16

جامعة بيرزيت

BIRZEIT UNIVERSITY

-Physics Department-

-physics 132-

1st Hour Exam
Time: 75 Minutes

First Summer 2103
23/6/2013

Student Name: Lubna Farah

Student Number: [redacted]

ضع علامة (X) هنا	Instructor Name	Section No.
X	[illegible]	40
	[illegible]	30
	[illegible]	10

Answer Sheet

QN	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		[illegible]		X	
16	X				
17			X		

Constants:
$\epsilon_0 = 8.85 \times 10^{-12}\ C^2/N m^2$ $e = 1.6 \times 10^{-19}$ C $m_e = 9.11 \times 10^{-31}$ kg $m_p = 1.67 \times 10^{-27}$ kg

1. A "free" electron and a "free" proton are placed in an identical electric field. Which of the following is the True statement?
A) The magnitude of the electrostatic force acting on the proton is greater than that acting on the electron.
B) The direction of the electrostatic force acting on the proton is the same as that acting on the electron.
$\boxed{\text{C) The magnitude of the acceleration of the proton is less than that of the electron.}}$
D) The magnitude of the acceleration of the proton is greater than that of the electron.
E) The magnitude of the acceleration of the proton is equal to that of the electron.

$F = ma$
equal for e and p
$m_p > m_e$
$a_p < a_e$

$F = ma$

2. A charge of 9 μC is to be split into two parts that are then separated by 3mm. The maximum possible magnitude of the electrostatic force between these two parts is:
$\boxed{\text{A) } 2 \times 10^4 \text{ N}}$
B) 8 × 10[illegible] N
C) 2.4 × 10[illegible] N
D) 7.3 × 10[illegible] N
E) 4.5 × 10[illegible] N

$\boxed{F = 20250}$

$F = \frac{k(Q-q)\times q}{r^2}$

$F = \frac{k \frac{Q}{2} \times \frac{Q}{2}}{R^2}$

$\frac{kQ^2}{4R^2} = \frac{9\times10^9 \times 81\times10^{-12}}{4 \times 9 \times 10^{-6}}$

$\boxed{= 20.25 \times 10^3}$

3. The electric potential in a certain region is given by $V = 7x - 3x^2y + 2yz^2$. The electric field in this region is given by:
$\boxed{\text{A) } E = (6xy - 7)i + (3x^2 - 2z^2)j - 4yz\,k}$
B) 0
C) $E = -(6xy - 7)i - (3x^2 - 2z^2)j - 4yz\,k$
D) $E = (6xy - 7)i - (3x^2 - 2z^2)j + 4yz\,k$
E) $E = -(6xy - 7)i + (3x^2 + 2z^2)j + 4yz\,k$

$E_x = -\frac{\partial V}{\partial x} = -(7 - 6xy)$
$E_y = -\frac{\partial V}{\partial y} = -(-3x^2 + 2z^2)$
$E_z = -\frac{\partial V}{\partial z} = -(4yz)$

$E_x = -\frac{\partial V}{\partial x} = -7 + 6xy$
$E_y = -\frac{\partial V}{\partial y} = +3x^2 - 2z^2$
$E_z = -\frac{\partial V}{\partial z} = -4yz$

4. A dipole has a dipole moment of 2×10^{-9} C·m in the negative x-direction. A torque of [illegible] in the positive z-direction is exerted on the dipole when it is in a uniform electric field. The magnitude and direction of the electric field is:
A) 5.7 × 10[illegible] N/C, positive y-axis
$\boxed{\text{B) 175 N/C, negative y-axis}}$
C) 175 N/C, negative z-axis
D) 175 N/C, negative x-axis
E) [illegible]

$p = 2\times10^{-9}$
$\tau = 3.5\times10^{-7}$ $-\hat{k}$

$\vec{\tau} = \vec{p} \times \vec{E}$
magnitude $\tau = 2\times10^{-9} \times E$
$E = \frac{3.5\times10^{-7}}{2\times10^{-9}}$

$p = 2\times10^{-9}$ Cm $(-\hat{i})$
$\tau = 3.5\times10^{-7}$ N/m $(+\hat{k})$
$\tau = \vec{p} \times \vec{E}$
$|E| = 175$

$\vec{\tau} = \vec{p} \times \vec{E}$

5. Five positive charges are placed in a box. The first charge has a magnitude q. The second charge has a magnitude which is twice the first charge. The third charge has a magnitude which is twice the second charge. The fourth charge has a magnitude which is twice the third charge. The fifth charge has a magnitude which is twice the fourth charge. The net electric flux through the box is 6.8×10^7 N m²/C. The magnitude of the charge q is:

A) 425 μC B) 1.6×10^{-19} C C) 47.2 μC [✓ D) 19.4 μC] E) 38.6 μC

$q_1 = q$

$q_2 = 2q$

$q_3 = 4q$

$q_4 = 8q$

$q_5 = 16q$

$\Phi = 6.8 \times 10^7$

$q_{enc} = q + 2q + 4q + 8q + 16q$

$\Phi = \frac{q_{enc}}{\varepsilon_0} \rightarrow \Phi = \frac{31q}{8.85 \times 10^{-12}} = 6.8 \times 10^7$

6. A spherical conducting shell has a positive charge Q. A particle with a positive charge q is placed at the center of the cavity. The charge on the inner surface of the shell and the net charge on the outer surface of the shell, respectively, are:

A) Q, 0
B) 0, Q
C) q, Q − q
[✓ D) −q, Q + q]
E) −q, 0

$-q$ Q_{out}

$Q_{out} = q_{shell} - q_{inner}$

inner

$(Q + q)$

$Q = q_i + (Q)$

$q_{inner} = -q$

$Q = q + Q$

$q_{outer} = Q + q$

7. A nonconducting solid sphere of radius R has a nonuniform volume charge density $\rho(r) = A/r + Br^2$ with the radial distance r is measured from the sphere's center, A and B are constants. The SI units of the constants A and B respectively are:

A) C/m², C/m³
[✓ B) C/m², C/m⁵]
C) C/m³, C/m³
D) C/m³, C/m⁵
E) unit-less, unit-less

$\rho = A/r + Br^2$

$\frac{C}{m^3} = \frac{A}{m} = B\,m^2$

$\boxed{A = C/m^2}$

$\boxed{B = C/m^5}$

$\boxed{A = C/m^2}$

$\frac{C}{m^3} = B\,m^2$

$\boxed{B = \frac{C}{m^5}}$

8. An infinitely long, nonconducting, solid cylinder of radius R has a nonuniform volume charge density given by $\rho(r) = \gamma r^2$ where γ is a positive constant and r is the radial distance from the axis of the cylinder. The magnitude of the electric field at a radial distance r > R is:

[✓ A) $(\gamma R^4) / (4\varepsilon_0 r)$]
B) $(\gamma r^3) / (4\varepsilon_0)$
C) 0, because the cylinder is infinitely long
D) $(\gamma r^2) / (4\varepsilon_0)$
E) infinity, because the cylinder is infinitely long

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

$E(2\pi rL) = \frac{\gamma 2\pi L R^4}{4\varepsilon_0}$

$E = \frac{\gamma R^4}{4\varepsilon_0 r}$

$q = \int \rho\,dv$

$q = \int \gamma r^2 (2\pi r L\,dr)$

$q = \gamma 2\pi L \int r^3\,dr$

$\boxed{q_{enc} = 2\pi L \gamma \frac{r^4}{4}}$

$dq = \rho\,dV$

$dV = 2\pi r L\,dr$

$\Phi = \frac{q_{enc}}{\varepsilon_0}$

Ch25 not included

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

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

A) increasing the charge.

