جامعة بيرزيت
BIRZEIT UNIVERSITY
Physics Department

physics 132

Instructor: Ghassan Abbas

Final Exam — **First Sem 2012/2013**

Time: 2:30 hours — **16-1-2013**

Student Name:..

Student Number:...

Answer Sheet

Q#	A	B	C	D	E	Q#	A	B	C	D	E
1						19					
2						20					
3						21					
4						22					
5						23					
6						24					
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12						30					
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16											
17											
18											

$e = 1.6 \times 10^{-19}$C
$M_e = 9.11\times10^{-31}$kg
$\epsilon_0 = 8.85\times10^{-12}$ $C^2/N.m^2$
$\mu_0 = 4\pi \times 10^{-7}$ T.m/A
$M_p = 1.67\times10^{-27}$kg
1 eV = 1.6×10^{-19}J

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. A 2-T uniform magnetic field makes an angle of 30° with the z axis. The magnetic flux through a 3-m² portion of the xy plane is:

a. 12 Wb
b. 2.0 Wb
c. 3.0 Wb
d. 6 Wb
e. 5.2 Wb

____ 2. A rectangular loop of wire has area A. It is placed perpendicular to a uniform magnetic field B and then rotated around one of its sides at frequency f. The maximum induced emf is:

a. BAf
b. $2\pi BAf$
c. BAf
d. $4\pi BAf$
e. $2BAf$

____ 3. Four 20-Ω resistors are connected in series and the combination is connected to a 20-V emf device. The current in any one of the resistors is:

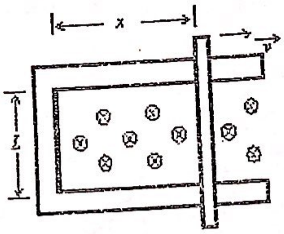
a. 0.25 A
b. 5.0 A
c. 4.0 A
d. 1.0 A
e. 100 A

____ 4. A particle (mass = 5.0 g, charge = 40 mC) moves in a region of space where the electric field is uniform and is given by $E_x = 2.5$ N/C, $E_y = E_z = 0$. If the velocity of the particle at $t = 0$ is given by $v_y = 30$ m/s, $v_x = v_z = 0$, what is the speed of the particle at $t = 2.0$ s?

a. 50 m/s
b. 25 m/s
c. 70 m/s
d. 10 m/s
e. 89 m/s

Name: ____________________

____ 5. A rod with resistance R lies across frictionless conducting rails in a constant uniform magnetic field B, as shown. Assume the rails have negligible resistance. The magnitude of the force that must be applied by a person to pull the rod to the right at constant speed v is:



qv x B

a. B^2L^2v/R
b. BLv/R
c. B^2Lxv/R
d. BLv
e. 0

____ 6. The electric field in a region of space is given by $E_x = (3.0x)$ N/C, $E_y = E_z = 0$, where x is in m. Points A and B are on the x axis at $x_A = 3.0$ m and $x_B = 5.0$ m. Determine the potential difference $V_B - V_A$.

a. −6.0 V
b. −24 V
c. +24 V
d. +30 V
e. −18 V

____ 7. What is the kinetic energy of an electron that passes undeviated through perpendicular electric and magnetic fields if $E = 4.0$ kV/m and $B = 8.0$ mT?

$v = \frac{E}{B}$

10^6

a. 0.65 eV
b. 0.71 eV
c. 1.4 eV
d. 0.84 eV
e. 0.54 eV

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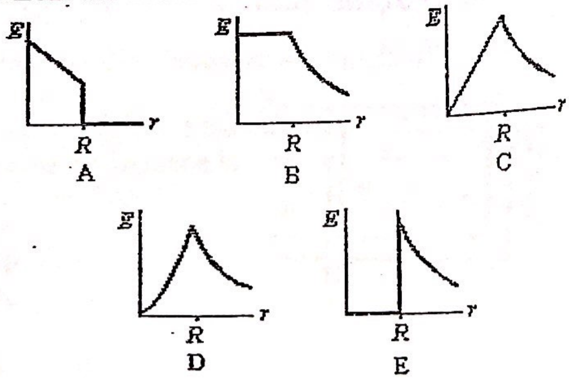
____ 8. Which of the following graphs represents the magnitude of the electric field as a function of the distance from the center of a solid charged conducting sphere of radius R?



a. A
b. D
c. E
d. B
e. B

____ 9. A +20-nC point charge is placed on the x axis at $x = 2.0$ m, and a −25-nC point charge is placed on the y axis at $y = -3.0$ m. The angle between the net electric field at the origin and +x axis counterclockwise is :

a. 209°
b. 61°
c. 151°
d. 29°
e. 241°

____ 10. In the Hydrogen atom (H), assuming the electron is moving in a uniform circular motion of radius 5.29×10^{-11} m centered at the nucleus of charge 1.6×10^{-19} C. The kinetic energy of the electron is:

a. 2.18×10^{-18} J
b. 4.36×10^{-18} J
c. 8.23×10^{-18} J
d. -2.18×10^{-18} J
e. -4.36×10^{-18} J

____ 11. Which of the following equations, along with a symmetry argument, can be used to calculate the electric field produced by a uniform time-varying magnetic field?

a. $\oint \vec{E}\cdot d\vec{A} = q/\varepsilon_0$
b. none of these
c. $\oint \vec{E}\cdot d\vec{s} = -d\Phi_B/dt$
d. $\oint \vec{B}\cdot d\vec{s} = \mu_0 i + \mu_0\varepsilon_0 d\Phi_E/dt$
e. $\oint \vec{B}\cdot d\vec{A} = 0$

____ 12. If the charge on a parallel-plate capacitor is doubled:
a. the capacitance is halved
b. the electric field is halved
c. the capacitance is doubled
d. the electric field is doubled
e. the surface charge density is not changed on either plate

____ 13. A straight wire of length L carries a current I in the positive z direction in a region where the magnetic field is uniform and specified by $B_x = 3B$, $B_y = -2B$, and $B_z = B$, where B is a constant. What is the magnitude of the magnetic force on the wire?
a. 3.6 ILB
b. 4.2 ILB
c. 3.2 ILB
d. 5.0 ILB
e. 1.0 ILB

____ 14. A certain capacitor has a capacitance of 5.0 μF. After it is charged to 5 μC and isolated, the plates are brought closer together so its capacitance becomes 10 μF. The work done by the agent is about:
a. 1.25×10^{-6} J
b. 8.3×10^{-7} J
c. -1.25×10^{-6} J
d. -8.3×10^{-7} J
e. 0

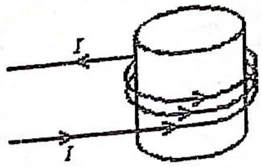
____ 15. Of the following the copper conductor that has the least resistance is:
a. thick, long and hot
b. thick, short and cool
c. thin, short and cool
d. thin, short and hot
e. thin, long and hot

____ 16. An inductance L, resistance R, and ideal battery of emf ε are wired in series. A switch in the circuit is closed at time 0, at which time the current is zero. At any later time t the potential difference across the resistor is given by:
a. $\varepsilon e^{-Rt/L}$
b. $\varepsilon(1 + e^{-Rt/L})$
c. $\varepsilon e^{-Lt/R}$
d. $\varepsilon(1 - e^{-Lt/R})$
e. $\varepsilon(1 - e^{-Rt/L})$

____ 17. A charge (uniform linear density = 9.0 nC/m) is distributed along the x axis from $x = 0$ to $x = 3.0$ m. Determine the magnitude of the electric field at a point on the x axis with $x = 4.0$ m.
a. 20 N/C
b. 74 N/C
c. 61 N/C
d. 81 N/C
e. 88 N/C

Name: ____________________

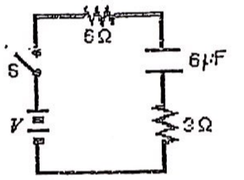
____ 18. Magnetic field lines inside the solenoid shown are:



a. in no direction since $B = 0$
b. clockwise circles as one looks down the axis from the top of the page
c. toward the bottom of the page
d. counterclockwise circles as one looks down the axis from the top of the page
(e.) toward the top of the page

____ 19. A current of 4.0 A is maintained in a single circular loop having a circumference of 80 cm. An external magnetic field of 2.0 T is directed so that the angle between the field and the plane of the loop is 20 °. Determine the magnitude of the torque exerted on the loop by the magnetic forces acting upon it.
a. 0.38 N · m
b. 0.27 N · m
c. 0.41 N · m
d. 0.14 N · m
e. 0.77 N · m

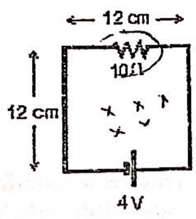
____ 20. In the circuit shown V=15 V, the capacitor is initially uncharged. At time $t = 0$, switch S is closed. If τ denotes the time constant, the approximate current through the 3 Ω resistor when $t = \tau/10$ is:



a. 0.50 A
b. 1.0 A
c. 0.75 A
d. 1.5 A
e. 0.38 A

____ 21. Equal charges, one at rest, the other having a velocity of 10^4 m/s, are released in a uniform magnetic field. Which charge has the largest force exerted on it by the magnetic field?
a. The charge that is moving, if its velocity is parallel to the magnetic field direction when it is released.
b. The charge that is moving if its velocity makes an angle of 45° with the direction of the magnetic field when it is released.
c. The charge that is at rest.
d. All the charges above experience equal forces when released in the same magnetic field.
e. The charge that is moving if its velocity is perpendicular to the magnetic field direction when it is released.

____ 22. The circuit shown is in a uniform magnetic field that is into the page. The current in the circuit is 0.60 A. At what rate is the magnitude of the magnetic field changing: Is it increasing or decreasing?:

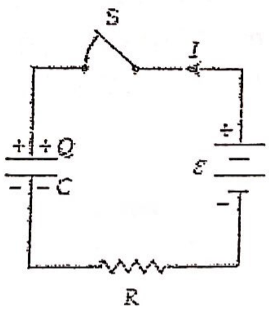


$\frac{d\phi B}{dt}$

$= A \frac{dB}{dt}$

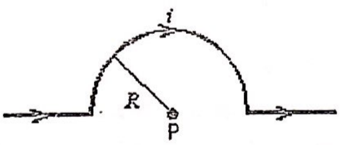
a. 420 T/s, decreasing
b. 420 T/s, decreasing
c. 140 T/s, decreasing
d. 140 T/s, increasing
e. zero

____ 23. At $t = 0$ the switch S is closed with the capacitor uncharged. If $C = 30\ \mu F$, $\varepsilon = 50$ V, and $R = 10\ k\Omega$, what is the potential difference across the capacitor when $I = 2.0$ mA?



a. 45 V
b. 15 V
c. 20 V
d. 30 V
e. 25 V

____ 24. The magnitude of the magnetic field at point P, at the center of the semicircle shown, is given by:



a. $2\mu_0 i/R^2$
b. $\mu_0 i/2R$
c. $\mu_0 i/4R$
d. $\mu_0 i/2\pi R$
e. $\mu_0 i/4\pi R$

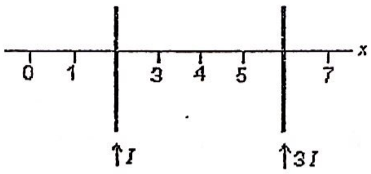
____ 25. In the Hydrogen atom (H), assuming the electron is moving in a uniform circular motion of radius 5.29×10^{-11} m centered at the nucleus of charge 1.6×10^{-19}. The electric potential energy of the electron is :

a. -4.36×10^{-18} J
b. -8.23×10^{-8} J
c. -2.18×10^{-18} J
d. 8.23×10^{-8} J
e. 4.36×10^{-18} J

____ 26. A particle ($m = 3.0\ \mu g$, $q = 5.0\ \mu C$) moves in a uniform magnetic field given by (60j) mT. At $t = 0$ the velocity of the particle is equal to (30j − 40k) m/s. The subsequent path of the particle is

a. helical with a 40-cm radius.
b. helical with a 6.3-cm pitch.
c. circular with a period of 31 ms.
d. circular with a 50-cm radius.
e. circular with 40 cm radius.

____ 27. 16. Two long straight current-carrying parallel wires cross the x axis and carry currents I and $3I$ in the same direction, as shown. At what value of x is the net magnetic field zero?



a. 5
b. 0
c. 3
d. 7
e. 1

____ 28. Two parallel long wires carry the same current and repel each other with a force F per unit length. If both these currents are doubled and the wire separation tripled, the force per unit length becomes:

a. $2F/9$
b. $4F/3$
c. $6F$
d. $4F/9$
e. $2F/3$

____ 29. Gauss' law for magnetism tells us:
a. the magnetic field of a current element
b. charges must be moving to produce magnetic fields
c. that magnetic monopoles do not exist
d. that the line integral of a magnetic field around any closed loop must vanish
e. the net charge in any given volume

7. The units of $1/4\pi\varepsilon_0$ are:

A) $N \cdot m^2/C^2$
B) N^2/C^2
C) $N \cdot m/C$
D) m^2/C^2
E) $N^2 \cdot m^2/C^2$

8. A uniform electric field of 300 N/C makes an angle of 25° with the dipole moment of an electric dipole. If the moment has a magnitude of $2x10^{-9}$ C ·m, the torque exerted by the field has a magnitude of:

A) $6.0x10^{-7}$ N ·m
B) $2.5x10^{-7}$ N ·m
C) $2.8x10^{-7}$ N ·m
D) $5.4x10^{-7}$ N ·m
E) $6.7x10^{-12}$ N ·m

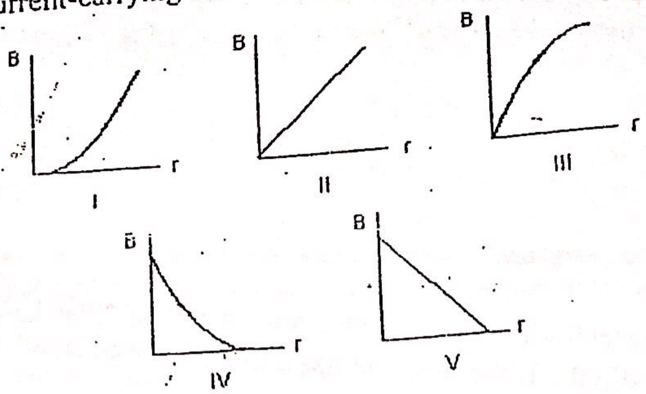
9. A physics instructor in a laboratory charges an electrostatic generator to 25 μC, then carries it into the lecture hall. The net electric flux in $N \cdot m^2/C$ through the lecture hall walls is:

A) $25x10^{-6}$
B) can't tell unless the lecture hall dimensions are given
C) $2.8x10^{6}$
D) 0
E) $2.2x10^{5}$

10. A certain capacitor, in series with a 720 Ω resistor, is being charged. At the end of 10 ms its charge is half the final value. The capacitance is about:

A) 14 μF
B) 20 μF
C) 9.6 μF
D) 10 F
E) 7.2 F

11. Which graph correctly gives the magnitude of the magnetic field outside an infinitely long straight current-carrying wire as a function of the distance r from the wire?



A) IV.
B) V.
C) I.
D) II.
E) III.

12. A dielectric slab is slowly inserted between the plates of a parallel plate capacitor, while the potential difference between the plates is held constant by a battery. As it is being inserted:

A) the potential difference between the plates increases, the charge on the positive plate decreases, and the capacitance remains the same
B) the capacitance, the potential difference between the plates, and the charge on the positive plate all increase
C) the capacitance and the charge on the positive plate decrease but the potential difference between the plates remains the same
D) the capacitance and the charge on the plate increase but the potential difference between the plates remains the same
E) the capacitance, the potential difference between the plates, the charge on the positive plate all decrease

13. A 5-cm radius conducting sphere has a charge density of 2×10^{-6} C/m^2 on its surface. Its electric potential, relative to the potential far away, is:

A) 2.2×10^4 V
B) 1.1×10^4 V
C) 2.3×10^5 V
D) 7.2×10^6 V
E) 3.6×10^5 V

14. The electric potential in a certain region of space is given by $V = -7.5x^2 + 3x$, where V is in volts and x is in meters. In this region the equipotential surfaces are:

A) planes parallel to the x axis
B) unknown unless the charge is given
C) concentric spheres centered at the origin
D) concentric cylinders with the x axis as the cylinder axis
E) planes parallel to the yz plane

15. Electrons (mass m, charge -e) are accelerated from rest through a potential difference V and are then deflected by a magnetic field B that is perpendicular to their velocity. The radius of the resulting electron trajectory is:

A) $(\sqrt{2eV/m})/B$
B) $B\sqrt{2eV/m}$
C) $(\sqrt{2mV/e})/B$
D) $B\sqrt{2mV/e}$
E) none of these

16. A cylindrical region of radius R = 3.0 cm contains a uniform magnetic field parallel to its axis. The field is 0 outside the cylinder. If the field is changing at the rate 0.60 T/s, the electric field induced at a point 2R from the cylinder axis is:

A) 0
B) 0.0045 V
C) 0.0090 V
D) 0.018
E) none of these

17. Two long straight wires are parallel and carry current in opposite directions. The currents are 8.0 A and 12 A and the wires are separated by 0.40 cm. The magnetic field in tesla at a point midway between the wires is:

A) 12×10^{-4}
B) 20×10^{-4}
C) 8.0×10^{-4}
D) 4.0×10^{-4}
E) 0

18. Nine identical wires, each of diameter d and length L, are connected in series. The combination has the same resistance as a single similar wire of length L but whose diameter is:

A) 3d
B) d/81
C) d/9
D) 9d
E) d/3

19. The emf that appears in Faraday's law is:

A) perpendicular to the surface used to compute the magnetic flux
B) around a conducting circuit
C) around the boundary of the surface used to compute the magnetic flux
D) throughout the surface used to compute the magnetic flux
E) none of the above

20. The magnetic dipole moment of a current-carrying loop of wire is in the positive z direction. If a uniform magnetic field is in the positive x direction the magnetic torque on the loop is:

A) in the negative z direction
B) 0
C) in the negative y direction
D) in the positive z direction
E) in the positive y direction

21. Copper contains 8.4×10^{28} free electrons/m^3. A copper wire of cross-sectional area 1 mm^2 carries a current of 1 A. The electron drift speed is approximately:

A) 10^{-4} m/s
B) 10^{-23} m/s
C) 3×10^{8} m/s
D) 1 m/s
E) 10^{3} m/s

22. A charge q is to be brought from far away to a point near an electric dipole. No work is done if the final position of q is on:

A) the line through the charges of the dipole
B) a line that is perpendicular to the dipole moment
C) a line that makes an angle of 45° with the dipole moment
D) a line that makes an angle of 30° with the dipole moment
E) none of the above

23. Solenoid 2 has twice the radius and six times the number of turns per unit length as solenoid 1. The ratio of the magnetic field in the interior of 2 to that in the interior of 1 is:

A) 1
B) 6
C) 2
D) 1/3
E) 4

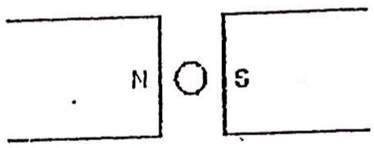
24. Of the three chief kinds of magnetic materials (diamagnetic, paramagnetic, and ferromagnetic) which are used to make permanent magnets?

