Second

BIRZEIT UNIVERSITY

Physics 132

Coordinator: Tayseer [illegible]

1st. [illegible] EXAM
TIME: 50 min

2nd. Sem. 2012
[illegible]

Student Name: [redacted]

Student No.: [redacted]

[illegible] (X) [illegible]

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☐	[illegible]	1, 2, 5	☐	[illegible]	3, 6
☐	[illegible]	7, 8	☐	[illegible]	4, 9, 10
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[illegible]

(1) [illegible]
(2) [illegible]
(3) [illegible] (X) [illegible]
(4) [illegible]
(5) [illegible]
(6) عدد الأسئلة 17 سؤالاً

10

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A							X		X	X						X	
B	X			X										X			
C			X								X	X					
D		y				X									X		
E					X			X					X				X

$Q = V_1 + V_2 + V_3$ $q = q_1 = q_2 = q_3$

$q = q_1 \Rightarrow$ $4 \times 30 = \mu C$ $120 = q_1$

$CV = C_{eq} V_1$

✗ Determine the energy stored in C_1 when $C_1 = 10\ \mu F$, $C_2 = 12\ \mu F$, $C_3 = 15\ \mu F$, and $V_0 = 30$ V.

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

$U = U_1 + U_2 + U_3$ $= \frac{1}{2} \frac{q^2}{C}$

- A) [illegible] mJ
- B) [illegible] mJ
- C) [illegible] mJ
- D) [illegible] mJ
- E) [illegible] mJ

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

$\Rightarrow \frac{1}{10} + \frac{1}{12} + \frac{1}{15}$

$\frac{180 + 150 + 120}{1800} = \frac{450}{1800}$ $C_{eq} = 4\ \mu F$

$q = C_{eq} V = 120\ \mu C$

✗ If 5.0×10^{21} electrons pass through a 30-Ω resistor in 10 min, what is the potential difference across the resistor?

$n = 5 \times 10^{21}$, $R = 30$

$I = \frac{dq}{dt} = \frac{5 \times 10^{21} \times 1.6 \times 10^{-19}}{10 \times 60}$

$V = IR = 40$ V

- A) 13 V
- B) 67 V
- C) 27 V
- D) 53 V
- E) 40 V

$q = CV$

$q = Ne$

$\boxed{q = 800}$

$I = \frac{q}{t}$

$I = \frac{800}{10 \times 60}$

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

$\boxed{I = \frac{q}{t}}$

✗ A certain substance has a dielectric constant of 4.7 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:

$K = 4.7$ $E = \frac{V}{d}$

$C = 15\ nF$

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

$V = 8\ kV$

$d = 5 \times 10^{-4}$ m

$A = 0.1801$

$q = \epsilon_0 E A$

$\Rightarrow \frac{30 \times 800}{10 \times 60} = 40$

- A) 0.13 m²
- B) 0.37 m²
- C) 0.24 m²
- D) 0.18 m²
- E) 0.48 m²

$A = 1.8 \times 10^{-1}$ m²

Ⓐ

$V = E d$

$\boxed{V = \frac{q d}{K \epsilon_0 A}}$

$V = \frac{(CV) d}{K \epsilon_0 A}$

$K \epsilon_0 A = \frac{CVd}{V}$

$\Rightarrow \frac{8}{d} = 16$

$\boxed{d = 0.5\ m}$

$16 \frac{V}{m}$

$\boxed{\frac{V}{d} = 16}$

$\mu_0 = 4\pi \times 10^{-7}$ T·m/A $= 1.26 \times 10^{-6}$ T·m/A
$\epsilon_0 = 8.85 \times 10^{-12}$ C²/N·m²
$e = 1.6 \times 10^{-19}$ C $\quad m_e = 9.1 \times 10^{-31}$ kg

$u_i = \frac{1}{2}CV_i^2 \quad u_f = 80\% u_i$
$u_f = \frac{1}{2}CV_f^2$

1. How long will it take a charged 80-μF capacitor to lose 20% of its initial energy when it is allowed to discharge through a 75-Ω resistor? $R = 75$

$C = 80\ \mu F \quad Q = Q_0 e^{-t/RC} \quad u_f = 20\%\ u_i$
$V = V_0 e^{-t/RC} \Rightarrow u = .8\, u_i$
$u = \frac{1}{2}V^2C \Rightarrow \frac{1}{2}V^2C = .8\,\frac{1}{2}V_0^2C$

A) 0.89 ms
B) 0.67 ms
C) 0.40 ms
D) 0.17 ms
E) 0.30 ms

$I = \frac{V}{R} \Rightarrow \frac{CV}{t}$
$\Rightarrow t = \frac{q}{I} \Rightarrow$ $t = 6.99 \times 10^{-4}$

2. A light bulb is rated at 100 W when operated (connected) at 120 V. How much charge enters (and leaves) the light bulb in 1.0 min?

$P = 100\ W \quad \rightarrow V = 120\ V$
$t = 1$ min
$P = IV$
$100 = I\ 120 \quad P = IV \Rightarrow \frac{100}{120} = I$
$I = 0.83$ Amp
$\frac{dq}{dt} = 0.83$
$dq = 0.83 \times 60 = 50$ C
$\boxed{I = .83} \times 60 = 50$

A) 75 C
B) 15 C
C) 30 C
D) 50 C
E) 60 C

3. A 40-μF capacitor charged to 40 V and a capacitor C charged to 20 V are connected to each other, with the two positive plates connected and the two negative plates connected. The final potential difference across the 40-μF capacitor is 30 V. What is the value of the capacitance of C? parallel

$C_1 = 40\ \mu F \quad V = 40\ V$
$V = 20\ V$
$q = CV$
$q = \left(\frac{C_1 C}{C_1 + C}\right)30$
$q = \left(\frac{40C}{40+C}\right)30$
$V_f = 40\ V \quad C = 30$

A) 40 μF
B) 25 μF
C) 80 μF
D) 55 μF
E) 120 μF

$q = q_2 \Rightarrow$
$\left(\frac{40C}{40+C}\right)30 = q_2$
$\frac{V_1 C_1}{V_2} = \frac{V_2 C}{V_2}$

$\boxed{\frac{40C}{40+C} = \frac{30}{20}}$

$\Rightarrow C = \boxed{80\ \mu F}$
$\frac{C_1 C}{} \quad \frac{40C}{} = .67C$

$q = q_1 = q_2$
$\frac{1}{C_1} + \frac{1}{C} \Rightarrow \frac{C_1 + C}{C_1 C} \Rightarrow$

$40 \cdot \frac{1}{2} q \Delta V = E$

$\frac{1}{2}mv^2 = [illegible] = 1.6 \times 10^{-19} \cdot 5 \cdot 3 \times 10^{3}$

$v^2 = 1.7 \times 10$

7. A velocity selector where E = E ĵ and B = B k̂, with B = 40 mT. If the selector is designed ([illegible] to select) 5×10 [illegible] electrons, then the value of E is

$V = \frac{E}{B} \Rightarrow \frac{E}{B}$ =

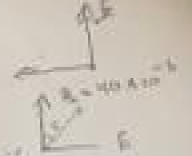
- (A) 21.0 x 10⁵ V/m
- (B) 12.8 x 10⁵ V/m
- (C) 8.8 x 10⁵ V/m
- (D) 16.8 x 10⁵ V/m
- (E) None of these

$\frac{1}{2} \cdot 9.1 \times 10^{-31} \cdot 5 \times 10^{3} \times 1.6 \times 10^{-19} = E$

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

$= 6 \cdot 4 \times 10^{3} = \frac{E}{40 \times 10^{-3}}$

$E = 16.4 \times 10^{3}$ V/m



X Copper contains 8.4 x 10²⁸ free electrons/m³. A copper wire of cross-sectional area 0.4 mm² carries a current of 6 A. The electron drift speed is approximately (___ m/s)

$n = 8.4 \times 10^{28}$ e/m³

- A) 3 x 10² m/s
- B) 1.1 x 10⁻³ m/s
- C) 7.4 x 10⁻⁴ m/s
- D) 1.5 x 10⁻³ m/s
- E) 8.3 x 10⁻⁴ m/s

$A = .4 \text{ mm}^2$

$I = 6$ A

$I = v e n A$

$V_d = \frac{I}{neA}$

$V_d = \frac{I}{[illegible]} \Rightarrow \frac{6}{.4 \times 10^{-6} \times 8.4 \times 10^{28} \times 1.6 \times 10^{-19}}$

