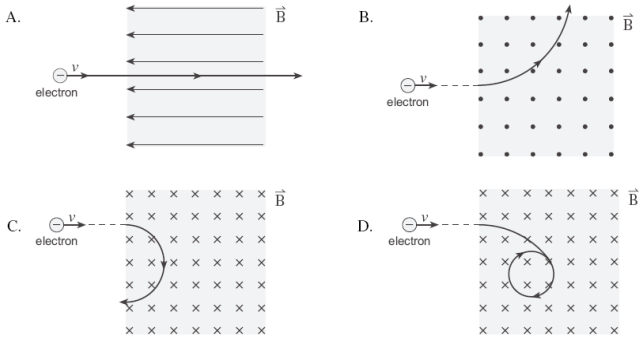
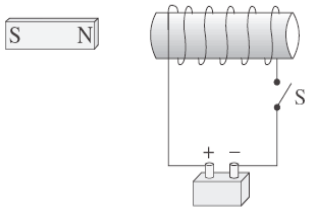
Name:

Physics12 Unit 8/9 Electromagnetism

1. An electron, travelling with a constant velocity, enters a region of uniform magnetic field. Which of the following is **not** a possible pathway?

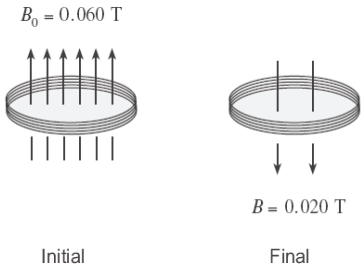


2. A bar magnet is at rest, next to a fixed coil. When switch S is closed, the bar magnet will move



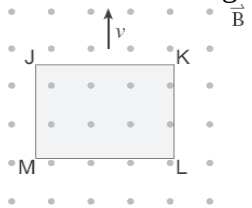
A. to the left.
B. to the right.
C. up the page.
D. down the page.

3. A 500-turn circular coil with an area of $1.54 \times 10^{-2}\ m^2$ is perpendicular to a 0.060 T field. The magnetic field changes to 0.020 T in the opposite direction in 0.12 s.



What is the average emf induced in the coil?
A. 5.1×10^{-3} V
B. 1.0×10^{-2} V
C. 2.6 V
D. 5.1 V

4. A metal block moves with a constant speed in a uniform magnetic field.

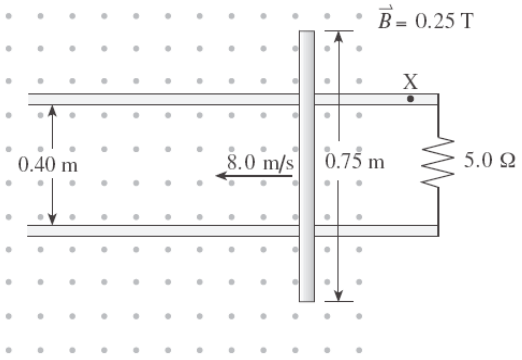


Which side of the block is positive?
A. JK
B. KL
C. LM
D. MJ

5. A 120 V dc motor has an armature resistance of 5.0 Ω and draws 6.0 A when it is operating normally. What is the starting current of the motor and the back emf when it is operating?

	STARTING CURRENT	BACK EMF WHEN OPERATING
A.	6.0 A	30 V
B.	6.0 A	90 V
C.	24 A	30 V
D.	24 A	90 V

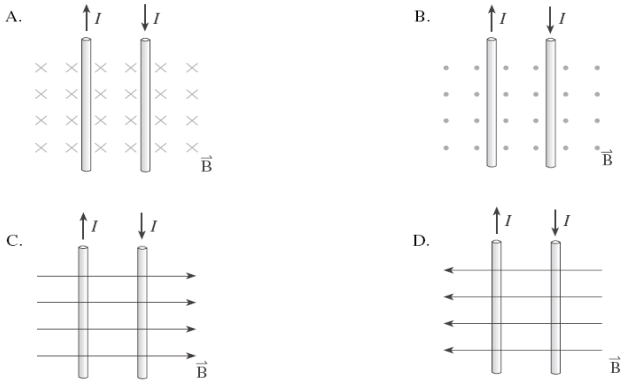
6. A 0.75 m conducting rod is moved at 8.0 m/s across a 0.25 T magnetic field along metal rails. The electrical resistance of the system is 5.0 Ω.