A) only diamagnetic
B) only paramagnetic and ferromagnetic
C) only ferromagnetic
D) all three
E) only paramagnetic

25. If an electron has an orbital angular momentum with magnitude L the magnitude of the orbital contribution to its magnetic dipole moment is given by:

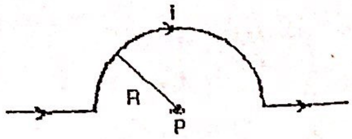
A) eL/m
B) eL/2m
C) mL/e
D) mL/2e
E) none of the above (it does not depend on L)

26. The diagram shows a straight wire carrying a flow of electrons into the page. The wire is between the poles of a permanent magnet. The direction of the magnetic force exerted on the wire is:



A) ↓
B) →
C) ←
D) into the page
E) ↑

27. The magnitude of the magnetic field at point P, at the center of the semicircle shown, is given by:



A) $\mu_0 i/4\pi R$
B) μ_0/R^2
C) $\mu_0 i/4R$
D) $\mu_0 i/2R$
E) $\mu_0/2\pi R$

28. In the formula $F = qv\times B$:

A) F must be perpendicular to v but not necessarily to B
B) F must be perpendicular to B but not necessarily to v
C) v must be perpendicular to B but not necessarily to F
D) all three vectors must be mutually perpendicular
E) none of the above

29. An unknown resistor dissipates 0.5 W when connected to a 3 V potential difference. When connected to a 1 V potential difference, this resistor will dissipate:

A) 0.5 W
B) none of these
C) 0.056 W
D) 1.5 W
E) 0.167 W

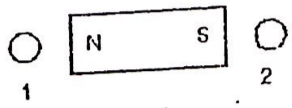
30. For an ohmic substance the electron drift velocity is proportional to:

A) the cross-sectional area of the sample
B) the length of the sample
C) the mass of an electron
D) the electric field in the sample
E) none of the above

31. A 3.5-cm radius hemisphere contains a total charge of 6.6×10^{-7} C. The flux through the rounded portion of the surface is 9.8×10^{4} N·m²/C. The flux through the flat base is:

A) -9.8×10^{4} N·m²/C
B) -2.3×10^{4} N·m²/C
C) $+2.3\times10^{4}$ N·m²/C
D) $+9.8\times10^{4}$ N·m²/C
E) 0

32. The diagram shows two small diamagnetic spheres, one near each end of a bar magnet. Which of the following statements is true?

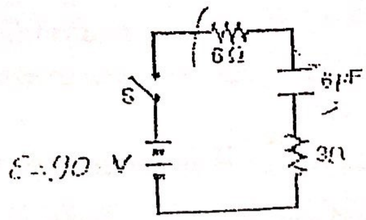


A) The magnet does not exert a force on either sphere
B) The forces on 1 and 2 are both away from the magnet
C) The forces on 1 and 2 are both toward the magnet
D) The force on 1 is away from the magnet and the force on 2 is away from the magnet
E) the force on 1 is toward the magnet and the force on 2 is away from the magnet

33. Displacement current is:

A) $-d\Phi_B/dt$
B) $\mu_0 d\Phi_E/dt$
C) $\varepsilon_0 d\Phi_E/dt$
D) $\mu_0\varepsilon_0 d\Phi_E/dt$
E) $d\Phi_E/dt$

34. In the circuit shown, the capacitor is initially uncharged. At time $t = 0$, switch S is closed. If τ denotes the time constant, the approximate current through the 3 Ω resistor when
$t = 3\tau$ is:



A) 3/4 A
B) 3/8 A
C) 1 A
D) 3/2 A
E) 1/2 A

35. A charged oil drop with a mass of 2×10^{-4} kg is held suspended by a downward electric field of 300 N/C. The charge on the drop is:

A) -6.5×10^{-6} C
B) -1.5×10^{-6} C
C) $+6.5\times10^{-6}$ C
D) 0
E) $+1.5\times10^{-6}$ C

36. A hollow conductor is positively charged. A small uncharged metal ball is lowered by a silk thread through a small opening in the top of the conductor and allowed to touch its inner surface. After the ball is removed, it will have:

A) a negative charge
B) no appreciable charge
C) a positive charge
D) a charge whose sign depends on where the small hole is located in the conductor
E) a charge whose sign depends on what part of the inner surface it touched

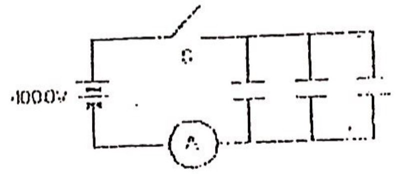
37. An 8.0-mH inductor and a 2.0-Ω resistor are wired in series to an ideal battery. A switch in the circuit is closed at time 0, at which time the current is 0. The current reaches half its final value at time:

A) 170 s
B) 4.0 ms
C) 250 s
D) 3 s
E) 2.8 ms

38. A toroid has a square cross section with the length of an edge equal to the radius of the inner surface. The ratio of the magnitude of the magnetic field at the inner surface to the magnitude of the field at the outer surface is:

A) 2
B) 1
C) 1/2
D) 4
E) 1/4

39. Each of the three 25-μF capacitors shown is initially uncharged. How many coulombs of charge pass through the ammeter A after the switch S is closed?



A) 0.10
B) 0.30
C) 10
D) 0.033
E) none of these

40. Charge Q is on the y axis a distance a from the origin and charge q is on the x axis a distance d from the origin. The value of d for which the x component of the force on q is the greatest is:

A) a
B) 0
C) $\sqrt{2}a$
D) $a/\sqrt{2}$
E) $a/2$

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BIRZEIT UNIVERSITY

Physics Department

phys 132

Final Exam
Time: 2:30 hours

1st Semester 2007/2008
Date: 29/1/2008

Coordinator: غسان عباس

Student Name: ______________ **Student NO:.**______________

ضع علامة (X) هنا	Instructor Name	Section No.	Class Time
	اسماعيل بدران	1D	S 12-12:50
	اسماعيل بدران	2D	S 13-13:50
	وفاء خاطر	3D	W 12-12:50
	تيسير عاروري	4D	M 11-11:50

Answer Sheet

Q. #	A	B	C	D	E
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Useful constants:

$\epsilon_o = 8.85\times10^{-12}\ C^2/N.m^2$

$e = 1.6\times10^{-19}$ C

$m_e = 9.11\times10^{-31}$ kg
$m_p = 1.67\times10^{-27}$ kg
$\mu_o = 4\pi\times10^{-7}$ T.m/A
$g = 9.82\ m/s^2$

1- Choose the correct statement about electric field lines:

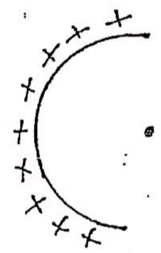
a) Field lines may cross.
b) None of the above.
c) Field lines point away from a negative charge.
d) Field lines are close together where the field is weak.
e) Field lines never cross.

2- A proton is located at the origin and an electron is located at y = -5cm. The electrostatic force acting on the electron from the proton is directed to:

a) The negative y - axis.
b) The negative z - axis.
c) The positive z – axis.
d) The positive y - axis.
e) The negative x - axis .

3- Positive charge Q is uniformly distributed on a semicircular rod. The direction of the electric field at the center of the semicircle is:

a) →
b) ↑
c) ↓
d) ↖
e) ←



4- A charged oil drop with mass of 2× 10^{-4} kg is held suspended (معلقة في الهواء) by a downward electric field of 300 N/C. The charge on the drop is:

a) - 1.5 ×10^{-6} C
b) + 6.5 ×10^{-6} C
c) -6.5 ×10^{-6} C
d) + 1.5 ×10^{-6}
e) 0

5- A 5 – cm radius conducting sphere has a charge density of 2×10^{-6} C/m^2 on its surface. Its electric potential is:

a) 7.2×10^{6}V
b) 2.2×10^{4} V
c) 2.3×10^{5} V
d) 3.6×10^{5} V
e) 1.1×10^{4} V

6- An electron is accelerated in vacuum, from rest through a potential difference V. its final speed proportional to:

a) V
b) V^2
c) $1/\sqrt{V}$
d) 1/ V
e) $\sqrt{V}$

7- The equipotential surfaces associated with a charged point particles are:

a) radially outward from the particle
b) concentric spheres centered at the particle
c) horizontal planes
d) vertical planes
e) concentric cylinders with the particle on the axis.