B) decreasing the charge.

C) decreasing the distance between the plates.

D) increasing the distance between the plates.

E) decreasing the plate area.

An electron moves in a circular path around a proton of radius 5.29×10^{-11} m. The proton is at rest at the center of the circle, the kinetic energy of the circulating electron is

A) $4.4\times10^{[illegible]}$ J

B) $2.18\times10^{[illegible]}$ J

C) $8.7\times10^{[illegible]}$

D) $8.2\times10^{[illegible]}$

E) $4.4\times10^{[illegible]}$

$ma = m\frac{v^2}{r}$

$\frac{Kq^2}{r^2} = m_e\frac{v^2}{r}$

$\frac{1}{2}\frac{Kq^2}{r} = \frac{1}{2}m_e v^2$

$2.18\times10 = K$

$F = ma$

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

$\frac{Kq_1q_2}{R^2} = \frac{mv^2}{R}$

Charge is distributed uniformly on the surface of a large flat plate. The electric field at 2 mm from the plate is 33 N/C. The electric field at 4 mm from the plate is

A) 16.5 N/C B) 37 V/m C) 66 N/C D) 8.25 V/m E) 33 V/m

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

A thin glass rod is bent into a semicircle of radius r. A charge +q is distributed uniformly along the upper half, and a charge −q is distributed uniformly along the lower half as in the figure. Answer the following two questions.

The magnitude and direction of the electric field at point P at the center of the semicircle is

A) $q/(\pi^2\varepsilon_0 r^2)$ vertically downward

B) $q/(\pi^2\varepsilon_0 r^2)$ vertically upward ✗

C) zero ✗

D) $q/(\pi^2\varepsilon_0 r)$ vertically downward

E) $q/(2\pi^2\varepsilon_0 r^2)$ vertically downward

$dE = \frac{Kdq}{R^2}$

$E_y = \frac{K2q}{\pi r^2}$

The electric potential at point P at the center of the semicircle is

A) $q/(\pi^2\varepsilon_0 r^2)$

B) $q/(\pi^2\varepsilon_0 r^2)$ vertically upward

C) $q/(\pi^2\varepsilon_0 r)$

D) zero

E) $q/(\pi^2\varepsilon_0 r^2)$ vertically downward

$E_{good} = \frac{q}{\pi^2\varepsilon_0}$ $E = K\lambda\int\frac{dr}{R^2}$

$E = K\lambda[\ldots]$

$E = K\pi\frac{q}{\pi R^2}$

$q^2/\pi^2\varepsilon_0 r^2 q$

$V = \frac{Kq}{r}$

$V = \frac{1}{4\pi\varepsilon_0 R}(+q - q)$

$= \frac{1}{4\pi\varepsilon_0 R}\cdot 0$

$= 0$

$\lambda = \frac{q}{R}$

C

14. The energy stored in a $\boxed{13\text{-}\mu F}$ capacitor is $\boxed{130\ \mu J}$. The charge on the capacitor is:
A) 65 µC [✓ B) 58 µC] C) 13 µC D) 60 µC E) 47 µC

$U = \frac{1}{2}\left(\frac{Q^2}{C}\right)$

$130 \times 10^{-6} = \frac{1}{2}\ldots q^2$

$\boxed{B\ 5.8 \times 10^{-5}}$

Three equal positive charges of magnitude q each are placed at the corners of an equilateral triangle of sides d as shown in the figure. Answer the following three questions: (See Geometry of equilateral triangle below)

15. The magnitude of the electric potential at the center (the point p) of the triangle is:
A) 3 q/(4πε₀d²)
B) 2/3
C) 2√3 q/(4πε₀d²)
$\boxed{\text{D) } 3\sqrt{3}\ q/(4\pi\varepsilon_0 d)}$
E) 3 q²/(4πε₀d)

$V = V_1 + V_2 + V_3$

$= K\left(\frac{q}{\ldots} + \frac{q}{\ldots} + \frac{q}{\ldots}\right)$

$= \frac{q}{4\pi\varepsilon_0}\left(\frac{\sqrt{3}}{d} + \frac{\sqrt{3}}{d} + \frac{\sqrt{3}}{d}\right)$

$= \frac{3\sqrt{3}\ q}{4\pi\varepsilon_0\ d}$

16. The magnitude of the electric field at the center (the point p) of the triangle is:
$\boxed{\text{A) } 0}$
B) 3 q²/(4πε₀d)
C) 2√3 q/(4πε₀d²)
D) 3 q/(4πε₀d²)
E) 2√3 q/(4πε₀d)

$E = \frac{kq}{r^2} \ldots$

17. The electric potential energy stored in the system of the three charges is:
A) 3 q/(4πε₀d²)
B) 3√3 q/(4πε₀d²)
$\boxed{\text{C) } 3\ q^2/(4\pi\varepsilon_0 d)}$
D) 0
E) 3√3 q/(4πε₀d)

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

$\boxed{U = q\ldots}$

$U = U_{12} + U_{13} + U_{23}$

$= \frac{kq_1q_2}{d} + \frac{kq_1q_3}{d} + \frac{kq_2q_3}{d}$

$= \frac{3q^2}{4\pi\varepsilon_0 d}$

Geometry:
For equilateral triangle,
Length of CO = 2/3 length of CF
Length of BO = 2/3 length of BE
Length of AO = 2/3 length of AD

$U = \frac{kq}{R}$

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

$U = Vq = \boxed{\frac{kqQ}{R}}$

FO ⇒ $\sin 30 = \frac{FO}{BO}$

$\cos 30 = \frac{FB}{BO}$

$\cos 30 = \frac{d/2}{BO}$

$BO = \frac{d/2}{\cos 30} = \frac{d}{\sqrt{3}}$

14

جامعة بيرزيت
BIRZEIT UNIVERSITY
-Physics Department-
-physics 132-

1st Hour Exam
Time: 80 Minutes

Summer Semester 2013-2014
20/7/2014

Student Name: Hani [illegible]
Student Number: [illegible]

ضع علامة (x) هنا	Instructor Name	Section No.
	[illegible]	1L
	[illegible]	2L
	[illegible]	3L ✓
	[illegible]	4L

