CHAPTER 8 FREESTANDING PRACTICE QUESTIONS

1. A helium nucleus traveling at speed v feels a magnetic force of magnitude F_B due to a solenoid that produces a magnetic field. If the number of turns per unit length in the solenoid is doubled while the current is kept constant, what is the magnitude of the force that the helium nucleus feels if it is traveling with the same speed in the same direction?

    A) $0.5F_B$
   B) $1F_B$
    C) $2F_B$
    D) $4F_B$

2. At the particle accelerator at CERN, a proton is accelerated to a velocity that is 99.99% of the speed of light around a track that has a radius of approximately 4000 m. The mass of a proton can be taken to be 1.6×10^{-27} kg, the charge is 1.6×10^{-19} C and the speed of light is 3×10^8 m/s. If the circular trajectory of the proton were caused by a large magnetic field, how would this magnetic field compare to that of the Earth? ($B_{Earth} \approx 5 \times 10^{-5}$ T)

    A) 0.15 times
    B) 1.5 times
    C) 15 times
    D) 1500 times

3. An air capacitor stores potential energy. If you wanted the potential energy to double by adding a dielectric between the plates while keeping the voltage constant, what would have to be the value of the dielectric constant?

    A) 0.5
    B) 2
    C) 4
    D) 8

4. Determine the total power dissipated through the circuit shown below in terms of V, R_1, R_2, and R_3.
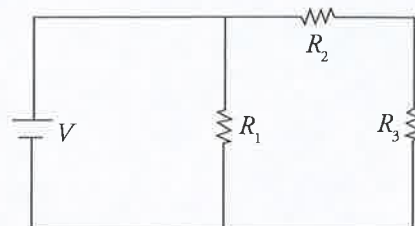
    A) $\dfrac{V^2}{R_1 + R_2 + R_3}$

    B) $\dfrac{R_1 + R_2 + R_3}{V^2}$

    C) $\dfrac{R_1(R_2 + R_3)}{V^2(R_1 + R_2 + R_3)}$

    D) $\dfrac{V^2(R_1 + R_2 + R_3)}{R_1(R_2 + R_3)}$

5. Lightning is an atmospheric discharge of electricity that can propagate at speeds of up to 60,000 m/s and can reach temperatures of up to 30,000°C. A single lightning strike lasts for approximately 250 ms and can transfer up to 500 MJ of energy across a potential difference of 2×10^7 volts. Estimate the total amount of charge transferred and average current of a single lightning strike.

    A) 6.25×10^{-4} coulombs, 8×10^7 amps
    B) 6.25×10^{-4} coulombs, 2.5×10^{-3} amps
    C) 25 coulombs, 100 amps
    D) 25 coulombs, 8×10^7 amps