جامعة بيرزيت

BIRZEIT UNIVERSITY

18

Physics 132 Second Exam
Second Semester 2016/2017

Date: Sunday 7/5/2017

Time: 60 Minutes

Student Name: Sajeda Nedal Murra	Student ID #: 1160724

Please circle your discussion section:

Instructor	Section #			
Areej Abdel Rahman	D1			
Wael Karain	D2			
Hebah Fataftа	D3	D10		
Ghassan Abbas	D4	D8		
Hazem Abu Sara	D5			
Dua' Abu Murra	D6	D11	D13	[✓ D15]
Abdallah Sayyed-Ahmad	D7	D9	D14	
Nedaa Hamamra	D12	D16		

exam instructions:

- Write your name and student # where asked in the top of the sheet.
- Mark one box only using (x) in the answer sheet below to indicate the answer you consider best for each question. If you enter more than one (x) for a particular question, zero mark will be given to it.
- Before you start the exam, make sure that you have 7 pages and 18 questions.
- Cell phones are not allowed and should be kept off during the exam.
- Last page has some useful constants and formulas.

Answer Sheet

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
(a)		✓		✓				✓					✓					
(b)					✓					✓							✓	
(c)							✓					✓		✓				
(d)			✓						✓						✓			✓
(e)	✓					✓					✓					✓		

e
a
d
a

(1) An initially uncharged capacitor in an RC circuit reaches a potential difference of 6.3 V in a time of 2 s after the circuit is connected to an emf source of 10 V. If the resistance in the circuit is 500 Ω, what is the capacitance of the capacitor?

$q(t) = \mathcal{E}C(1-e^{-t/(RC)})$

$V = \mathcal{E}(1-e^{-t/(RC)})$

$6.3 = 10(1-e^{-t/(RC)})$

$0.63 = 1 - e^{-t/RC}$

$e^{-t/RC} = 0.37$

$-\frac{t}{RC} = -0.9943$

$C = \frac{-t}{R(-0.9943)}$

$= 4.022 \times 10^{-3} F$

(a) 1.0 mF
(b) 3.0 mF
(c) 2.0 mF
(d) 5.0 mF
[✓ (e) 4.0 mF]

(2) A wire having a length of 150 m, and diameter of 0.30 cm, has 10.0 V voltage applied across its two ends so that it carries a current with a uniform current density of 2.8 × 10^5 A/m². The resistivity of the wire is

L

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

$R = \frac{V}{I}$

$J = \frac{I}{A}$

$I = JA$

$= 2.8\times10^5 (\pi \frac{3\times10^{-3}}{2})^2$

1.9782

506

$R = \frac{V}{JA}$

$\frac{\rho L}{A} = \frac{V}{JA}$

$\rho = \frac{V}{JL}$

[✓ (a) 2.4 × 10^{-7} Ωm.]
(b) 6.8 × 10^{-7} Ωm.
(c) 3.6 × 10^{-7} Ωm.
(d) 4.8 × 10^{-7} Ωm.
(e) 1.2 × 10^{-7} Ωm.

(3) Kirchhoff's voltage rule or loop rule is based on what physical principle?

D

(a) Gauss's Law.
(b) Quantization of charge.
(c) Conservation of charge.
[✓ (d) Conservation of energy.]
(e) Conservation of angular momentum.

(4) A charged isolated metal sphere of diameter 10 cm has a potential difference of 8000 V relative to V = 0 at infinity. Calculate the energy density in the electric field near the surface of the sphere.

$r = 5\times10^{-2}$

$E = \int V dr$ $C = 4\pi\epsilon_0 r$

$= 5.5578\times10^{-12}$

$V = EL$

$\frac{1}{2}CV^2$

$E = \frac{q}{4\pi\epsilon_0 r^2}$

$\epsilon_0 \oint E\, dA = q_{enc}$

$\frac{1}{2}\epsilon_0 E^2$

$u = \frac{1}{2}\, 8.85\times10^{-12}($

$= 0.11228$

[✓ (a) 1.1 × 10^{-1} J/m³]
(b) 3.1 × 10^{-2} J/m³
(c) 5.0 × 10^{-3} J/m³
(d) 1.0 × 10^{-3} J/m³
(e) 8.0 × 10^{-3} J/m³

b
e
c
a

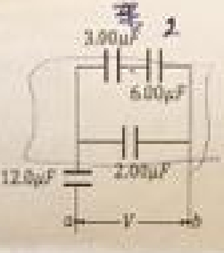
(5) Three particles shot into a region where a uniform magnetic field $\vec{B}$ points out of the page as shown in the figure. If the particles curve as shown in the arrows, the charges of these particles are

(a) $q_A > 0, q_B = 0$ and $q_C > 0$
[✓ (b)] $q_A > 0, q_B = 0$ and $q_C < 0$
(c) $q_A < 0, q_B = 0$ and $q_C > 0$
(d) $q_A > 0, q_B = 0$ and $q_C = 0$
(e) $q_A < 0, q_B < 0$ and $q_C < 0$