$6 = v(1.6 \times 10^{-19})(8.4 \times 10^{28})(0.4 \times 10^{-6})$

$v = 1.116 \times 10^{-3}$

$= 9.34 \times 10^{-7}$

X A charged oil drop with a mass of 6.0 x 10⁻³ kg is held suspended by an upward electric field of 400 N/C. The charge on the drop is:

- A) +1 x 10⁻⁴ C
- B) -2 x 10⁻⁴ C
- C) -1.5 x 10⁻⁴ C
- D) +2 x 10⁻⁴ C
- E) none of these

$m = 6 \times 10^{-3}$

$E = 400$ N/C

$mg = qE$

$q = 6 \times 10^{-3}(9.8) = q\, 400$

$q = .147 \times 10^{-3} = qV$

$F_{net} = ma$

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

$q_{in} = \varepsilon_0 E A$

$\Rightarrow E =$

$F = qE$

$\frac{m g}{E} = \frac{qE}{E}$

$q = \frac{mg}{E} = \frac{6 \times 10^{-3} \times 10}{400} = 3 \times 10^{-4}$ C

$V_1 = I_1 3 \Rightarrow 12 =$

$V_2 = 5 I_1$

~~The current in the 5.0-Ω resistor in the~~ [illegible]

$I = 12$

$I = \frac{\varepsilon}{R} \rightarrow \frac{12}{8} = 1.5$

$\frac{12}{11} = 2A$

$I =$

$\boxed{\text{A) 1.5 A}}$
B) 2.4 A
C) 3.0 A
D) 1.0 A
E) none of these

$V = V_1 + V_2$

$12 = 3$

$12 = 3 I_1 + 5 I_1$

$A = \frac{12}{8} = \frac{8 I_1}{8} \rightarrow I_1 = 1.5 A$

$\frac{1}{3} - \frac{1}{6} = \frac{1}{6} = \frac{6}{1}$ ③

$\frac{1}{3} - \frac{1}{6} = \frac{1}{6} \Rightarrow \frac{6}{1} = 6$

$I = \frac{\varepsilon}{R_{eq}} \Rightarrow \frac{12}{4} =$

$I = 3$

~~A wire is 1.0 m long and 1 mm² in cross-sectional area. When connected to a potential difference of 3.2 V, a current of 8 A exists in the wire. The resistivity of this wire is:~~

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

$I A = 1 \quad , A = 1\,mm^2 \qquad R = \frac{\rho L}{A}$

$V = 3.2 V \quad , i = 8$

$0.4 = \frac{\rho 1}{1 \times 10^{-6}} \quad \rho = E J A$

A) $1 \times 10^{-7}\ \Omega \cdot m$
B) $2 \times 10^{-7}\ \Omega \cdot m$
$\boxed{\text{C) } 4 \times 10^{-7}\ \Omega \cdot m}$
D) $5 \times 10^{-7}\ \Omega \cdot m$
E) $8 \times 10^{-7}\ \Omega \cdot m$

$\rho = \frac{E}{J} = \frac{\frac{V}{L \cdot A}}{I/A}$

$\Rightarrow \frac{V \cdot A}{L \cdot I} \quad \Rightarrow \boxed{\frac{V}{L}}$

$\rho = 4 \times 10^{-7} \Rightarrow \frac{V}{L A} = E$

~~A battery of emf 40 V and internal resistance of 2.0 Ω is connected to an 18-Ω resistor. The terminal potential difference of the battery is:~~

$I = \frac{40}{20} = 2A \quad \varepsilon_{int} = \varepsilon = 40V$

$r_{in} = 2\ \Omega$

$R = 18\ \Omega$

$40 - Ir = 40 - 2 \cdot 2 = 36V$

A) 0
B) 45 V
$\boxed{\text{C) 36 V}}$
D) 18 V
E) 27 V

$I = \frac{\varepsilon}{r_{int} + R}$

$\Rightarrow \frac{2 \times 9}{18} = \boxed{2 = I}$

$\frac{I}{A} = \frac{\sigma V}{l}$

$V = \varepsilon V$

$\frac{V}{A} = \frac{E d}{d}$

$\rho = \frac{\frac{V}{d}}{I/A}$

$\Rightarrow \rho = \frac{V A}{d I}$

$\Rightarrow \frac{3.2 \times 1 \times 10^{-6}}{1 \times 8}$

$V =$

$\textcircled{2} \times 2 = 0 \qquad \frac{2 = \rho}{J}$

$V = 2 \times 18 = 36$

3L x (0.05ĵ + 0.02 k̂) ⇒

⇒ $\boxed{-.15\hat{k}}$

X A wire 60 cm long lying along the x axis carries a current of 5 A in the positive x direction, through a magnetic field B = (0.05 T)ĵ + (0.02 T)k̂. The force on the wire is

l = 60 cm F = I(l)B
= 5(0.6)î × (0.05ĵ + 0.02k̂)
= 5(0.03k̂ − 0.012ĵ)
= 0.15k̂ − 0.06ĵ

I = 5A

F = qv

F = Il × B
= 60×10⁻² × 5î × 0.05ĵ + ...

A) −0.06ĵ + 0.12k̂ N
B) 0.06ĵ + 0.12k̂ N
C) −0.03ĵ + 0.09k̂ N
D) 0.3ĵ + 0.12k̂ N
[✓ E) none of these]

0.15k̂ − 0.06ĵ

14. Suppose the electric company charges 25 cents per kW·h. How much does it cost to use a 150 watt lamp 8 hours a day for 30 days? ($1 = 100 cents)

P = 150 W
= 150 × 30 × 8 ÷ 1000
= 36 kW·h

25 cents = $ 36 kW·h
= 8 × 30 × 8 ×

= 3.6 kW

A) $1.20
B) $6.40
[✓ C) $9.00]
D) $2.20
E) none of these

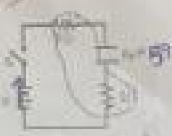
15. In the circuit shown, V = 60V and the capacitor is initially uncharged. At time t = 0, switch S is closed. If τ is the time constant, the approximate current through the 3 Ω resistor when t = 3τ is:

q(t) = CE(1 − e^{-t/RC})

I = ε/R e^{-t/RC}

= ε/R e^{-3}

V =



I = CV

V = CV/3R

Ans ~~[illegible]~~ 0.398 Amp

~~[illegible]~~ R = 3 Ω

τ = 3τ

t = 3τ

A) 1.0 A
B) 0.33 A
C) 1.0 A
D) 0.17 A
E) none of these

$$I = \left(\frac{\varepsilon}{R}\right)e^{-t/RC}$$

Q = εC

$$I = \left(\frac{8.85\times10^{-12}}{3}\right)e^{-t/RC}$$

$$I \Rightarrow \left(\frac{8.85\times10^{-12}}{3}\right)e^{-t/RC}$$

16. An electron (m = 9.1x10^{-31} kg) with speed 8000 km/s is projected into a uniform magnetic field B of 0.2 mT with its velocity vector making an angle of 60° with B. The pitch of the path is:

Pitch = $V_{\parallel} T$

$= 4 \times 10^{6}$ T

$T = \frac{2\pi r}{V_{\perp}} = \frac{2\pi m}{qB} = 1.788 \times 10^{-7}$

A) 0.54 m
B) 0.80 m
C) 1.6 m
D) 0.71 m
E) none of these

17. In a Hall-effect experiment, a current of 3 A is sent through a copper strip 8 cm long, 1 cm wide, and 1 mm thick. The magnetic field B is 0.4 T. Hall potential difference V is: (The number of charge carriers per unit volume for copper is 8.5 x 10^{28} electrons / m^3)

$I = V_d e n A$

$qE = q V_d B$

$E = V_d B$

$\frac{V}{L} = \frac{V_d}{B}$

$V = \frac{EL}{\text{width}}$

A) 2.8 x 10^{-8} V
B) 3.6 x 10^{-8} V
C) 1.1 x 10^{-7} V
D) 8.4 x 10^{-7} V
E) None of these

A = L × thickness

~~$\frac{I}{en\,V} = \frac{VB}{L}$~~

~~$\frac{3}{1.6 \times 10^{-19} \times 8.5 \times 10^{28} \times 1 \times 10^{-4}} = 0.4\,V$~~