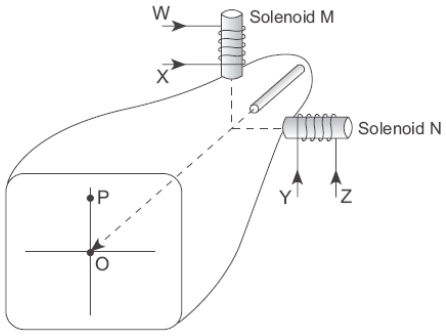
What are the magnitude and direction of the current through point X?

	MAGNITUDE OF CURRENT	DIRECTION OF CURRENT THROUGH X
A.	0.16 A	Left
B.	0.16 A	Right
C.	0.30 A	Left
D.	0.30 A	Right

7. In which diagram would an **external** magnetic field, B , cause two current-carrying wires to move towards one another?



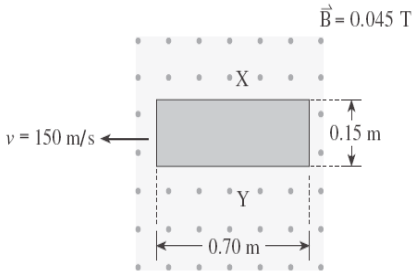
8. When there is no current in the solenoids, the electron beam in the cathode ray tube strikes the screen at the origin O.



In order to move the beam to position P, which solenoid is used and what is the direction of the current applied?

	SOLENOID	CURRENT DIRECTION
A.	M	W
B.	M	X
C.	N	Y
D.	N	Z

9. A solid conductor travels at 150 m/s across a uniform 0.045 T magnetic field. Which side is positively charged and what is the emf across this block?

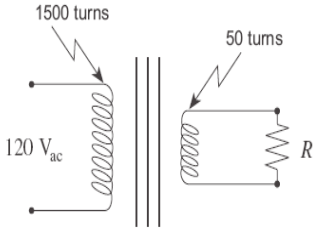


	Positive Side	Emf
A.	X	1.0 V
B.	X	4.7 V
C.	Y	1.0 V
D.	Y	4.7 V

10. A motor operating at full speed draws a current of 4.0 A when connected to a 110 V source. The motor has an armature resistance of 3.5 Ω. What is the back emf at full speed?

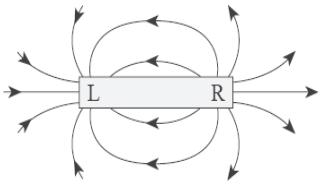
A. 14 V
B. 96 V
C. 110 V
D. 124 V

11. An ideal transformer with 120 V_{ac} on the primary coil supplies power to the resistor *R*. If this resistor dissipates 35 W, what is the current in the primary coil and in the secondary coil?



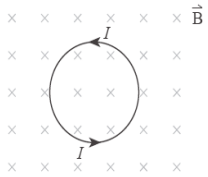
	Current in Primary	Current in Secondary
A.	0.29 A	0.29 A
B.	0.29 A	8.8 A
C.	8.8 A	0.29 A
D.	8.8 A	8.8 A

12. Identify the magnetic poles labelled L and R in the diagram shown.



	Pole L	Pole R
A.	North	North
B.	North	South
C.	South	North
D.	South	South

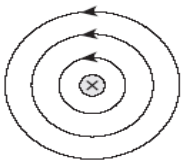
13. The diagram shows current *I* flowing in a circular coil located in a magnetic field.

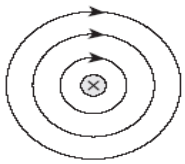


The magnetic force acting on the coil will tend to cause it to

A. expand.
B. contract.
C. move up the page.
D. move down the page.

14. Which one of the following diagrams best illustrates the magnetic field produced by a current-carrying wire?

A. 

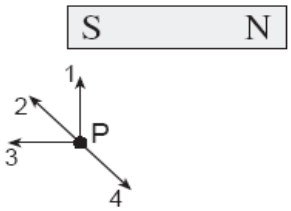
B. 

C. 

D. 

