Inelastic crossroad collision

Consider four flat objects moving toward the origin of the coordinate system with a 1m×1m grid size as shown. Each object has uniform density (1kg/m²). They collide inelastically and stick together to form a single object as shown.

(a) Find the momentum \((p_x, p_y)\) and the velocity \((v_x, v_y)\) of the center of mass after the collision.
(b) Find the angular momentum \(l_z\) and the angular velocity \(\omega_z\) of the rotational motion about the center of mass after the collision.
(c) Find the amount of energy \(E_{\text{dis}}\) dissipated during the collision.

Describe also in words the tools (principles, laws) you are using in each part.

Hint: For part (b) think of the cross-shaped object as a composite of seven 2m×2m square tiles.

Solution: