Last Name:________________First Name_________________Network-ID__________

Discussion Section:________Discussion TA Name:______________________________

**Turn off your cell phone and put it out of sight.**
**Keep your calculator on your own desk. Calculators cannot be shared.**
**This is a closed book exam. You have ninety (90) minutes to complete it.**

1. Use a #2 pencil. Do not use a mechanical pencil or pen. Darken each circle completely, but stay within the boundary. If you decide to change an answer, erase vigorously; the scanner sometimes registers incompletely erased marks as intended answers; this can adversely affect your grade. Light marks or marks extending outside the circle may be read improperly by the scanner. Be especially careful that your mark covers the **center** of its circle.

2. Print your **NETWORK ID** in the designated spaces at the *right* side of the answer sheet, starting in the left most column, then **mark the corresponding circle** below each character. If there is a letter "o" in your NetID, be sure to mark the "o" circle and not the circle for the digit zero. If and only if there is a hyphen "-" in your NetID, mark the hyphen circle at the bottom of the column. When you have finished marking the circles corresponding to your NetID, check particularly that you have not marked two circles in any one of the columns.

3. Print **YOUR LAST NAME** in the designated spaces at the *left* side of the answer sheet, then mark the corresponding circle below each letter. Do the same for your **FIRST NAME INITIAL**.

4. You may find the version of **This Exam Booklet at the top of page 2**. Mark the **version** circle in the **TEST FORM** box near the middle of your answer sheet. **DO THIS NOW!**

5. Do not write in or mark the circles in any of the other boxes (STUDENT NUMBER, DATE, SECTION, SCORES, SPECIAL CODE).

6. Sign your name **(DO NOT PRINT)** on the **STUDENT SIGNATURE** *line*.

7. On the **SECTION** *line*, print your **DISCUSSION SECTION**. You need not fill in the COURSE or INSTRUCTOR lines.

*Before starting work, check to make sure that your test booklet is complete. You should have 16* ***numbered pages*** *plus three Formula Sheets.*

*Academic Integrity*—**Giving assistance to or receiving assistance from another student or using unauthorized materials during a University Examination can be grounds for disciplinary action, up to and including dismissal from the University.**

**This Exam Booklet is Version A**. Mark the **A** circle in the **TEST FORM** box near the middle of your answer sheet. **DO THIS NOW!**

*Exam Grading Policy—*

The exam is worth a total of **126**points, composed of three types of questions.

**MC5:** *multiple-choice-five-answer questions, each worth 6 points.*
**Partial credit will be granted as follows.**

(a) If you mark only one answer and it is the correct answer,
you earn **6** points.
(b) If you mark *two* answers, one of which is the correct answer,
you earn **3** points.
(c) If you mark *three* answers, one of which is the correct answer,
you earn **2** points.
(d) If you mark no answers, or more than *three*, you earn 0 points.

**MC3:** *multiple-choice-three-answer questions, each worth 3 points.*
**No partial credit.**

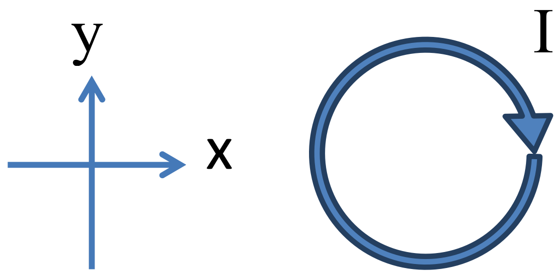
(a) If you mark only one answer and it is the correct answer,
you earn **3** points.
(b) If you mark a wrong answer or no answers, you earn **0** points.

**MC2:** *multiple-choice-two-answer questions, each worth 2 points.*
**No partial credit.**

(a) If you mark only one answer and it is the correct answer,
you earn **2** points.
(b) If you mark the wrong answer or neither answer, you earn **0** points.