Answer Sheet

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

$e = 1.6 \times 10^{-19}$ C
$\mu_0 = 4\pi \times 10^{-7}$ T.m/A

$M_e = 9.11 \times 10^{-31}$ kg
$M_p = 1.67 \times 10^{-27}$ kg

$\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/N.m^2
1 eV = 1.6×10^{-19} J

Name: ____________________ Class: ________________ Date: ________ ID:

phys132-first

$F_3 = F_{3net} = F_2 - F_1$
$= k\left(\frac{q_1 q_3}{(0.2)^2} + \frac{q_2 q_3}{(0.3)^2}\right)$
$= 36 + 20$
$= 56\ N\ (-\hat{i})$

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

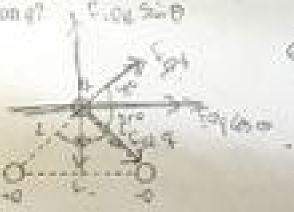
____ 1. A particle (charge = +40 μC) is located on the x axis at the point x = −20 cm, and a second particle (charge = −50 μC) is placed on the x axis at x = +30 cm. What is total electrostatic force on a third particle (charge = −4.0 μC) placed at the origin (x = 0)?

a. -36i N
b. 16i N
[✓ c. -56i N]
d. 36i N
e. 56i N

$F_{31} = k\frac{40\times10^{-6} \times 4\times10^{-6}}{20\times10^{-2}} \times 9\times10^{9}$

36

____ 2. If Q = 25 μC, q = 10 μC, and L = 40 cm in the figure, what is the electrostatic force on q?



$F = \frac{25\times10^{-6} \times 10\times10^{-6} \times 9\times10^{9}}{(40\times10^{-2})^2}$
$= 5.6\times10^{0}$ $\boxed{[illegible]}$

a. 28j N
b. -22i N
[✓ c. 20i N]
d. 14i N
e. zero

$56\cos\theta + 56\cos\theta$

$F_y = 0$

$F_x = \frac{kqQ}{L^2}\left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)$
$= 19.88\ C$

Name: ____________________

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

$$\frac{kq_1q_2}{r^2} = \frac{mv^2}{r}$$

$$r = \frac{kq_1q_2}{mv^2} = \frac{9\times10^9(5\times10^{-6})(5\times10^{-6})}{20\times10^{-3}\times(7)^2}$$

___ 3. A particle with a charge of 5 × 10⁻⁶ C and a mass of 20 g moves uniformly with a speed of 7 m/s in a circular orbit around a stationary particle with a charge of −5 × 10⁻⁶ C. The radius of the orbit is:

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

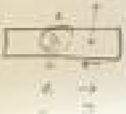
$$\frac{kq^2}{r^2} = \frac{mv^2}{r} \qquad F_{12} = \frac{9\times q_1q_2}{r^2} = \frac{mv^2}{r}$$

$$\frac{9(25\times10^{-12})}{r} = 2\times10^{-2}\times49$$

$$= 25\times9\times10$$

[✓ b. 0.23 m]
c. 1.2 m
d. 1.6 m
e. 4.4 m

___ 4. Positive charge +Q is uniformly distributed on the upper half of 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?



$\theta = 90$

___ 5. The dipole moment of a dipole in a 300N/C electric field is initially perpendicular to the field, but it rotates so it is in the same direction as the field. If the moment has a magnitude of 2 × 10⁻⁹ C · m the work done by the field is:

a. −12 × 10⁻⁷ J
b. −6 × 10⁻⁷ J
c. 0
[✓ d. 6 × 10⁻⁷ J]
e. 12 × 10⁻⁷ J

$W = -\vec{p}\cos\theta$

6

$300 \times 2 \times 10^{-9}$

$W = -\Delta U$

$U = -\vec{p}\cdot\vec{E}$

$$\Delta U = -pE\cos 0 + pE\cos 90$$
$$= -6\times10^{-7}$$
$$\Rightarrow -\Delta U = 6\times10^{-7}$$

$\boxed{\lambda = \frac{q}{L}}$

ID:

Name: ______________________

___ 6. A 24nC charge is distributed uniformly along the x axis from x = 2 m to x = 6 m. Which of the following integrals is correct for the magnitude (in N/C) of the electric field at x = +8 m on the x axis?

[✓ a.] $\boxed{\int_2^6 \frac{54dx}{(8-x)^2}}$

b. $\int_2^6 \frac{216dx}{(8-x)^2}$

c. $\int_2^6 \frac{54dx}{x^2}$

d. $\int_2^6 \frac{216dx}{x^2}$

e. $\int_2^6 54dx/(8-x)^2$

$\lambda = \frac{q}{L}$

$dq = \lambda dx$

$E = \int \frac{dq}{4\pi\epsilon_0}$

$E = k\int \frac{dq}{r^2}$

$E = k\lambda \int \frac{dx}{(8-x)^2}$

$= k\lambda \int_2^6 \frac{dx}{(8-x)^2}$

$= 54 \int_2^6 \frac{dx}{(8-x)^2}$

$\int b\,dx$

$8 - L - x = 2$

$\lambda = \frac{q}{4}$

$\lambda = \frac{24 \times 10^{-9}}{(6-2)} = 6 \times 10^{-9}$

$k\lambda = 54$

___ 7. A particle (q = 3.0 mC, m = 20 g) has a speed of 20 m/s when it enters a region where the electric field has a constant magnitude of 80 N/C and a direction which is the same as the velocity of the particle. What is the speed of the particle 3.0 s after it enters this region?

a. 68 m/s

b. 41 m/s

[✓ c.] $\boxed{56 \text{ m/s}}$

d. 80 m/s

e. 36 m/s

$v_0 = 20 \text{ m/s}$

$E = 80 \text{ N/C}$

$q = 3\text{mC}$

$m = 20\text{g}$

$F = ma$

$Eq = ma$

$a = \frac{Eq}{m} = 12 \text{ m/s}^2$

$m\vec{a} = q\vec{E}$

$20\times10^{-3} a = 80 \times 3\times10^{-3}$

$a = 12$

$V_2 = V_0 + at$

$= 20 + 12(3)$

$= 56$

___ 8. The flux of the electric field (24 N/C)$\hat{i}$ + (30 N/C)$\hat{j}$ + (16 N/C)$\hat{k}$ through a 2.0 m² portion of the xy plane is:

[✓ a.] $\boxed{32 \text{ N} \cdot \text{m}^2/\text{C}}$

b. 34 N · m²/C

c. 42 N · m²/C

d. 48 N · m²/C

e. 60 N · m²/C

$V = V_0 + at$

$= 20 + 12(3)$

$\int (16)\hat{k}\, dA\hat{k}$

$16A =$

$\vec{A} = 2 \text{ m}^2 \hat{k}$

$\Phi = E \cdot A$

$= 32 \text{ N}\cdot\text{m}^2/\text{C}$

$$E \cdot \frac{4\pi R}{16} = \frac{q}{\epsilon_0}$$

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

Name: ____________________ ID: [illegible]