8- A uniform electric field of 300 N/C makes an angle 25° with the dipole moment of an electric dipole. If the torque exerted by the field has a magnitude of 2.5×10^{-7} N.m, the dipole moment must be:

a) 8.3×10^{-10} C.m
b) 2.0×10^{-9} C.m
c) 9.2×10^{-10} C.m
d) 8.3×10^{-5} C.m
e) 1.8×10^{-4} C.m

9- A physics instructor in a lab. Charges an electrostatic generator to 25 μ C, then carries it into the lecture hall. The net electric flux in Nm^2/ C through the lecture hall walls is:

a) 2.8×10^{6}
b). 25×10^{-6}
c) 2.2×10^{5}
d) 0
e) Can not tell unless the lecture hall dimensions are given.

10- Charge is distributed uniformly on the surface of a large thin sheet. The electric field at 2 cm from the center of the sheet is 33 N/C. The electric field at 4 cm from the center of the sheet is:

a) 16.5 N/C
b) 132 V/m
c) 66 N/C
d) 33 N/C
e) 8.25 V/m

11- The work required to carry a 6C charge from a 5V equipotential surface to a 6V equipotential surface is:

a) 36 J
b) 30 J
c) 0 J
d) 6J
e) 66 J

12- The electric potential in the xy plane is given by $V = (2x^2 - 3y^2)$ V, where x and y are in meters. The electric field is given by:

a) $(-4\ x\hat{i} + 6\ y\hat{j}\ )$ V/C
b) $(4\ x\hat{i} + 6\ y\hat{j}\ )$ N/C
c) $(-4\ x\hat{i} + 6\ y\hat{j}\ )$ V/m
d) $(-4\ x\hat{i} + 6\ y\hat{j}\ )$ V/N
e) $(-4\ x\hat{i} - 6\ y\hat{j}\ )$ V/m

13- The unit of measuring $\frac{1}{2}\ \epsilon_o E^2$ is :

a) J/m^2
b) J/C
c) J/V
d) J/F
e) J/m^3

14- The capacitance of a parallel-plate capacitor can be increased by:

a) Increasing the charge
b) Decreasing the plate separation
c) Increasing the plate separation
d) Decreasing the voltage between the plates
e) Decreasing the plates area

15- A parallel –plate capaçitor has a plate area of 0.2 m^2 and a plate separation of 0.1mm. To obtain an electric field of 2.0×10^6 V/m between the plates, the magnitude of the charge on each plate should be:

a) 3.5×10^{-6} C
b) 1.8×10^{-6} C
c) 8.9×10^{-7} C
d) 7.1×10^{-6} C
e) 1.4×10^{-5} C

16- Capacitors A and B are identical, where the capacitance for each of them is 5μ F. Capacitor A is charged so it stores 4 J of energy and capacitor B is uncharged. The capacitors are then connected in parallel. The total stored energy in the capacitors is now:

a) 16 J
b) 8 J
c) 2 J
d) 4 J
e) 1 J

17- A 2 μ F and 1 μ F capacitors are connected in series and a potential difference is applied across the combination. The 2μF capacitor has:

a) Twice the potential difference of the 1μF capacitor.
b) Twice the charge of the 1μF capacitor.
c) None of the above.
d) Half the charge of the 1μF capacitor.
e) Half the potential difference of the 1μF capacitor.

18- A parallel plate capacitor, with air between the plates, is charged by a battery, after which the battery is disconnected. A slab of glass is inserted between the plates. This process will:

a) Increase the charge on the capacitor
b) Increase the capacitance of the capacitor
c) Increase the energy stored in the capacitor
d) Increase the potential difference between the plates
e) Increase all the following quantities. Q,V,U, and C.

19- Copper contains 8.4×10^{28} free electrons/m^3. A copper wire of cross-sectional area 1mm^2 carries a current of 1 A. The electron drift speed is approximately:

a) 10^{-4} m/s
b) 10^3 m/s
c) 1 m/s
d) 3×10^8 m/s
e) 10^{-23} m/s

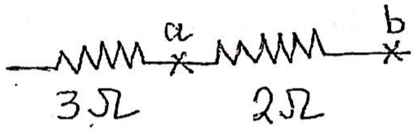
20- Two 110-V light bulbs, one "25W" and the other "100W" are connected in series to a 110V source. Then:

a) The current in the 100-W bulb is greater than that in the 25-W bulb.
b) The same current will pass in each bulb.
c) Both bulb will light with equal brightness.
d) Each bulb will have a potential difference of 55V
e) The current in the 100-W bulb is less.

21- Nine identical wires, each of diameter d and Length L, are connected in series. The equivalent resistance has the same resistance as a single similar wire of length L but its diameter is:

a) d/ 81
b) d/ 9
c) 9d
d) 3 d
e) d/3

22- In the diagram, the current in the 3 - Ω resistor is 4A. The potential difference between points a and b is:



a) 20 V
b) 8 V
c) 12 V
d) 1.25 V
e) 0.8 V

23- A 2 - Ω resistor and a 4 - Ω resistor are connected in parallel to a 6-V battery. The power dissipated in the 2 - Ω resistor is :

a) 27 W
b) 9 W
c) 8 W
d) 18 W
e) 0

24- A current of 3.0 A is clockwise around this page, which has an area of 5.8×10^{-2} m^2. The magnetic dipole moment in A m^2 is:

a) 0.17 into the page
b) 3.0 out of the page
c) 0.17 out of the page
d) 3.0 into the page
e). 0.17 clockwise around the page

25- A certain capacitor, in series with a resistor, is being charged. At the end of 10ms its charge is half the final value. The time constant for the process is about:

a) 0.43 ms
b) 14 ms
c) 6.9 ms
d) 10 ms
e) 2.3 ms

26- A magnetic field can not:

a) exert a force on a charge
b) accelerate a charge
c) change the kinetic energy of charge
d) change the momentum of a charge
e) exist.

27- At one instant an electron is moving in the xy plane has a velocity $\vec{v} = 5 \times 10^5 \hat{i} + 3\times10^5 \hat{j}$ m/s. A magnetic field $\vec{B} = 0.8\hat{i}$ T acting on the electron. At that instant the magnitude of the magnetic force acting on the electron is:

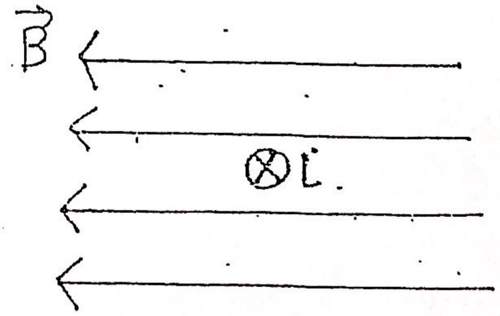
a) 0
b) 6.4×10^{-14} N
c) 5.1×10^{-14} N
d) 3.8×10^{-14} N
e) 7.5×10^{-14} N

28- A proton is in a region where a uniform electric field of 5×10^4 V/m is perpendicular to a uniform magnetic field of 0.8 T. If its acceleration is zero, then its speed must be:

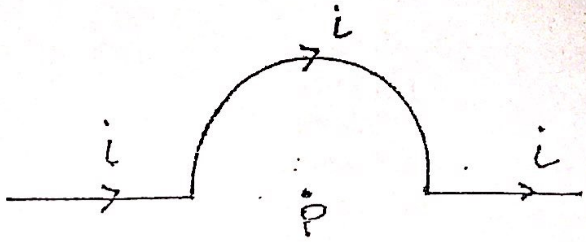
a) 6.3×10^4 m/
b) 1.6×10^{-5} m/s
c) 4.0×10^4 m/s
d) 0 s
e) Any value greater than zero and less than 3×10^8 m/s.

29- The figure shows a uniform magnetic field $\vec{B}$ directed to the left and wire carrying a current into the page. The magnetic force acting on the wire is:

a) Toward the left
b) Toward the bottom of the page
c) Toward the top of the page
d) Toward the right
e) Zero



30- The magnitude of the magnetic field at point P, at the center of the semicircle shown is given by:

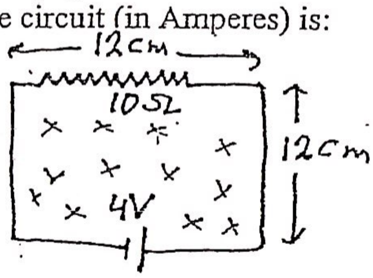


a) $2\mu_o i\ /R$
b) $\mu_o i\ /4R$
c) $\mu_o i\ /4\pi R$
d) $\mu_o i/2R$
e) $\mu_o i/R$

31- Two long straight wires enter a room through a window. One carries a current of 3A into the room while the other carries a current of 5A out. The magnitude in T.m of path integral $\oint \vec{B}.ds$ around the window frame is:

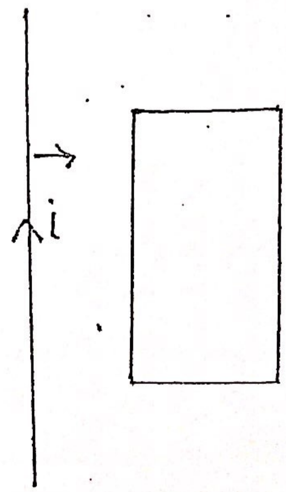
a) 1.0×10^{-5}
b) 3.8×10^{-6}
c) 6.3×10^{-6}
d) 2.5×10^{-6}
e) Zero

32- The circuit shown is in a uniform magnetic field that is into the page and is decreasing in magnitude at the rate 152 T/s. The current in the circuit (in Amperes) is:



a) 0
b) 0.22
c) 0.4
d) 0.62
e) 0.18

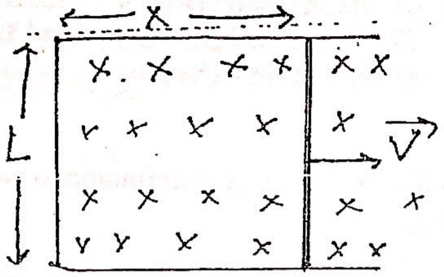
33- Along straight wire is in the plane of a rectangular conducting loop. The straight wire carries a constant current i, as shown. While the wire is being moved toward the rectangle, the current in the rectangle is:



a) Zero
b) Clockwise
c) Counterclockwise in the left side and clockwise in the right side.
d) Clockwise in the left side and counterclockwise in the right side.
e) Counterclockwise.

