

Wednesday Reading Assessment: Unit 3, Magnetic Forces and Fields

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1 Memory Bank

- $\vec{F} = q\vec{v} \times \vec{B}$... The Lorentz force, one version.
- $\vec{F} = i\vec{L} \times \vec{B}$... The Lorentz force, another version.
- $\vec{\tau} = \vec{r} \times \vec{F}$... Definition of torque.
- $\vec{\tau} = \vec{\mu} \times \vec{B}$... Torque on a current carrying loop in a uniform B-field.
- $\vec{\mu} = Ni\vec{A}$... Definition of the magnetic moment.

2 Torque, revisited

1. Suppose we apply a force $\vec{F} = 10\hat{j}$ N (upward) on the end of a 10 cm wrench it as *loosens* a bolt at the origin. The bolt is to the left of the wrench. What is the magnitude *and direction* of the torque?

3 The Power Generator

1. Consider Fig. 1, in which a DC power generator is depicted inside a 0.05 T B-field. Suppose the area of the loop is 10^{-2} m^2 , the voltage in the circuit is 24 V, and the circuit resistance is 50Ω . Also assume that there is just one loop of wire in the rotor. What is the *maximum torque* the system could achieve?

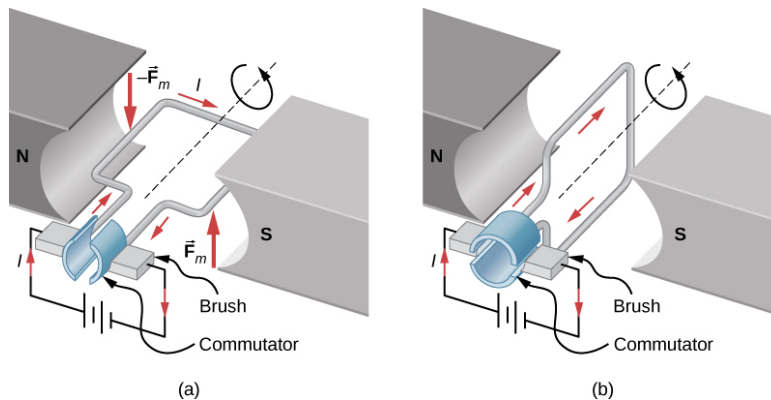


Figure 1: An illustration of how a power generator works. This version uses DC current and a commutator.

2. What would the maximum torque be if there were $N = 100$ turns of wire?