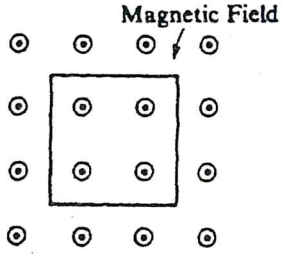
53. Two conducting spheres, X and Y, have the same positive charge $+Q$, but different radii ($r_X > r_Y$) as shown above. The spheres are separated so that the distance between them is large compared with either radius. If a wire is connected between them, in which direction will current be directed in the wire?

(A) From X to Y
(B) From Y to X
(C) There will be no current in the wire.
(D) It cannot be determined without knowing the magnitude of Q.
(E) It cannot be determined without knowing whether the spheres are solid or hollow.

54. The emf of a battery is 12 volts. When the battery delivers a current of 0.5 ampere to a load, the potential difference between the terminals of the battery is 10 volts. The internal resistance of the battery is

(A) 1 Ω
(B) 2 Ω
(C) 4 Ω
(D) 20 Ω
(E) 24 Ω



55. A square loop of wire of side 0.5 meter and resistance 10^{-2} ohm is located in a uniform magnetic field of intensity 0.4 tesla directed out of the page as shown above. The magnitude of the field is decreased to zero at a constant rate in 2 seconds. As the field is decreased, what are the magnitude and direction of the current in the loop?

(A) Zero
(B) 5 A, counterclockwise
(C) 5 A, clockwise
(D) 20 A, counterclockwise
(E) 20 A, clockwise

Questions 56-57 refer to a sphere of radius R that has a positive charge Q uniformly distributed on its surface.

56. Which of the following represents the magnitude of the electric field E and the potential V as functions of r, the distance from the center of the sphere, when $r < R$?

	E	V
(A)	0	$\frac{kQ}{R}$
(B)	0	$\frac{kQ}{r}$
(C)	0	0
(D)	$\frac{kQ}{r^2}$	0
(E)	$\frac{kQ}{R^2}$	0

57. Which of the following represents the magnitude of the electric field E and the potential V as functions of r, the distance from the center of the sphere, when $r > R$?

	E	V
(A)	$\frac{kQ}{R^2}$	$\frac{kQ}{R}$
(B)	$\frac{kQ}{R}$	$\frac{kQ}{R}$
(C)	$\frac{kQ}{R}$	$\frac{kQ}{r}$
(D)	$\frac{kQ}{r^2}$	$\frac{kQ}{r}$
(E)	$\frac{kQ}{r^2}$	$\frac{kQ}{r^2}$

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58. If R is 1 ohm and L is 1 henry, then L/R is

(A) 1 volt
(B) 1 farad
(C) 1 ampere
(D) 1 coulomb
(E) 1 second