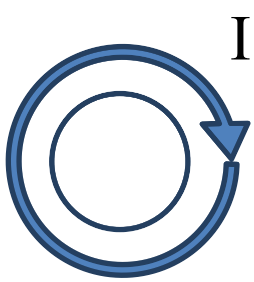
Some helpful information:

- A reminder about prefixes: p (pico) = $10^{-12}$; n (nano) = $10^{-9}$; μ (micro) = $10^{-6}$; m (milli) = $10^{-3}$; k (kilo) = $10^{+3}$; M or Meg (mega) = $10^{+6}$; G or Gig (giga) = $10^{+9}$.



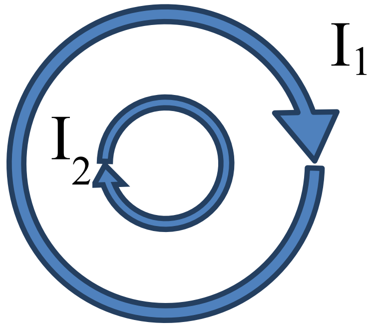

1. The picture above shows a top-down view of a solenoid. The current I in the solenoid flows clockwise. Which way does the magnetic field point at the center of the solenoid?

a. Into the page
b. Out of the page
c. Along the +y direction
d. Along the –y direction
e. Along the +x direction




2. As shown above, a loop of wire is added to the center of the solenoid. The current in the solenoid is increased in time. Which way does the induced current flow in the loop of wire?

a. Clockwise
b. Counter-clockwise
c. There is no current in the loop of wire




3. Suppose a smaller diameter solenoid is placed inside a larger diameter solenoid, as shown in the top-down view above. The first has current $I_1$ and turns per unit length $n_1$. The second has current $I_2$ and turns per unit length $n_2$. Both currents are in the clockwise direction. What is the magnitude of the magnetic field at the center of the solenoids?

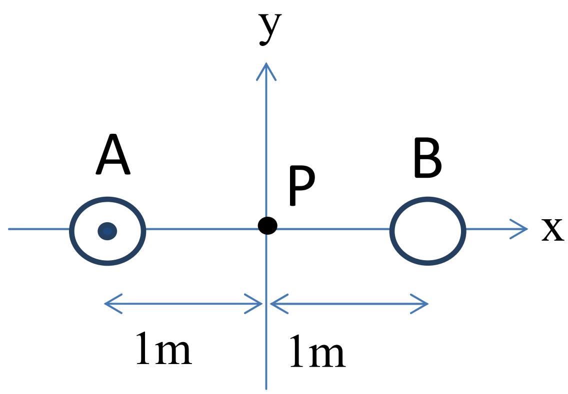
a. $B=0$
b. $B=\mu_0|I_1n_1+I_2n_2|$
c. $B=\mu_0|I_1n_1-I_2n_2|$
d. $B=\mu_0|I_1n_2+I_2n_1|$
e. $B=\mu_0|I_1n_2-I_2n_1|$

4. If you have a solenoid 13m long that consists of 169 turns, what current must you put through it to produce a 50μT magnetic field at the center?

a. 0.2A
b. 3.1A
c. 39.8A
d.235A
e. 3060A

***The next two questions refer to the following situation:***

As shown in the picture below, two long, straight wires are separated by 2m. The point P lies at the midpoint of the line connecting the two wires.




5. If the current through wire A is 1 A and no current flows through wire B, what is the magnitude of the magnetic field at point P?

