1. A straight rod of length 3.0 m is held perpendicular to a magnetic field of 2.0 T. It is rotated about its midpoint at a rate of 5.0 revolutions per second, remaining perpendicular to the field the entire time. The emf generated in the rod is most nearly

   A) 22.5 V

   B) 45 V

   C) 70.7 V

   D) 94.2 V

   E) 141 V

2. The expression 2 T × 2 A × 2 m^2 is equal to

   A) 8 watts

   B) 8 joules

   C) 8 coulombs

   D) 8 volts

   E) 8 Newtons

3. The expression 1 C × 1 T × 1 m has the same units as

   A) electric potential

   B) current

   C) energy

   D) momentum

   E) power

4. A square loop of copper wire enclosing an area of 0.10 m is initially placed perpendicular to a magnetic field of 2.0 T. The loop is rotates through 90 degrees , remaining perpendicular to the field. The turn takes 0.5 s. The average emf induced in the loop during the turn is

   A) 0 V

   B) 0.4 V

   C) 2.5 V

   D) 10 V

   E) 40 V

5. A wire of length *L* is pulled toward the right at constant velocity *v* through a uniform magnetic field *B* that points out of the page. The potential difference between the upper and lower end of the rod is

   A) 0

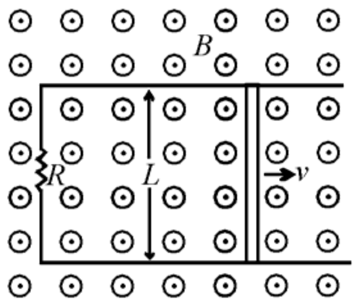
   B) $\frac{vBL}{2}$

   C) $\frac{-vBL}{2}$

   D) vBL

   E) $-vBL$

Base your answers to questions **6** and **7** on the diagram below of a metal rod with length L pushed along a set of conducting rails that completes a circuit with a total resistance R at a constant velocity v to the right. The circuit is in a magnetic field B that points out of the page.



6. What is the current induced in the circuit?

   A) $RBLv$ clockwise

   B) $BLv \times \frac{1}{R}$ counterclockwise

   C) $BLv \times \frac{1}{R}$ clockwise

   D) $BLv \times \frac{1}{2R}$ counterclockwise

   E) $BLv \times \frac{1}{2R}$ clockwise

7. The power supplied by an external force to keep the rod moving at a constant velocity is

   A) $RBlv$

   B) $\frac{Blv}{R}$

   C) $R(Blv)^2$

   D) $\frac{(Blv)^2}{R}$

   E) $(RBlv)^2$

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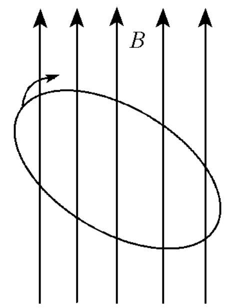
8. Base your answer to the following question on the diagram below, in which a circular loop of wire with a radius of 5 cm rotates clockwise at a constant angular velocity through a magnetic field B = 5 T. The plane of the loop goes from being perpendicular to the field to being at a 45º angle with the field in 0.25 s.



   The average emf induced in the loop will be

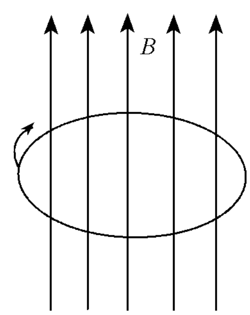
   A) 0 V

   B) 1.2×10^{-2} V

   C) 2.3×10^{-2} V

   D) 4.6×10^{-2} V

   E) 9.2×10^{-1} V

9. 

   In the diagram, a loop of wire with radius l rotates in a plane perpendicular to the uniform magnetic field B with constant velocity v. The emf induced in the loop is

   A) 0

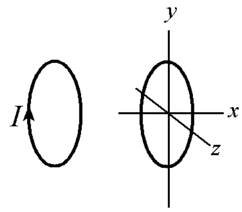
   B) 2pBlv clockwise

   C) 2pBlv counterclockwise

   D) pBvl^2 clockwise

   E) pBvl^2 counterclockwise

10.



In the above diagram, two loops of wire are shown. One is fixed along the x-axis, and carries a current I. The other is initially in the yz-plane with its center at the origin. Which of the following motions would NOT induce emf in this second loop?

A) Translation along the x-axis

B) Rotation about the x-axis

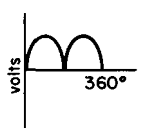
C) Translation along the y-axis

D) Rotation about the y-axis

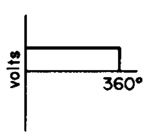
E) Rotation about the z-axis

11. A conducting loop in a uniform magnetic field is rotated at a constant rate. Which graph best represents the induced potential difference across the ends of the loop as a function of the angle it is rotated during one full rotation?

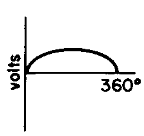
A)



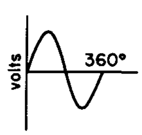
B)



C)

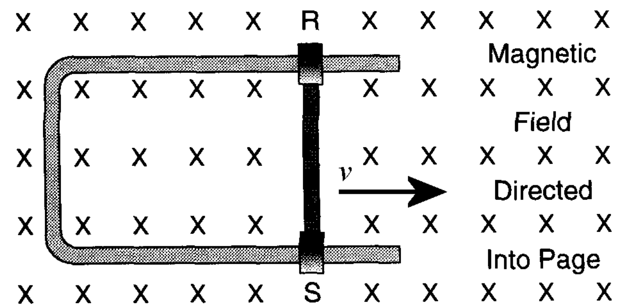


D)



E) none of the above

12. In the diagram below, a segment of wire, RS, which is 0.20 m in length, is free to slide along a U-shaped wire located in a uniform 0.60-T magnetic field directed into the page.



