

Answer on Question #77035 - Physics / Electromagnetism

Question:

A wheel having mass m has charges $+q$ and $-q$ on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of uniform vertical electric field E

Answer:

Wheel should roll due to the friction force acting on its bottom edge. This force for a wheel on inclined plane with angle β must be equal to the pulling force while the object remains at rest:

$$F_{fr} = \mu mg \sin \beta$$

On the other hand, we have compensating electric force on the opposite sides of wheel diameter:

$$F_{2q} = 2qE$$

Then the wheel will stay at rest if $F_{2q} = F_{fr}$ and

$$E = \frac{\mu mg \sin \beta}{2q}$$

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