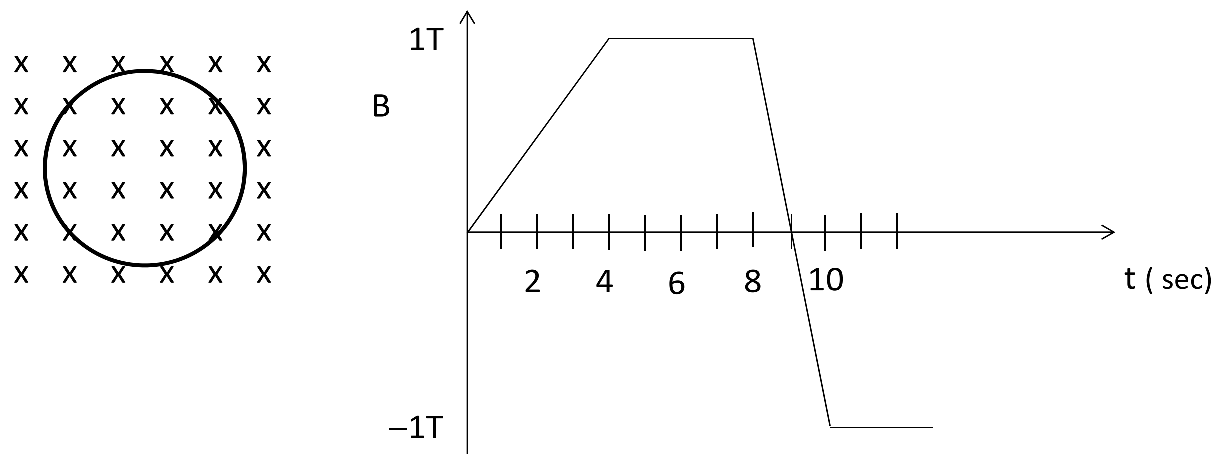
a. $1 \times 10^{-7}$ T
b. $2 \times 10^{-7}$ T
c. $4\times 10^{-7}$ T
d. $3.14 \times 10^{-7}$ T
e. $0.318 \times 10^{-7}$ T

6. What is the direction of the magnetic field at point P if 1A flows through wire B into the page?

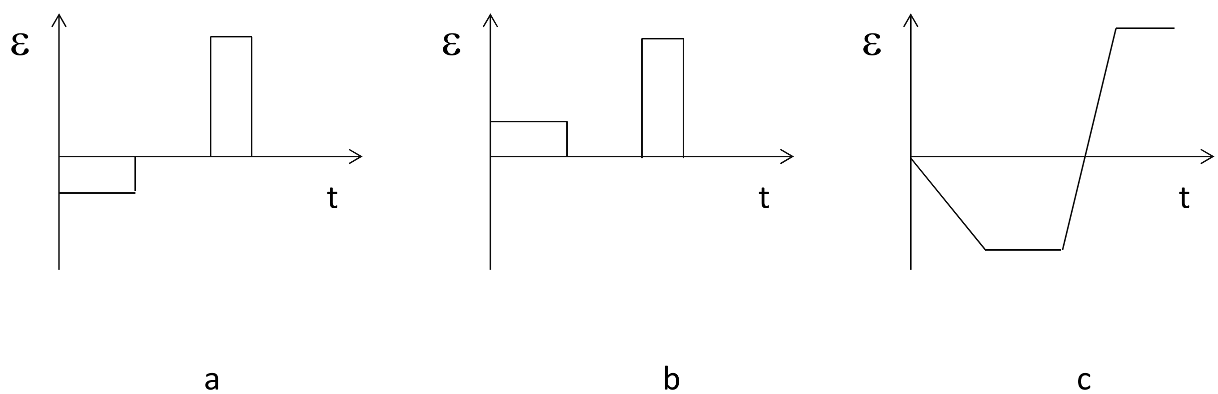
a. Into the page
b. Out of the page
c. +y direction
d. –y direction
e. The magnetic field would be zero

***The following 3 questions refer to the following situation.***

7. A conducting ring sits in an external magnetic field. Initially the magnetic field is zero. The field is varied with time according to the graph with a positive B field pointing into the page.