~~$V = 5.3 \times 10^{-7}$ V~~

~~$I = n V A$~~

$n = \frac{IB}{eV\,\text{thickness}}$

$V = \frac{IB}{e\,\text{thickness}\,n}$

$= \frac{3 \times 0.4}{1.6 \times 10^{-19} \times 8.5 \times 10^{28} \times 1 \times 10^{-3}}$

$= 8.8 \times 10^{-8}$

BIRZEIT UNIVERSITY

-Physics Department-

Physics 132

2nd Semester 2012/2013

Date:28 /4/2013

2nd hour exam

Time: 80:00 min

Coordinator Ghassan Abbas

Student Name: Dana [illegible] **Student NO.:** 1120224

[illegible] (X)	Instructor Name	Section No.	
X	[illegible]	1,2D	12:50 – 1:40
	[illegible]	3,4,5,6D	
	[illegible]	7,9,10D	
	[illegible]	8D	

Answer Sheet

Q#	A	B	C	D	E
1					X
2		X			
3			X		
4	X				
5					X
6				X	
7		X			
8			X		
9		X			
10	X				
11			X		
12					X
13	X				
14				X	
15		X			
16					X
17				X	

15

$1eV = 1.6\times10^{-19}J$

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

$Me = 9.11\times10^{-31}kg$

$\varepsilon_0 = 8.85\times10^{-12}\ C^2/N.m^2$

$\mu_0 = 4\pi\times10^{-7}\ T.m/A$

Name: ______________________ Class: ___________________ Date: _________ ID: A

phys132-22-213

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

____ 1. A parallel plate capacitor of capacitance C_0 has plates of area A with separation d between them. When it is connected to a battery of voltage V_0, it has charge of magnitude Q_0 on its plates. While it is connected to the battery, the space between the plates is filled with a material of dielectric constant 3. After the dielectric is added, the magnitude of the charge on the plates and the new capacitance are

a. $\frac{1}{3}Q_0, \frac{1}{3}C_0$
b. $Q_0, \frac{1}{3}C_0$
c. Q_0, C_0
d. $3Q_0, C_0$
[✓ e. $3Q_0, 3C_0$]

$C_0 = \frac{\varepsilon_0 A}{d} \rightarrow 3 \quad 3C_0$

$q = CV$
$q' = 3CV_0 = 3q_0$

____ 2. A certain parallel plate capacitor is filled with a dielectric material with κ = 2.8 and a dielectric strength of 18 MV/m. The area of each plate is 0.12 m². The capacitor will be able to withstand a potential difference of 4.0 kV. The capacitance of this capacitor is:

a. 7.3×10⁻⁹ F
[✓ b. 1.3×10⁻⁸ F]
c. 2.6×10⁻⁸ F
d. 2.5×10⁻⁸ F
e. 5.1×10⁻⁸ F

$E = \frac{V}{d}$

$18\times10^6 = \frac{4\times10^3}{d}$

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

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

$= \frac{2.8(8.85\times10^{-12})(0.12)}{2.2\times10^{-4}} \approx 9.2\times10$ [illegible]

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

$d = \frac{V}{E}$ [illegible]

____ 3. An air-filled parallel-plate capacitor has a capacitance of 2.1 pF. The separation of the plates is doubled, and WAX is inserted between them. The new capacitance is 2.6 pF. The dielectric constant of the WAX is:

a. 1.2
b. 0.2
[✓ c. 2.5]
d. 5.0
e. 1.6

$C_0 = \frac{\varepsilon_0 A}{d}$

$2.6\text{ pF} = \frac{K\varepsilon_0 A}{2d}$

$K = 2\left(\frac{2.6}{2.1}\right)$

$2.1 = \frac{\varepsilon_0 A}{d}$

$2.6 = K$ [illegible]

$9.1 = \frac{\varepsilon_0 2.1}{2}$ [illegible]

____ 4. How many electrons pass through a 20-Ω resistor in 10 min if there is a potential drop of 30 volts across it?

[✓ a. 5.6 × 10²¹]
b. 7.5 × 10²¹
c. 8.4 × 10²⁰
d. 1.1 × 10²⁰
e. 3.8 × 10²⁰

$I = \frac{V}{R}$
$= \frac{30}{20}$
$\frac{dq}{dt} = 1.5\text{A}$

$Q = t \times A$
$= 10\times60\times1.5$
$= 900\text{ C}$

$\Delta t = 900\text{ s}$

$I = \frac{q}{t}$

$\frac{q}{t} = \frac{q}{10\,100}$

$Q = en = 900$
$n = 5.625\times10^{21}$

$900 = 1.6\times10^{-19}$

$\uparrow \boxed{R} = \frac{\rho L}{\boxed{A}} \downarrow$ $T\uparrow$

Name ____________________

___ 5. Nadeem says that you can increase the resistance of a copper wire by making the wire narrower and longer. Aseel says that you can increase its resistance by heating the wire. Which one, if either, is correct, and why?

a. Aseel, because the resistivity of the wire increases when it is heated.
b. Aseel, because the resistivity of the wire decreases when it is heated.
c. Nadeem, because the resistivity of a wire is inversely proportional to its area and directly proportional to its length.
d. Nadeem, because the resistance of a wire is inversely proportional to its area and directly proportional to its length.
[✓ e.] Both are correct because (a) and (d) are both correct.

___ 6. The current density in a cylindrical wire of radius R is varies with radial distance r as J=αr. The current in the wire is:

a. $2\pi\alpha R^2$
b. $3\pi\alpha R^2$
c. $\pi\alpha R^3/2$
[✓ d.] $2\pi\alpha R^3/3$
e. $\pi\alpha R^3$

$i = \int J \cdot dA$ $i = \int \alpha r \, dA$

$= \int \alpha r \, 2\pi r \, dr$

$\int dA = 2\pi r$ $= \alpha \, 2\pi \frac{r^3}{3}$

$= 2\pi \int r^2 dr$

___ 7. A battery of emf 24 V is connected to a 6-Ω resistor. As a result, current of 3 A exists in the resistor. The internal resistance of the battery is:

a. 5 Ω
[✓ b.] 2 Ω
c. 4 Ω
d. 7 Ω
e. 20Ω

$3 = \frac{24}{6+r}$ $3 = \frac{24}{6+r}$

$r = 2\Omega$

___ 8. 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. 9.6 μF
b. 14 μF
[✓ c.] 20 μF
d. 7.2 F
e. 10 F

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

$\frac{1}{2}C\mathcal{E} = C\mathcal{E}\left(1 - e^{-\frac{t}{RC}}\right)$

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

$\frac{1}{2}\mathcal{E}C = \mathcal{E}C\left(1 - e^{-t/RC}\right)$

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

$\frac{10 \times 10^{-3}}{RC} = \ln 2$

$\ln A = \frac{t}{R}$

$0.69 = \frac{10 \times 10^{-3}}{720 C}$

$C = 2 \times 10^{-5}$

___ 9. A charged capacitor with Q_0 is being discharged through a resistor. At the end of two time constants the charge on the capacitor is :

a. $0.86\,Q_0$
[✓ b.] $0.14\,Q_0$
c. $0.37\,Q_0$
d. $0.63\,Q_0$
e. $0.5\,Q_0$

$q = q_0 e^{-\frac{t}{RC}}$

$q = q_0 e^{-2}$

2τ

$= Q_0 e^{-2RC/RC}$

$= Q e^{-2}$

____ 10. When switch S is open, the ammeter in the circuit shown reads 2.0 A. When S is closed, the ammeter reading:

$2 = \frac{V}{35}$

$V = 70$

$\frac{60 \times 20}{80} = 15$

$I = \frac{E}{35}$ $\boxed{E = 70}$

$I = \frac{70}{30}$

$\frac{70}{30}$

- [✓ a. increases slightly]
- b. remains the same
- c. decreases slightly
- d. doubles
- e. halves

____ 11. Determine the potential difference, $V_A - V_B$, in the circuit segment shown below when $I = 2.0$ mA and $Q = 50\ \mu C$.

