Philadelphia University
Faculty of Science
Department of Basic Sciences
Spring 2021/2022

Final Examination
General Physics (2) 211102
Date: 06/07/2022 Wednesday
Time: 120 Minutes

Name: **Student number:**

Check your section with [X] below:

*Check your correct answer with **X** in the table below:*

General Physics (211102)

Section	(Lecture time)	[X]	Lecturer
1	(11:15 – 12:45)	[ ]	Dr. Zuheir El-bayyari
2	(11:15 – 12:45)	[ ]	Dr. Zuheir El-bayyari
3	(09:45 – 11:15)	[ ]	Mr. Mustafa Al-zyout
4	(12:45 – 14:15)	[ ]	Mr. Mustafa Al-zyout

Q. No.	A	B	C	D
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Useful information:

$g = 9.8\, m/s^2$	$\epsilon_o = 8.85 \times 10^{-12}\, C^2/N.m^2$
$k_e = 1/4\pi\epsilon_o = 9 \times 10^9\, N.m^2/C^2$	$e = 1.6 \times 10^{-19} C$
$m_e = 9.11 \times 10^{-31} kg$	$m_p = 1.67 \times 10^{-27} kg$
$G = 6.67 \times 10^{-11}\, N.m^2/kg^2$	$1\, e.V = 1.6 \times 10^{-19} J$
$\rho_{Cu} = 1.6 \times 10^{-8} \Omega.m$	$n_{Cu} = 8.47 \times 10^{28} m^{-3}$
$\rho_{Ag} = 1.47 \times 10^{-8} \Omega.m$	$n_{Ag} = 5.86 \times 10^{28} m^{-3}$
$r_{Earth-Moon} = 3.84 \times 10^8 m$	$M_{Earth} = 5.97 \times 10^{24} kg$
$M_{Moon} = 7.35 \times 10^{22} kg$	$R_{Earth} = 6.37 \times 10^6 m$

- Each of the following problems has 2.0 points.
- You have a total of 20 questions.
- The use of a non-programmable calculator is allowed only.

Good Luck

Dr. Zuheir El-bayyari (Internal examiner)
Mr. Mustafa Al-Zyout (Module Coordinator)

Q.01) A particle of charge $3 \times 10^{-6}\, C$ is $12\, cm$ distant from a second particle of charge $1.5 \times 10^{-6}\, C$. Calculate the magnitude of the electric force between the particles (in N).

(A) 2.07 **(B)** 1.58 **(C)** 1.25 **(D)** 2.81

Q.02) What is the magnitude of a point charge that would create an electric field of $1\ N/C$ at points $39\, cm$ away (in C)?

(A) 1.69×10^{-11} **(B)** 1.44×10^{-11} **(C)** 1.21×10^{-11} **(D)** 1.00×10^{-11}

Q.03) An electron is accelerated eastward at $1.8 \times 10^{12}\ m/s^2$ by an electric field. Determine the magnitude of the field (in N/C).

(A) 7.97 **(B)** 6.83 **(C)** 10.25 **(D)** 9.11

Q.04) A particle carries a charge of $6 \times 10^{-6}\ C$. Calculate the electric flux through a spherical Gaussian surface that is centered on the particle and has a radius of $0.04\ m$ (in $N.m^2/C$).
(A) 5.6×10^5 **(B)** 4.5×10^5 **(C)** 3.4×10^5 **(D)** 6.8×10^5

Q.05) A positively charged solid sphere of radius $100\ mm$ has a uniform volume charge density of $250 \times 10^{-9}\ C/m^3$. Determine the electric field $20\ mm$ from the center of the sphere (in N/C).
(A) 470.8 **(B)** 188.3 **(C)** 282.5 **(D)** 376.6

Q.06) Particle A carrying a charge of $3 \times 10^{-9}\ C$ is at the origin, how much work must be done by an outside agent to bring particle B, also carrying a $3 \times 10^{-9}\ C$ charge, from infinity to $r = 4\ m$ (in J)?
(A) 1.35×10^{-8} **(B)** 1.16×10^{-8} **(C)** 2.03×10^{-8} **(D)** 1.62×10^{-8}

Q.07) A particle carrying charge $+q$ is located on the $x\ axis$ at $x = +d$. A particle carrying charge $+3q$ is located on the $x\ axis$ at $x = -7d$. With zero potential at infinity, at what locations, other than infinity, on the $x\ axis$ is the electric potential zero?
(A) $x = -d$ **(B)** $x = -d$ and $x = +5d$
(C) $x = +5d$ **(D)** Nowhere