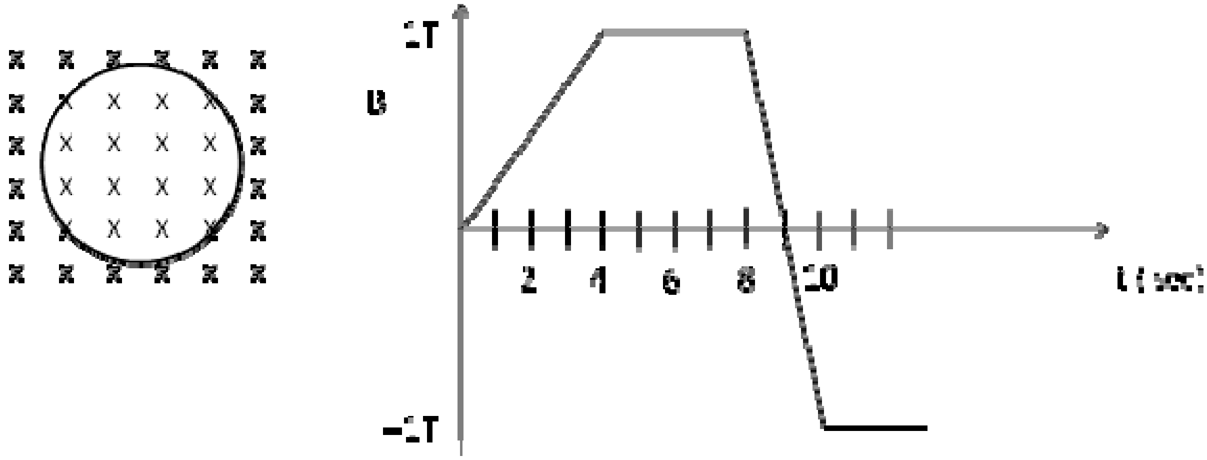



Which graph below best represents the EMF induced in the loop versus time?




a. a
b. b
c. c

***The following 2 questions continue from the previous page.***




8.  Relate the magnitude of the current in the loop at t=2 seconds to the magnitude of the current in the loop at t=9 seconds.

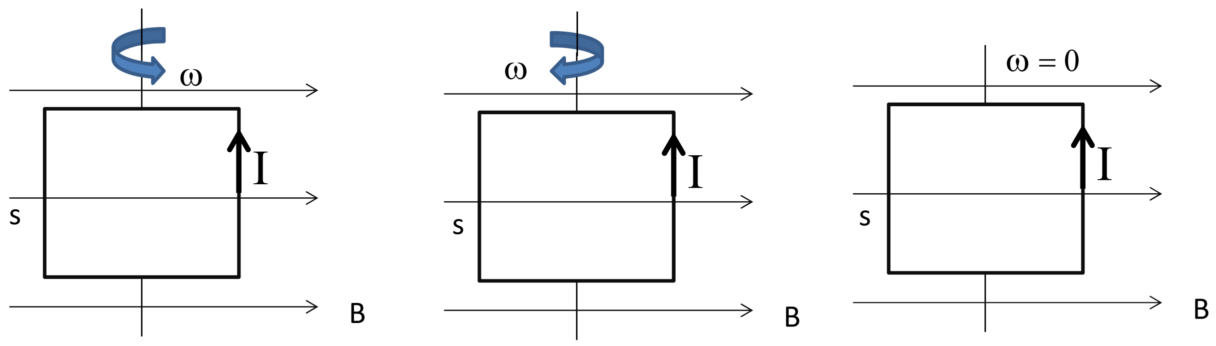
a. I( 2 sec ) > I( 9 sec )
b. I( 2 sec ) < I( 9 sec )
c. I( 2 sec ) = I( 9 sec )

9.  The current generated at t=2 seconds and t=9 seconds are

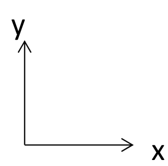
a. in the same direction
b. in opposite directions
c. no current is generated at those times

***The next two questions pertain to the same situation.***

10. A square loop (connected to a battery not shown in the picture) has a current I flowing in the loop as indicated below and lies in the x-y plane. The loop is in an external uniform magnetic field B which points in the x direction. The left side of the loop is labeled s. In which direction does the loop rotate?




a b c



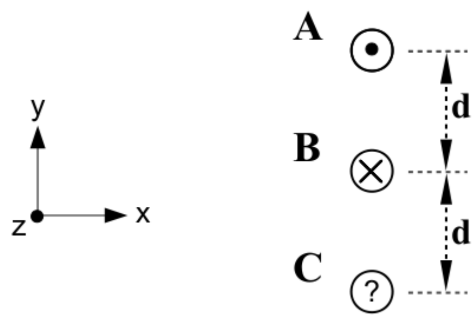

a. side s rotates out of the page
b. side s rotates into the page
c. the loop does not rotate