$V_A + 15 - \frac{Q}{C} + 15 \times 10^3 \times 2 \times 10^{-3} = V_B$

$V_A - V_B = 25 - 15 = -20$

- a. −45 V
- b. +45 V
- [✓ c. +20 V]
- [✓ d. −20 V]
- e. −10 V

____ 12. A proton (charge = +1.6 × 10^{-19} C) is moving at 3 × 10^{5} m/s in the positive x direction. A magnetic field of 0.8 T is in the positive z direction. The magnetic force on the electron is:

qvB Proton

- a. 0
- b. 4 × 10^{-14} N in the positive z direction
- c. 4 × 10^{-14} N in the negative z direction
- d. 4 × 10^{-14} N in the positive y direction
- [✓ e. 4 × 10^{-14} N in the negative y direction]

qvB

____ 13. A deuteron is accelerated from rest through a 20-kV potential difference and then moves perpendicularly to a uniform magnetic field with B = 1.6 T. What is the radius of the resulting circular path? (deuteron: m = 3.3 × 10^{-27} kg, q = 1.6 × 10^{-19} C)

- [✓ a. 13 mm]
- b. 18 mm
- c. 20.3 mm
- d. 10 mm
- e. 19.0 mm

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

$\frac{1}{2}(3.3 \times 10^{-27})v^2 = (1.6 \times 10^{-19})(20 \times 10^{3})$

$V = 9.8 \times 10^{5}$

$qV = E$

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

$v = \frac{...}{qB}$

$r = \frac{mv}{qB} = 0.0126 = 12.6 \times 10^{-3}$

15

جامعة بيرزيت

BIRZEIT UNIVERSITY

-Physics Department-

-physics 132-

First Summer 2103

7/7/2013

1st Hour Exam

Time: 75 Minutes

Student Name: [illegible]

Student Number: [illegible]

ضع علامة (X) هنا	Instructor Name	Section No.
	[illegible]	4D
	[illegible]	33D
X	[illegible]	1D

Answer Sheet

Q#	A	B	C	D	E
1					X
2					X
3				X	
4		X			
5			X		
6					X
7				X	
8			X		
9	X				
10					X
11				X	
12				X	
13	X				
14	X				
15	X				
16					X

$R_1 = \frac{\rho(4L)}{R}$ $L_2 = 4L_1$ $\frac{\rho 4L}{\frac{A}{16}}$

$R_2 = \frac{R_1}{4}$

Name: ____________ Class: ____________ Date: ____________ ID:

PHYS132-2ND $R_1 = \frac{\rho(4L)}{A}$, $R_2 = \frac{\rho(4L)}{\pi}$ ρ

Multiple Choice $A_2 = 4A$

$R_2 = \frac{\rho(4L)}{\frac{\pi}{16}}$

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

ch29 1. 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. 4F/9
b. 2F/9
c. 6F
d. 2F/3
e. 4F/3

$F = \frac{i_1 i_2 \mu_0}{2\pi d}$

____ 2. At t = 0 the switch S is closed with the capacitor uncharged. If C = [illegible], ε = [illegible] V, and R = 10 kΩ, what is the potential difference across the capacitor when I = 2.0 mA?

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

$I(t) = \frac{\varepsilon}{R} e^{-t/RC}$

$2\times10^{-3} = \frac{50}{10\times10^3} e^{[illegible]}$

$I = [illegible] = \frac{50}{10}$

$t = 0.276$

$10^3 \times 2 = 50 - V$

$1000\ \rho$ $\frac{\rho L}{A}$

a. 25 V
b. 20 V
c. 15 V
d. 11 V
e. 30 V

____ 3. A conductor of radius r, length ℓ and resistivity ρ has resistance R. What is the new resistance if it is stretched to 4 times its original length?

$R = \frac{\rho L}{\pi r^2}$

$V = V_0$

$R = \frac{\rho 4L}{A}$

$V = AL$ $\frac{A}{4}$ $4L$

$R = \frac{\rho 4L}{\frac{A}{4}} = 16R$

____ 4. To increase the current density in a wire of length ℓ and diameter D, you can

a. decrease the potential difference between the two ends of the wire
b. increase the potential difference between the two ends of the wire
c. decrease the magnitude of the electric field in the wire
d. heat the wire to a higher temperature
e. combine both (b) and (d)

$J = nev = \frac{I}{A} = \frac{V}{RA}$

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

$V = IR$

$q_{net} = 0.38$

22.8×10^{-6}

$38 \times 10^{-6} = C V$

Name: ____________________

$q_1 = 4 \times 10^{-6} \times 50 = \boxed{8.13}$

$5\mu + 2\mu$

$CV = 6 \times 10^{-6} \times 30 = 0.38$

___ 5. A 4.0-μF capacitor initially charged to 50 V and a 6.0-μF capacitor charged to 30 V are connected to each other with the positive plate of each connected to the negative plate of the other. What is the final charge on the 6.0-μF capacitor?

a. 12 μC
b. [illegible]
c. [illegible]
d. 10 μC
e. 8.0 μC

$q_{net} = 0.02$

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

$V = \frac{q_{net}}{C_{eq}}$

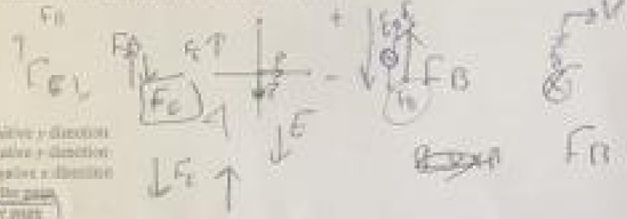
$q = CV = (6 \times 10^{-6})$

$6\mu f$, 2μ

12 μC

$= 228\ \mu C$

___ 6. An electron is travelling in the positive x direction. A uniform electric field $\vec{E}$ is in the negative y direction. If a uniform magnetic field with the appropriate magnitude and direction also exists in the region, the total force on the electron will be zero. The appropriate direction for the magnetic field is:



a. the positive y direction
b. the negative y direction
c. the negative x direction
d. out of the page
e. into the page

___ 7. At one instant an electron (charge = −1.6 × 10^-19 C) is moving in the xy plane, the components of its velocity being $v_x = 5 \times 10^5$ m/s and $v_y = 3 \times 10^5$ m/s. A magnetic field of 0.8 T is in the positive x direction. At that instant the magnitude of the magnetic force on the electron is:

a. 6.4 × 10^-14 N
b. 2.4 × 10^-14 N
c. 0
d. 3.8 × 10^-14 N
e. 1.8 × 10^-14 N

$\hat{i}$

$qv \times B$

$(\ldots)\ 1.6 \times 10^{-19}\ (\ldots)$

$qv \times B = 1.6 \times 10^{-19} \left(3 \times 10^5 \otimes 0.8T\right)$

___ 8. A parallel plate capacitor of capacitance C_0 has plates of area A with separation d between them. When it is connected to a battery of voltage V_0, it has charge of magnitude Q_0 on its plates. While it is connected to the battery the space between the plates is filled with a material of dielectric constant 3. After the dielectric is added, the magnitudes of the charge on the plates and the potential difference between them are

a. $\frac{1}{3}Q_0, \frac{1}{3}V_0$
b. $Q_0, \frac{1}{3}V_0$
c. $3Q_0, V_0$
d. $3Q_0, 3V_0$
e. Q_0, V_0

$3 \delta = \frac{q}{}$

$C_0 = A\,d$, C

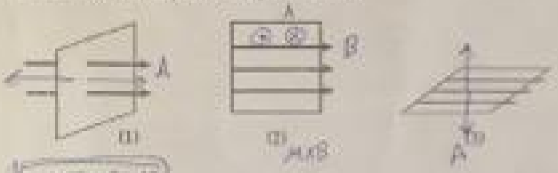
$C_1 > C_2$

$V = q_0$

$q = C_0 V$

Name: ________________________ ID: A

____ 9. A current loop is oriented in three different positions relative to a uniform magnetic field. In position 1 the plane of the loop is perpendicular to the field lines. In position 2 and 3 the plane of the loop is parallel to the field as shown. The torque on the loop is maximum in



[✓ a. positions 2 and 3]
b. position 3
c. position 1
d. position 2
e. all three positions

μ×B = μ B sin 90

____ 10. What is the current in the 20-Ω resistor when ε = 9.0 V?

30 I = 9/30 = 0.3A

30 I = 9
I = 0.3 A

0.3×10 = 3

a. 0.30 A
b. 0.24 A
c. 0.26 A
d. ~~0.60 A~~
[✓ e. 0.18 A]

0.3 × 10 = I₁ × 30

$V_b - V_b + 4 - 10 + 12 - 6 = 80$

$V_a - 4 + 4(2.5) - 12 + \frac{Q}{C} - 12(2.5) = V_b$

Name: ____________________

$V_a - V_b = +4 - 10 + 12 - \frac{18}{3} + 30$

____ 11. If $\mathcal{E}_1 = 4.0$ V, $\mathcal{E}_2 = 12.0$ V, $R_1 = 4$ Ω, $R_2 = 12$ Ω, $C = 3$ μF, $Q = 18$ μC, and $I = 2.5$ A, what is the potential difference $V_a - V_b$?

