Assignment: Magnetic Fields
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1. **To facilitate traffic flow, many stoplights now have a sensing system based on inductance to determine if a car is waiting at a red light. If that is the case, the light is then switched to green. Using credible sources, write a paragraph explaining how the system works. Include any in-text citations along with a reference list in APA style. (10 marks)**

Traffic signals can sense the presence of cars or pedestrians in a variety of ways, one of which is by the use of an inductive loop mechanism buried about 50 mm below the pavement. The machine is made up of a coiled wire in the form of a circle. When a vehicle with a metallic property crosses over or slows, this loop is used to calculate the difference in the magnetic field. When a car drives over or slows on the sensor, the loop detects the position of the vehicle by measuring the difference in the magnetic field. This is probable because the vehicle has the ability to lower the loop's inductance. The traffic light receives a warning that the driver is waiting at a red light when the detector detects a drop in inductance over a given amount of time, normally more than 4 seconds. This sensor device is useful because it can handle traffic that has been stopped for a long time and send vehicles in a timely manner.

2. **A 3.00 m long straight copper wire has a current of 9.0 A in it as it passes through a magnetic field. The magnitude of the force on the conductor is 2.00 N. The angle between the current and the magnetic field is 60.0°. What is the magnitude of the uniform magnetic field? (5 marks)**

- Let length of copper wine L = 3m, current I = 9.0A, the magnitude of the force F = 2.0N

$$F = I(\vec{L} \times \vec{B})$$

$$|\vec{F}| = B \bullet I \bullet L \bullet \sin\theta \ (where \ B = magnetic \ field)$$

$$B = \frac{F}{IL \bullet \sin\theta} = \frac{2.00N}{(9.0A) \times (3.00m) \times \sin 60^o} = 0.085T$$

Thus, the magnitude of the uniform magnetic field is $0.085T$.