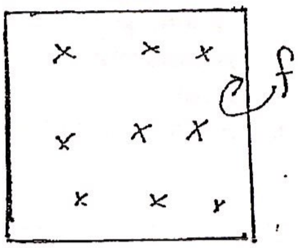
34- A rod with resistance R lies across frictionless conducting rails in a uniform magnetic field B, moves to the right with velocity v as shown. Assume the rails have negligible resistance. The induced electromotive force will have the following value:

a) 0
b) BLV/R
c) B^2L^2 V/R
d) BLV
e) B^2L V/R



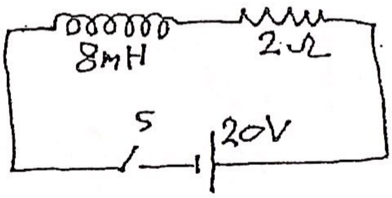
35- A rectangular loop of wire has area A. It is placed perpendicular to a uniform magnetic field B and then rotate (تدور) around one of its sides at frequency f. The maximum induced emf is:

a) 2 π fBA
b) 2BAf
c) BAf
d) 4 π fBA
e) Zero



36- An 8-mH inductor and a 2 - Ω resistor are connected in series to a 20-V ideal battery. A switch in the circuit is closed at t = 0. After a long time the potential difference across the inductor is:

a) 20 V
b) Zero
c) 5 V
d) 10 V
e) None of the above.



37- An 8-mH inductor and a 2 - Ω resistor are connected in series to an ideal battery. A switch in the circuit is closed at t = 0. The current reaches half its final value at time:

a) 3 s.
b) 4.0 ms
c) 2.8 ms
d) 170 s
e) 250 s

38- Gauss' Law for magnetism tells us:

a) That magnetic monopoles do not exist .
b) That the line integral of a magnetic field around any closed loop must vanish
c) The magnetic field of a current element.
d) The net charge in any closed area.
e) Charges must be moving to produce magnetic fields.

39- Maxwell's great contribution to electromagnetic theory was his hypothesis (فرضية) that :

a) Magnetism could be explained in terms of circulating currents in atoms.
b) Work is required to move a magnetic pole through a closed path surrounding a current.
c) The magnetic force on a moving charge particle is perpendicular to both $\bar{V}$ and $\bar{B}$.
d) A time-varying electric flux acts as a current for purpose of producing a magnetic field .
e) A time varying magnetic flux acts as battery.

40- Which of the following equations, along with symmetry argument, can be used to calculate the magnetic field produced by a uniform time-varying electric field?

a) None of these.
b) $\oint \bar{B}.\bar{d}A = 0$
c) $\oint \bar{E}.\bar{d}s = \frac{-d\varphi B}{dt}$
d) $\oint \bar{B}.\bar{d}s = \mu_0 i + \mu_o \epsilon_o \frac{d\Phi E}{dt}$
e) $\oint \bar{E}.\,\bar{d}A = Q/\epsilon_o$

جامعة بيرزيت

BIRZEIT UNIVERSITY

Physics Department

Physics 132

Final Exam

Time: *2.5 hours.*

1st Semester 2005/06

date: *Jan.22,2006*

Student Name: ______________________ *Student No.:* __________

Instructors: (Check one)

☐ Arouri T. ☐ Anini Y.

☐ Abdul-Baqi A.

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$\mu_0 = 4\pi \times 10^{-7}$ T.m/A $= 1.26 \times 10^{-6}$ T.m/A

$\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N.m^2$

$e = 1.6 \times 10^{-19}$ C ; $m_e = 9.1 \times 10^{-31}$ kg

1. A parallel-plate capacitor has a plate area of 0.30 m^2 and a plate separation of 0.1 mm. If the charge on each plate has a magnitude of 4.0×10^{-6} C the electric field between the plates is:

A) 1.0×10^4 V/m
B) 0
C) 4.0×10^{12} V/m
D) 2.0×10^6 V/m
E) 1.5×10^6 V/m

2. A particle with a charge of 8×10^{-6} C and a mass of 2.5 g moves uniformly with a speed of 12 m/s in a circular orbit around a stationary particle with a charge of -8×10^{-6} C. The radius of the orbit is:

A) 0.80 m
B) None of these
C) 0.23 m
D) 0.14 m
E) 1.6 m

3. A uniform electric field of 400 N/C makes an angle of 30° with the dipole moment of an electric dipole. If the dipole consists of charges of magnitude 4 μC separated by 0.5 mm, the torque exerted by the field has a magnitude of:

A) 6.7×10^{-12} N·m
B) None of these
C) 4.0×10^{-7} N·m
D) 7.7×10^{-7} N·m
E) 2.5×10^{-7} N·m

4. A point charge is placed in an electric field that varies with location. No force is exerted on this charge:

A) if the charge is moving perpendicular to a field line
B) at locations where the electric field strength is $1/(1.6\times10^{-19})$ N/C
C) at locations where the electric field is zero
D) if the field is caused by an equal amount of positive and negative charge
E) if the charge is moving along a field line

5. Three hundred turns of insulated copper wire are wrapped around a cylinder of cross-sectional area $0.20\ m^2$. A magnetic field along the coil axis is made to change from 1.00 T in one direction to 1.00 T in the other direction in 0.2s. The induced emf that appears in the coil is:

A) 1200 V
B) 600 V
C) None of these
D) 40 V
E) 4 V

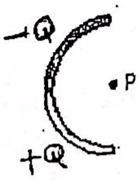
6. A 3-meter stick is parallel to an electric field $E = 60y\,\mathbf{j}$ N/C. If its begining is at $y = 2$m and its end is at $y = 5$m, then the potential difference between its ends is:

A) 210 V
B) 0
C) 420 V
D) None of these
E) 630 V

7. Copper contains 8.5×10^{28} free electrons/m^3. A copper wire of cross-sectional area 0.2 mm^2 carries a current of 3.4 A. The electron drift speed is:

A) None of these
B) 1.25×10^{-4} m/s
C) 1.0×10^{6} m/s
D) 5.0×10^{-2} m/s
E) 5.0×10^{-4} m/s

8. Positive charge -Q is uniformly distributed on the upper half a semicircular rod and negative charge +Q is uniformly distributed on the lower half. What is the direction of the electric field at point P, the center of the semicircle?



A) ↓
B) ↑
C) ↖
D) →
E) ←

9. J. J. Thomson's experiment, involving the motion of an electron beam in mutually perpendicular E and B fields, gave the value of:

A) earth's magnetic field
B) charge of the electron
C) Avogadro's number
D) charge/mass ratio for the electron
E) mass of the electron

10. Positive charge Q is distributed uniformly throughout an insulating sphere of radius R, centered at the origin. A positive point charge Q is placed at x = 2.5R on the x axis. The magnitude of the electric field at x = R/2 on the x axis is:

A) $17Q/200\pi\varepsilon_0R^2$
B) $Q/4\pi\varepsilon_0R^2$
C) $Q/72\pi\varepsilon_0R^2$
D) none of these
E) $Q/16\pi\varepsilon_0R^2$

11. A solenoid is 105 cm long and has a radius of 0.50 cm. It is wrapped with 500 turns of wire carrying a current of 2.0 A. The magnetic field in tesla at the center of the solenoid is:

A) $1.2x10^{-3}$
B) $3.6x10^{-3}$
C) $4.2x10^{-2}$
D) none of these
E) $1.8x10^{-2}$

12. A cylindrical region of radius $R = 8.0$ cm contains a uniform magnetic field parallel to its axis. If the field is changing at the rate 0.60 T/s, the electric field induced at a point R/2 from the cylinder axis is:

A) 0 V / m
B) none of these
C) 0.0075 V / m
D) 0.0045 V / m
E) 0.012 V / m

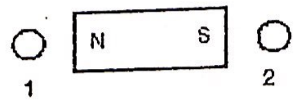
13. An electron ($m = 9.1x10^{-31}$ kg) with speed 4000 km/s is projected into a uniform magnetic field **B** of 0.15 T with its velocity vector making an angle of 30^o with **B.** the radius of the path is:

A) $1.3x10^{-4}$ m
B) None of these
C) $4.4x10^{-6}$ m
D) $7.6x10^{-5}$ m
E) $4.6x10^{-2}$ m

21. A parallel-plate capacitor with circular plates of radius $R = 8$ mm. The electric field between the plates is changing at a rate $dE/dt = 2\times10^{12}$ V/m.s. The displacement current is:

A) 3.6×10^{-3} A
B) None of these
C) 0 A
D) 1.4×10^{-3} A
E) 4.2×10^{-3} A

22. The diagram shows two small diamagnetic spheres, one near each end of a bar magnet. Which of the following statements is true?



