Name: ___________________________ Date: _____________

___ **1.** Suppose you are looking into one end of a long cylindrical tube in which there is a uniform electric field, pointing away from you. If the magnitude of the field is decreasing with time the field lines of the induced magnetic field are:
A) circles
B) ellipses
C) straight lines parallel to the electric field
D) straight lines perpendicular to the electric field
E) none of the above

___ **2.** A 10-turn conducting loop with a radius of 3.0 cm spins at 60 revolutions per second in a magnetic field of 0.50 T. The maximum emf generated is:
A) 0.014 V **B)** 0.53 V **C)** 5.3 V **D)** 18 V **E)** 180 V

___ **3.** A rectangular loop of wire has area A. It is placed perpendicular to a uniform magnetic field *B* and then spun around one of its sides at frequency *f*. The maximum induced emf is:
A) BAf **B)** BAf **C)** $2BAf$ **D)** $2\pi BAf$ **E)** $4\pi BAf$

___ **4.** A current of 1 A is used to charge a parallel plate capacitor with square plates. If the area of each plate is 0.6 m^2 the displacement current through a 0.3 m^2 area wholly between the capacitor plates and parallel to them is:
A) 1 A **B)** 2 A **C)** 0.7 A **D)** 0.5 A **E)** 0.25 A

___ **5.** One of the crucial facts upon which the Maxwell equations are based is:
A) the numerical value of the electron charge
B) charge is quantized
C) the numerical value of the charge/mass ratio of the electron
D) there are three types of magnetic materials
E) none of the above

___ **6.** Which of the following equations, along with a symmetry argument, can be used to calculate the magnetic field between the plates of a charging parallel plate capacitor with circular plates?
A) $\oint \vec{E} \cdot d\vec{A} = q/\varepsilon_0$
B) $\oint \vec{B} \cdot d\vec{A} = 0$
C) $\oint \vec{E} \cdot d\vec{s} = -d\Phi^{\text{mag}}/dt$
D) $\oint \vec{B} \cdot d\vec{s} = \mu_0 i + \mu_0 \varepsilon_0 d\Phi^{\text{elec}}/dt$
E) None of these

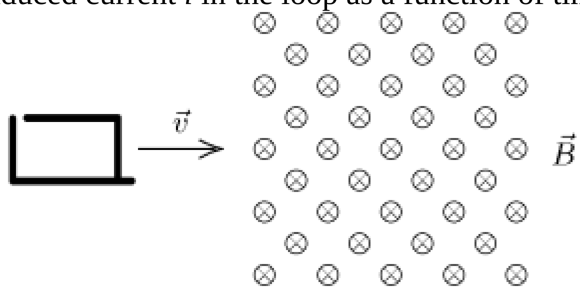
___ **7.** A single loop of wire with a radius of 7.5 cm rotates about a diameter in a uniform magnetic field of 1.6 T. To produce a maximum emf of 1.0 V, it should rotate at:
A) 0 **B)** 2.7 rad/s **C)** 5.6 rad/s **D)** 35 rad/s **E)** 71 rad/s