15. What is the direction of the magnetic field at point P due to the bar magnet?

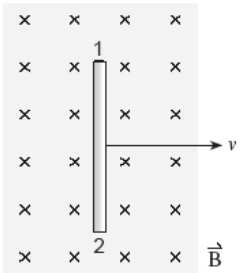
A. 1
B. 2
C. 3
D. 4



16. A positively charged object q = 1.6 x 10^{-19}C is travelling at 1.9 x 10^{4} m/s perpendicular to a 1.0 x 10^{-3} T magnetic field. If the radius of the resulting path is 0.40 m, what is the object's mass?

A. 3.4×10^{-27} kg
B. 3.1×10^{-19} kg
C. 2.1×10^{-9} kg
D. 0.77 kg

17. A conducting rod of length 0.25 m is moved to the right at 6.0 m/s as shown in the diagram. The induced emf is 3.0 V.



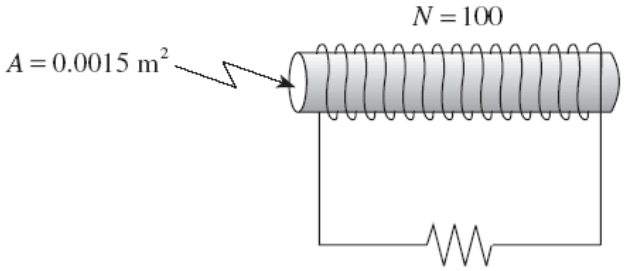
What is the magnitude of the magnetic field and which end of the conducting rod, 1 or 2, becomes positively charged?

	MAGNETIC FIELD	POSITIVELY CHARGED END
A.	1.50 T	1
B.	1.50 T	2
C.	2.0 T	1
D.	2.0 T	2

18. A coil consisting of 50 loops of radius 4.0 x 10^{-2} m is placed with its plane perpendicular to a magnetic field that is increasing at a rate of 0.20 T/s . What is the magnitude of the emf induced in the coil?

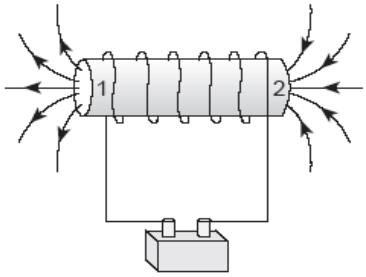
A. 0.0010 V
B. 0.050 V
C. 0.40 V
D. 1.3 V

19. One hundred turns of wire are wrapped around an iron core with a cross-sectional area of 0.0015 m^2. The ends of the wire are connected to a resistor producing a circuit with a total resistance of 10.0 Ω.



If the magnetic field in the iron core changes from 3.0 T towards the left to 1.0 T towards the right, how much charge flows in the circuit?
A. 0.030 C
B. 0.060 C
C. 0.30 C
D. 0.60 C

20. Identify the magnetic poles 1 and 2 of the current-carrying solenoid in the diagram below.

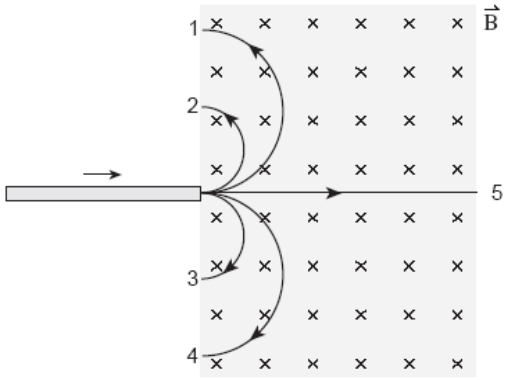


	POLE 1	POLE 2
A.	North	North
B.	North	South
C.	South	North
D.	South	South

21. Determine the direction of the magnetic force on the current-carrying conductor in the diagram below.

A. Towards the left
B. Towards the right
C. Towards the top of the page
D. Towards the bottom of the page

22. A beam made up of ions of various charges and masses enters a uniform magnetic field as shown.



One type of ion is observed to follow path 2. Which path describes the one taken by an oppositely charged ion with twice the mass and twice the charge? (Assume all ions have the same speed.)
A. Path 1
B. Path 3
C. Path 4
D. Path 5

23. A step-down transformer is required to operate a 12 V, 25 W halogen lamp. Which of the following sets of conditions could apply to this transformer?

