College of Sciences
Department of Physics & Astronomy

كلية العلوم
قسم الفيزياء والفلك

Midterm Exam	الامتحان الفصلي
Academic Year 1444 H – 3rd Semester	العام الدراسي ١٤٤٤هـ - الفصل الثالث

30

Exam Information		معلومات الامتحان	
Course name:	General Physics II	فيزياء عامة - ٢	اسم المقرر:
Course code:	104 PHYS	١٠٤ فيز	رمز المقرر:
Exam date:	Tuesday 02/05/2023G	الثلاثاء ١٤٤٤/١٠/١٢ هـ	تاريخ الامتحان:
Exam time:	07:00 PM	٠٧:٠٠ مساء	وقت الامتحان:
Exam duration:	Two Hours	ساعتان	مدة الامتحان:

Student Information	معلومات الطالب	
Student's name:		اسم الطالب:
Student ID no.:		الرقم الجامعي:
Section no.:		رقم الشعبة:
Roll no.:		رقم التحضير:
Exam room no.:		رقم قاعة الامتحان:
Lecturer's name:		اسم أستاذ المقرر:

The exam consists of 20 QUESTIONS and 5 PAGES (including the cover page and the graph sheet)
All answers are given in MKS (unless the unit is stated)

Physical Constants

$k_e = 9 \times 10^9 \ \mathrm{N \cdot m^2 \cdot C^{-2}}$	$\epsilon_0 = 8.85 \times 10^{-12} \ \mathrm{C^2 \cdot N^{-1} \cdot m^{-2}}$	$\mu_0 = 4\pi \times 10^{-7} \ \mathrm{T \cdot m \cdot A^{-1}}$	$\lvert e \rvert = 1.6 \times 10^{-19} \ \mathrm{C}$
$g = 9.8 \ \mathrm{m \cdot s^{-2}}$	$N_A = 6.02 \times 10^{23} \ \mathrm{mol^{-1}}$	$m_e = 9.1 \times 10^{-31} \ \mathrm{kg}$	$m_p = 1.67 \times 10^{-27} \ \mathrm{kg}$

Choose the letter of the correct answer and write it in CAPITAL LETTER in the appropriate box

1	2	3	4	5	6	7	8	9	10
D	B	C	D	C	D	A	B	A	A

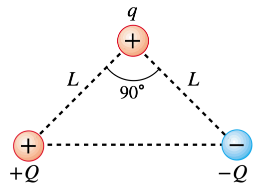
11	12	13	14	15	16	17	18	19	20
C	A	B	C	B	D	D	A	B	C

#	Questions (<u>1.5 mark for each</u>)

01. Three electrons were removed from a neutral atom. The charge of the atom in (C) unit becomes:

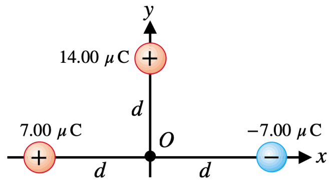
A. -4.8×10^{-19} B. -3×10^{-19} C. 3×10^{-19} D. 4.8×10^{-19}

02. Three-point charges are arranged as shown in the figure, where $Q = 25\ \mu\text{C}$, $q = 10\ \mu\text{C}$, and $L = 40$ cm. The magnitude of the resultant electric force on the charge q in (N) unit equals:



A. 14.06 B. 19.88 C. 22.15 D. 28.26

03. Three-point charges are arranged as shown in the figure, where $d = 1$ m. The magnitude of the resultant electric field at the origin O in (kN/C) unit equals:



A. 63.24 B. 126.01 C. 178.19 D. 252.02

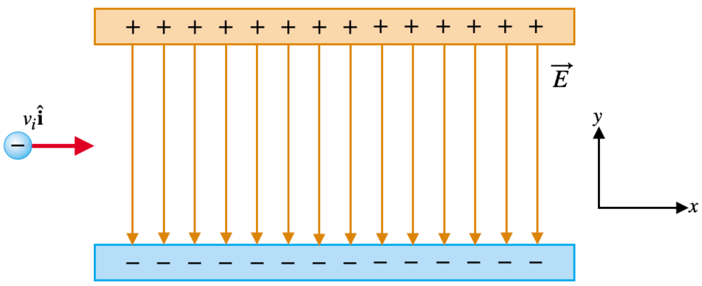
04. In the ***previous question*** (**Q.03**), the angle of the resultant electric field at the origin O in the *counterclockwise* direction with respect to the *positive x-axis* in (°) unit is:

A. 45 B. 135 C. 225 D. 315

05. Two positive charges, q_1 and q_2 are separated by a distance, d. If $q_1 = 4q_2$, which of the following is correct about the magnitude of the repulsive forces acting on these two charges:

A. $|F_{12}| = 4|F_{21}|$ B. $|F_{12}| = \frac{1}{4}|F_{21}|$ C. $|F_{12}| = |F_{21}|$ D. $|F_{12}| = 2|F_{21}|$

06. An electron enters a region of uniform electric field as shown in the figure, with $v_i = 3 \times 10^6$ m/s and $E = 200$ N/C. The horizontal length of the plates is $l = 0.1$ m. The magnitude and direction of the acceleration of the electron when it moves inside the electric field in (m/s^2) unit is: [ignore any gravitational effects]



A. 2.1×10^{13} in the direction of the *positive y axis*.

B. 2.1×10^{13} in the direction of the *negative y axis*.

C. 3.5×10^{13} in the direction of the *negative y axis*.

D. 3.5×10^{13} in the direction of the *positive y axis*.

07. The total electric flux through a closed cylindrical surface (length $= 1.2$ m, diameter $= 0.2$ m) is equal to $5.0\ \text{N} \cdot \text{m}^2/\text{C}$. The net charge within the cylinder in (pC) unit equals:

A. 44.25 B. 53.12 C. 62.87 D. 71.85

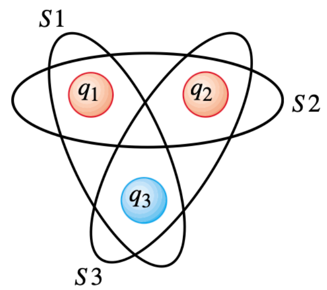
08. The electric field near a uniformly charged insulating plate is 130 N/C. If the area of the plate is 10 cm^2, then the total charge on the plate in (pC) unit equals:

A. 1.1 B. 2.3 C. 3.2 D. 5.4

09. An infinite, uniformly charged, straight line has a charge density $\lambda = 4$ nC/m. The magnitude of the electric field 2.5 m from the axis of the line in (N/C) unit equals:

A. 28.8 B. 36.2 C. 43.4 D. 50.7

10. Three charges are arranged as shown in the figure, where $q_1 = +2Q$, $q_2 = +Q$ and $q_3 = -3Q$. The electric flux through the surfaces S1, S2 and S3 respectively are:



A. $-Q/\epsilon_0$, $+3Q/\epsilon_0$ and $-2Q/\epsilon_0$

B. $+2Q/\epsilon_0$, $+Q/\epsilon_0$ and $-Q/\epsilon_0$

C. $+Q/\epsilon_0$, $-Q/\epsilon_0$ and $-2Q/\epsilon_0$

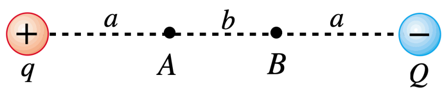
D. $-2Q/\epsilon_0$, $-3Q/\epsilon_0$ and $+2Q/\epsilon_0$

11. For a point charge, q, placed at the center of a spherical gaussian surface. When the radius of the spherical gaussian surface is doubled. The total flux, Φ_E, on this surface will:

A. increase 4 times. B. be doubled.

C. remain the same. D. reduce to half.

12. If $a = 30$ cm, $b = 20$ cm, $q = +2.0$ nC, and $Q = -3.0$ nC in the figure, then the potential difference $V_A - V_B$ in (V) unit equals:

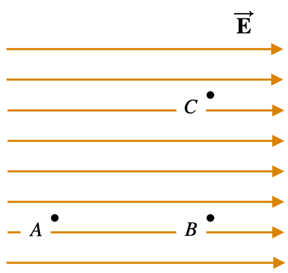


A. +60 B. +72 C. +84 D. +96

13. Two positive charges of equal value (Q) are separated by a distance $2d$. The net potential at the midpoint P between the two charges is:

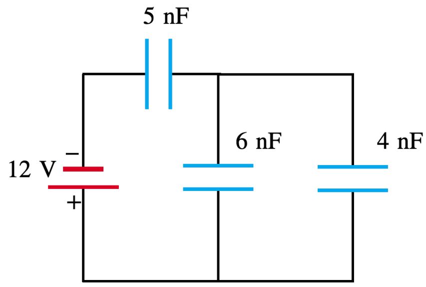
A. Zero B. $2k_eQ/d$ C. k_eQ/d D. $4k_eQ/d$

14. Assume a uniform electric field as shown in the figure. Which of the following is correct about the electric potential at the points A, B and C respectively:



A. $V_A < V_B = V_C$ B. $V_A = V_B < V_C$

C. $V_A > V_B = V_C$ D. $V_A = V_B > V_C$

15.	A proton starts from rest at point A and has a speed of 40 km/s at point B. Assuming only electric forces act on it during its motion, the potential difference $V_B - V_A$ in (V) unit equals: A. -4.82 B. -8.35 C. -12.28 D. -16.61
16.	The unit $farad$ (F) is equivalent to: A. $\mathrm{C/(N\cdot m)}$ B. $\mathrm{C^2/(N\cdot m^2)}$ C. $\mathrm{C/(N\cdot m^2)}$ D. $\mathrm{C^2/(N\cdot m)}$
17.	A parallel-plate capacitor with capacitance C_1 is charged using a battery with a terminal voltage difference ΔV_1 until it reached a charge Q_1, then it was disconnected from the battery. If a dielectric material ($\kappa = 2$) is inserted between the two plates, then $Q_2 = Q_1$ and A. $\Delta V_2 = \Delta V_1$ and $C_2 = 2C_1$. B. $\Delta V_2 = \frac{1}{2}\Delta V_1$ and $C_2 = C_1$. C. $\Delta V_2 = \Delta V_1$ and $C_2 = C_1$. D. $\Delta V_2 = \frac{1}{2}\Delta V_1$ and $C_2 = 2C_1$.
18.	A uniform electric field $E = 2000\ \mathrm{V/m}$ exists within a certain region. The stored energy in a volume of $10\ \mathrm{m^3}$ of this region due to the electric field in (J) unit equals: A. 1.77×10^{-4} B. 3.63×10^{-4} C. 1.77×10^{-5} D. 3.63×10^{-5}
19.	For the system of capacitors shown in the figure, the magnitude of the electric potential difference across the 4 nF capacitor in (V) unit is:  A. 3 B. 4 C. 8 D. 10
20.	In the ***previous question*** (**Q.19**), the total energy stored by the system of capacitors in (nJ) unit is: A. 20 B. 180 C. 240 D. 480

“Best wishes” ...