___ 9. Charge Q is distributed uniformly throughout an insulating sphere of radius R. The magnitude of the electric field at a point $R/4$ from the center is:

$$\oint E\,dA = \frac{q_{enc}}{\epsilon_0} \qquad \frac{Q}{? R^2} = \frac{Q}{4\pi\epsilon_0 \left(\frac{R^2}{16}\right)} \qquad E = \frac{Q}{4\pi\epsilon_0 \frac{R^2}{16}}$$

$$E(4\pi r^2) = \frac{\rho \times \pi r^3}{3\epsilon_0}$$

$$\boxed{E = \frac{4Q}{4\pi\epsilon_0 R^2}} \qquad \frac{Q}{4\pi\epsilon_0 \frac{R^2}{4}}$$

a. $Q/4\pi\epsilon_0 R^2$

b. $Q/\pi\epsilon_0 R^2$

c. $3Q/4\pi\epsilon_0 R^2$

d. $Q/8\pi\epsilon_0 R^2$

e. $\boxed{Q/16\pi\epsilon_0 R^2}$

$$E = \frac{\rho r}{3\epsilon_0} = \frac{3q}{4\pi R^3}\left(\frac{r}{3\epsilon_0}\right) \qquad \rho = \frac{q}{V} = \frac{q}{\frac{4}{3}\pi R^3} = \frac{3q}{4\pi R^3}$$

___ 10. Three particles lie on the x axis: particle 1, with a charge of 1×10^{-8} C is at $x = 1$ cm, particle 2, with a charge of 2×10^{-8} C is at $x = 2$ cm, and particle 3, with a charge of -3×10^{-8} C, is at $x = 3$ cm. The potential energy of this arrangement, relative to the potential energy for infinite separation, is:

1×10^{-8} 2×10^{-8} -3×10^{-8}

a. $+3 \times 10^{-?}$ J

b. $\boxed{-3 \times 10^{-?}\ \text{J}}$

c. $+9 \times 10^{-?}$ J

d. $\boxed{-9 \times 10^{-?}\ \text{J}}$

e. zero

$$U = U_{12} + U_{23} + U_{13}$$

___ 11. A conducting sphere of radius 5 cm has a charge density of 2×10^{-6} C/m² on its surface. Its electric potential is:

$$V = \frac{q}{4\pi\epsilon_0 R} \qquad V = \frac{\sigma \times 4\pi R^2}{4\pi\epsilon_0 R} = 11299.435 = 1.1\times10^{4}\ \text{V}$$

a. $\boxed{1.1 \times 10^{4}\ \text{V}}$

b. $2.2 \times 10^{?}$ V

c. $2.3 \times 10^{?}$ V

d. $3.6 \times 10^{?}$ V

e. $7.2 \times 10^{?}$ V

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

$$V = \frac{q}{4\pi\epsilon_0 r}$$

$$V = \frac{\sigma 4\pi r^2}{4\pi\epsilon_0 r} = \frac{\sigma}{2\epsilon_0}$$

$$2 - 3\left(\frac{1}{2}\right) - 3\left(\frac{2}{1}\right)$$

$$2 - \frac{3}{2} - 6$$

Name: ____________________ ID:

___ 12. 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 $V_B - V_A$.

$$V_B - V_A = -\int_3^5 E\,dx$$

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

$$V = -\int E\,dx$$
$$= -(\tfrac{3}{2}x^2) = -\int_3^5 3x\,dr = -\left[\frac{3x^2}{2}\right]_3^5$$
$$V_A = -\tfrac{3}{2}(3)^2$$
$$V_B = -\tfrac{3}{2}(5)^2$$
$$V_B = -\tfrac{3}{2}(25-9) \quad 37.5 - 13.5$$

___ 13. When a positive charge is released and moves along an electric field line, it moves to a position of

[✓ a. lower potential and lower potential energy.]
b. lower potential and higher potential energy.
[✓ c.] higher potential and lower potential energy.
d. higher potential and higher potential energy.
e. greater magnitude of the electric field.

مع المجال ينتقل
لموضع أقل وتزداد طاقة
الحركة

___ 14. The electric potential at any point in space is given by V=3xy²z,the electric field at any point in space is given by:

[✓ a. $-3y^2zi-6xyzj-3xy^2k$]
b. $3y^2zi+6xyzj+3xy^2k$
c. $-6yj$
d. $-6xyzk$
e. $-3xi-6yj-3zk$

$$E_x = -3y^2z\,i$$
$$E_y = -6xyz\,j$$
$$E_z = -3xy^2\,k$$

$$V = 3xy^2z$$

$$E_x = -\frac{dV}{dx} = -3y^2z \;(i)$$
$$E_y = \frac{-dV}{dy} = -6xyz \;(j)$$
$$E_z = \frac{-dV}{dz} = -3xy^2 \;(k)$$

BIRZEIT UNIVERSITY
Physics 132
Coordinator: Tayseer AROURI

[illegible]
TIME: [illegible]

2nd Sem. 2014
12 / 2014

Student Name: Mohammed Rateb [illegible]   Student No.: 1120060

ضع إشارة (X) في مربع المدرس الذي تتبع له شعبتك، ورقم الشعبة على ورقة الشعبة

	المدرس	الشعبة		المدرس	الشعبة
☐	[illegible]	1	☐	[illegible]	2، 5
✓	[illegible]	8 (9)	☐	[illegible]	3، 6
☐	وفاء خاطر	10	☐	[illegible]	7، 8

تعليمات:

1) لا تفتح ورقة الامتحان حتى يسمح لك بذلك
2) اكتب اسمك ورقمك في أعلى هذه الصفحة
3) اختر الجواب الأقرب للجواب الصحيح وانقله على هذه الصفحة، وذلك بوضع إشارة (X) في الخانة المناسبة
4) السؤال الذي له أكثر من إجابة ليس له علامة
5) يجب إعادة أوراق الامتحان كاملة
6) عدد الأسئلة 12 سؤالاً

13

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

11
2

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

$$\frac{kq_1q_2}{r^2} = \frac{mv^2}{r}$$

$$r = \frac{kq_1q_2}{mv^2}$$

$$= \frac{9\times10^9(5\times10^{-6})(48\times10^{-9})}{(15\times10^{-3})(2)^2}$$

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

1. A particle with a charge of 5x10⁻⁶ C and a mass of 15 g moves uniform[illegible] with a speed of 7 m/s in a circular orbit around a stationary [illegible] with a charge of -48x10⁻⁹ [illegible]. The radius of the orbit is:

- A) 0.75 m
- ~~B) 0.23~~
- [✓ C) 1.50 m]
- D) 0.62 m
- E) 1.00 m

$$\frac{(15)(7)^2 \quad 5\times10^{-6} \quad (48\times10^{-9})}{r^2} = \frac{(15)(7)^2}{r}$$