$V_a - \mathcal{E}_1 + I_1 R_1 - \mathcal{E}_2 + V_c + I_2 R_2 = V_b$

$V_a - V_b = \mathcal{E}_1 - I_1 R_1 + \mathcal{E}_2 - V_c - I_2 R_2$

$V_a - 2.5 \times 4 + 12 - 6 - 2.5 \times 12$

a. −3.0 V
b. 2.0 V
c. [illegible]
d. [illegible]
e. −2.0 V

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

$V = \frac{q}{C} = \frac{18}{3} = 6$

____ 12. An electron is launched with velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$. The angle θ between $\vec{v}$ and $\vec{B}$ is between 0 and 90°. As a result, the electron follows a helix, its periodic time is:

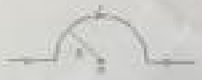
a. $2\pi m \cos\theta / eB$
b. $2\pi m / eB$
c. $2\pi m \sin\theta / eB$
d. $2\pi m / eB$
e. $2\pi m$

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

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

$T = \frac{2\pi r}{eB} = \frac{2\pi r}{V \sin\theta}$

____ 13. The magnitude of the magnetic field at point P, at the center of the semicircle shown, is given by:



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

$B = \frac{\mu_0 i N}{2R}$ $\frac{\mu_0 i}{4R}$

____ 14. A 2.0-m wire carries a current of 15 A directed along the positive x axis in a region where the magnetic field is uniform and given by $B = (30\hat{i} - 40\hat{j})$ mT. What is the resulting magnetic force on the wire?

a. $(-1.2\hat{k})$ N
b. $(-1.5\hat{k})$ N
c. $(+0.90\hat{k})$ N
d. $(+1.2\hat{k})$ N
e. $(+1.5\hat{k})$ N

$F = i\,l \times B$

$= 15(2\hat{i}) \times (30\hat{i} - 40\hat{j}) \times 10^{-3}$

$= 15(-80)\hat{k} \times 10^{-3}$

$= -1.2\hat{k}$

$i\,\vec{l} \times \vec{B}$

$15(2\hat{i}) \times [(30\hat{i} - 40\hat{j})]10^{-3}$

80

$B = 30\hat{i} - 40\hat{j}$ mT

$\varepsilon C(1-e^{-t/RC})$ $.85\,\varepsilon C = \varepsilon C(1-e^{-t/RC})$

$\rightarrow -0.15 = -e^{-2.4/\tau}$

Student: ____________ ID:

___ 15. A capacitor in a single-loop RC circuit is charged to 85% of its final potential difference in 2.4 s. What is the time constant for this circuit?

[✓ a. 1.3 s]
b. 1.9 s
c. 2.5 s
d. 2.9 s
e. 1.7 s

$Q = \varepsilon C(1-e^{-t/RC})$

$V = \varepsilon(1-e^{-2.4/\tau})$

$0.85\varepsilon = \varepsilon(1-e^{-2.4/\tau})$

$-0.15 = -e^{-2.4/\tau}$

$(1.897) = \frac{2.4}{\tau}$

$-1.9 = -\frac{2.4}{\tau}$ $\tau = 1.26$

___ 16. Two long straight wires enter a room through a window. One carries a current of 3.0 A into the room while the other carries a current of 5.0 A out. The magnitude in T·m of the path integral $\oint \vec{B}\cdot d\vec{s}$ around the window frame is:

check

a. 3.8×10^{-6} T·m
b. none of these
c. 1.0×10^{-5} T·m
d. 6.3×10^{-6} T·m
[✓ e. 2.5×10^{-6} T·m]

جامعة بيرزيت

BIRZEIT UNIVERSITY

Physics 132

Coordinator: Tayseer AROURI

2nd. Sem. 2014
15.5.2014

2nd. H. EXAM
Time: 50 min

Student Name: [illegible]

Student No.: 1130800

ضع إشارة (X) في كل من المربع المقابل لمدرس شعبتك ودائرة على رقم الشعبة

الاربعا 11-5

	المدرس	الشعبة		المدرس	الشعبة
☐	تيسير عاروري	2	[illegible]	إسماعيل بدران	1 , 5 , 6
☐	[illegible]	3 ، 8 ، 11	☐	[illegible]	7 , 9
☐	[illegible]	4 ، 10	☐		

تعليمات:

1) لا تفتح ورقة الامتحان حتى يسمح لك بذلك
2) اكتب اسمك ورقمك في أعلى هذه الصفحة
3) اختر الجواب الأكثر قرباً للجواب الصحيح وظلله على هذه الصفحة، وذلك بوضع إشارة (X) في الخانة المناسبة
4) السؤال الذي له أكثر من إجابة يعطى علامة صفر
5) يجب إعادة أوراق الامتحان كاملة
6) عدد الأسئلة 14 سؤالاً

	1	2	3	4	5	6	7	8	9	10	11	12	13
A		X	X										
B					X								
C							X	X	X		X	X	
D						X							
E	X			X					X				X

13
14

17
17

$B = 2\pi$ [illegible]

$B = \frac{3A}{2}$ $= 3A$

$\epsilon_0 = 8.85 \times 10^{-12}$ C²/N m²
$e = 1.6 \times 10^{-19}$ C

1. A battery of emf 24 V and internal resistance 2 Ω is connected to a 6-Ω resistor. The terminal potential difference of the battery is:

$I = \frac{24}{8} = 3A$

- A) 30 V
- B) 24 V
- C) 8
- D) 36 V
- E) 18 V

$V = \mathcal{E} - Ir$
$= 24 - 3(2)$
$= 18$

2. In a Hall-effect experiment, a current of 6.0 A is sent through a copper strip, 8 cm long, 1 cm wide, and 0.2 mm thick. The magnetic field is 0.51 T. Hall potential difference V:
(The number of charge carriers per unit volume for copper is 8.5×10^{28} electrons / m³)

$n = \frac{IB}{eVt}$ $qE = qvB$

$V = \frac{6 \times 0.51}{1.6 \times 10^{-19} \times 8.5 \times 10^{28}}$ [illegible]

- A) [illegible] $\times 10^{-7}$
- B) 1.5×10^{-7}
- C) 2.5×10^{-6}
- D) 6.0×10^{-7}
- E) 1.25×10^{-6}

3. An electron ($m_e = 9.1 \times 10^{-31}$ kg) with speed 800 km/s is projected into a uniform magnetic field B of 0.02 T with its velocity vector making an angle of 60° with B. The radius of the path is:

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

$r = \frac{mv}{qB}$ $r = \frac{mv}{qB}$ $\sin 60$

- A) 1.97×10^{-4} m
- B) 4.6×10^{-4} m
- C) 3.94×10^{-4} m
- D) 5.1×10^{-4} m
- E) 2.3×10^{-4} m

$= 1.97 \times 10^{-4}$

$V_\perp = 800 \times 10^3 \times \sin 60$

$R_1 + R_2 = 48$

$\frac{12 \times 3}{48}$

4. By using only two resistors, R_1 and R_2 (one of them or both of them), a student is able to obtain resistances of 9 Ω, 12 Ω, 36 Ω and 48 Ω. The values of R_1 and R_2 (in ohms) are:

