Answer on Question#61352 – Physics – Electromagnetism

9) One end of a simple rectangular wire-loop current balance is inserted into a solenoid. A force of 3.0×10−3 N is found to act on this end when a current of 2.0A is flowing in it. If the length of the conductor forming the end of the the wire-loop is 0.

a) 0.043T

b) 0.26T

c) 0.43T

d) 0.015T

Solution. The magnetic field of an infinitely long straight wire can be obtained by applying Ampere's law. Using formula $F = IBl$, $I = 2.0A$ current, $l = 0.1m$ – length of the conductor, B – magnetic field. Hence $B = \frac{F}{Il} = \frac{0.003}{2 \cdot 0.1} = 0.015T$.

Answer. d) 0.015T

10) A straight wire 1.0m long carries a current of 100A at right-angles to a uniform magnetic field of 1.0T. Find the mechanical force on the wire and the power required to move it at 15m/s in a plane at right-angles to the field.

a) 100N and 1.5kW

b) 200N and 2.5kW

c) 300N and 1.4kW

d) 200N and 2.7kW

Solution. The magnetic field of an infinitely long straight wire can be obtained by applying Ampere's law. Using formula $F = IBl$, $I = 100A$ current, $l = 1.0m$ – length of the straight wire, $B = 1.0T$ – magnetic field.

Hence $F = 100 \cdot 1 \cdot 1 = 100N$.

Using definition of power as rate of work get

$$P = \frac{W}{t} = \frac{Fd}{t} = Fv$$

where W – work, t – time, d – displacement, $v = 15\frac{m}{s}$ – speed.

$P = 100 \cdot 15 = 1500W = 1.5kW$.

Answer. $F = 100N$, $P = 1.5kW$.