A) The forces on 1 and 2 are both toward the magnet
B) The force on 1 is away from the magnet and the force on 2 is toward the magnet
C) The magnet does not exert a force on either sphere
D) the force on 1 is toward the magnet and the force on 2 is away from the magnet
E) The forces on 1 and 2 are both away from the magnet

23. A certain substance has a dielectric constant of 3.5 and a dielectric strength of 16 MV/m. If it is used as the dielectric material in a parallel-plate capacitor, the minimum area should the plates of the capacitor have to obtain a capacitance of 15 nF and to ensure that the capacitor will be able to withstand a potential difference of 8.0 kV is:

A) 1.1 m^2
B) None of these
C) 0.11 m^2
D) 0.63 m^2
E) 0.24 m^2

24. A long straight wire carrying a 2.0 A current enters a room through a circular window radius 2.0 m. The path integral $\oint \mathbf{B} \cdot ds$ around the window frame has the value (in T·m):

A) 2.5x10-6
B) 6.3x10-6
C) 0.20
D) none of these
E) 3.8x10-6

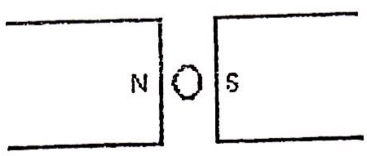
25. A magnetic field CANNOT:

A) change the kinetic energy of a charge
B) exist near a charge
C) accelerate a charge
D) change the momentum of a charge
E) exert a force on a charge

26. At any point the magnetic field lines are in the direction of:

A) the magnetic force on a moving negative charge
B) none of these
C) the magnetic force on a moving positive charge
D) the velocity of a moving negative charge
E) the velocity of a moving positive charge

27. The diagram shows a straight wire carrying a flow of electrons into the page. The wire is between the poles of a permanent magnet. The direction of the magnetic force exerted on the wire is:



A) ←
B) →
C) into the page
D) ↓
E) ↑

28. If an electron has an orbital angular momentum with magnitude L, the magnitude of the orbital magnetic dipole moment is given by:

A) none of these
B) - eL/m
C) - eL/2m
D) mL/e
E) eL/2m

29. Charge is distributed uniformly on the surface of a large flat plate. The electric field 5 cm from the plate is 40 N/C. The electric field 10 cm from the plate is:

A) 20 N/C
B) 10 N/C
C) 160 N/C
D) 80 N/C
E) 40 N/C

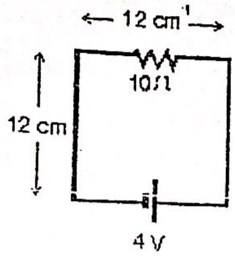
30. The emf that appears in Faraday's law is:

A) around the boundary of the surface used to compute the magnetic flux
B) none of these
C) around a conducting circuit
D) throughout the surface used to compute the magnetic flux
E) perpendicular to the surface used to compute the magnetic flux

31. A battery of emf 36 V is connected in parallel to two resistors 11 Ω each. As a result, a current of 2.0 A existed in each resistor. The terminal potential difference of the battery is:

A) 18 V
B) 22 V
C) 32 V
D) 36 V
E) 0 V

14. The circuit shown is in a uniform magnetic field that is out of the page and is decreasing in magnitude at the rate 1400 T/s: The current in the circuit (in amperes) is:



A) 1.12
B) 2.42
C) 0.32
D) 1.62
E) None of these

15. A parallel-plate capacitor has a plate separation of 0.1 mm. The charge on each plate has a magnitude of 4×10^{-6} C and the potential difference across the plates is 300V. The energy density between the plates is:

A) 17.7 J/m^3
B) none of these
C) 70.8 J/m^3
D) 35.4 J/m^3
E) 39.8 J/m^3

16. A 2-μF and a 1-μF capacitor are connected in series and a potential difference is applied across the combination. The 2-μF capacitor has:

A) twice the potential difference of the 1-μF capacitor
B) half the potential difference of the 1-μF capacitor
C) none of these
D) twice the charge of the 1-μF capacitor
E) half the charge of the 1-μF capacitor

17. A wire is 1 m long and 1 mm^2 in cross-sectional area. When connected to a potential difference of 0.8 V; a current of 2 A exists in the wire. The resistivity of this wire is:

A) $4 \times 10^{-7}\ \Omega \cdot m$
B) $10^{-7}\ \Omega \cdot m$
C) $8 \times 10^{-7}\ \Omega \cdot m$
D) $2 \times 10^{-7}\ \Omega \cdot m$
E) $5 \times 10^{-7}\ \Omega \cdot m$

18. A certain capacitor, in series with a 1200 Ω resistor, is being charged. At the end of 5 ms its charge is half the final value. The capacitance is about:

A) None of these
B) 6.0 μF
C) 7.5 F
D) 15 μF
E) 9.6 μF

19. An 8.0-mH inductor and a 4.0-Ω resistor are wired in series to an ideal battery. A switch in the circuit is closed at time 0, at which time the current is 0. The current reaches half its final value at time:

A) 250 s
B) 0.35 s
C) 4.0 ms
D) 1.4 ms
E) 2.8 ms

20. A long solenoid has 100 turns / cm and carries a current i. An electron (the electron mass $= 9.1 \times 10^{-31}$ kg) moves within the solenoid in a circle of radius 4.5 cm perpendicular to the solenoid axis. The epeed of the electron is 0.05c (c = speed of light). The current in the solenoid is:

A) 0.15 A
B) 0.45 A
C) None of these
D) 3.70 A
E) 0.27 A

32. 10 C of charge are placed on a spherical conducting shell. A (-7 C) point charge is placed at the center of the shell. The net charge in coulombs on the inner surface of the shell is:

A) +3
B) -3
C) -7
D) +7
E) 0

33. The induced magnetic field 1.5 mm from the central axis of a circular parallel-plate capacitor and between the plates is 4×10^{-7} T. The plates have radius 3 mm. At what rate dE/dt is the electric field between the plates changing?

A) 4.8×10^{13} V/m.s
B) 1.2×10^{13} V/m.s
C) None of these
D) 1.4×10^{9} V/m.s
E) 2.4×10^{13} V/m.s

Final

BIRZEIT UNIVERSITY

Physics Department

Physics 132

Final Exam
Time: 2.5 hours.

1st Semester 2005/06
date: Jan.22,2006

Student Name: ISSRA AL-ZURBA   Student No.: 1021649

Instructors: (Check one)

- ☐ Arouri T.
- ☐ Anini Y.
- ☒ Abdul-Baqi A.

No	A	B	C	D	E	No	A	B	C	D	E
1					✓	18		✓			
2					✓	19				✓	
3			✓			20	✓				
4			✓			21	✓				
5			✓			~~22~~					
6					✓	23					✓
7		✓				24	✓				
8		✓				25	✓				
9				✓		26		✓			
10				✓		27					✓
11	✓					~~28~~					
12						29					✓
13				✓		30	✓				
14		✓				31		✓			
15					✓	32				✓	
16		✓				33			✓		
17	✓										

$\mu_0 = 4\pi \times 10^{-7}$ T.m/A $= 1.26 \times 10^{-6}$ T.m/A

$\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N.m^2

$e = 1.6 \times 10^{-19}$ C ; $m_e = 9.1 \times 10^{-31}$ kg

1. A parallel-plate capacitor has a plate area of 0.30 m^2 and a plate separation of 0.1 mm. If the charge on each plate has a magnitude of 4.0×10^{-6} C the electric field between the plates is:

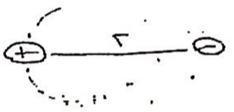
$C = \frac{\varepsilon_0 A}{d} = \frac{(8.85\times10^{-12})(0.3)}{0.1\times10^{-3}} = 2.7\times10^{-8}$

$V = \frac{q}{c} = \frac{4\times10^{-6}}{2.7\times10^{-8}} = 1.48\times10^{2}$

$E = \frac{V}{d} = \frac{1.48\times10^{2}}{10^{-4}} = 1.48\times10^{6} \approx 1.5\times10^{6}$ V/m

A) 1.0×10^{4} V/m
B) 0
C) 4.0×10^{12} V/m
D) 2.0×10^{6} V/m
E) 1.5×10^{6} V/m

2. A particle with a charge of -8×10^{-6} C and a mass of 2.5 g moves uniformly with a speed of 12 m/s in a circular orbit around a stationary particle with a charge of $+8\times10^{-6}$ C. The radius of the orbit is:



$F = ma$

$\frac{k q_1 q_2}{r^2} = \frac{m v^2}{r}$

$r = \frac{k q_1 q_2}{m v^2} = \frac{(9\times10^{9})(8)(8)}{(2.5\times10^{-3})(12)^2} = 1.6$ m

A) 0.80 m
B) None of these
C) 0.23 m
D) 0.14 m
E) 1.6 m

3. A uniform electric field of 400 N/C makes an angle of 30° with the dipole moment of an electric dipole. If the dipole consists of charges of magnitude 4 µC separated by 0.5 mm, the torque exerted by the field has a magnitude of:

$\tau = P \times E$

$= PE \sin\theta$

$= qd E \sin\theta$

$= (4\times10^{-6})(0.5\times10^{-3})(400)\sin 30$

$\tau = 4\times10^{-7}$ N.m

A) 6.7×10^{-12} N·m
B) None of these
C) 4.0×10^{-7} N·m
D) 7.7×10^{-7} N·m
E) 2.5×10^{-7} N·m