11. The current in the loop is I = 2.2 A, the side is 10 cm, the magnetic field B = 2 T and the number of turns in the loop N = 3. What is the magnitude of the torque on the loop?

a. $\tau = 0.023$ N-m
b. $\tau = 0.974$ N-m
c. $\tau = 0.132$ N-m

***The next two questions pertain to the following situation:***

The picture below shows three wires oriented vertically, each spaced a distance d = 10 cm apart. Wire A has current $I_A$ = 5 A pointing out of the page (+z direction) and Wire B has current $I_B$ = 5 A pointing into of the page (-z direction). Wire C has unknown current and direction. Each wire is 10 m long.



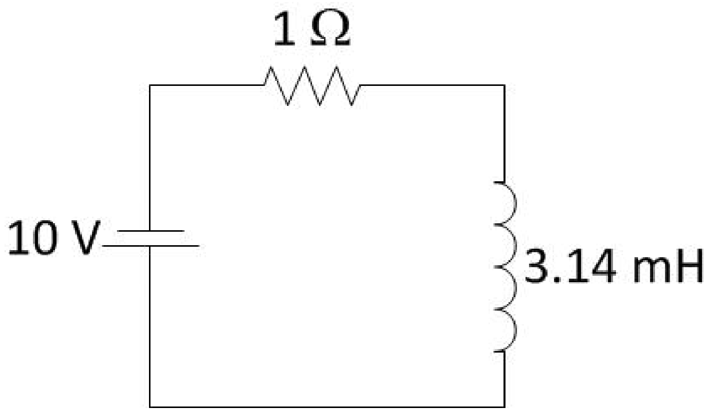

12. If we want current B to have a net force of zero on it, then in what direction should current C point?

a. out of the page
b. into the page
c. no current is necessary

13. Assume the direction and magnitude of the current in wire C is such that the net force on wire B is zero. In which direction could an external magnetic field $B_{ext}$ be applied so that there continues to be no net force on wire B?

a. +x
b. +y
c. +z

14. A 1 Ohm resistor and 3.14 mH inductor have been connected in series to a 10 V battery for a long time.

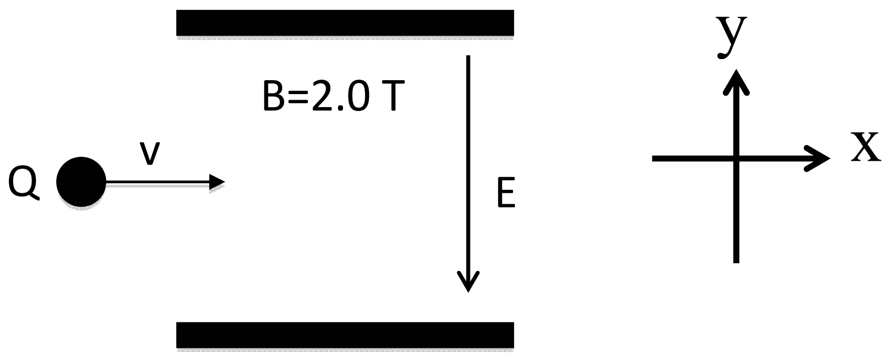



How much energy is stored in the inductor?

a. –0.25 J
b. –0.16 J
c. 0 J
d. 0.16 J
e. 0.25 J

***The next two questions pertain to the following situation:***

A charge with m= 1 kg and Q= +1.0 C enters into a parallel plate capacitor with E=100.0 V/m. An external magnetic field with magnitude of 2.0 T is applied in some direction. Ignore the force of gravity.