2. 16 C of charge are placed on a spherical conducting shell. A 9 C-point charge is placed at the center of the cavity. The net charge in coulombs on the outer surface of the shell is

- A) -7 C
- B) +7 C
- C) 0 C
- [✓ D) +25 C]
- E) +16 C

$q_{enc} = 16 - 9$
$q = -9 + q_{inner} = 25$ C

3. The work in joules required to carry a 15.0-C charge from a 15.0-V equipotential surface to a 6.0-V equipotential surface and then to a 11.0-V surface is:

$$\Delta V = \frac{\Delta U}{q}$$

$$11 - 15 = \frac{\Delta U}{15}$$

$$\Delta U = 60$$

$$W = -\Delta U = -60$$

- ~~A) zero~~
- [✓ B) -60 J]
- C) 60 J
- D) 45 J
- E) -45 J

4. The electric potential in a certain region of space is given by $V = -5x^2 + 3x$, where V is in volts and x is in meters. In this region the equipotential surfaces are:

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

$E = -10x + 3$

1. A [illegible] dipole with dipole moment
$\vec{p} = (?\hat{i} + 6\hat{j}) \times 10^{-?}$ C m
is in an electric field $\vec{E} = (\hat{i} + 2\hat{k}) \times 10^{?}$ N/C
The torque acting on the dipole is:

A) ([illegible]) $\times 10^{-21}$ N m
B) ([illegible]) $\times 10^{-21}$ N m
C) ([illegible]) $\times 10^{-21}$ N m
D) $3.0 \times 10^{-?}$ N m
E) ([illegible]) $\times 10^{-21}$ N m

$3^{-?} \times 6$

$T = \vec{P} \times \vec{E}$

$= (6\hat{i} - ?\hat{j}) \times 10^{-?} \times (\hat{i} + 2\hat{k}) \times 10^{?} \left(12\hat{i} \ldots \right)$

$= \left(6(-3) + 6(-?) + 12\hat{?} \right) \times 10^{-21}$

2. Two point charges: $q_1 = 27 \times 10^{-?}$ C is located at ([illegible]) and $q_2 = -125 \times 10^{-?}$ is located at [illegible]. The electric field at point P(0, [illegible]) is:

A) [illegible] N/C
B) [illegible]
C) $27\hat{i} - 72\hat{j}$ N/C
D) $27\hat{i} - ?\hat{j}$ N/C
E) $27\hat{i}$ [illegible] N/C

$E_1 = \frac{kq}{r^2}$

$= 27 (\hat{j})$

$E_2 = 9 \times 125 = \frac{(12?)}{(5)^2} = 45$

$E_2 = \frac{?}{?}$

$= 45$

3. A 8×10^{-8} C charge is fixed at the origin. A -5×10^{-8} C charge is moved from x = 10 cm on the x axis to y = [illegible] m on the y axis. The change in potential energy is:

A) [illegible] $\times 10^{-?}$ J
B) [illegible]
C) $1.? \times 10^{-?}$ J
D) $-1.8 \times 10^{-?}$ J
E) $9.0 \times 10^{-?}$ J

$E_x = 45$

$E_y = 45 \sin 37$

$E_y = E_x \cos ?$

$= 36$

$= 45 \sin 37$

$U_{AA} = \frac{q_1 q_2}{4\pi\varepsilon_0 r}$

$= -3.6 \times 10^{-4}$ J

$U_{BB} = 1.8 \times 10^{-4}$ J

$\Delta U = U_{BB} - U_{A}$

$= 1.8 \times 10^{-?}$ J

4. [illegible] charge density of [illegible] C/m² [illegible]. The electric potential, relative to the potential far away, is:

[illegible]

V

$V = \frac{q}{4\pi\varepsilon_0 r}$

$= 45197.74$

$9 \times 10^9 \times 8 \times 10^{-8} \times 5 \times 10$

$E_x = -6xy$

9. The electric potential at points in an xyz space is given by $V = 3x^2y - 3y + 4xz^2$ V/m². The electric field at the point p(1,0,2) is

$E_x = 6xy - 3y^2 = 14z^2 \quad -16$

A) E = 0
[✓ B) E = −1 i − 3j − 16k N/C]
C) E = −16i + 9j + 4k N/C
D) E = −2i + 3j N/C
E) E = −32i − 3j + 12k N/C

$E_y = 3x^2 - 6yz +$ [illegible] $= -3$

$E_z = -3y^2 + 6xz \quad =$

10. A charged oil drop with a mass of 8.0x10⁻³ kg is held suspended by an upward electric field of 200 N/C. The charge on the drop is:

$8\times10^{-3}\times 9.8 = q \cdot E$

$8\times10^{-3} = q \cdot 200$

A) + 2x10⁻⁴ C
B) + 2.5x10⁻⁴ C
[✓ C) + 4x10⁻⁴ C]
D) − 2.5x10⁻⁴ C
E) − 4x10⁻⁴ C

$q = \frac{mg}{E}$

$= 3.92\times10^{-4}$

11. The flux of the electric field (3i + 5j + 8k) N/C through a 4.0 m² portion of the xy plane is:

$A = 4m^2\,\hat{k}$

$\Phi = E \cdot A$

$= 8\hat{k} \cdot 4\hat{k}$

$= 32$

A) 24 N·m²/C
B) 16 N·m²/C
[✓ C) 32 N·m²/C]
D) 20 N·m²/C
E) 64 N·m²/C

12. An alpha particle has a mass of 6.64 x 10⁻²⁷ kg and a charge +2e is released from rest in a uniform electric field of magnitude 4.00x10⁴ N/C. The acceleration of the particle in m/s² is:

[✓ A) 1.93 x 10¹²]
B) 3.86 x 10¹²
C) 0.48 x 10¹²
D) 0.96 x 10¹²
E) 2.41 x 10¹²

E m q

$a = \frac{Eq}{m}$

$= 1.93\times10^{12}$

$ma = 9\times10^4 \times 2 \times 1.6\times10^{-19}$

$6.04\times10^{-27} \cdot a =$

$\frac{12.8\times10^{-15}}{6.04\times10^{-27}}$

$1.1\ 10^{12}$

Name: ______________________

___ 11. 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. B
c. C
d. D
e. E

___ 12. Charge of uniform linear density (4.0 nC/m) λ is distributed along an infinite thin wire placed on the x-axis. Determine the magnitude of the electric field on the y axis at $y = 2.5$ m.