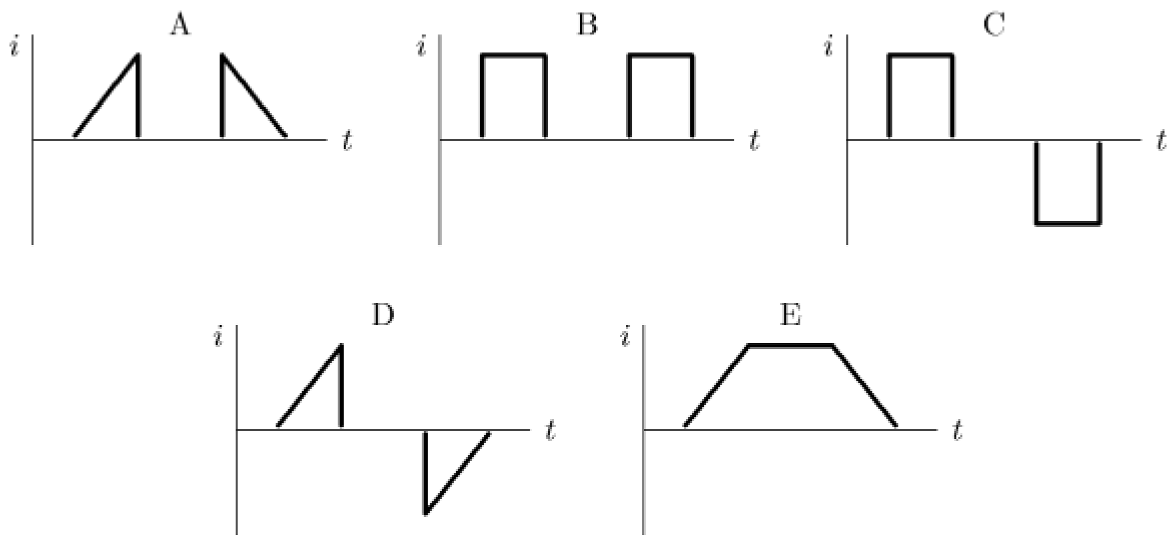
___ **8.** A 2-T uniform magnetic field makes an angle of 30º with the *z* axis. The magnetic flux through a 3-m^2 portion of the *xy* plane is:
A) 2.0 Wb **B)** 3.0 Wb **C)** 5.2 Wb **D)** 6.0 Wb **E)** 12 Wb

___ **9.** A magnetic field exists between the plates of a capacitor:
A) always
B) never
C) when the capacitor is fully charged
D) while the capacitor is being charged
E) only when the capacitor is starting to be charged

___ **10.** A vertical bar magnet is dropped through the center of a horizontal loop of wire, with its north pole leading. At the instant when the midpoint of the magnet is in the plane of the loop, the induced current at point P, viewed from above, is:
A) maximum and clockwise
B) maximum and counterclockwise
C) not maximum but clockwise
D) not maximum but counterclockwise
E) essentially zero

___ **11.** A square loop of wire moves with a constant speed *v* from a field-free region into a region of constant uniform magnetic field, as shown. Which of the five graphs correctly shows the induced current *i* in the loop as a function of time *t*?

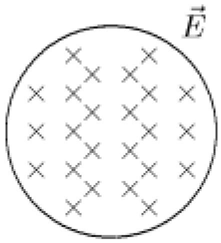


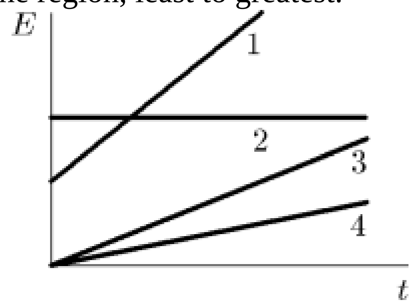


A) A **B)** B **C)** C **D)** D **E)** E

___ **12.** A cylindrical region of radius R = 3.0 cm contains a uniform magnetic field parallel to its axis. If the electric field induced at a point *R*/2 from the cylinder axis is 4.5×10^{-3} V/m the magnitude of the magnetic field must be changing at the rate:
A) 0 **B)** 0.30 T/s **C)** 0.60 T/s **D)** 1.2 T/s **E)** 2.4 T/s

___ **13.** An electric field exists in the cylindrical region shown and is parallel to the cylinder axis. The magnitude of the field might vary with time according to any of the four graphs shown. Rank the four variations according to the magnitudes of the magnetic field induced at the edge of the region, least to greatest.





