A rigid, uniform disc of mass m, radius a, magnetic moment **M**, is about to roll under gravity from a stationary position on a step, as shown, when it is brought to equilibrium by a vertical magnetic field B. **M** makes an angle θ with the vertical, and is oriented perpendicular to the radius vector from the disc center to S at the step corner, which exerts a net force **F** on the disc at S.

(a). For the particular case when MB = mga, draw a sketch showing the gravitational potential energy U_g and magnetic potential energy U_m as functions of θ for $0 \leq \theta \leq \pi/2$.

(b). Explain why the equilibrium is stable, neutral or unstable, as the case may be.

(c). For the general case find how the equilibrium value of θ depends on m, **M**, g, B and a.

(d). Calculate the smallest coefficient of friction μ at the step required for stability.