457. An electron moves with a speed of 2.2×10^6 m/s at right angles through a 1.1×10^{-2} T magnetic field. How large is the magnetic force on the electron?

458. A pulsar's magnetic field is 1×10^{-8} T. How fast does an electron move perpendicular to this field so that a 3.2×10^{-22} N magnetic force acts on the charge?

459. A levitation device designed to suspend 75 kg uses 10.0 m of wire and a 4.8×10^{-4} T magnetic field, perpendicular to the wire. What current is needed?

460. A power line carries 1.5×10^3 A for 15 km. Earth's magnetic field is 2.3×10^{-5} T at a 45° angle to the power line. What is the magnetic force on the line?

Chapter 20 Electromagnetic Induction

461. A coil with 540 turns and a 0.016 m^2 area is rotated exactly from 0° to 90.0° in 0.050 s. How strong must a magnetic field be to induce an emf of 3.0 V?

462. A 550-turn coil with an area of 5.0×10^{-5} m^2 is in a magnetic field that decreases by 2.5×10^{-4} T in 2.1×10^{-5} s. What is the induced emf in the coil?

463. A 246-turn coil has a 0.40 m^2 area in a magnetic field that increases from 0.237 T to 0.320 T. What time interval is needed to induce an emf of −9.1 V?

464. A 9.5 V emf is induced in a coil that rotates from 0.0° to 90.0° in a 1.25×10^{-2} T magnetic field for 25 ms. The coil's area is 250 cm^2. How many turns of wire are in the coil?

465. A generator provides a rms emf of 320 V across 100 Ω. What is the maximum emf?

466. Find the rms current in the circuit in problem 465.

467. Some wind turbines can provide an rms current of 1.3 A. What is the maximum ac current?

468. A transformer has 1400 turns on the primary and 140 turns on the secondary. What is the voltage across the primary if secondary voltage is 6.9 kV?

469. A transformer has 140 turns on the primary and 840 turns on the secondary. What is the voltage across the secondary if the primary voltage is 5.6 kV?

470. A step-down transformer converts a 3.6 kV voltage to 1.8 kV. If the primary (input) coil has 58 turns, how many turns does the secondary have?

471. A step-up transformer converts a 4.9 kV voltage to 49 kV. If the secondary (output) coil has 480 turns, how many turns does the primary have?

472. A 320-turn coil rotates from 0° to 90.0° in a 0.046 T magnetic field in 0.25 s, which induces an average emf of 4.0 V. What is the area of the coil?

473. A 180-turn coil with a 5.0×10^{-5} m^2 area is in a magnetic field that decreases by 5.2×10^{-4} T in 1.9×10^{-5} s. What is the induced current if the coil's resistance is 1.0×10^2 W?

474. A generator provides a maximum ac current of 1.2 A and a maximum output emf of 211 V. Calculate the rms potential difference.

475. Calculate the rms current for problem 474.

476. A generator can provide a maximum output emf of 170 V. Calculate the rms potential difference.

477. A step-down transformer converts 240 V across the primary to 5.0 V across the secondary. What is the step-down ratio ($N_1:N_2$)?

Chapter 21 Atomic Physics

478. Determine the energy of a photon of green light with a wavelength of 527 nm.

479. Calculate the de Broglie wavelength of an electron with a velocity of 2.19×10^6 m/s.

480. Calculate the frequency of ultraviolet (UV) light having a photon energy of 20.7 eV.

481. X-ray radiation can have an energy of 12.4 MeV. To what wavelength does this correspond?

482. Light of wavelength 240 nm shines on a potassium surface. Potassium has a work function of 2.3 eV. What is the maximum kinetic energy of the photoelectrons?

483. Manganese has a work function of 4.1 eV. What is the wavelength of the photon that will just have the threshold energy for manganese?

484. What is the speed of a proton with a de Broglie wavelength of 2.64×10^{-14} m?

485. A cheetah can run as fast as 28 m/s. If the cheetah has a de Broglie wavelength of 8.97×10^{-37} m, what is the cheetah's mass?

486. What is the energy of a photon of blue light with a wavelength of 430.8 nm?