$48 = r_1 + r_2$

$9 = \frac{r_1 r_2}{r_1 + r_2}$

A) 3, 16
B) 16, 32
C) 8, 24
D) 10, 40
E) 12, 36

5. An electron ($m = 9.1 \times 10^{-31}$ kg) with speed 8×10^6 m/s is projected into a uniform magnetic field B of 0.42 T with its velocity vector making an angle of 60° with B, the pitch of the path is:

pitch $= V_{\parallel} T$

$= V_{\parallel} \left(\frac{2\pi m}{qB} \right)$

$= 8 \times 10^6 \cos 60 \left(\frac{2\pi m}{qB} \right)$

$= 3.38 \times 10^{-4}$

pitch $= \frac{2\pi r}{V}$

$U_{\parallel}$

$\left(\frac{2\pi m}{qB} \right) 8 \times 10^6 (\cos 60)$

A) 3.2×10^{-4} m
B) 3.4×10^{-4} m
C) 4.8×10^{-4} m
D) 6.5×10^{-4} m
E) 1.6×10^{-4} m

6. A parallel-plate capacitor has a plate separation of 0.3 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:

$U = \frac{1}{2} \frac{q^2}{C} = \frac{1}{2} qV$

$d = 0.3 \times 10^{-3}$ m

$q = 4 \times 10^{-6}$

300 V

A) 31.8 J/m³
B) 17.7 J/m³
C) 4.4 J/m³
D) 79.6 J/m³
E) 35.4 J/m³

$\frac{\frac{1}{2} \frac{q^2}{C}}{A d}$

$q = CV$

$4 \times 10^{-6} = C \, 300$

$C = 1.33 \times 10^{-8}$

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

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

$A = \frac{dC}{\varepsilon_0}$

$= \frac{0.3 \times 10^{-3} \times 1.33 \times 10^{-8}}{8.85 \times 10^{-12}}$

$= 0.45$

$\frac{1}{2}$

$\frac{1}{2} C V^2$

$= \frac{CV^2}{2 A d}$

$\frac{\text{Energy}}{A d}$

$\frac{1}{2} \varepsilon_0 E^2$

$C = k\frac{\varepsilon_0}{d\,V}$

E $E\,d = V$

$\kappa = 3.5$ $E = 16\times10^{6}$ V/m

7. 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 5 nF and to ensure that the capacitor will be able to withstand a potential difference of 4.0 kV is:

$C = \frac{k\varepsilon_0 A}{d} \Rightarrow A = \frac{C d}{k\varepsilon_0} = 0.0807\ m^2$

$E = \frac{V}{d}$

$d = 5\times10^{-4}$

$\frac{k\varepsilon_0 A E}{V}$

A) 0.63 m²
B) 0.11 m²
C) 0.081 m²
D) 1.1 m²
E) 0.145 m²

8. When 240 V is applied across a wire that is 8 m long and has 0.30 mm radius, the current density is 1.5 x 10⁴ A/m². The resistivity of the wire is:

$J = \frac{I}{A}$ $\frac{V}{JA}$ $R = \rho\frac{L}{A}$

$J = \frac{V/R}{A}$

$\frac{V}{LJ} = \rho L$

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

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

$R = \frac{V}{JA} = \frac{240}{1.5\times10^{4}\,(0.3\times10^{-3})^2\,\pi} = 56617.13$ $\rho = 2\times10^{-3}$

A) 1.5 x 10⁻³ Ω·m
B) 4.5 x 10⁻⁴ Ω·m
C) 2.0 x 10⁻³ Ω·m
D) 4.0 x 10⁻⁷ Ω·m
E) 8.2 x 10⁻⁴ Ω·m

9. A wire 1.0 m long lying along the x axis carries a current of 5 A in the positive x direction, through a magnetic field
B = (0.030 T)j + (0.020 T)k. The force on the wire is:

$F = I\,(L\times B)$

$= 5\,(1\hat{i})\times(0.03\hat{j} + 0.02\hat{k})$

$= 5\,[0.03\,\hat{k} - 0.02\,\hat{j}]$

$0.15\,\hat{k} - 0.1\,\hat{j}$

$\boxed{F = I\,L\times B}$

A) −0.8j N
B) −0.08j + 0.12k N
C) −0.1j + 0.15k N
D) 0.08j + 0.12k N
E) −0.18j + 0.24k N

$A = \frac{VC}{\varepsilon_0 E k}$

$6\times10^{-9} = 5\times10^{-9}$

$V_d = \frac{I}{nA}$

$n = 8.4 \times 10^{28}$

$A = 8.4\ mm^2$

10. Copper contains 8.4×10^{28} free electrons/m³. A copper wire of cross-sectional area 8.4 mm² carries a current of 16.8 A. The electron drift speed is :

0.48×10^{-6}

$I = vena$

$v = \frac{I}{enA}$

$= 2.125 \times 10^{-3}$

A) 3.0 x 10^? m/s
B) 3 x 10^8 m/s
C) 10^8 m/s
D) 7.8 x 10^? m/s
E) 1.5 x 10^-4 m/s

11. A certain capacitor, in series with a 120 Ω resistor, is being charged. At the end of 5 ms its charge is half the final value. The capacitance is about:

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

$\frac{1}{2}Q_f = Q_f(1 - e^{-t/RC})$

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

$\frac{t}{RC} = 0.693$

$5 \times 10^{-3}\frac{1}{RC} = 0.693$

$RC = 7.215 \times 10^{-3}$

$C = 6 \times 10^{-5}$

$= 60\ \mu F$

A) 9.6 μF
B) 30 μF
C) 60 μF
D) 17 μF
E) 20 μF

12. A velocity selector where E = Eî and B = Bk̂ with B = 40 mT. If the selector is designed to select 5 keV electrons, then the value of E is:

$\frac{1}{2}mv^2 = 5 \times 10^3 \times 1.6 \times 10^{-19}$

$5 \times 10^3\ eV$

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

$E = 1677285.74$

$= 16.8 \times 10^5$

$Eq = 200$

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

A) 4.2 x 10^5 V/m
B) 13.6 x 10^5 V/m
C) 16.8 x 10^5 V/m
D) 2.4 x 10^5 V/m
E) 8.4 x 10^5 V/m

13. A 220 potential difference is applied to a lamp whose resistance is 242 ohms. If the price for 1 KW.h is 0.2 $, then the cost to operate the lamp for one week is:

$P = \frac{V^2}{R} = 200$

$R = 242$

$7 \times 24 \times 200 = 33600$ watt

33.6 kW.h

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

A) 3.0 $
B) 28.8 $
C) 28.5 $
D) 30.5 $
E) 6.7 $

200

(17)

BIRZEIT UNIVERSITY

Physics 132

Second Hour Exam   Summer, 2014   Time: 80 minutes

Student Name: Rorad Rafat Ahmed Sharif   Student No.: 1130592

Please read these instructions and remarks before starting the exam:

- Write your name and student number in the above box.
- The exam consists of 17 multiple choice problems, answer all of them.
- Mark the correct answers of the multiple choice problems on the answer sheet.
- Turn in the whole exam sheets.
- Select the section you are registered in by inserting a ✓ mark beside the section.

✓	Sec.	Instructor	Time
	1	Ghassan Abbas	MTWR 09:30-10:50
	2	Wafaa Khater	MTWR 12:50-01:50
✓	3	Ghassan Abbas	MTWR 08:00-09:20
	4	Aziz Shawabkeh	MTWR 12:50-01:50

Some useful formulas and constants:

1) $\vec{F} = q\vec{v} \times \vec{B}$	5) $\vec{J} = nq\vec{v}_d$
2) $\vec{F} = i\vec{L} \times \vec{B}$	6) $e = 1.6 \times 10^{-19}$ C
3) $q = q_0(1 - e^{-\frac{t}{RC}})$	7) $\epsilon_0 = 8.85 \times 10^{-12}$ F/m
4) $R = \frac{\rho L}{A}$	

Answer Sheet:

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

Last Name:..................

$1 = 10ms$

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

$\frac{1}{2}\xi = \xi(1-e^{-t/RC})$

$\frac{t}{RC} = 0.693$

$Q(t) = C\xi(1-e^{-t/RC})$

$\frac{1}{2}\frac{Q}{C} = \frac{Q}{C}(1-e^{-t/RC})$

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

$\frac{t}{RC} = 0.693$

$C = 2 \times 10^{-5}$

1) 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	9.6 μF
B	14 μF
[✓ C]	20 μF
D	7.2 μF
E	10 μF

$20 \times 10^{-6} = 20\ \mu F$

2) Determine the potential difference $V_b - V_a$ in the circuit segment shown when I = 2.0 mA and Q = 50 μC.