15. Which direction should the magnetic field point to make it possible for the particle to travel in a straight line?

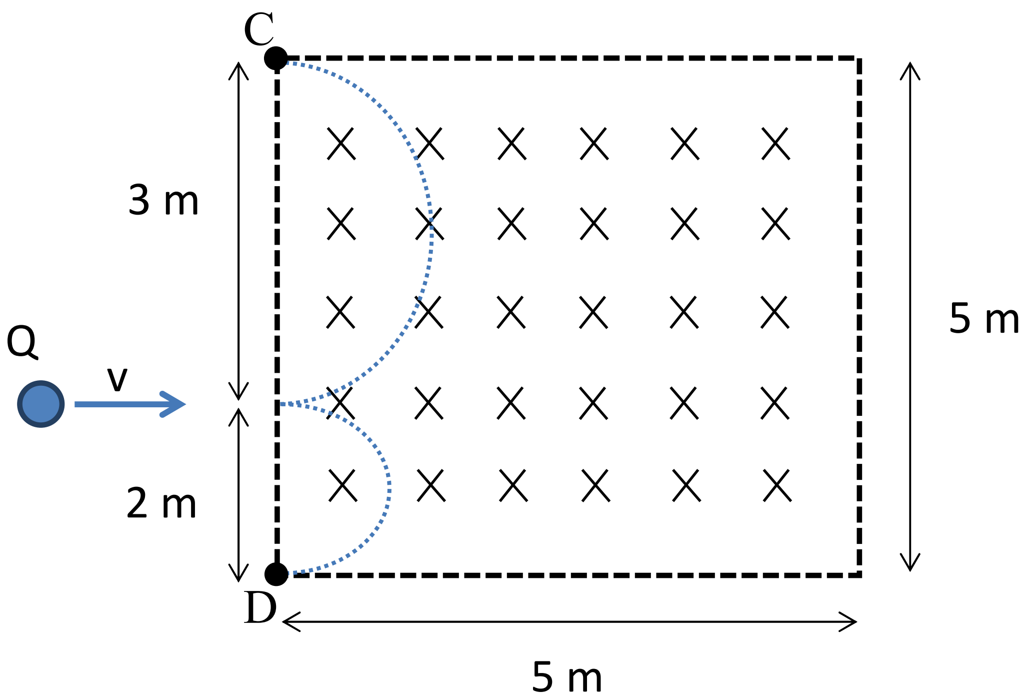
a. Into the page
b. Out of the page
c. +y
d. –y
e. +x

16. What is the initial speed of this charge if it travels in a straight line?

a. 40 m/s
b. 50 m/s
c. 100 m/s
d. 0.02 m/s
e. 65 m/s

***The next question pertains to the following situation:***

A charged particle with charge Q= 1C is travelling at v = 1 m/s in the +x direction toward a square with side length 5m containing magnetic field B= 3 Tesla, directed into the page. The particle enters the field at y=2 meters above the bottom of the square. There is no magnetic field anywhere outside the square.

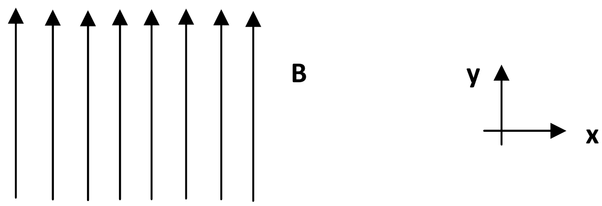



17. The particle travels in a complete semi-circle. Given the direction of the magnetic field, this means that the particle exits at either point C or D, which you must determine. What is the mass of the particle?

a. 0.3 kg
b. 1 kg
c. 3 kg
d. 4.5 kg
e. 7.5 kg

***The next three questions pertain to the following situation:***

A particle of charge **-q** moves at a velocity **v** in a magnetic field **B**, directed at the +y direction.




