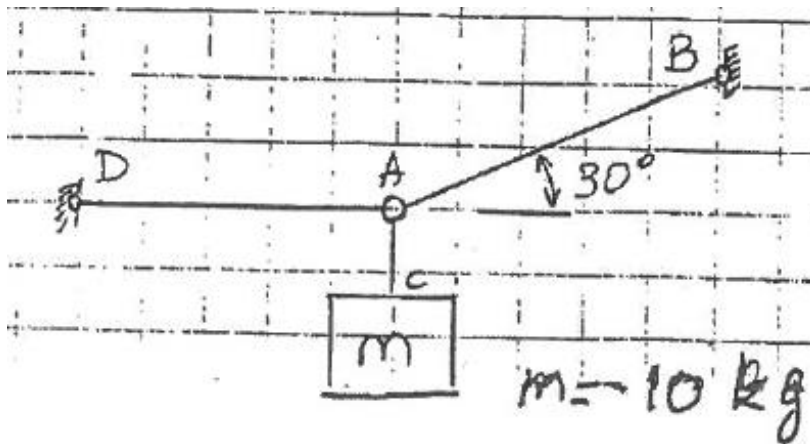
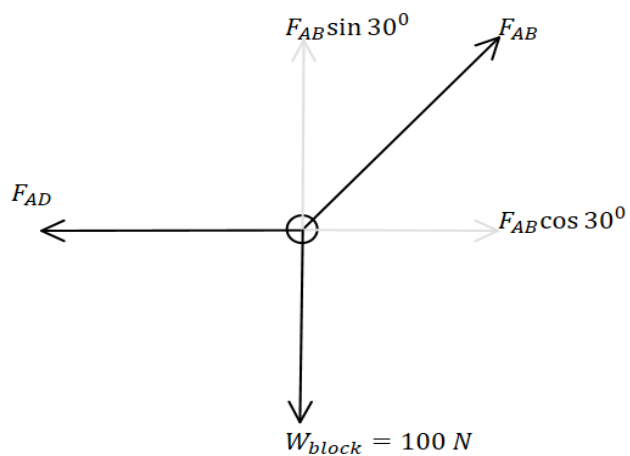


ES 221 MECHANICS I (STATICS) RECITATION III

Q1)

Determine the tension in cords AB and AD.

**Answer to Q1**Free Body Diagram of Point A:

$$\sum F_x = 0$$

$$F_{AB} \cos 30^\circ - F_{AD} = 0$$

$$\sum F_y = 0$$

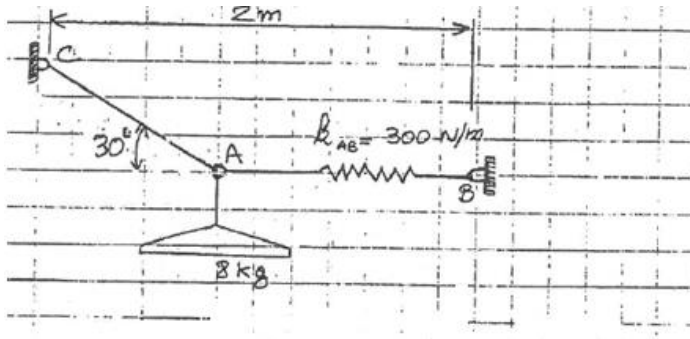
$$F_{AB} \sin 30^\circ - 100 \text{ N} = 0$$

$$F_{AB} = 200 \text{ N}$$

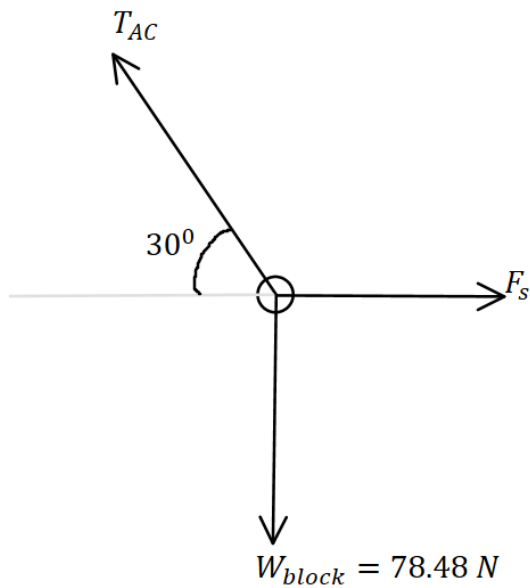
$$F_{AD} = 173.2 \text{ N}$$

Q2)

Determine the required length of cord AC. The unstretched length of spring AB is 0.4m.



