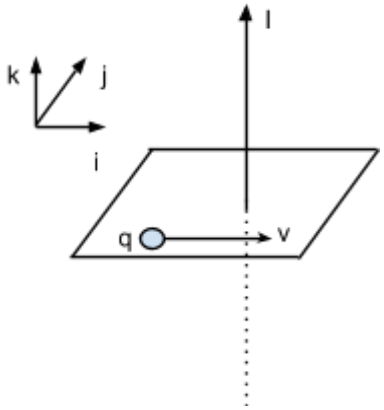
Module 5: Magnetic Fields and forces

Q1. A negative particle (q) is moving in the i-direction at speed v when it passes by a wire lying perpendicularly to the i-j plane, and carrying current in the k-direction, as shown below.



The particle will:

A change its path and start moving in the k-direction
B stop completely
C continue in its path along the i-direction **(BRAVO!** $\boldsymbol{F = qv \times B}$ **There is no force on the particle because the cross-product is zero)**
D change its path and start moving towards the wire

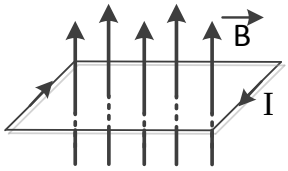
A,B,D prompt: (False, review lectures 5.1_Magnetism & 5.2_Magnetic Force on Charges)

Q2. A long straight copper wire lies in the north-south direction and carries a current pointing to north. The wire is immersed in a uniform magnetic field pointing into the sky. The direction of the force on the wire is

A north
B east **(BRAVO!** $\boldsymbol{\vec{F} = I\vec{L}X\vec{B}}$ **)**
C south
D west
E into the sky
F into the ground

A,C,D,E,F prompt: (Incorrect, review lecture 5.2.1_Magnetic Force on Wire)

Q3. A rigid rectangular current loop is placed in a uniform magnetic field with the plane of the loop perpendicular to the direction of the field. The magnetic field exerts on the current loop:

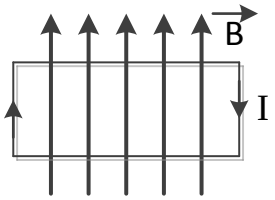


A a net torque
B a net force
C a net torque and a net force
D neither a net torque nor a net force

(BRAVO! $\vec{F} = I\vec{L}X\vec{B}$, forces in all directions cancel each other)

A,B,C prompt: (Incorrect, review lecture 5.2.1_Magnetic Force on Wire)

Q4. A rigid rectangular current loop is placed in a uniform magnetic field with the plane of the loop parallel to the direction of the field. The field exerts on the current loop:



A a net torque **(BRAVO! $\vec{F} = I\vec{L}X\vec{B}$, force on the top segment points out of the page while that on the bottom segment points into of the page)**
B a net force
C a net torque and a net force
D neither a net torque nor a net force

B,C,D prompt: (Incorrect, review lecture 5.2.1_Magnetic Force on Wire)

Q5. Which of the following statement(s) is true?

A magnetic field obeys the principle of superposition
(True statement, but there is another correct statement)

B magnetic field lines of a moving charge form closed loops
(True statement, but there is another correct statement)

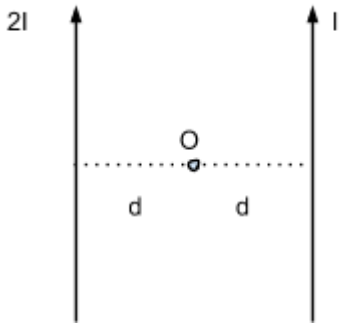
C magnetic flux through a closed surface is proportional to the total number of magnetic poles enclosed by the surface (False, review lectures 5.1_Magnetism & 5.4_Ampere's Law)

D none of the above (False, review lectures 5.1_Magnetism & 5.4_Ampere's Law)

E two of the above **(BRAVO! A & B are correct statements)**

F Statements A, B and C (False, review lectures 5.1_Magnetism & 5.4_Ampere's Law)

Q6. Which of the following is the correct expression of the total magnetic field at point O mid-way between the two current-carrying wires?



A $B_{total} = 0$

B $B_{total} = \frac{\mu_o I}{2\pi d}$ into the page **(BRAVO!)**

C $B_{total} = \frac{\mu_o 3I}{2\pi d}$ out of the page

D $B_{total} = \frac{\mu_o I}{\pi d}$ into the page

E none of the above

A,C,D,E prompt: (Incorrect, review lecture 5.4_Ampere's Law)