Q.08) A capacitor consisting of two concentric spheres and one consisting of two coaxial cylinders both have an inner radius $a = 10\ mm$ and an outer radius $b = 30\ mm$. If the two capacitors have the same capacitance, what is the length of the cylinders (in mm)?
(A) 30 **(B)** 33 **(C)** 32 **(D)** 31

Q.09) A parallel-plate capacitor with air between its plates carries a charge of $6.6 \times 10^{-6}\ C$ when a $9\ V$ battery is connected to it. How much energy is stored in the capacitor (in J)?
(A) 29.7×10^{-6} **(B)** 26.4×10^{-6} **(C)** 23.1×10^{-6} **(D)** 19.8×10^{-6}

Q.10) A $6 \times 10^{-6}\ F$ air-filled capacitor is connected across a $100\ V$ voltage source. After the source fully charges the capacitor, the capacitor is immersed in oil ($\kappa = 4.5$). How much *additional* charge flows from the voltage source, which remained connected during the process (in C)?
(A) 2.73×10^{-3} **(B)** 2.10×10^{-3} **(C)** 2.31×10^{-3} **(D)** 2.52×10^{-3}

Q.11) Each plate of an air-filled parallel-plate air capacitor has an area of $0.004\ m^2$, and the separation of the plates is $0.08\ mm$. An electric field of $5.3 \times 10^6\ V/m$ is present between the plates. What is the energy density between the plates (in J/m^3)?
(A) 175.6 **(B)** 235.8 **(C)** 304.8 **(D)** 124.3

Q.12) Three capacitors: $5\ \mu F$, $10\ \mu F$, and $50\ \mu F$, are connected in series across a $12\ V$ voltage source. How much charge is stored in the $5\ \mu F$ capacitor (in μC)?
(A) 50 **(B)** 56.25 **(C)** 37.5 **(D)** 43.75

Q.13) Each plate of a parallel-plate air-filled capacitor has an area of $0.002\,m^2$, and the separation of the plates is $0.02\,mm$. An electric field of $4 \times 10^6\,V/m$ is present between the plates. What is the surface charge density on the plates (in $\mu C/m^2$)?

(A) 35.4 **(B)** 44.25 **(C)** 53.1 **(D)** 61.95

Q.14) The plates of a parallel plate capacitor of capacitance $C_\circ$ are horizontal. Into the gap, a slab of dielectric material with $\kappa = 2$ is placed, filling the bottom half of the gap between the plates. What is the resulting new capacitance?

(A) $C = \frac{12}{7}C_\circ$ **(B)** $C = \frac{16}{9}C_\circ$ **(C)** $C = \frac{4}{3}C_\circ$ **(D)** $C = \frac{8}{5}C_\circ$

Q.15) During $4\,min$, a $5\,A$ current is set up in a wire, how many electrons pass through any cross section across the wire's width?

(A) 1.875×10^{21} **(B)** 7.5×10^{21} **(C)** 5.625×10^{21} **(D)** 3.75×10^{21}

Q.16) A wire of Nichrome is $1\,m$ long and $1\,mm^2$ in cross-sectional area. It carries a current of $4\,A$ when a $2\,V$ potential difference is applied between its ends. Calculate the conductivity s of Nichrome (in $(\Omega.m)^{-1}$).

(A) 3×10^6 **(B)** 4×10^6 **(C)** 5×10^6 **(D)** 2×10^6

Q.17) What is the magnitude of the applied electric field inside a copper wire of radius $1\,mm$ that carries a $2\,A$ current (in V/m)?

(A) 0.01 **(B)** 0.02 **(C)** 0.03 **(D)** 0.04

Q.18) If the current through a $10\,\Omega$ resistor is $2\,A$, how much energy is dissipated by the resistor in $1\,h$ (in kJ)?

(A) 9.6 **(B)** 15 **(C)** 2.4 **(D)** 5.4

Q.19) How strong must an electric field in a metal be in order for electrons in the field to have a drift speed of $12\,mm/s$ if the time interval between electron-ion collisions is $1 \times 10^{-14}\,s$ (in N/C)?

(A) 85.4 **(B)** 6.83 **(C)** 7.4 **(D)** 7.97

Q.20) When a $22\,\Omega$ resistor is connected across the terminals of a $12\,V$ battery, the voltage across the terminals of the battery falls by $0.3\,V$. What is the internal resistance of this battery (in Ω)?

(A) 0.56 **(B)** 0.62 **(C)** 0.67 **(D)** 0.72

Answer Table for form A

(Final Exam on Wednesday 06/07/2022. G. Physics 211102)

Q. No.	A	B	C	D
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			
18			X	
19		X		
20	X			