A) 2, 4, 3, 1
B) 3 and 4 tie, then 1, 2
C) 4, 3, 2, 1
D) 4, 3, 1, 2
E) 2, 1, 3, 4

___ **14.** Two of Maxwell's equations contain a path integral on the left side and an area integral on the right. Suppose the area is the surface of a piece of paper at which you are looking and $d\vec{A}$ is chosen to point toward you. Then the path integral is:
A) clockwise around the circumference of the paper
B) counterclockwise around the circumference of the paper
C) from left to right
D) from right to left
E) from top to bottom

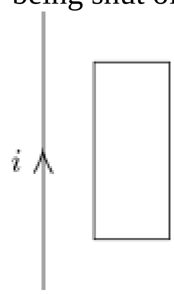
___ **15.** 1 weber is the same as:
A) $1\ \text{V}\cdot\text{s}$ **B)** $1\ \text{T}\cdot\text{s}$ **C)** 1 T/m **D)** 1 V/s **E)** $1\ \text{T/m}^2$

___ **16.** Maxwell's equations, along with an appropriate symmetry argument, can be used to calculate:
A) the electric force on a given charge
B) the magnetic force on a given moving charge
C) the flux of a given electric field
D) the flux of a given magnetic field
E) none of these

___ **17.** As a loop of wire with a resistance of 10 Ω moves in a non-uniform magnetic field, it loses kinetic energy at a uniform rate of 5 mJ/s. The induced emf in the loop:

A) is 0
B) is 0.2 V
C) is 0.28 V
D) is 2 V
E) cannot be calculated from the given data

___ **18.** A long straight wire is in the plane of a rectangular conducting loop. The straight wire initially carries a constant current *i* in the direction shown. While the current *i* is being shut off, the current in the rectangle is:



A) zero
B) clockwise
C) counterclockwise
D) clockwise in the left side and counterclockwise in the right side
E) counterclockwise in the left side and clockwise in the right side

___ **19.** Faraday's law states that an induced emf is proportional to:

A) the rate of change of the magnetic field
B) the rate of change of the electric field
C) the rate of change of the magnetic flux
D) the rate of change of the electric flux
E) zero

___ **20.** A 1.2-m radius cylindrical region contains a uniform electric field along the cylinder axis. It is increasing uniformly with time. To obtain a total displacement current of 2.0×10^{-9} A through a cross section of the region, the magnitude of the electric field should change at a rate of:

A) 5.0 V/m · s
B) 12 V/m · s
C) 37 V/m · s
D) 50 V/m · s
E) 4.0×10^{7} V/m · s

Answer Key

1. A
Origin: Chapter 31- Induction and Maxwell's Equations, 64
2. C
Origin: Chapter 31- Induction and Maxwell's Equations, 40
3. D
Origin: Chapter 31- Induction and Maxwell's Equations, 36
4. D
Origin: Chapter 31- Induction and Maxwell's Equations, 60
5. E
Origin: Chapter 31- Induction and Maxwell's Equations, 83
6. D
Origin: Chapter 31- Induction and Maxwell's Equations, 93
7. D
Origin: Chapter 31- Induction and Maxwell's Equations, 41
8. C
Origin: Chapter 31- Induction and Maxwell's Equations, 3
9. D
Origin: Chapter 31- Induction and Maxwell's Equations, 62
10. E
Origin: Chapter 31- Induction and Maxwell's Equations, 19
11. C
Origin: Chapter 31- Induction and Maxwell's Equations, 31
12. C
Origin: Chapter 31- Induction and Maxwell's Equations, 49
13. A
Origin: Chapter 31- Induction and Maxwell's Equations, 57
14. B
Origin: Chapter 31- Induction and Maxwell's Equations, 87
15. A
Origin: Chapter 31- Induction and Maxwell's Equations, 6
16. E
Origin: Chapter 31- Induction and Maxwell's Equations, 94
17. B
Origin: Chapter 31- Induction and Maxwell's Equations, 47
18. B
Origin: Chapter 31- Induction and Maxwell's Equations, 16
19. C
Origin: Chapter 31- Induction and Maxwell's Equations, 8
20. D
Origin: Chapter 31- Induction and Maxwell's Equations, 59