g mass

