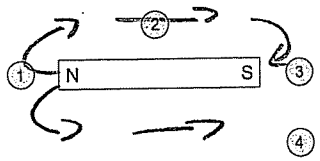
Magnetism & Induction Review

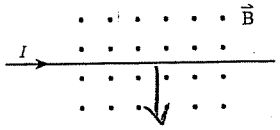
1. A compass is positioned at each of the following locations near a bar magnet.



In which location will the compass needle point to the right-hand side of the page?

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

2. A current-carrying conductor is placed in a uniform magnetic field as shown.

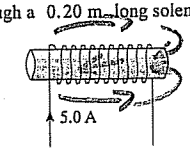


R. H. R

What is the direction of the magnetic force on this conductor?

A. Into the page
B. Out of the page
C. Towards the top of the page
D. Towards the bottom of the page

3. A 5.0 A current flows through a 0.20 m long solenoid that contains 1 500 loops.

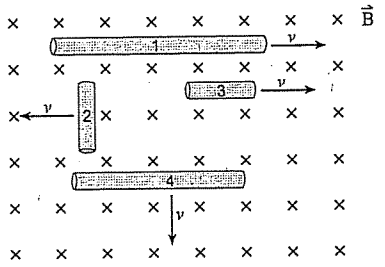


$B = \frac{\mu_0 N I}{\ell} = \frac{(4\pi \times 10^{-7})(1500)(5A)}{.2} = .047$

What are the magnitude and direction of the magnetic field at the centre of the solenoid?

	MAGNITUDE	DIRECTION
A.	9.4×10^{-3} T	left
B.	9.4×10^{-3} T	right
C.	4.7×10^{-2} T	left
D.	4.7×10^{-2} T	right

4. Four conductors of different lengths are moved through a uniform magnetic field at the same speed.



$B\ell v = 4$

Which conductor will induce the greatest emf?

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

5. A motor has an armature resistance of 3.5 Ω and is connected to a 12.0 V source. At full speed the current through the armature is 0.18 A. What is the back emf at full speed?

A. 0 V
B. 0.63 V
C. 11.4 V
D. 12.0 V

$V_{back} = Emf - Ir$
$= 12v - (.18)(3.5)$
$= 11.37v$

6. A **step-down** transformer has a 500 turn primary that operates at 120 V ac. Which of the following sets of conditions best describes the number of secondary turns and secondary voltage of this transformer?

	SECONDARY TURNS	SECONDARY VOLTAGE
A.	40 ✓	9.6 V ac ✓
B.	40 ✓	1 500 V ac
C.	2 000	30 V ac
D.	2 000	480 V ac

Step down reduces V & N

$\mathcal{E}mf = \frac{N\Delta\Phi}{\Delta t} = \frac{-(1)(0-.17)(4.5\times10^{-2}\,m^2)}{.35\,s}$

$= .022\,V$

7. A flexible loop of wire of area 4.5×10^{-2} m^2 is positioned in a 0.17 T magnetic field as shown in Figure A. The loop is then stretched until its area is zero in a time of 0.35 s (Figure B). What is the average induced emf in the circuit and the direction of the current through resistor R?

Figure A

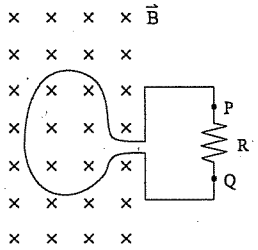
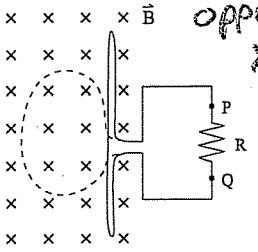


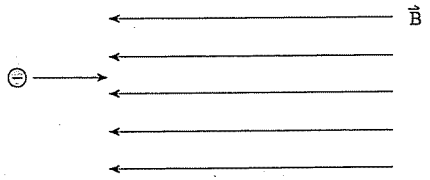
Figure B



since x is reduced oppose this by increasing x inside loop

	AVERAGE EMF	DIRECTION OF CURRENT THROUGH R
(A.)	2.2×10^{-2} V ✓	P to Q ✓
B.	2.2×10^{-2} V ✓	Q to P
C.	4.9×10^{-1} V	P to Q
D.	4.9×10^{-1} V	Q to P

8. An electron enters a uniform magnetic field as shown below.

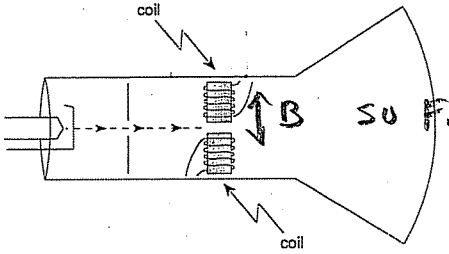


The path of the electron upon entering the field would be

(A.) linear.
B. circular.
C. parabolic.
D. hyperbolic.

B must be ⊥ to Q or I

9. The diagram below represents a cross-sectional view from the side of a cathode ray tube. What is the purpose of the coils in a functional cathode ray tube?



so Fm determined by L.H.R.

A. They increase the speed of the electrons.
B. They focus the electrons into a fine beam.
(C.) They deflect the electrons into or out of the page.
D. They deflect the electrons toward the top or bottom of the page.