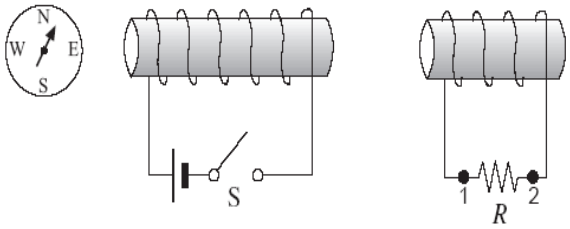
A. $N_p = 20,\ N_s = 200$
B. $V_p = 120\ \text{V},\ I_s = 0.21\ \text{A}$
C. $I_p = 2.1\ \text{A},\ I_s = 2.1\ \text{A}$
D. $V_p = 120\ \text{V},\ I_p = 0.21\ \text{A}$

24. A 0.25 m wire is perpendicular to a uniform 0.20 T magnetic field. What force is exerted on this wire when it carries a 15 A current?

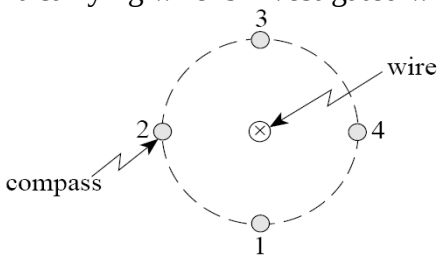
A. 0.12 N
B. 0.75 N
C. 3.0 N
D. 6.0 N

25. As switch S is closed, in what direction does the compass needle point and what is the direction of the current through resistor R?

	Compass Needle Direction	Current Direction through R
A.	west	From 1 to 2
B.	west	From 2 to 1
C.	east	From 1 to 2
D.	east	From 2 to 1



26. The magnetic field around a current-carrying wire is investigated with a compass.



At which of the four positions shown in the diagram will the compass needle point towards the bottom of the page?
A. 1
B. 2
C. 3
D. 4

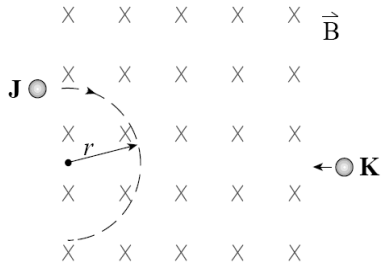
27. When a 15.0 A current flows through a 0.120 m long solenoid, the magnetic field along its centre is 8.00×10^{-2} T. How many turns make up this solenoid?
A. 23
B. 162
C. 509
D. 4 240

28. A coil of wire has an area of 2.5×10^{-3} m^2. What is the magnetic flux through this coil when its plane is perpendicular to a 0.75 T magnetic field?
A. 0 Wb
B. 1.9×10^{-3} Wb
C. 3.3×10^{-3} Wb
D. 0.75 Wb

29. A dc motor has an armature resistance of 1.5 Ω. When running at full speed, the motor draws a current of 2.0 A from a 16 V source. What is the back emf at this speed?
A. 0 V
B. 3 V
C. 13 V
D. 16 V

30. In order to induce an emf in a coil, the magnetic flux must be
A. zero.
B. small.
C. large.
D. changing.

31. Charged particles **J** and **K** enter a magnetic field as show in the diagram below.



Particle **J** travels in a circular path of radius ***r***. Particle **K** has twice the charge and half the momentum of particle **J**. How does the radius of particle **K's** path compare to that of particle **J**?