(6) The equivalent capacitance between the points a and b is:

(a) 1.00μF
(b) 2.00μF
(c) 9.00μF
(d) 6.00μF
[✓ (e)] [illegible].00μF

3, 6 → 2
2, 2 → 4
4, 12 →



4

(7) Electric Current is a measure of
(a) force that moves a charge past a point
(b) resistance to the movement of a charge past a point
[✓ (c)] amount of net charge that moves past a point per unit time
(d) energy used to move a charge past a point
(e) speed with which a charge moves past a point

ε	r	R	P
6	1	1	9
6	1	2	8
6	1	[illegible]	3
6	1	[illegible]	[illegible]
6	0	[illegible]	4.5

(8) In the circuit shown, the battery has an emf, ε, and internal resistance, r. If we connect this battery to a resistor with resistance, R, then the power dissipation for R is greatest when R equals

b [✓ (a)] 1.00 r 2.25
(b) [illegible] 2.2
(c) 0.50 r $(0.5)^2 = 2$
(d) 0.75 r 2.2
(e) 0.25 r 1.45

$P = I^2R$
$= 2\ J$

$\varepsilon - ir - IR = 0$

$I = \frac{\varepsilon}{\quad}$

$I = \frac{\varepsilon}{2r}$

$\frac{3}{3} = 1$

$\frac{\varepsilon}{2r}$

$I = \frac{\varepsilon}{2}$

$= \frac{2 \cdot 2}{1.5} = 2$

ε	I	P	
[illegible]	1	3	9
1	2	2	8
1	0.6	4	8
1	0.3	3.[illegible]	2.7
1	0.4	[illegible]	6.[illegible]
1			

$P = I\,V$
$P = \frac{V}{R}\,\Delta I$

I^2R
$\frac{V^2}{R^2}R = \frac{V^2}{R}$

$\left(\frac{\varepsilon}{2r}\right)^2 r$
$= \frac{\varepsilon^2}{4r}$

$\frac{\varepsilon^2}{4r}$

d
b
e

(9) Imagine that you want to build a 1.0 F parallel-plate capacitor with a plate separation distance of 1.0 mm, the area of the plates would be

(a) smaller than the area of BZU campus.
(b) smaller than a typical classroom.
(c) greater than the area of Palestine.
[✓ (d)] greater than the area of BZU campus.
(e) none of the above.

$C = \frac{\epsilon_0 A}{d}$

$1\,F = \frac{8.85\times10^{-12} \times A}{1\times10^{-3}}$

$A = 112994350.3$
$= 1.13 \times 10^{8}\ m^2$
$113\ Km^2$ $10^{8}\ Km^2$

(10) An electron of kinetic energy $\overset{\frac{1}{2}mv^2}{1.20}$ keV circles in a plane perpendicular to a uniform magnetic field. If the orbit radius is 25.0cm, then the magnitude of the magnetic field is

(a) 251 nT
[✓ (b)] 467 µT
(c) 349µT
(d) 121µT
(e) 180µT

$\frac{1}{2}mv^2 = 1.2\times10^{3} \times 1.6\times10^{-19}$

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

20.5×10^{6}

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

$\frac{9.11\times10^{-31}\ v}{r} = qB$

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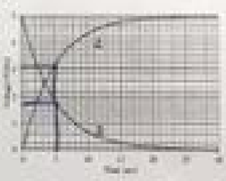
(11) The following figure shows the charging and discharging curves of a capacitor in an RC circuit. Which one of the following statements is **FALSE**?

(a) The time constant of the circuit is the same in the charging and discharging process.
(b) Curve A represents the charging process.
(c) Curve B represent the discharging process.
(d) The time constant of the circuit is 5 seconds.
[✓ (e)] The time constant of the circuit is 2 seconds.



C
a
c
d

(12) A wire 2.00 m long carries a current 13.0 A and makes an angle of 30° with a uniform magnetic field of magnitude 0.150 T. The magnitude of the magnetic force on the wire is

(a) 4.00 N
(b) 2.25 N
[✓ (c)] 1.95 N
(d) 1.10 N
(e) 3.38 N

$= i L \times B$

$= 13(2)(0.15) \times \sin 30$

(13) A circular coil of 150 turns (N) has a radius (r) of 4.00 cm and carries a current (I) of 2.00 A. The maximum magnitude of the torque that the coil can experience in a uniform 0.0900 T magnetic field is

[✓ (a)] 0.136 N.m
(b) 2.06 N.m
(c) 7.56 N.m
(d) 0.250 N.m
(e) 1.36 N.m

$\tau = \vec{\mu} \times \vec{B}$

$= NIA\, B$

$= 150(2)(4\times10^{-2})^2 \pi \times 0.09$

(14) In the figure, R_1 = 100 Ω, R_2 = 50.0 Ω, R_3 = 200 Ω and the ideal batteries have emfs $\mathcal{E}_1$ = 3.00 V, $\mathcal{E}_2$ = 7.00 V and $\mathcal{E}_3$ = 4.00 V. Find $V_b - V_a$

