14

Section number : _____

Student name (بالعربية): _____

Lecturer name : _____

Student number : _____

Notes: **Turn off your cell phone** and put it out of sight. Keep your calculator on your own desk. Calculators cannot be shared. You have sixty **(60) minutes** to complete your exam. Be sure to **fill the box** below with your final answers before the end of the exam.

❖ Some helpful information:
p (pico) = 10^{-12}; n (nano) = 10^{-9}; μ (micro) = 10^{-6}; k_e = 9 × 10^9 N.m²/C²; ε_0 = 8.85 × 10^{-12} C²/N.m²;
g = 9.8 m/s²

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

A   C   D

1. A solid conducting sphere has net positive charge and radius R = 0.3 m. At a point 1.2 m from the center of the sphere, the electric potential due to the charge on the sphere is 24 V. Assuming that V = 0 at an infinite distance from the sphere, what is the electric potential (in V) at the center of the sphere?

    A) 96   B) 47   C) 39   D) 36   E) 72

2. A small object with electric dipole moment **p** = (2 × 10^{-3} **i** + 4 × 10^{-3} **j**) C.m is placed in a uniform electric field **E** = (-7.8 × 10^{+3} **i** + 4.9 × 10^{+3} **j**) N/C. The torque acting on this object (in N.m) is:

    A) -19.7 **k**   B) +30.3 **k**   C) -30.3 **k**   D) -41 **k**   E) +41 **k**

3. Negative charge -Q is distributed uniformly around a quarter-circle of radius a that lies in the first quadrant (الربع الأول) with the center of curvature at the origin, the x-component of the electric field at the origin is:

    A) $Q/(4\pi \varepsilon_0 a^2)$ B) $Q/(8\pi^2 \varepsilon_0 a^2)$ C) $Q/(2\pi^2 \varepsilon_0 a^2)$
   D) $Q/(8 \varepsilon_0 a^2)$ E) $Q/(4\pi^2 \varepsilon_0 a^2)$
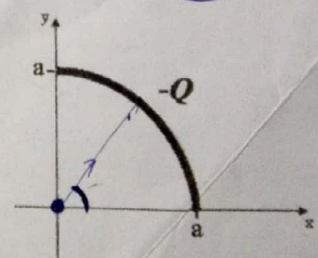
4. A point charge q_1 = 4.15 nC is located on the x-axis at x = 1.15 m, and a second point charge q_2 = -6.15 nC is on the y-axis at y = 1.8 m. What is the total electric flux (in N.m²/C) due to these two point charges through a spherical surface centered at the origin with radius 1.4 m?

    A) -8.12 × 10^{-2} B) -6.95 × 10^2 C) 4.69 × 10^2 D) -2.25 × 10^2 E) 7.91 × 10^{-2}

5. Over a certain region of space, the electric potential is V = -5x-3xy - 2yz (in V). The x-component of the electric field (in V/m) at the point P that has the coordinates (1, -1, 30) m is:

    A) -2   B) 2   C) -5   D) 5   E) 0

6. Consider the following assembly of charges.
   · How much work (in J) do you need to bring a charge of 9.3 nC from far away to the center?

   A) 10   (B) 0
   C) 30   D) 45.5
   E) 125

   $Q_1 = 4\mu C$ 4cm   2 $Q_2 = 4\mu C$
   1.5
   3cm   Center
   $Q_3 = -4\mu C$ $Q_4 = -4\mu C$
   7.5 90
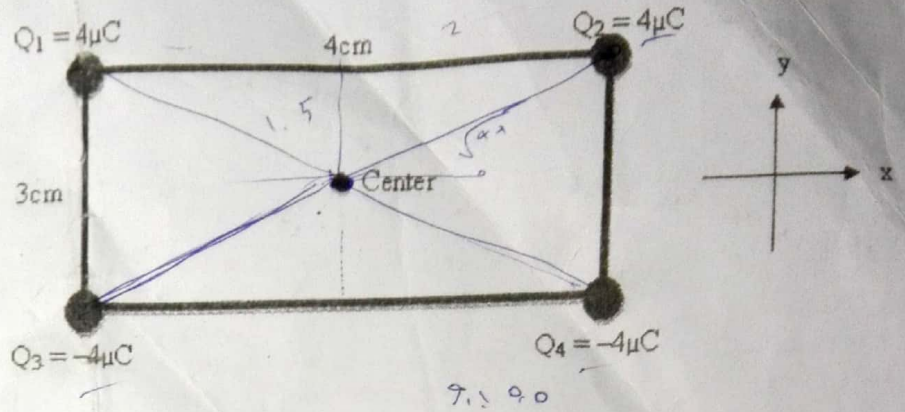
7. A small metal ball of mass 4 grams is charged with -10 μC. A constant uniform electric field is generated in order to suspend (يعلق) the ball in air. What is the minimum field required to achieve this suspension (in N/C)?

   A) 3050 (+j)   B) 2940 (+j)   C) 3920 (+j)   D) 2940 (-j)   E) 3920 (-j)

8. What is the equivalent capacitance C_{eq} of this circuit (in terms of C_0)?
   A) $C_{eq} = 4 C_0$
   B) $C_{eq} = 4 C_0 / 3$
   C) $C_{eq} = C_0 / 4$
   D) $C_{eq} = 3C_0 / 4$
   E) $C_{eq} = C_0$
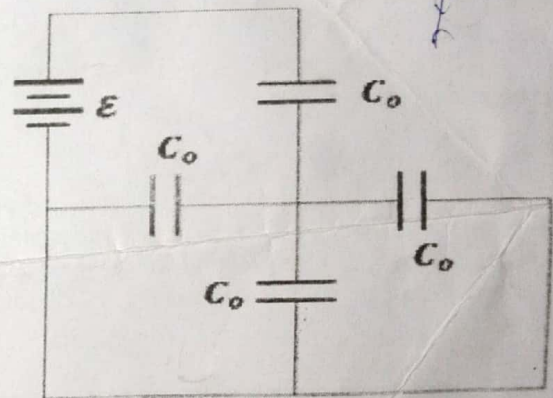
9. Consider a parallel plate capacitor in a free space. The electric field between the plates is 3.6×10^5 V/m. When the space between the plates is completely filled with dielectric material, the electric field becomes 2.5×10^5 V/m. What is the value of the dielectric constant?

   A) 2.5   B) 3.0   C) 1.32   D) 1.44   E) 4.1

10. A solid nonconducting sphere of radius 12 cm has a charge of uniform density (-19 nC/m³) distributed throughout its volume. The magnitude of the electric field (in N/C) 15 cm from the center of the sphere is:

   A) 55   B) 20   C) 66   D) 78   E) 49

The end of the exam

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