Answer to Q2



$$\frac{78.48 \text{ N}}{\sin 150^\circ} = \frac{T_{AC}}{\sin 90^\circ} = \frac{F_s}{\sin 120^\circ}$$

$$F_s \approx 136 \text{ N}$$

$$F_s = kx = 300 \frac{\text{N}}{\text{m}} \times x_s$$

$$x_s = 0.453 \text{ m}$$

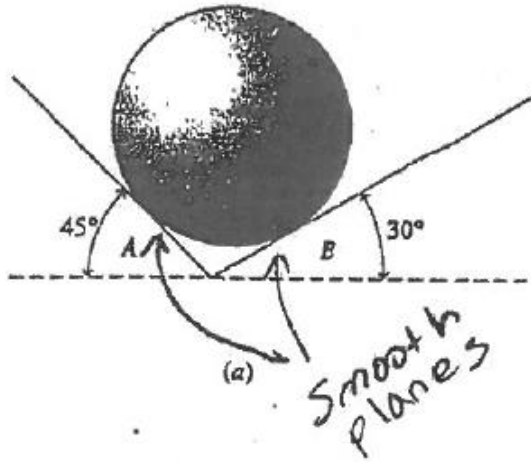
$$x_{total} = x_u + x_s = 0.4 \text{ m} + 0.453 \text{ m} = 0.853 \text{ m}$$

$$l_{AC} \times \cos 30^\circ = 2 \text{ m} - 0.853 \text{ m}$$

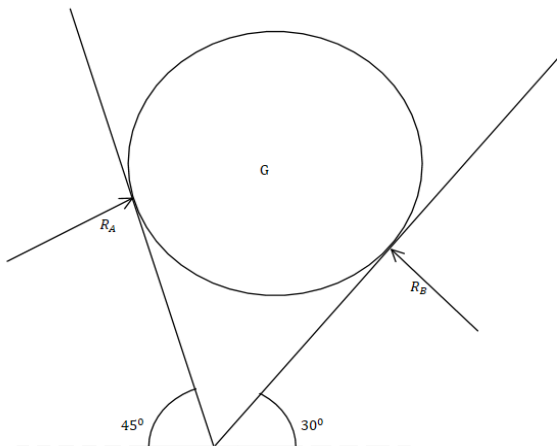
$$l_{AC} = 1.324 \text{ m}$$

Q3)

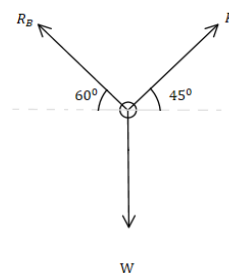
A homogeneous sphere with a mass of 50 kg rests against two smooth planes that form a V-shaped trough as shown in the figure. Determine the forces exerted on the sphere by the planes at contact points A and B.



Answer to Q3



Free Body Diagram of the Sphere



$$\frac{W}{\sin 75^\circ} = \frac{R_B}{\sin 135^\circ} = \frac{R_A}{\sin 150^\circ}$$

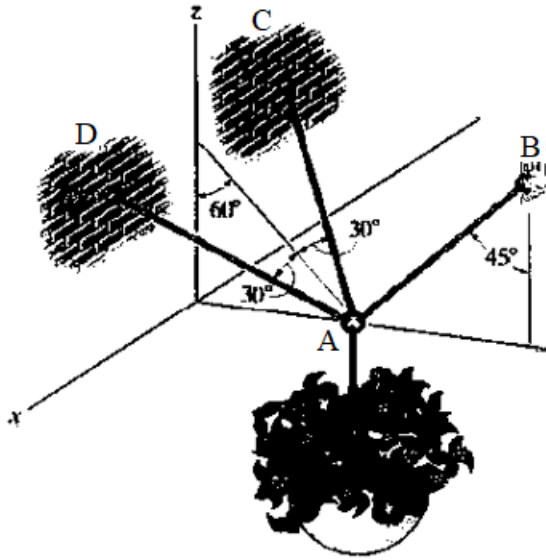
$$W = 490.5 \text{ N}$$

$$R_A = 254 \text{ N}$$

$$R_B = 359 \text{ N}$$

Q4)

The 25-kg flowerpot is supported at A by the three cords. Determine the force acting in each cord for equilibrium.



Answer to Q4

$$\vec{F}_{AB} = \{F_{AB}\sin 45^\circ \vec{j} + F_{AB}\cos 45^\circ \vec{k}\} \text{ N}$$

$$\vec{F}_{AC} = \{-F_{AC}\sin 30^\circ \vec{i} - F_{AC}\cos 30^\circ \sin 60^\circ \vec{j} + F_{AC}\cos 30^\circ \cos 60^\circ \vec{k}\} \text{ N}$$

$$\vec{F}_{AD} = \{F_{AD}\sin 30^\circ \vec{i} - F_{AD}\cos 30^\circ \sin 60^\circ \vec{j} + F_{AD}\cos 30^\circ \cos 60^\circ \vec{k}\} \text{ N}$$

$$\sum F_x = 0$$

$$-F_{AC}\sin 30^\circ + F_{AD}\sin 30^\circ = 0$$

$$\sum F_y = 0$$

$$F_{AB}\sin 45^\circ - F_{AC}\cos 30^\circ \sin 60^\circ - F_{AD}\cos 30^\circ \sin 60^\circ = 0$$

$$\sum F_z = 0$$

$$F_{AB}\cos 45^\circ + F_{AC}\cos 30^\circ \cos 60^\circ + F_{AD}\cos 30^\circ \cos 60^\circ - 245.25 \text{ N} = 0$$

$$\begin{bmatrix} 0 & -0.5 & 0.5 \\ \sin 45^\circ & -0.75 & -0.75 \\ \cos 45^\circ & \sqrt{3}/4 & \sqrt{3}/4 \end{bmatrix} \begin{bmatrix} F_{AB} \\ F_{AC} \\ F_{AD} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 245.25 \end{bmatrix}$$

$$F_{AB} = 220 \text{ N}$$

$$F_{AC} = F_{AD} = 103.7 \text{ N}$$