4. A point charge is placed in an electric field that varies with location. No force is exerted on this charge:

$F = qE$

A) if the charge is moving perpendicular to a field line
B) at locations where the electric field strength is $1/(1.6\times10^{-19})$ N/C
C) at locations where the electric field is zero
D) if the field is caused by an equal amount of positive and negative charge
E) if the charge is moving along a field line

5. Three hundred turns of insulated copper wire are wrapped around a cylinder of cross-sectional area 0.20 m^2. A magnetic field along the coil axis is made to change from 1.00 T in one direction to 1.00 T in the other direction in 0.2s. The induced emf that appears in the coil is:

A) 1200 V
B) 600 V
C) None of these
D) 40 V
E) 4 V

$\mathcal{E} = -N\frac{d\varphi_B}{dt}$
$= -NA\frac{\Delta B}{\Delta t}$
$= -(100)(0.2)\left(\frac{-1-1}{2}\right)$
$\mathcal{E} = 20\,V$

6. A 3-meter stick is parallel to an electric field $E = 60y\,\hat{j}$ N/C. If its begining is at y = 2m and its end is at y = 5m, then the potential difference between its ends is:

A) 210 V
B) 0
C) 420 V
D) None of these
E) 630 V

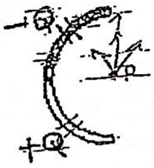
$\Delta V = -\int_2^5 \vec{E}\cdot d\vec{s}$
$V_5 - V_2 = -\int_2^5 60y\,dy$
$= -30y^2\Big]_2^5$
$= -30\,[25-4]$
$|\Delta V| = 630\,V$

7. Copper contains 8.5×10^{28} free electrons/m^3. A copper wire of cross-sectional area 0.2 mm^2 carries a current of 3.4 A. The electron drift speed is:

A) None of these
B) 1.25×10^{-4} m/s
C) 1.0×10^{6} m/s
D) 5.0×10^{-2} m/s
E) 5.0×10^{-4} m/s

$v_d = \frac{I}{Ane} = \frac{3.4}{(0.2\times10^{-6})(8.5\times10^{28})(1.6\times10^{-19})} = 0.125\times10^{-3}$ m/s

8. Positive charge -Q is uniformly distributed on the upper half a semicircular rod and negative charge +Q is uniformly distributed on the lower half. What is the direction of the electric field at point P, the center of the semicircle?



A) ↓
B) ↑
C) ↖
D) →
E) ←

9. T.J. Thomson's experiment, involving the motion of an electron beam in mutually perpendicular E and B fields, gave the value of:

A) earth's magnetic field
B) charge of the electron
C) Avogadro's number
D) charge/mass ratio for the electron
E) mass of the electron

10. Positive charge Q is distributed uniformly throughout an insulating sphere of radius R, centered at the origin. A positive point charge Q is placed at x = 2.5R on the x-axis. The magnitude of the electric field at x = R/2 on the x axis is:

A) $17Q/200\pi\varepsilon_0 R^2$
B) $Q/4\pi\varepsilon_0 R^2$
C) $Q/72\pi\varepsilon_0 R^2$
D) none of these
E) $Q/16\pi\varepsilon_0 R^2$

$q_{enc} = Q\left(\frac{r}{R}\right)^3$

$= Q\left(\frac{R/2}{R}\right)^3$

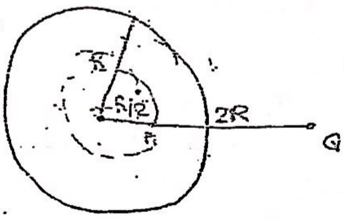
$q_{enc} = \frac{Q}{8}$

$\oint E \cdot dA = \frac{q_{enc}}{\varepsilon_0}$

$E\, 4\pi r^2 = \frac{q_{enc}}{\varepsilon_0}$

$E\, 4\pi \left(\frac{R}{2}\right)^2 = \frac{Q}{8\varepsilon_0}$

$E = \frac{Q}{8\pi R^2 \varepsilon_0}$



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لأنه بناخذ الشحنة اللي
جوا غاوس فقط

$q_{enc} = \rho V_{enc}$

$= \frac{Q}{\frac{4}{3}\pi R^3} \frac{4}{3}\pi r^3$

$q_{enc} = Q\left(\frac{r}{R}\right)^3$

11. A solenoid is 105 cm long and has a radius of 0.50 cm. It is wrapped with 500 turns of wire carrying a current of 2.0 A. The magnetic field in tesla at the center of the solenoid is:

A) 1.2×10^{-3}
B) 3.6×10^{-3}
C) 4.2×10^{-2}
D) none of these
E) 1.8×10^{-2}

$B = \mu_0 I \frac{N}{L}$

$= (4\pi\times10^{-7})(2)(500) / 105\times10^{-2}$

$= 120\times10^{-5}$

$= 1.2\times10^{-3}$

12. A cylindrical region of radius R = 8.0 cm contains a uniform magnetic field parallel to its axis. If the field is changing at the rate 0.60 T/s, the electric field induced at a point R/2 from the cylinder axis is:

A) 0 V/m
B) none of these
C) 0.0075 V/m
D) 0.0045 V/m
E) 0.012 V/m

$\oint \vec{E}\cdot d\vec{s} = -\frac{d\Phi_B}{dt}$

$E(2\pi r) = -A\frac{dB}{dt}$

$E(2\pi r) = (\pi r^2)(0.6)$

$E = (\frac{R}{2})(0.3)$

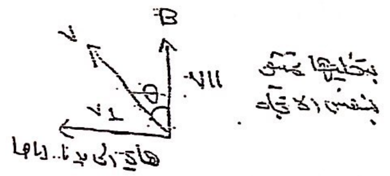
$= (4\times10^{-2})(0.3)$

$E = 1.2\times10^{-2}$

13. An electron ($m = 9.1\times10^{-31}$ kg) with speed 4000 km/s is projected into a uniform magnetic field B of 0.15 T with its velocity vector making an angle of 30° with B. the radius of the path is:

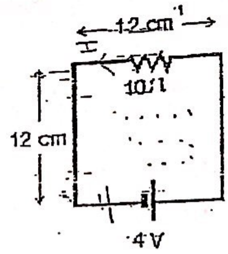
A) 1.3×10^{-4} m
B) None of these
C) 4.4×10^{-6} m
D) 7.6×10^{-5} m
E) 4.6×10^{-2} m

$r = \frac{mv}{qB}\sin 30 = \frac{(9.1\times10^{-31})(4\times10^{6})}{(1.6\times10^{-19})(0.15)(2)} = 7.6\times10^{-5}$



$v_\perp = v\sin\theta$

14. The circuit shown is in a uniform magnetic field that is out of the page and is decreasing in magnitude at the rate 1400 T/s. The current in the circuit (in amperes) is:



$\mathcal{E}_{ind} = A\frac{dB}{dt} = (12)(12)\times10^{-4}(1400) = 20.16$

A) 1.12
B) 2.42
C) 0.32
D) 1.62
E) None of these

$I = \frac{\mathcal{E}_{ind} + \mathcal{E}}{R} = \frac{20.16+4}{10} = 2.42\ A$

15. A parallel-plate capacitor has a plate separation of 0.1 mm. The charge on each plate has a magnitude of 4×10^{-6} C and the potential difference across the plates is 300 V. The energy density between the plates is:

$V = E\,d$

$\Rightarrow E = \frac{V}{d} = \frac{300}{0.1\times10^{-3}} = 3\times10^{6}$

A) 17.7 J/m^3
B) none of these
C) 70.8 J/m^3
D) 35.4 J/m^3
E) 39.8 J/m^3

(energy density) $u = \frac{1}{2}\epsilon_0 E^2 = (\frac{1}{2})(8.85\times10^{-12})(3\times10^{6})^2 = 39.8$

16. A 2-μF and a 1-μF capacitor are connected in series and a potential difference is applied across the combination. The 2-μF capacitor has:

$q_1 = q_2$

$V = \frac{q}{C}$

A) twice the potential difference of the 1-μF capacitor
B) half the potential difference of the 1-μF capacitor
C) none of these
D) twice the charge of the 1-μF capacitor
E) half the charge of the 1-μF capacitor

$V_1 = \frac{q}{2} = \frac{1}{2}q$

$V_2 = \frac{q}{1} = q$

17. A wire is 1 m long and 1 mm^2 in cross-sectional area. When connected to a potential difference of 0.8 V; a current of 2 A exists in the wire. The resistivity of this wire is:

A) $4 \times 10^{-7}\ \Omega \cdot m$
B) $10^{-7}\ \Omega \cdot m$
C) $8 \times 10^{-7}\ \Omega \cdot m$
D) $2 \times 10^{-7}\ \Omega \cdot m$
E) $5 \times 10^{-7}\ \Omega \cdot m$

$R = \frac{V}{I} = \frac{0.8}{2} = 0.4\ \Omega$

$R = \frac{\rho L}{A}$

$\Rightarrow \rho = \frac{RA}{L} = \frac{(0.4)(1\times10^{-6})}{1} = 4\times10^{-7}$

18. A certain capacitor, in series with a 1200 Ω resistor, is being charged. At the end of 5 ms its charge is half the final value. The capacitance is about:

A) None of these
B) 6.0 μF
C) 7.5 F
D) 15 μF
E) 9.6 μF

$q = q_0 e^{-t/\tau}$

$\frac{1}{2} q_0 = q_0 e^{-5\times10^{-3}/\tau}$

$\ln 2 = 5\times10^{-3}/\tau$

$\tau = 7\times10^{-3}$

$\tau = RC$

$\Rightarrow C = \frac{\tau}{R} = \frac{7\times10^{-3}}{1200} = 0.6\times10^{-5}$

