For Ex. CG of Mount Everest is not located at its CM, because for the whole body of Mt. Everest value of g cannot be considered constant.

vary from one point of the body to the other. If the body is so extended that **g** varies from part to part of the body, then the centre of gravity and centre of mass will not coincide. Basically, the two are different concepts. The centre of mass has nothing to do with gravity. It depends only on the distribution of mass of the body.

In Sec. 7.2 we found out the position of the centre of mass of several regular, homogeneous objects. Obviously the method used there gives us also the centre of gravity of these bodies, if they are small enough.

Figure 7.25 illustrates another way of determining the CG of an irregular shaped body like a cardboard. If you suspend the body from some point like A, the vertical line through A passes through the CG. We mark the vertical AA_1. We then suspend the body through other points like B and C. The intersection of the verticals gives the CG. Explain why the method works. Since the body is small enough, the method allows us to determine also its centre of mass.

Example 7.8 A metal bar 70 cm long and 4.00 kg in mass supported on two knife-edges placed 10 cm from each end. A 6.00 kg load is suspended at 30 cm from one end. Find the reactions at the knife-edges. (Assume the bar to be of uniform cross section and homogeneous.)

Answer

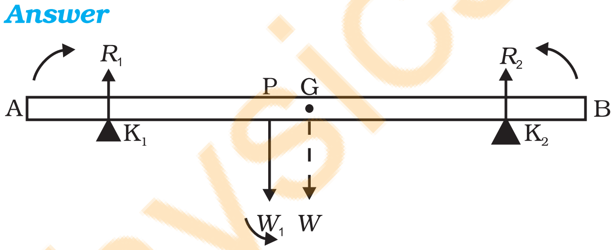

Fig. 7.26

Figure 7.26 shows the rod AB, the positions of the knife edges K_1 and K_2 , the centre of gravity of the rod at G and the suspended load at P.

Note the weight of the rod W acts at its centre of gravity G. The rod is uniform in cross section and homogeneous; hence G is at the centre of the rod; AB = 70 cm. AG = 35 cm, AP = 30 cm, PG = 5 cm, AK_1 = BK_2 = 10 cm and K_1G = K_2G = 25 cm. Also, W= weight of the rod = 4.00 kg and W_1= suspended load = 6.00 kg; R_1 and R_2 are the normal reactions of the support at the knife edges.

For translational equilibrium of the rod,

$R_1 + R_2 - W_1 - W = 0$ (i)

Note W_1 and W act vertically down and R_1 and R_2 act vertically up.

For considering rotational equilibrium, we take moments of the forces. A convenient point to take moments about is G. The moments of R_2 and W_1 are anticlockwise (+ve), whereas the moment of R_1 is clockwise (-ve).

For rotational equilibrium,

$-R_1 (K_1G) + W_1 (PG) + R_2 (K_2G) = 0$ (ii)

It is given that $W = 4.00g$ N and $W_1 = 6.00g$ N, where g = acceleration due to gravity. We take $g = 9.8\ \mathrm{m/s^2}$.

With numerical values inserted, from (i)

$R_1 + R_2 - 4.00g - 6.00g = 0$

or $R_1 + R_2 = 10.00g$ N (iii)

$= 98.00$ N

From (ii), $-0.25\ R_1 + 0.05\ W_1 + 0.25\ R_2 = 0$

or $R_1 - R_2 = 1.2g$ N $= 11.76$ N (iv)

From (iii) and (iv), $R_1 = 54.88$ N,

$R_2 = 43.12$ N

Thus the reactions of the support are about 55 N at K_1 and 43 N at K_2.

Example 7.9 A 3m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall as shown in Fig.7.27. Find the reaction forces of the wall and the floor.

Answer

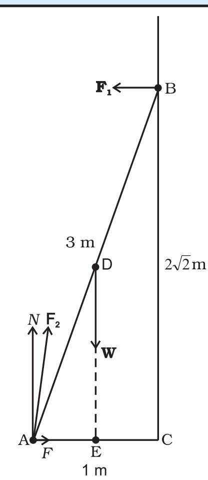

Fig. 7.27

The ladder AB is 3 m long, its foot A is at distance AC = 1 m from the wall. From