A	-40 V
B	+40 V
[✓ C]	+20 V
D	-20 V
E	+60 V

$V_b - V_a = 15 \cdot 2 = 30 \rightarrow 20V$

$V_b - 20 = V_a \longrightarrow V_b - V_a = 20V$

3) A proton (mass = 1.67 × 10^{-27} kg, q = 1.6 × 10^{-19} C) is accelerated to a speed of 2.0 × 10^{6} m/s and then moves perpendicularly to a uniform magnetic field with B = 1.8 T. What is the radius of the resulting circular path?

$qvB = \frac{mv^2}{r} \rightarrow R = \frac{mv}{qB} = 0.012\ m = 12\ mm$

$R = \frac{mv}{qB}$

$= 0.012\ m$

$= 12\ mm$

[✓ A]	11.6 mm
B	12.0 mm
C	20.3 mm
D	24.5 mm
E	58.0 mm

4) A conductor of radius r, length L and resistivity ρ has resistance R. What is the new resistance if it is stretched to 2 times its original length?

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

$A = \pi r^2$

$R_2 = \frac{\rho 2L}{A_2}$

$R_0 = \frac{\rho L_0}{A_0}$

$V_1 = V$

$A_0 L_0 = A' 2L_0$

$= 4R$

A	R/16
B	R/8
C	R
[✓ D]	4R
E	16R

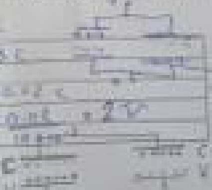
5) A 4.0 mF capacitor initially charged to 50 V and a 6.0 mF capacitor charged to 30 V are connected to each other with the positive plate of each connected to the negative plate of the other. What is the final charge on the 6.0 mF capacitor?

$q_1 = C_1V_1 = 0.2\ C$

$q_2 = C_2V_2 = 0.18\ C$

$q_{net} = 0.2 - 0.18 = 0.02\ C$

$V = \frac{q_{net}}{C_{eq}} = \frac{0.02}{10 \times 10^{-3}} = 2V$



A	20 mC
B	4.0 mC
C	10 mC
[✓ D]	12 mC
E	290 mC

$Q = CV$

$q_1 + q_2 = q_1' + q_2'$

$0.2 - 0.18 = q_1' + q_2' = 0.02\ C$

$V = \frac{q_1'}{C_1} = \frac{q_2'}{C_2} \longrightarrow \frac{0.02 - q_2}{4 \times 10^{-3}} = \frac{q_2}{6 \times 10^{-3}}$

$6 \times 10^{-3}(0.02 - q_2) = 4 \times 10^{-3}\ q_2$

$P = iV = 1V\,1A$

$3 = i(15 + 30)$

$V = iR$

$I = \frac{9}{...} = 0.3A$

$P = I^2 R$

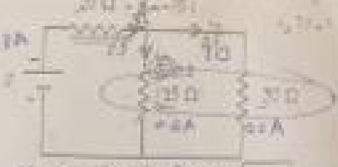
$= (0.3)^2\, 15$

$= 0.6$

$P = iV = \frac{9}{...}$

6) At what rate is thermal energy generated in the 15 Ω resistor when ε = 9 V?

A)	0.35 Watt
B)	0.30 Watt
C)	0.10 Watt
D)	0.25 Watt
[✓ E)]	0.40 Watt



7) Determine the equivalent capacitance of the combination shown when C = 48 μF.

A)	30 μF
[✓ B)]	32 μF
C)	34 μF
D)	36 μF
E)	38 μF

8) A certain parallel plate capacitor is filled with a dielectric material with κ = 3 and a dielectric strength of 18 MV/m, the area of each plate is 0.63 m². The capacitor will be able to withstand a potential difference of 4.0 kV. The capacitance of this capacitor is:

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

$E = \frac{V}{d}$

$d = 2.22 \times 10^{-4}$

$V = Ed$

A)	7.0×10[illegible] F
[✓ B)]	7.8×10[illegible] F
C)	3.4×10[illegible] F
D)	3.3×10[illegible] F
E)	5.1×10[illegible] F

9) The current density in a cylindrical wire of radius R varies with radial distance r as αr, where α is a constant. The current in the wire is:

$I = \int J\,dA$

$I = \int_0^R \alpha r\, 2\pi r\, dr$

$= 2\pi\alpha \frac{R^3}{3}$

A)	2παR²
B)	3παR³
C)	παR³/2
[✓ D)]	2παR³/3
E)	2πR³

10) How many electrons pass through a 20 Ω resistor in 1 min if there is a potential drop of 30 volts across it?

$Q =$ $I = \frac{V}{R} = 1.5\,A$

$Q = ne$

$n = 5.625 \times 10^{20}$

A)	3.4×10[illegible]
[✓ B)]	5.6×10²⁰
C)	7.8×10[illegible]
D)	1.1×10[illegible]
E)	3.8×10[illegible]

$Q = 90$

q V R t

$V = IR$

$n = \frac{Q}{e}$

$Q = 90$

11) A straight wire of length 2L is bent into the shape shown. A magnetic field B to the right acting on it. The net magnetic force on the wire is:

A)	ILB into the page
B)	ILB out of the page
C)	1.4 ILB out of the page
D)	1.7 ILB out of the page
[✓ E)]	[✓ Zero]

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

$= ILB\sin 30°$

$F_1 = ILB\sin$ [illegible]

$F_2 = ILB\sin 30°$

12) At one instant an electron is moving in the x-y plane, the components of its velocity being $v_x = 5\times10^5$ m/s and $v_y = 3\times10^5$ m/s. A magnetic field of 0.8 T is in the positive x direction. At that instant the magnitude of the magnetic force on the electron is:

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

A)	0
B)	2.6×10^{-14} N
[✓ C)]	[✓ 3.8×10^{-14} N]
D)	6.4×10^{-14} N
E)	1.0×10^{-13} N

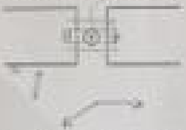
$F = q\vec{v}\times\vec{B}$

$= (1.6\times10^{-19})$ [illegible] (0.8)

$= 3.84\times10^{-14}$

13) The diagram shows a straight wire carrying a current out of 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)	←
E)	[illegible]



$\vec{I}\times\vec{B}$

F_B

14) You are facing a loop of wire which carries a clockwise current of 3.0 A and which surrounds an area of radius 0.1 m. The magnetic dipole moment of the loop is:

$r = 0.1$

A)	3.00 A·m², into the page
B)	3.00 A·m², out of the page
[✓ C)]	[✓ 0.094 A·m², into the page]
D)	0.094 A·m², out of the page
E)	0.17 A·m², from left to right

$\mu = NIA$

$= 3\pi(0.1)^2$

$= 0.0942(-\hat{k})$

15) An isolated conducting sphere whose radius R is 5 cm has a charge q = 1.25 μC. The potential energy stored in the electric field of this charged conductor is:

$U = \frac{1}{2}\frac{q^2}{C}$

A)	0
[✓ B)]	[✓ 0.14 J]
C)	1.4 mJ
D)	2.8 J
E)	2.8 μJ

$C = 4\pi\epsilon_0 R$

$C = \frac{R}{k} = \frac{5\times10^{-2}}{9\times10^{9}}$

$U = \frac{1}{2}CV^2 = \frac{q^2}{2C}$

$\frac{q^2}{2C} = \frac{(1.25\times10^{-6})^2}{2}$ [illegible]

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

$VC = q$

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

16) The electron density in copper is 8.49×10^28 electrons/m³. When a 1.00 A current is present in a copper wire with a 0.40 mm² cross-section, the electron drift velocity in m/s is

A)	1.84×10^{-5}
[✓ B)]	1.84×10^{-4}
C)	1.84
D)	5.43×10^{3}
E)	5.43×10^{4}

$I = VeA$

$V_d = \frac{I}{neA}$

$v_d = \frac{J}{ne}$

17) A parallel plate capacitor of capacitance C_0 was fully charged to a potential V_0 and charge Q_0 when connected to a battery. It is then disconnected from the battery and the plates are pulled apart to twice the plate separation without discharging them. After being pulled, the magnitude of the charge on the plates and the potential difference between the plates are