18. What is the direction of the magnetic force on the particle if the velocity of the particle is in the +y-direction?

a. –y
b. +x
c. –x
d. Into the page
e. 0 (no force)

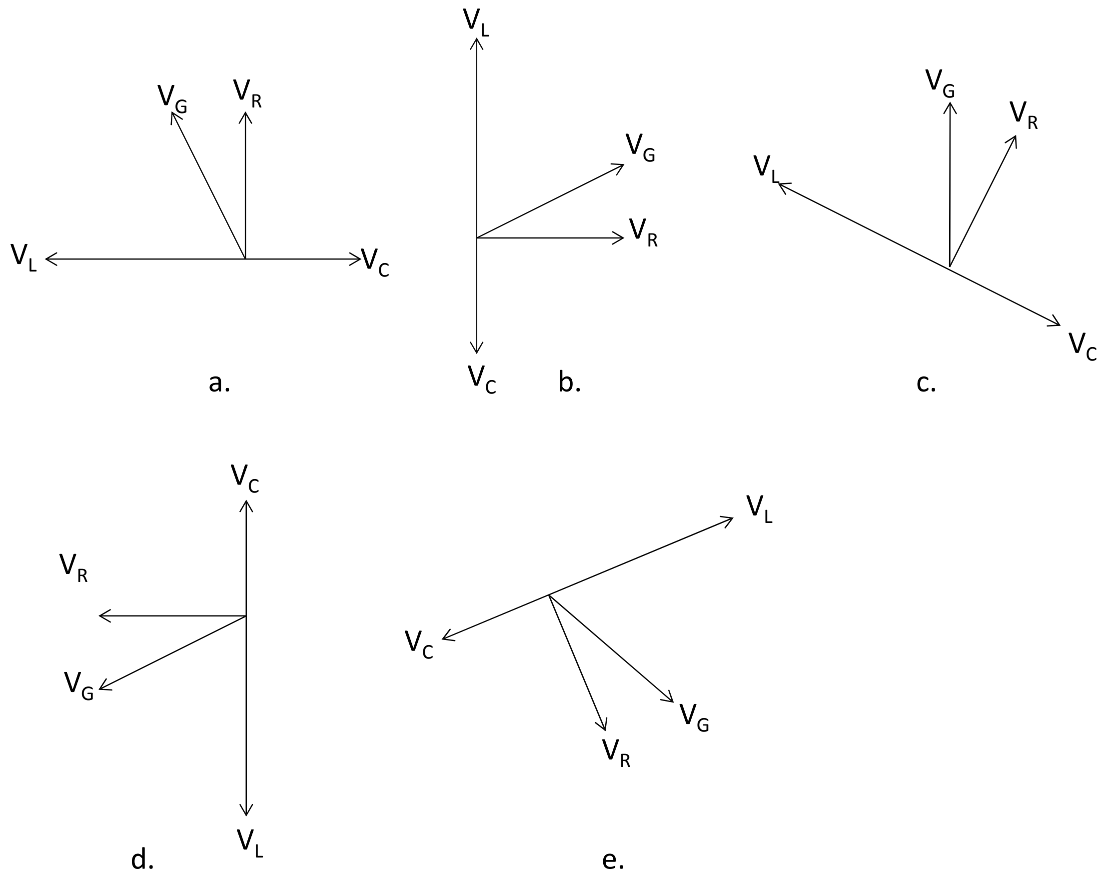
19. Suppose the particle travels in the +x direction while in the field. Now what direction does the magnetic force point in?

a. –x
b. +y
c. Out of the page
d. Into the page
e. 0 (no force)

20. Now suppose that the particle travels at a velocity **v** with components $v_x$= -1m/s and $v_y$= -2m/s. If the B-field has strength 3T and the charge of the particle is q = -5μC, what is the magnitude of the magnetic force on the particle?

a. $3.4 \times 10^{-5}$ N
b. $3.0 \times 10^{-5}$ N
c. $1.5 \times 10^{-5}$ N
d. $1.2 \times 10^{-5}$ N
e. 0 N

21. In a series RLC circuit, which of the following phasor diagrams corresponds to the instant that maximum current is flowing through the circuit?