a. 36 N/C
b. 29 N/C
c. 43 N/C
d. 50 N/C
e. 58 N/C

$E = \frac{\lambda}{2\pi\varepsilon r}$

$\frac{4}{2\pi\varepsilon H}$

$\lambda = \frac{q}{l}$

h =

$E\,2\pi hr = \frac{\lambda h}{\varepsilon_0}$

dE = $\frac{k\,dq}{(d^2 + x^2)}$

$E = \frac{}{2\pi\varepsilon_0}$

$dq = \lambda dx$

$\frac{2k\lambda}{y}$

0.887

9.25

-physics 132-

MIDTERM EXAM
Time: 1:45 Minutes

First Summer 2014/2015
28 /6/2015

Student Name:…[redacted]……………………………………
Student Number: [redacted]……………………………………

ضع علامة (X) هنا	**Instructor Name**	**Section No.**
X	*Ghassan Abbas*	02
	Ismael Badran	[illegible]

Answer Sheet

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

Ch 5 electric current → test
Ch 6 : electric circuit bank

(11) At a certain distance from a charged particle, the magnitude of the electric field is 500 V/m and the electric potential is -3 kV. The electric charge on the particle is:

$V = \frac{kq}{r}$

$q = \frac{Vr}{k}$

$= 2 \times 10^{-6}$ C

$q = ?$ $\xrightarrow{}$ $E = 500$ V/m

$V = -3$ kV

- [✓ A. 2 μC]
- B. 4 μC
- C. −2 μC
- D. 0.5 μC
- E. 6 μC

$V = \frac{kq}{r}$

$E = \frac{kq}{r^2}$

$\frac{V}{E} = r = 6\,m$ $E = \frac{kq}{r^2}$

$V = -\int \vec{E} \cdot d\vec{s}$

$V = -\vec{E}\,s \Rightarrow$

$+3 \times 10^3 = +500 * s$

$s = 1666\ldots$

(12) An electron is moving in a circular path around a long, uniformly charged wire carrying λ = 2.5 nC/m. the speed of the electron is:

$\lambda = 2.5$ nC/m

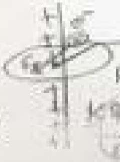
- A. 2.8×10^6 m/s
- B. 1.4×10^6 m/s
- C. 2.8×10^6 m/s
- D. 2×10^6 m/s
- [✓ E. 5.6×10^6 m/s]

$v_f^2 = v_0^2 + 2a\Delta x$

$v_f = v_0 + at$

$\Delta x = v_0 t +$

$\vec{F_g} + \vec{F_E} = \frac{v^2}{r}$



$F_c = \frac{m_e v^2}{r}$

$\frac{kq_1 q_2}{r^2} = \frac{m_e v^2}{r}$

$E = \frac{2k\lambda}{r}$

(13) A spherical charge distribution of radius R is given by $\rho = \rho_0 r^2/R^2$, where r is the radial distance and ρ is the volume charge density. The total charge is:

- [✓ A. $4\pi\rho_0 R^3/3$]
- B. $4\pi\rho_0 R^3/5$
- C. $4\pi\rho_0 r^5/5R^2R$
- D. [illegible]
- E. $4\pi\rho_0 R^3/5$

$\frac{2k\lambda e}{m_e} = v^2$

$\rho = \frac{\rho_0 r^2}{R^2}$

charge density = $\frac{\text{charge }(q)}{\text{volume}}$

$\int \left(\frac{\rho_0 r^2}{R^2}\right) dr$

$\rho_0 r^2 \int \frac{1}{R^2} dr$

$\frac{1}{-2+1} R^{-2+1}$

$\frac{-1}{R}$

$\frac{\rho_0}{R^2} \int r^2 dr$

$\frac{\rho_0}{R^2} \cdot \frac{r^3}{3}$

$\frac{4\pi r^3}{3} = \frac{\rho_0 r^3}{3R^2}$

$\frac{4\pi R^2}{3R^2}$

1 meter

Q4: A small object has charge Q. Charge q is removed from it and placed on a second small object. The two objects are placed 1m apart. For the force that each object exerts on the other to be a maximum q should be:

A. Q/2

B. Q/4

[✓ C.] Q

D. Q/3

E. 2Q/3

$F = \frac{kq_1q_2}{r^2}$

$K q_1 q_2 = kq$

Q5: Positive charge +Q is uniformly distributed on the upper half a semicircular rod of radius R and negative charge –Q is uniformly distributed on the lower half. What is the magnitude and direction of the electric field at point P, the center of the semicircle?

A. $Q/(\pi\varepsilon_0 R^2)$ and ↑

B. $Q/(\pi^2\varepsilon_0 R^2)$ and ↓

C. $Q/(\pi^2\varepsilon_0 R^2)$ and ←

D. $Q/(4\pi\varepsilon_0 R^2)$ and ↓

[✓ E.] 0

$E = E_Q \cos\theta + E_Q \cos\theta$
$= 0$

$E_Q = E_Q \cos\theta$

Q6: Two conducting spheres are far apart. The smaller sphere carries a total charge Q. The larger sphere has a radius that is twice that of the smaller and is neutral. After the two spheres are connected by a conducting wire, the charges on the smaller and larger spheres, respectively, are:

A. Q/2 and Q/2

[✓ B.] Q/3 and 2Q/3

C. 2Q/3 and Q/3

D. zero and Q

E. 2Q and –Q

$\frac{kq}{(r)^2} = \frac{kq}{(2r)^2}$

$q_1 = q_2 = q$

$q(Q-q) = 0$

$K(Q-q)q$

(7) A hollow conducting sphere is charged to a potential V. The potential at its center is:

A. πV

[✓ B. 0]

C. −V

D. 2V

E. V

$\to V.$

$V_s - V_0 = \int$

$V_0 =$ [illegible]

(8) 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:

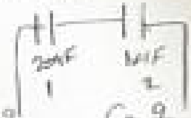
A. twice the charge of the 1-μF capacitor

[✓ B. half the charge of the 1-μF capacitor]

C. twice the potential difference of the 1-μF capacitor

D. half the potential difference of the 1-μF capacitor

E. none of the above



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

(9) Three 10μC charges, initially far apart, are brought into a line where they are spaced by 100 nm intervals. The work required to assemble this charge distribution is:

A. Zero

B. 50 J

C. 9×10 J

[✓ D. 4.5×10 J]

E. 2.25×10 J

$q_1 = q_2$

$q_1 = \frac{1}{2} q_2$

work $= 0 + q_2 V_{from\ 1} + q_3 V_{from\ 1} V_{from\ 2}$

$= 0 + 10\left(\frac{Kq_1}{r}\right) + 10\left(\frac{Kq_1}{r}\right)\left(\frac{Kq_2}{r}\right)$

$8.99 \times 10 + 10(4.496 \times 10)(8.99 \times 10)$

Q10 Three point charges lie along the x axis. The positive charge q_1=15μC is at x =2 m, the positive charge q_2 = 6 μC is at the origin, and the net electrostatic force on q_3 is zero. The position of q_3 is:

A. 0.500 m

[✓ B. 0.775 m]

C. −0.775 m

D. 2.775 m

E. −0.500 m

$15 r_{23}^2 = 6 r_{13}^2$

$\frac{15}{r_{13}^2} = \frac{6}{r_{23}^2}$ $r_{23}^2 = 0.4 r_{13}$ $r_{23} = 0.6 r_{13}$

$\left(10\left(\frac{Kq}{r_{12}}\right)\right)\left(10\left(\frac{Kq_1}{r_{13}}\right)\left(\frac{Kq_2}{r_{23}}\right)\right)$

$10 \times k \times q\left(\frac{1}{r_{12}} \cdot \frac{1}{r_{13}^2} \cdot \frac{1}{r_{23}^2}\right)$

$\frac{Kq_1q_3}{r_{13}^2} = \frac{Kq_2q_3}{r_{23}^2}$

Net force = 0.