A)	$Q_0/2$, V_0 ✓
B)	Q_0, $V_0/2$ ✗
C)	$2Q_0$, V_0 ✗
[✓ D)]	Q_0, $2V_0$ ✓
E)	$2Q_0$, $2V_0$ ✗

$q = CV$

$q = \frac{1}{2}C\ V$

$V = 2V_0$

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

$Q_0 = 2V_0$

$C' = \frac{\varepsilon_0 A}{2d} = \frac{1}{2}C$

$C_0 = \frac{\varepsilon_0 A}{d}$

$C_0 = \frac{Q}{V}$

$Q = CV$

$= \frac{C_0}{2} V_0$

$C = \frac{\varepsilon_0 A}{2d} = \frac{C_0}{2}$

$Q_0 = C_0 V_0$

$Q = \frac{C_0}{2} V$

$V = \frac{Q}{C} = \frac{Q}{2C} = 2V$

$V = \frac{2Q}{C_0}$

$Q = \frac{C_0}{2}$

$V = \frac{Q}{C} = \frac{Q_0}{\frac{C_0}{2}}$

$V = \frac{2Q_0}{C_0} = 2V_0$

16

BIRZEIT UNIVERSITY

Physics 132 Time: 80 minutes

Second Hour Exam Summer, 2014

Student Name: [illegible] Student No: 1110909

Please read these instructions and remarks before starting the exam:

- Write your name and student number in the above box.
- The exam consists of 17 multiple choice problems, answer all of them.
- Mark the correct answers of the multiple choice problems on the answer sheet.
- Turn in the whole exam sheets.
- Select the section you are registered in by inserting a ✓ mark beside the section

✓	Sec	Instructor	Time
	1	Ghassan Abbas	MTWR 09:30-10:50
	2	Wafaa Khater	MTWR 12:30-01:50
✓	3	Ghassan Abbas	MTWR 08:00-09:20
	4	Aziz Shawabkeh	MTWR 12:30-01:50

Some useful formulas and constants:

1) $\vec{F} = q\vec{v}\times\vec{B}$	5) $\vec{J} = \sigma\vec{E}$
2) $\vec{F} = I\vec{L}\times\vec{B}$	6) $e = 1.6\times10^{-19}$ C
3) $\vec{F} = q(\vec{E} + \vec{v}\times\vec{B})$	7) $\varepsilon_0 = 8.85\times10^{-12}$ F/m
4) $R = \frac{mv}{qB}$	

Answer Sheet:

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

R = 720 Ω

$q(t) = Q_f(1 - e^{-t/RC})$ [illegible]

$\frac{1}{2}Q_f = Q_f(1 - e^{-10 \times 10^{-3}/720 C})$

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)	9.6 µF
B)	14 µF
[✓ C)]	20 µF
D)	7.2 µF
E)	10 µF

2.0×10^{-5} F

Determine the potential difference, $V_B - V_A$, in the circuit segment shown when I = 2.0 mA and Q = 50 µC.

$V_B - V_A$

A)	-40 V
B)	+40 V
[✓ C)]	+20 V
D)	-20 V
E)	-10 V

$V_B = 15 - \frac{q}{C} + (15)(2) \times 10^{-3} \times 10^{3} = V_B$

A proton (mass = 1.67 × 10^{-27} kg, q = 1.6 × 10^{-19} C) is accelerated to a speed of 2.0 × 10^{6} m/s and then moves perpendicularly to a uniform magnetic field with B = 1.6 T. What is the radius of the resulting circular path?

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

[✓ A)]	13.0 mm
B)	18.0 mm
C)	20.3 mm
D)	24.0 mm
E)	15.0 mm

13×10^{-3}

45) A conductor of radius r, length L and resistivity ρ has resistance R. What is the new resistance if it is stretched to 2 times its original length?

$R = \frac{\rho L}{A}$ $R_1 = \frac{\rho 2L}{A}$

A)	R/16
B)	R/4
C)	R
[✓ D)]	4R
E)	16R

A 4.0 mF capacitor initially charged to 50 V and a 6.0 mF capacitor charged to 30 V are connected to each other with the positive plate of each connected to the negative plate of the other. What is the final charge on the 6.0 mF capacitor?

A)	20 mC
B)	8.0 mC
C)	10 mC
[✓ D)]	12 mC
E)	230 mC

$q_1 + q_2 = q_1' - q_2'$ $C_1 = 4 \times 10^{-3}$ F

$V = 50$ V

200×10^{-3}

$C_2 = 6 \times 10^{-3}$ C

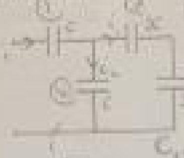
$V_2 = 30$ V

180×10^{-3}

At what rate is thermal energy generated in the 15 Ω resistor when ε = [illegible] V?

A)	[illegible] watt
B)	[illegible] watt
C)	[illegible] watt
D)	[illegible] watt
E)	[illegible] watt

Determine the equivalent capacitance of the combination shown when C = [illegible] μF.



A)	[illegible] μF
B)	[illegible] μF
C)	[illegible] μF
D)	[illegible] μF
E)	[illegible] μF

A certain parallel plate capacitor is filled with a dielectric material with κ = [illegible] and a dielectric strength of [illegible]. The area of each plate is [illegible] m². The capacitor will be able to withstand a potential difference of [illegible]. The capacitance of this capacitor is

A)	[illegible] F
B)	[illegible] F
C)	[illegible] F
D)	[illegible] F
E)	[illegible] F

The current density in a cylindrical wire of radius R varies with radial distance r as J = Cr, where C is a constant. The current in the wire is:

$I = \int J \cdot dA = \int Cr \, 2\pi r \, dr$

A)	[illegible]
B)	[illegible]
C)	[illegible]
D)	[illegible]
E)	[illegible]

How many electrons pass through a 20 Ω resistor in 1 min if there is a potential drop of 30 volts across it?

A)	[illegible]
B)	[illegible]
C)	[illegible]
D)	[illegible]
E)	[illegible]

V = IR

I = V/R

$\boxed{Q = ne}$

$\boxed{Q = It}$

V = 30 , R = 20

t = 60s

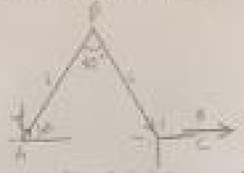
I = 1.5

Q = 90

$L_{AC} = L_{AB} + L_{BC}$
$= L\cos 60\,\hat{i} - L\sin 60\,\hat{j} + L\cos 60\,\hat{i} - L\sin 60\,\hat{j}$
$= 2L\cos 60\,\hat{i}$
$= L\hat{i}$

$\Rightarrow F_B = i\vec{L}\times\vec{B}$
$= i\,LB(\hat{i}\times\hat{i})$

11) A straight wire of length 2L is bent into the shape shown. A magnetic field B to the right acting on it. The net magnetic force on the wire is:



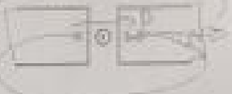
A)	iBL into the page
B)	iBL out of the page
C)	1.4 iBL out of the page
D)	1.7 iBL out of the page
[✓ E)]	Zero

12) At one instant an electron is moving in the x-y plane, the components of its velocity being $v_x = 5\times10^5$ m/s and $v_y = 3\times10^5$ m/s. A magnetic field of 0.8 T is in the positive x direction. At that instant the magnitude of the magnetic force on the electron is:

A)	0
B)	2.6×10^{-14} N
[✓ C)]	3.8×10^{-14} N
D)	6.4×10^{-14} N
E)	1.3×10^{-13} N

13) The diagram shows a straight wire carrying a current out of 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)	→
E)	↙



14) You are facing a loop of wire which carries a clockwise current of 3.0 A and which surrounds an area of radius 0.1 m. The magnetic dipole moment of the loop is:

A)	3.00 A.m², into the page
B)	3.00 A.m², out of the page
[✓ C)]	0.09 A.m², into the page
D)	0.09 A.m² out of the page
E)	0.17 A.m², from left to right

15) An isolated conducting sphere whose radius R is 5 cm has a charge q = 1.25 μC. The potential energy stored in the electric field of this charged conductor is:

A)	0
[✓ B)]	0.14 J
C)	3.8 mJ
D)	2.8 J
E)	2.8 μJ

$U = \frac{q^2}{2C}$

$F_{B1} + F_{B2} =$

$q(v\times B) =$
$(3)(0.8)$ $= 3.8\times10^{5}\times10^{-19} = 3.8\times10^{-14}$

$C = 4\pi\varepsilon_0(5\times10^{-2})\times10^{-12}$ $= 0.14\times10^{-6}$