10. A solenoid of length 0.35 m and diameter 0.040 m carries a current of 5.0 A through its windings. If the magnetic field in the centre of the solenoid is 2.8×10^{-2} T, what is the number of turns per metre for this solenoid?

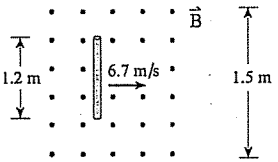
A. 1.8×10^{2} turns/m
B. 7.8×10^{2} turns/m
C. 1.6×10^{3} turns/m
(D.) 4.5×10^{3} turns/m

$B = \mu_0 n I$

$.028 = (4\pi\times10^{-7})(n)(5.0\,A)$

$n = 4456$

11. A 1.2 m length of wire is pulled through a uniform 0.045 T magnetic field at 6.7 m/s as shown. What emf is generated between the ends of the wire?



A. 0 V
B. 0.090 V
(C.) 0.36 V
D. 0.45 V

$\mathcal{E} = Blv$

$= (.045\,T)(1.2)(6.7\,m/s)$

$= .3618\,V$

12. A dc motor is connected to a 12.0 V power supply. When the armature is rotating, the current through it is 0.78 A and the back emf is 10.6 V. What is the resistance of the armature?

A. 1.4 Ω
B. 1.8 Ω
C. 14 Ω
D. 15 Ω

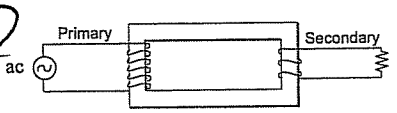
$V_{back} = \mathcal{E} - Ir$

$10.6V = 12V - (.78)(r)$

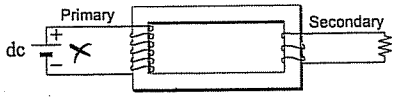
$r = 1.79\,\Omega$

13. In which of the following diagrams is the secondary **current** greater than the primary **current**?

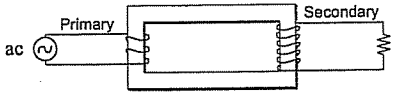
A.



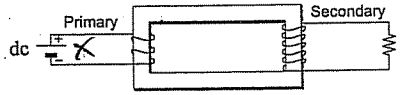
B.



C.



D.

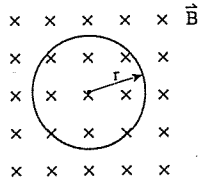


$\frac{N_p}{N_s} = \frac{I_s}{I_p}$

for $I_s > I_p$

$N_p > N_s$

14. An electron circulates in a uniform 5.0×10^{-4} T magnetic field as shown. If the electron has 3.2×10^{-18} J of kinetic energy, what is its radius of orbit, r?



$E_K = \frac{1}{2}mv^2$

$3.2\times10^{-18} = \frac{1}{2}(9.11\times10^{-31})v^2$

$v = 2.65\times10^6$ m/s

A. 2.3×10^{-7} m
B. 4.6×10^{-4} m
C. 2.5×10^{-3} m
D. 3.0×10^{-2} m

$F_m = F_c$

$QvB = \frac{mv^2}{r}$

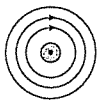
$r = \frac{mv}{QB}$

$r = \frac{(9.11\times10^{-31})(2.65\times10^6)}{(1.6\times10^{-19})(5\times10^{-4})}$

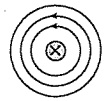
$= .030$

15. Which of the following diagrams shows the magnetic field produced by a long current-carrying wire?

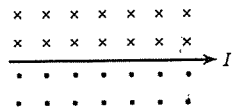
A.



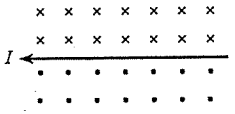
B.



C.



D.



RHR

16. Which of the following devices commonly uses a solenoid?

A. kettle
B. television
C. battery
D. incandescent bulb

17. An electric motor is connected to a constant source of potential. Considering back emf, which of the following observations is correct?

A. At full speed the applied voltage increases. ✗
B. At full speed the armature resistance increases. ✗
C. If the motor is kept from rotating at full speed, the armature heats up. ✗
D. If the motor is kept from rotating at full speed, the armature temperature decreases. ✓

$P = I^2 R$

18. Which of the following are correct units for magnetic flux?

A. T
B. Wb
C. V/m
D. $N \cdot m^2$

19. In a **step-up** transformer, how does the secondary voltage V_s compare with the primary voltage V_p, and the number of turns in the secondary N_s compare with the number of turns in the primary N_p ?

$V_s > V_p$

$N_s > N_p$

	VOLTAGE	NUMBER OF TURNS
A.	$V_s < V_p$	$N_s > N_p$
B.	$V_s > V_p$	$N_s > N_p$ ✓
C.	$V_s < V_p$	$N_s < N_p$
D.	$V_s > V_p$	$N_s < N_p$

20. An ideal transformer has a potential difference of 130 V ac across the primary windings and a potential difference of 780 V ac across the secondary windings. There are 390 turns in the secondary. The secondary current is

A. twice the primary current.
B. one half the primary current.
C. six times the primary current.
D. one-sixth the primary current.

$V_p = 130\ V$ } 6 times
$V_s = 780\ V$ }

$V_s \uparrow$ $I_s \downarrow$ by 6 times

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