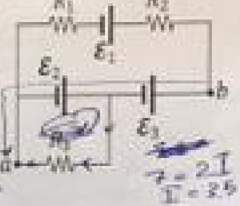
(a) 2.00 V
(b) −11.0 V
[✓ (c)] 11.0 V
(d) 10.0 V
(e) −10.0 V

$V_b - 4 - 7 = V_a$

$V_b - V_a = 11$

$V_a + 7 + 4 = V_b$

$V_b - V_a = +11$ V

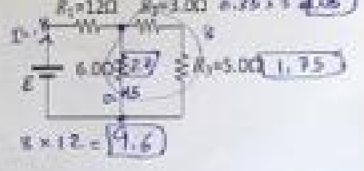


$7 = 2I$

$I = 2.5$

(15) Consider the circuit shown in the figure with resistors R_1, R_2 and R_3. The ideal battery has an emf $\mathcal{E}$ = 12.00 V. Rank the resistors according to the voltage drops across them

(a) [illegible]
(b) [illegible]
(c) [illegible]
[✓ (d)] [illegible]
(e) [illegible]



e
b
d

(16) A parallel plate air-filled 1.00 mF capacitor is connected to a battery until 1.00 mC charge accumulated on it. After removing the battery, if a dielectric material with κ = 5.00 is inserted to fill the space between the plates of the capacitor. Which of the following statements is **FALSE**:

30, V

V q constant

(a) The new voltage across the plates is 0.20 V.
(b) The new electric field between the plates is reduced.
(c) The induced charge on the dielectric surface is 0.80 mC.
(d) The new capacitance is 5.00 mF.
[✓ (e)] The new charge on the plates 5.00 mC.

$C = \frac{\kappa\varepsilon_0 A}{d} = 5(1) = 5$

$q = CV$

$1 = 5$

$V = q/$

(17) A cell phone with a 3.82 V battery that has an initial charge of 1960 mAh. Assuming the potential across the battery terminals stay constant until the battery is completely discharged and talking on the phone consumes energy at a rate of 1.05 W, how many hours will the cell phone battery last?

$Q = I\,t$
$= 1960 \times 10^{-3} \times 3600$

(a) 12 hours
[✓ (b)] 7 hours
(c) 4 hours
(d) 3 hours
(e) 2 hours

$V = 3.82\ V$

$q = 1960\ mAh$

$q = I t = 1960 \times 10^{-3} \times 3600$

$= 7056\ C$

$P = 1.05\ W$

$1.05 = I V$

$1.05 = \frac{Q}{t} V$

$1.05 = \quad 3.82$

$\frac{Q}{t} = .275$

$t = \frac{Q}{.275}$

25,720.4

(18) An electron enters a uniform magnetic field $\vec{B}$ region with velocity $\vec{v}$ in. The angle θ between $\vec{v}$ and $\vec{B}$ is between 0 and 90°. As a result, the electron follows a helix. Its velocity vector returning to its initial state in a time interval of:

(a) $2\pi m v \sin\theta$.
(b) $2\pi m v \cos\theta$.
(c) $2\pi m v/eB$.
[✓ (d)] $2\pi m/eB$.
(e) none of these

$T = \frac{2\pi r}{v}$

$T = \frac{2\pi m}{qB}$

Some Useful Formulae and Constants

1. $k = \frac{1}{4\pi\epsilon_0} = 9.0 \times 10^9\ Nm^2/C^2$
2. $\epsilon_0 = 8.85 \times 10^{-12}\ C^2/N.m^2$
3. $e = 1.6 \times 10^{-19}\ C$
4. $m_e = 9.11 \times 10^{-31}\ kg$

Capacitance

5. $q = CV$
6. $C = \frac{\epsilon_0 A}{d}$
7. $U = \frac{q^2}{2C}$
8. $u = \frac{1}{2}\epsilon_0 E^2$
9. $\epsilon_0 \oint \kappa \vec{E} \cdot d\vec{A} = q$

Current and Resistance

10. $\vec{J} = ne\vec{v}_d$
11. $\vec{E} = \rho\vec{J}$
12. $R = \frac{\rho L}{A}$
13. $P = i^2 R$

Circuits

14. $\varepsilon = \frac{dW}{dq}$
15. $V = \varepsilon(1 - e^{-\frac{t}{RC}})$

Magnetic Fields

16. $\vec{F} = q\vec{v} \times \vec{B}$
17. $\vec{F} = i\vec{L} \times \vec{B}$
18. $\mu = NiA$
19. $\vec{\tau} = \vec{\mu} \times \vec{B}$
20. $U = -\vec{\mu} \cdot \vec{B}$
21. $W_a = U_f - U_i$