d. A $550N$ physics student stands on a bathroom scale in an elevator. As the elevator starts moving the scale reads $450N$. Draw free body diagram of the problem and find the magnitude and direction of the acceleration of the elevator.

8. Find the torque of a force $2\hat{\imath} + 3\hat{\jmath} - 4\hat{k}$ about the origin which acts on a particle whose position vector is $\hat{\imath} + 2\hat{\jmath} - \hat{k}$.

9. Two people are carrying a uniform wooden board that is $3m$ long and weights $160N$ if one person applies an upward force equal to $60N$ at one end, at what point does the other person lift?

10. Free body diagram is a graphical illustration used to visualize the applied forces, using free body diagram technique solve the following problems,

    a. A chair of mass 10kg is sitting on a horizontal floor which is not frictionless. You push on the chair with a constant force of magnitude 30N which is directed at an angle of 30^0 below the horizontal and chair slides along the floor. Draw free body diagram and calculate normal force that the floor exerts on the chair.

    b. In a physics lab experiment, a 6kg box is pushed across a flat table by a horizontal force F.
       i.   If the box is moving at a constant speed of 0.35m/s and the coefficient of kinetic friction is 0.12, What is the magnitude of F?
       ii. If the box is speeding up with a constant acceleration of $0.18m/s^2$, what will be the magnitude of F?

    c. Two masses $10kg$ and $15kg$ are connected at the two ends of a light inextensible string that passes over a frictionless pulley. Using free body diagram method, find the acceleration of masses and the tension in the string, when the masses are released.
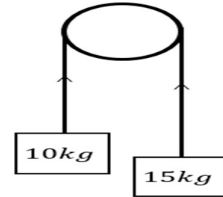
    d. A block of mass m_1, is lying on frictionless plane inclined at an angle of 30^0. It is connected to another block of mass m_2, with the help of a string passing over a pulley. If $m_1 = 6kg$ and $m_1 = 8kg$ then calculate the tension and acceleration of the each block.
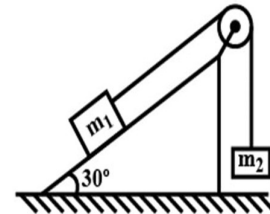
    e. Two bodies of masses $4kg$ and $5kg$ are tied to a string as shown in figure. If the table and pulley both are smooth, find the acceleration of the masses and the tension in the string.
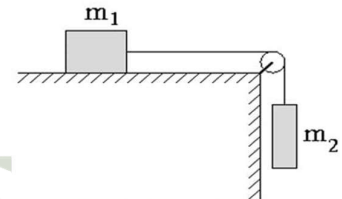
    f. A block of mass $10kg$ is kept on a rough inclined plane as shown in figure. A force of $3N$ is applied on the block. The coefficient of static friction is 0.6. What should be the minimum value of force P, such that the block does not move downward?
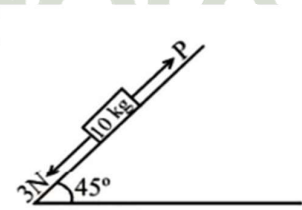
Some additional short questions:

    a. What is equilibrium? Write the conditions for a body to be in stable equilibrium.
    b. Can a body be in equilibrium if it is in motion? Explain.
    c. Why does a man carry a load on his back lean forward?
    d. Why horse is more stable than a man?
    e. What is moment of force? Why is it difficult to open and close a door by applying force near a hinge?
    f. Write down the differences between centre of gravity and centre of mass.