Q11 For the circuit shown if R=1 kΩ, C = 10 μF, and ε =10 V. If S is closed at t =0 s. The charge on the capacitor at t = ∞ is:

[✓ A. 10 μC]
B. 50 μC
C. 200 μC
D. 100 μC
E. None of these

$q_{max} = EC(1-e^{-t/RC})$

$I_m = \frac{E}{R} e^{-t/RC}$

$\sum_{loop} \Delta V = zero$

$-10 + I_1 R = 0$

Q12 A dipole with dipole moment 1.5 nC.m is oriented at 30° to 4.0 MN/C electric field. The magnitude of the torque on the dipole is:

A. 3×10^{-3} N.m
[✓ B. 3.2×10^{-3} N.m]
C. 6×10^{-3} N.m
D. 3×10^{3} N.m
E. 6×10^{3} N.m

$p = 1.5$ nC.m

~~$\tau = \vec{p}\times\vec{E} = pE\sin\theta$~~

$\tau = \vec{p}\cdot\vec{E}$

$pE\cos\theta$

Q13 An electric field is given by $\vec{E} = E_0\left(1+\frac{z}{a}\right)\hat{i}$. Where E_0 and a are constants. The electric flux through the square in the x-z plane bounded by the points (0,0,0), (0, 0, a), (a,0,0), (a,0, a) is:

[✓ A. 0]
B. $3E_0a^2/2$
C. $E_0a^2/2$
D. E_0a^2
E. None of the above

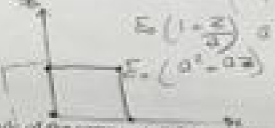
$dA = a^2\hat{j}$

$E = E_0\left(1, \frac{z}{a}\right)\hat{j}$

$E_0\left(1+\frac{z}{a}\right)a^2$

$E_0(a^2 - az)$

$\oint E\cdot dA = \int_0^a$



Q14 Two conductors s are made of the same material and have the same length. Conductor A is a solid wire of diameter 1.0 mm. Conductor B is a hollow tube of outer diameter 2.0 mm and inner diameter 1.0mm. The ratio of R_A/R_B is:

[✓ A. 1/3]
B. 1
C. [illegible]
D. 4
E. 3

$r_A = 0.5$

$r_B = 1.5$

$R_A/R_B =$

Q15. The electric potential (in Volts) at points in space is given by $V = x^2 + y^2 + z^{3/2}$. The magnitude of the electric field (in volts/m) at the point (1m, -2m, 0m) are:

$V = x^2 + y^2 + z^{3/2}$

- A. $(5)^{1/2}$
- B. $(6)^{1/2}$
- C. Zero
- [✓ D.] $(20)^{1/2}$
- E. 6

$\frac{dV}{dx} = 2x$ $\frac{dV}{dy} = 2y$ $\frac{dV}{dz} = \frac{3}{2}z^{\frac{1}{2}}$

$\vec{E} = 2x\hat{i} + 2y\hat{j} + \frac{3}{2}z^{1/2}\hat{k}$

$2\hat{i} + -4\hat{j} + 0$ $\sqrt{4+16}$

Q16. A battery has an emf of 16 V. The terminal voltage of the battery is 12 V when delivering 20 W of power to an external resistor R. The values of R and the internal resistor r_{in} are: power $= IV = 20$ watt

$V = RI$

$12 = RI$

- A. 6.73 Ω and 1.93 Ω
- [✓ B.] 7.2 Ω and 2.4 Ω
- C. 10 Ω and 1 Ω
- D. 10 Ω and 2 Ω
- E. need more information to answer

$I^2R = 20$ watt

$I(12) = 20$ watt

$\boxed{I = 1.67}$

Power $= QV$

$= 12$

Q17. Two concentric imaginary spherical surfaces of radius R and $2R$ respectively surround a positive point charge Q located at the centre of the surfaces. When compared to the electric flux Φ_1 through the surface of radius R, the electric flux Φ_2 through the surface of radius $2R$ is

- A. $\Phi_2 = \Phi_1/4$
- [✓ B.] $\Phi_2 = \Phi_1/2$
- $\boxed{\text{C.} \quad \Phi_2 = \Phi_1}$
- D. $\Phi_2 = 2\Phi_1$
- E. $\Phi_2 = 4\Phi_1$

$\overset{\Phi}{E/A} = \frac{q_{enc}}{\varepsilon_0}$

$\Phi = \frac{q_{enc}}{\varepsilon_0} = \frac{Q}{\varepsilon_0}$

$\Phi_1 = EL^2$

$\Phi_2 = EL^2$

$\frac{\Phi_1}{\Phi_2} = \frac{EL^2}{EL^2}$ $\frac{KQ}{R^2} \cdot \frac{4R^2}{KQ}$

$\Phi_1 = 2\Phi_2 \leftarrow \frac{\Phi_1}{\Phi_2} = 2$ / $\Phi_2 = \frac{1}{2}\Phi_1$

Q24 The sum of the currents entering a junction equals the sum of the currents leaving a junction because

A. charge is neither created nor destroyed at a junction.
B. there are no transformations of energy from one type to another in a circuit loop.
C. capacitors tend to maintain current through them at a constant value.
[✓ D.] current is used up after it leaves a junction.
E. the potential of the nearest battery is the potential at the junction.

Q19 How much heat is produced in the 10-Ω resistor in 5.0 s when ε = 18V

A. 72 J
B. 32 J
C. 50 J
D. 18 J
[✓ E.] 90 J

$\Sigma_{abx} = 0$

$18 - 12I_1 - 18I_2$

$18 - 12I_1 - 16I_2$

$I_1 + I_3 = I_2$

$-12I_1 -$

$\Sigma_{abxa} = 0$

$-I_3(10) + 18I_2$

$= 10I_3 - 18I_2$

Q26: A 10 kΩ resistor and a capacitor are connected in series and then a 1[illegible] V potential difference is applied across them. The potential across the capacitor rises from zero to 5V in 1.3 μs. The capacitance of the capacitor is

A. 161 μF
[✓ B.] 161 pF
C. 240 pF
D. 90 μF
E. 40 pF

BIRZEIT UNIVERSITY

Physics Department

Phys 132

First Exam **Summer, 2016**

Time: 90 min **Date: 17/7/2016**

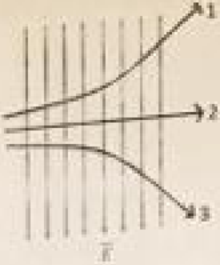
Student name: .... **Student number:** ....