a. a
b. b
c. c
d. d
e. e

22. Which of the following statements is (are) always true for a series RLC circuit?

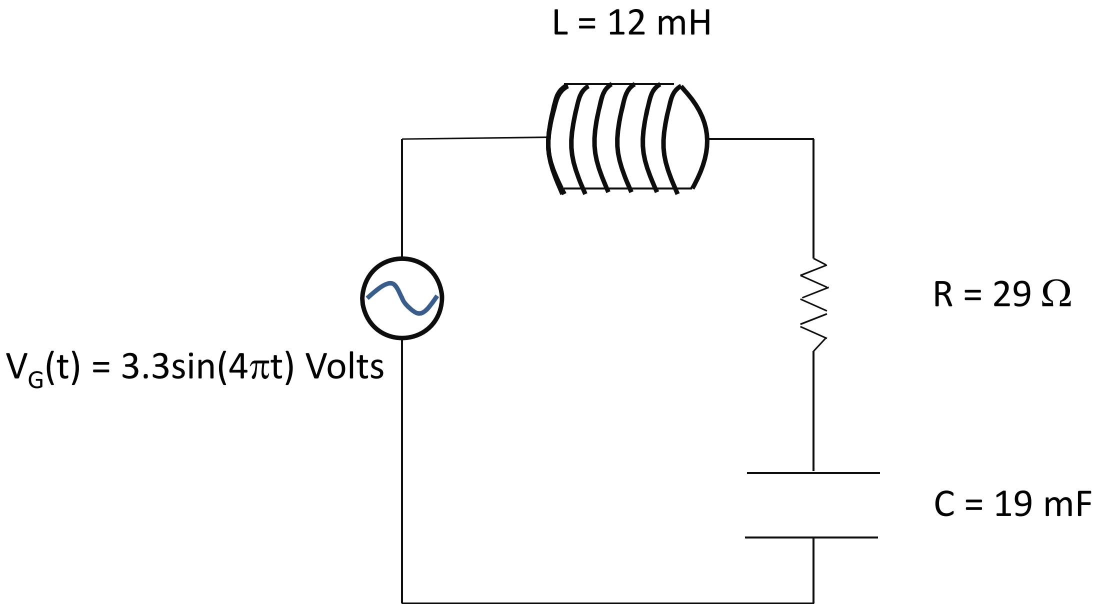
I: $V_{gen}(t) = V_L(t) + V_R(t) + V_C(t)$

II: $V_{gen,rms} = V_{L,\,rms} + V_{R,\,rms} + V_{C,\,rms}$

a. I
b. II
c. I and II

***The following three questions pertain to the picture below.***

Consider the following LRC circuit.




23. What is the total impedance Z of the circuit?

a. 18.4 Ohms
b. 12.8 Ohms
c. 32.3 Ohms
d. 29.3 Ohms
e. 24.3 Ohms

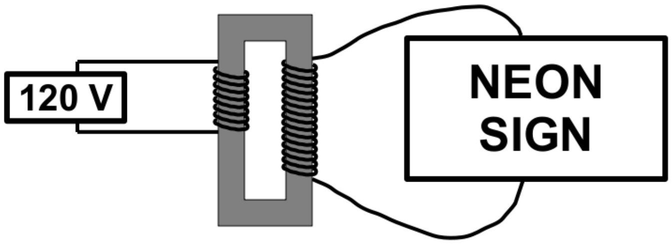
24. Suppose the capacitance is increased. What will happen to the total impedance Z?

a. the impedance will increase
b. the impedance will decrease
c. impedance will remain unchanged

25. Given the values for R, L, and C in the diagram, what is the resonant frequency of the circuit?

a. 8.44 1/s
b. 10.54 1/s
c. 9.23 1/s
d. 14.89 1/s
e. 18.40 1/s

26. A step-up transformer is used to supply adequate voltage to a neon sign.




The transformer is designed to have an output voltage of 1200 V when the primary is connected to a 120 V source. How many turns must the secondary winding have if the number of primary turns is 50?

a. 10 turns
b. 50 turns
c. 100 turns
d. 500 turns
e. 1000 turns

**Did you bubble in your name, exam version, and network ID?**
**Check to make sure you have bubbled in all your answers.**

KEY
Fall 2011 – Exam 2

1. a
2. b
3. b
4. b
5. b
6. c
7. a
8. b
9. b
10. a
11. c
12. a
13. c
14. d
15. a
16. b
17. d
18. e
19. d
20. c
21. a
22. a
23. d
24. b
25. b
26. d