$C = 6\times10^{-6}\ F$

19. An 8.0 mH inductor and a 4.0 Ω resistor are wired in series to an ideal battery. A switch in the circuit is closed at time 0, at which time the current is 0. The current reaches half its final value at time:

A) 250 s
B) 0.35 s
C) 4.0 ms
D) 1.4 ms
E) 2.8 ms

$I = I_0 (1 - e^{-t/\tau})$

$\frac{1}{2} I_0 = I_0 (1 - e^{-t/\tau})$

$e^{-t/\tau} = \frac{1}{2}$

$t/\tau = \ln 2$

$t = \ln 2\ \tau = \ln 2 \frac{L}{R} = \ln 2 \frac{8\times10^{-3}}{4} = 1.4\times10^{-3}$ sec

20. A long solenoid has 100 turns/cm and carries a current i. An electron (the electron mass $= 9.1 \times 10^{-31}$ kg) moves within the solenoid in a circle of radius 4.5 cm perpendicular to the solenoid axis. The speed of the electron is 0.05c (c = speed of light). The current in the solenoid is:

A) 0.15 A
B) 0.45 A
C) None of these
D) 3.70 A
E) 0.27 A

$r = \frac{mv}{|q|B}$

$\Rightarrow B = \frac{mv}{|q|r} = \frac{(9.1\times10^{-31})(0.05)(3\times10^{8})}{(1.6\times10^{-19})(4.5\times10^{-2})} = 0.19\times10^{-2}$

$B = \mu_0 n I$

$\Rightarrow I = \frac{B}{\mu_0 n} = \frac{0.19\times10^{-2}}{(4\pi\times10^{-7})(100/10^{-2})} = 0.15\ A$

21. A parallel-plate capacitor with circular plates of radius $R = 8$ mm. The electric field between the plates is changing at a rate $dE/dt = 2\times10^{12}$ V/m.s. The displacement current is:

$A = \pi r^2$

$I_d = \varepsilon_0 \frac{d\Phi_E}{dt}$

$= \varepsilon_0 A \frac{dE}{dt}$

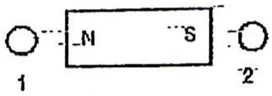
$= (8.85\times10^{-12})(\pi)(8\times10^{-3})^2(2\times10^{12})$

$= 3559\times10^{-6}$

$I_d = 3.6\times10^{-3}$

A) 3.6×10^{-3} A
B) None of these
C) 0 A
D) 1.4×10^{-3} A
E) 4.2×10^{-3} A

22. The diagram shows two small diamagnetic spheres, one near each end of a bar magnet. Which of the following statements is true?



A) The forces on 1 and 2 are both toward the magnet
B) The force on 1 is away from the magnet and the force on 2 is toward the magnet
C) The magnet does not exert a force on either sphere
D) the force on 1 is toward the magnet and the force on 2 is away from the magnet
E) The forces on 1 and 2 are both away from the magnet

23. A certain substance has a dielectric constant of 3.5 and a dielectric strength of 16 MV/m. If it is used as the dielectric material in a parallel-plate capacitor, the minimum area should the plates of the capacitor have to obtain a capacitance of 75 nF and to ensure that the capacitor will be able to withstand a potential difference of 8.0 kV is:

$V = Ed$

$\Rightarrow d = \frac{V}{E} = \frac{8\times10^3}{16\times10^6} = 5\times10^{-4}$

$C = \frac{k\varepsilon_0 A}{d}$

$\Rightarrow A = \frac{Cd}{k\varepsilon_0} = \frac{(75\times10^{-9})(5\times10^{-4})}{(3.5)(8.85\times10^{-12})} = 2.4\times10^{-1} = 0.24\ m^2$

A) 1.1 m^2
B) None of these
C) 0.11 m^2
D) 0.63 m^2
E) 0.24 m^2

24. A long straight wire carrying a 2.0 A current enters a room through a circular window radius 2.0 m. The path integral $\oint \vec{B} \cdot d\vec{s}$ around the window frame has the value (in T·m):

$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{enc}$
$= (4\pi \times 10^{-7})(2)$
$= 2.5 \times 10^{-6}$

A) 2.5×10^{-6}
B) 6.3×10^{-6}
C) 0.20
D) none of these
E) 3.8×10^{-6}

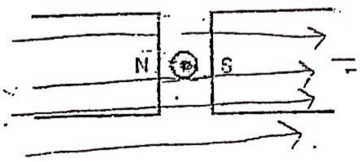
25. A magnetic field CANNOT:

A) change the kinetic energy of a charge
B) exist near a charge
C) accelerate a charge
D) change the momentum of a charge
E) exert a force on a charge

26. At any point the magnetic field lines are in the direction of:

A) the magnetic force on a moving negative charge
B) none of these
C) the magnetic force on a moving positive charge
D) the velocity of a moving negative charge
E) the velocity of a moving positive charge

27. The diagram shows a straight wire carrying a flow of electrons into the page. The wire is between the poles of a permanent magnet. The direction of the magnetic force exerted on the wire is:



$\vec{F} = q\vec{v} \times \vec{B}$

$\vec{F} = I\vec{L} \times \vec{B}$

A) ←
B) →
C) into the page
D) ↓
E) ↑

28. If an electron has an orbital angular momentum with magnitude L, the magnitude of the orbital magnetic dipole moment is given by:

A) none of these
B) -eL/m
C) - eL/2m
D) mL/e
E) eL/2m

29. Charge is distributed uniformly on the surface of a large flat plate. The electric field 5 cm from the plate is 40 N/C. The electric field 10 cm from the plate is:

$E = \frac{\sigma}{\varepsilon_0}$

لا تعتمد على المسافة

يعني المجال الكهربائي ثابت

A) 20 N/C
B) 10 N/C
C) 160 N/C
D) 80 N/C
E) 40 N/C

30. The emf that appears in Faraday's law is:

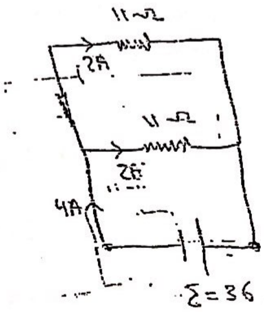
A) around the boundary of the surface used to compute the magnetic flux
B) none of these
C) around a conducting circuit
D) throughout the surface used to compute the magnetic flux
E) perpendicular to the surface used to compute the magnetic flux

31. A battery of emf 36 V is connected in parallel to two resistors 11 Ω each. As a result, a current of 2.0 A existed in each resistor. The terminal potential difference of the battery is:

A) 18 V
B) 22 V
C) 32 V
D) 36 V
E) 0 V

1. $V = IR = (2)(11) = 22V$

أو 2. $V = I_{equ} R_{equ} = (4)(5.5) = 22V$



* يا بنحسب المقاومة المكافئة وبنضربها بالتيار الكلي

* أو بناخذ وحدة من المقاومات وبنضربها بتيار هذه المقاومة

1. A beam of electrons is sent horizontally down the axis of a tube to strike a fluorescent screen at the end of the tube. On the way, the electrons encounter a magnetic field directed vertically downward. The spot on the screen will therefore be deflected:

A) downward
B) upward
C) not at all
D) to the right as seen from the electron source
E) to the left as seen from the electron source

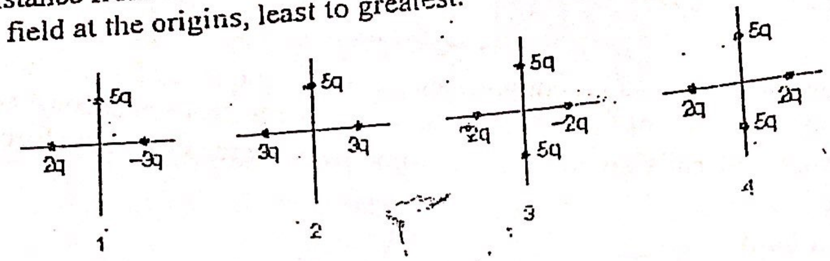
2. Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 1 mm. Conductor B is a hollow tube of inside diameter 1 mm and outside diameter 2 mm. The ratio of their resistance, R_A/R_B, is:

A) $\sqrt{2}$
B) 2
C) 4
D) 3
E) 1

3. A current is clockwise around the outside edge of this page and a uniform magnetic field is directed parallel to the page, from left to right. If the magnetic force is the only force acting on the page, the page will turn so the right edge:

A) moves away from you
B) moves toward you
C) moves to your right
D) does not move
E) moves to your left

4. The diagrams below show four different charge distributions. The charges are all the same distance from the origin. Rank the situations according to the magnitude of the electric field at the origins, least to greatest.



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

5. Pulling the plates of an isolated charged capacitor apart:

A) does not affect the capacitance
B) increases the capacitance
C) decreases the potential difference
D) does not affect the potential difference
E) increases the potential difference

6. One hundred turns of insulated copper wire are wrapped around an iron core of cross-sectional area 0.100 m^2. The circuit is completed by connecting the coil to a 10 Ω resistor. The magnetic field along the coil axis is made to change from 1.00 T in one direction to 1.00 T in the other direction. The total charge that flows through the resistor in this process is:

A) 2×10^{-2} C
B) 0.20 C
C) 2 C
D) 1 C
E) 10^{-2} C