✓	Sec	Instructor Name	Time	
○	1	Ghassan Abbas	M, T, W, R	09:20 - 10:30
○	2	Arraj Abdelrahman	M, T, W, R	12:20 - 13:30
○	3	Ghassan Abbas	M, T, W, R	08:00 - 09:10
○	4	Wafia Khater	M, T, W, R	12:20 - 13:30
○	5	Isma el Baltan	M, T, W, R	11:00 - 12:10

Answer Sheet

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

1) Electron, proton, and neutron are initially moving to the right when they enter a uniform electric field directed downward. Their trajectories



a) 1 for electron, 2 for proton, 3 for neutron
b) 1 for proton, 2 for electron, 3 for neutron
[redacted]
d) 1 for neutron, 2 for proton, 3 for electron
e) 1 for proton, 2 for neutron, 3 for electron

2) Four point charges are placed at the corners of a square of edge $d = 1$ m as in the figure below. The net force on a charge Q at the center of the square is

a) $4KqQ$
b) $6KqQ$
c) $\sqrt{8}KqQ$
d) $2\sqrt{8}KqQ$
[redacted]

3) A thin rod extends along the x-axis from $x = 0$ to $x = L$ and carries a linear charge density $\lambda = \lambda_0(x/L)$, where λ_0 is a constant. The electric potential at a distance $y = a$ is

[redacted]

b) $(K\lambda_0 L)(\sqrt{L^2+a^2}-a)$

c) $(K\lambda_0/L)(a-\sqrt{L^2+a^2})$

d) $(K\lambda_0 L)(\sqrt{L^2+a^2}-L)$

e) $(K\lambda_0/L)(\sqrt{L^2+a^2}+a)$

4) An initially-stationary electric dipole of dipole moment $\vec{P} = (2.0\times10^{-8})\hat{i}$ C.m placed in an electric field $\vec{E} = (3.0\times10^{6}\ N/C)\hat{i} + (2.7\times10^{6}\ N/C)\hat{j}$. What is the torque that the electric field exerts on the dipole?

a) $0.054\hat{i}$ N.m

[redacted]

c) $0.060\hat{k}$ N.m

d) $0.054\hat{j}$ N.m

e) $0.060\hat{j}$ N.m

5) *A piece of plastic has a net charge of* −2.00 nC. How many more electrons than protons *does this piece of plastic have*

a) 1.60×10^{-19}

b) 2.00×10^{-9}

c) 1.25×10^{9}

d) 1.25×10^{10}

[redacted]

6) An electric field is given by $\vec{E} = 2\hat{j} + 3x^2\hat{k}$ N/C. The flux through a square in the x-y plane bounded by the points (0,0), (0,1), (1,1), (1,0), where coordinates in meters

[redacted]

b) 2.0 m^2/C

c) 3.0 N.m^2/C

d) 1.0 N.m^2/C

e) 5.0 N.m^2/C

$\int_0^1 x^2$

7) The electric potential in a region is given by $V = xy - 3zx + y^2$ where V in volts and coordinates in meters. The strength of the electric field at the point (1,1,1)

a) $1.0\ N/C$
b) $1.4\ N/C$
c) $1.7\ N/C$
d) $2.8\ N/C$
[redacted]

8) An electric field is given by $\vec{E} = 2x\hat{\imath}\ N/C$. The voltage difference $(V_{23} = V_2 - V_3)$ between $x = 2$ m and $x = 3$ m is

a) 5 volts
[redacted]
c) 6 volts
d) −6 volts
e) −2 volts

9) An isolated metal sphere with radius $R = 2$ cm carries 8 μC. If a proton is released from rest at the surface, what would be its kinetic energy far from the sphere

a) $-2.88 \times 10^{-13}\ J$
b) $2.88 \times 10^{-13}\ J$
c) $-5.76 \times 10^{-13}\ J$
[redacted]
e) $2.88 \times 10^{-13}\ J$

10) A conductor carries a net charge +Q. There is a cavity inside the conductor that contains a point charge -2Q. In electrostatic equilibrium, the charge on the outer surface is

a) $-Q$
b) $-2Q$
[redacted]
d) $+Q$
e) $+3Q$

11) Two electrical charges (each 1 μC) are initially extremely far apart . How much work does it take to put the two charges close to each other such as the distance between them is 2 cm

[redacted]
- b) 900 mJ
- c) 450 KJ
- d) 900 KJ
- e) 22500 mJ

12) A very large thin sheet carries a uniform charge density σ. The electric field strength 3.0 cm from the sheet is 20 N/C. Find the electric field strength at 6.0 cm from the sheet

- a) 10 N/C

[redacted]
- c) 30 N/C
- d) 40 N/C
- e) 70 N/C

13) A sphere with radius R carries a volume charge density $\rho = \rho_0 r/R$. The electric field strength at a distance $r = R/2$ from the axis of the sphere is

- a) $16\rho_0 R/\epsilon_0$
- b) $\rho_0 R^2/16\epsilon_0$

[redacted]
- d) $\rho_0 R/8\epsilon_0$
- e) $\rho_0 R^2/8\epsilon_0$

14) At a distance $D > R$ from a uniformly charged conducting sphere with radius R, the electric field strength is 1000 N/C. At what distance from the center of the sphere will the field strength to be 2000 N/C

- a) $2D$
- b) $D/2$

[redacted]
- d) $\sqrt{2}D$
- e) $D/4$

15) Choose the correct statement

a) If the electric potential at a point in space is zero, then the electric field at that point must also be zero

[redacted]

c) If the electric field is zero everywhere inside a region of space, the potential must also be zero in that region

d) If the electric potential at a point in space is zero, then the electric field at that point must also be zero

e) (a) and (b) are correct

16) A particle of mass 5g and charge 40 mC moves in a region of space where the electric field is given by $\vec{E} = 2.5\hat{i}$ N/C. If the velocity of the particle at $t = 0$ is given by $\vec{v} = 30\hat{j}$ m/s, what is the speed of the particle at $t = 2$ s

[redacted]

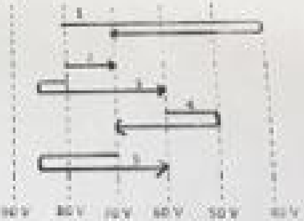
b) 25 m/s

c) 70 m/s

d) 50 m/s

e) 89 m/s

17) The figure below shows parallel equipotential surfaces (in cross section) and five paths along which we shall move an electron from surface to another. The correct rank for the paths according to the work we done, greatest first



a) 1, then 3 and 5 tie, then 4, then 2

b) 1, then 2, 4, and 5 tie, then 4

c) 1, 2, 4, and 5 tie, then 3

[redacted]

e) 3, then 1, 2, 4, and 5 tie