A. $\frac{1}{4}r$

B. r

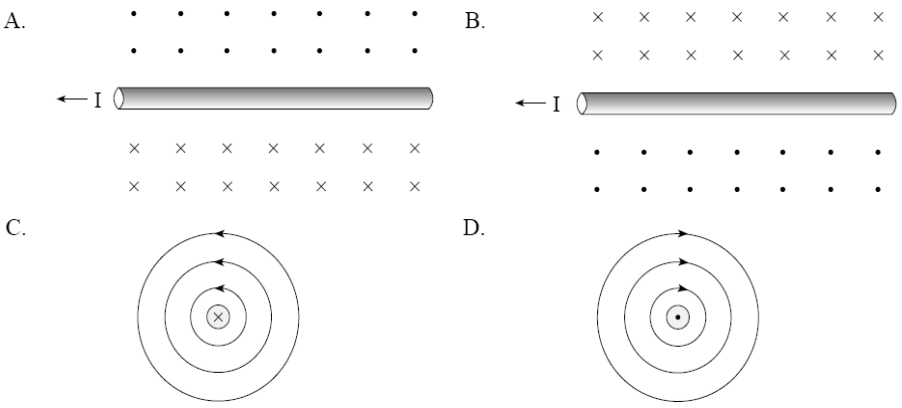
C. $2r$

D. $4r$

32. A transformer is used to reduce the house supply (120 V ac) to operate a small toy that requires 9.0 V ac at 0.240 A. Which of the following gives the primary current and possible values for primary and secondary windings?

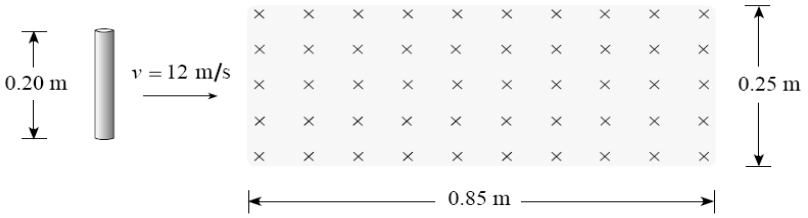
	PRIMARY CURRENT	PRIMARY WINDINGS	SECONDARY WINDINGS
A.	0.018 A	720	54
B.	0.018 A	54	720
C.	3.2 A	720	54
D.	3.2 A	54	720

33. Which of the following shows the magnetic field produced by a current carrying conductor?

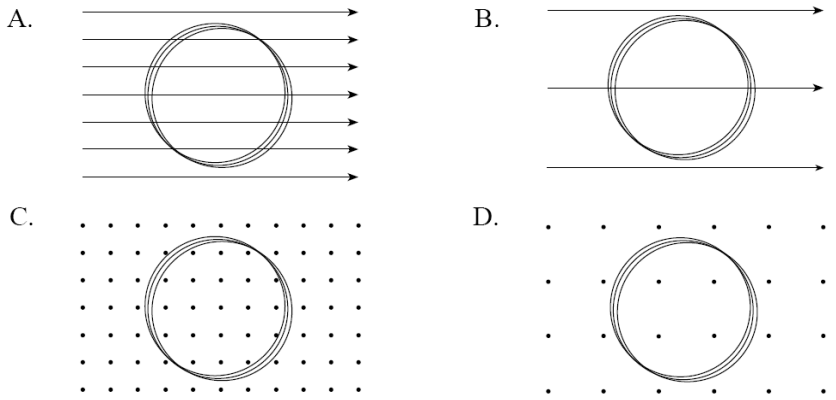


34. A 0.20 m conductor moves at 12 m/s through the 0.60 T field shown below. Calculate the emf induced in the conductor while passing through the field.

A. 0 V
B. 0.13 V
C. 1.4 V
D. 1.8 V



35. Which of the following shows a coil having the largest flux?



WRITTEN SECTION (DO ON SEPARATE PAPER!)

1. The magnetic field at the centre of a solenoid of length 0.25 m is 1.2×10^{-2} T. The current in the windings is 7.5 A.
a) How many windings does the solenoid have? **(4 marks)**
b) If the cross-sectional area of the solenoid is $8.5 \times 10^{-4}\ m^2$, what is the flux through it?
(3 marks)

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2. Electrons accelerated from rest through a potential difference of 300 V enter a 4.1×10^{-2} T magnetic field at right angles. What is the radius of curvature of the path taken by the electrons? **(7 marks)**

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3. a) A 16.0 V power supply is used to run a dc motor. When the motor is jammed so that it cannot turn, it draws a current of 12.0 A. What is the back or counter emf when the motor runs freely, drawing a current of 2.50 A? **(5 marks)**
b) Using principles of physics, explain why the motor draws a much higher current when jammed than when running freely. **(4 marks)**

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4. A 0.120 m diameter coil consisting of 200 loops is placed in a 0.35 T magnetic field. The magnetic field is changed to 0.25 T in the opposite direction in 0.80 s.

What is the magnitude of the current through the 33Ω resistor connected to the coil?
(Ignore the resistance of the coil.) **(7 marks)**