If wire segment RS is slid to the right at a constant speed of 4.0 meters per second, the potential difference induced across the ends of the wire segment is

A) 0.12 V

B) 0.48 V

C) 1.2 V

D) 2.4 V

E) 4.8 V

13. Which expression is a unit of potential difference equivalent to a volt?

A) $\frac{\text{Tesla} \times \text{meter}}{\text{second}}$

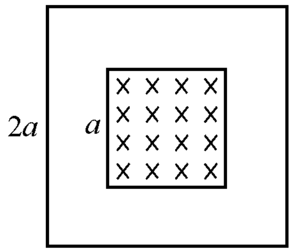
B) $\frac{\text{Tesla} \times \text{second}}{\text{meter}}$

C) $\frac{\text{Tesla} \times \text{meter}^2}{\text{second}}$

D) $\frac{\text{Tesla} \times \text{second}}{\text{meter}^2}$

E) $\frac{\text{Tesla} \times \text{meter}}{\text{second}^2}$

14. Base your answer to the following question on the diagram below of two square loops of the same wire, one with side length *a* and side length 2*a*. A uniform magnetic field *B* directed into the page is contained within the area enclosed by the square of side *a*.



The magnetic field *B* varies at a constant rate such that the emf induced in the wire with side *a* is ε. What is the emf induced in the loop with side 2*a*?

A) 0

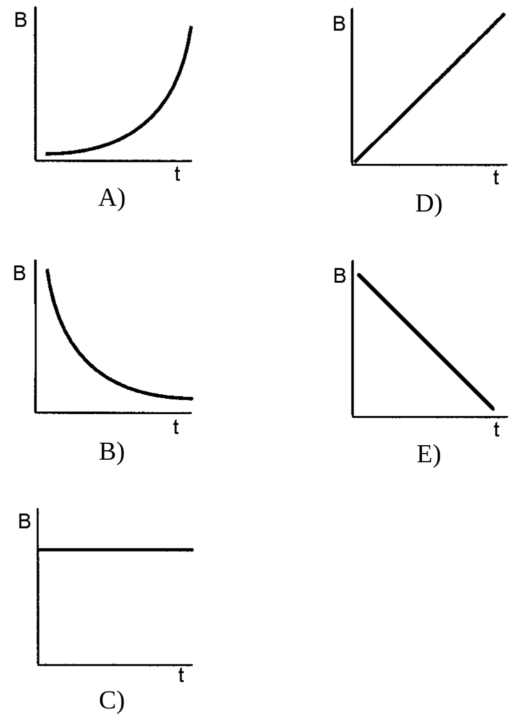
B) ε/4

C) ε/2

D) ε

E) 2ε

15. A loop of wire is in a plane perpendicular to a magnetic field and is decreasing in diameter at a constant rate. The magnetic field is changing in magnitude such that no EMF is induced. Which of the following best shows the magnetic field?



16. Under which of the following circumstances could EMF be induced in a loop of wire?

A) The loop moves parallel to a constant magnetic field

B) There is a change in the magnetic flux through the loop

C) The loop is moved through a perpendicular electric field

D) The loop moves perpendicular to a constant, infinitely large magnetic field

E) A magnetic field parallel to the loop changes in magnitude

17. The magnetic field from a loop of current carrying wire in the plane of the page is directed out of the page. In which direction do the electrons in the wire loop move?

A) counterclockwise

B) clockwise

C) they all move to the right side of the loop

D) they all move to the left side of the loop

E) they are stationary

18. A square wire loop of length d is pushed through a perpendicular square magnetic field of length l, with $l \geq d$, at a constant velocity v. If the loop begins completely out of the magnetic field and is pushed through the field until it is again completely out of the field, what is the total amount of time during which an EMF is induced in the loop?

A) 0

B) d/v

C) $2d/v$

D) $(d + l)/v$

E) $(2d + l)/v$

19. Which of the following will result in an induced EMF in a stationary circular loop of wire in a perpendicular magnetic field?

A) moving the loop parallel to the magnetic field lines

B) increasing the area of the wire loop while proportionately decreasing the magnetic field

C) rotating the loop around an axis parallel to the magnetic field lines

D) rotating the magnetic field to an angle 45° from the plane of the wire loop while increasing the magnetic field by a factor of `2

E) bending the wire loop into a square

20. According to Faraday's Law, the induced EMF is equal to which of the following?

A) the change in electric flux

B) the change in magnetic flux

C) the negative change in electric flux

D) the rate of change in magnetic flux

E) the negative rate of change in magnetic flux

Answer Key
Magnetic Flux MC Questions [Mar 28, 2011]

1. E
2. B
3. D
4. A
5. E
6. C
7. D
8. D
9. A
10. B
11. D
12. B
13. C
14. D
15. A
16. B
17. B
18. C
19. E
20. E

Name ________________________________ Class __________________________ Date ___________

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