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Part I	Part II				Total
(4) =	O1	O2	O3	O4	

PART I: choose the correct answer **(15×4=60 pts)**

1) Charge is quantized means that:

- | | |
|---|---|
| a) charge is always conserved. | b) the net charge is always neutral. |
| c) charge is an integral multiple of electron's charge. | d) charge is either positive or negative. |

2) Which of the following is incorrect concerning the electric force between two point charges:

- | | |
|--|----------------------------|
| a) it is conservatice force . | b) it obeys Newton's laws. |
| c) it is directed along the line joining them. | d) it si attractive only. |

3) The unit of the electric field is:

- | | | | |
|------|--------|--------|--------|
| a) N | b) N.C | c) N/m | d) N/C |
|------|--------|--------|--------|

4) A uniform electric field directed east. The electric force **F** acting on an electron exists in this field is directed:

- | | | | |
|----------|----------|---------|---------|
| a) north | b) south | c) east | d) west |
|----------|----------|---------|---------|

5) Which of the following statements is **incorrect** concerning the electric field lines?

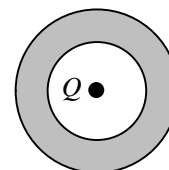
- | | |
|--|--|
| a) They are imaginary lines. | b) They are tense where the electric filed is large. |
| c) They are either staright or curved. | d) They are parallel to the equipotential surfaces. |

6) Consider Gauss's law: $\oint \mathbf{E} \cdot d\mathbf{A} = q_{in}/\epsilon_0$. Which of the following is **correct**?

- | | |
|--|--|
| a) E must be due to the charge inside the Gaussian surface only. | b) E is due to the charge of the whole system. |
| c) the integration is over any surface. | d) q_{in} is the charge of the system. |

7) A point charge of Q is at the center of a spherical shell. The flux through the inner surface of the shell is related to the flux through its outer surface as:

- | | | | |
|-----------------------|-----------------------|-----------------------|----------------|
| a) $f_{in} > f_{out}$ | b) $f_{in} < f_{out}$ | c) $f_{in} = f_{out}$ | d) non of them |
|-----------------------|-----------------------|-----------------------|----------------|



8) If the net electric flux through a closed surface is zero, which of the following statements is correct:

- a) There are no charges inside the surface. b) The electric field inside the surface is zero.
c) The electric field on the surface is constant d) The number of electric field lines entering must equal to the lines leaving the surface.

9) The electric potential at point P is given to be 15 V. The work required to bring a unit charge from ∞ to P is:

- a) 15 V b) -15 V c) 15 J d) -15 J

10) A conducting sphere is charged with Q . The work required to transfer a charge q from the center of the sphere to a point on the surface of the sphere is:

- a) positive b) negative c) depends on the sign of Q . d) zero

11) A system of two point charges q_1 and q_2 . If the potential energy of the system is negative then:

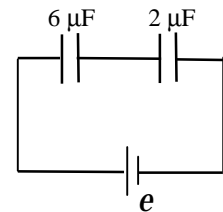
- a) the force is attractive. b) the force is repulsive.
c) the force is nonconservative. d) the force is zero.

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

- a) increasing the charge Q . b) increasing the voltage V .
c) decreasing the plates separation d d) decreasing the voltage V .

13) Two capacitors are connected as shown. If the charge on the 6- μF capacitor is 8 μC , the charge on the 2- μF capacitor is:

- a) 8 μC b) 4 μC c) 16 μC d) 6 μC



14) A capacitor is charged by a battery to charge Q and voltage V . If the battery remains **connected** and a dielectric slab is inserted inside the capacitor, which of the following is **correct**?

- a) both C and Q will be increased b) C will be increased but V will not change
c) both C and V will be increased d) C will be increased but Q will not change

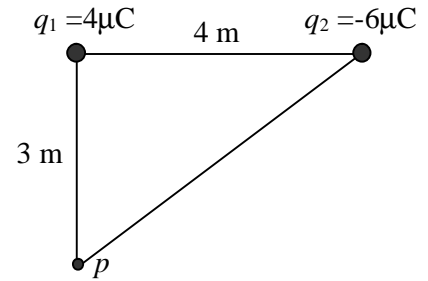
15) A capacitor of 0.25 F is charged with 10 C. The maximum energy stored in the capacitor is

- a) 400 J b) 4 J c) 0.2 J d) 200 J

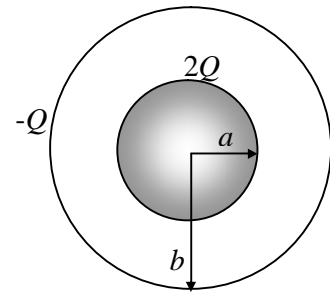
PART II: Solve the following problems

(4×10=40 pts)

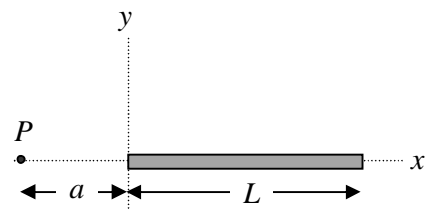
Q1) Two point charges, $q_1 = 4\text{mC}$, and $q_2 = -6\text{mC}$, are arranged as shown in the figure. Find the electric field E at point p .



Q2) A solid conducting sphere of radius a has a net positive charge $2Q$. Concentric with this sphere is a conducting thin spherical shell of radius b and has a charge $-Q$. Find the electric field at a point outside the shell with ($r > b$).



- Q3)** A thin rod of length L lies along the x -axis with its left end at the origin. It has a nonuniform charge density $\lambda = \alpha x$ where α is a positive constant. Calculate the electric potential at point P .



- Q4)** Consider the circuit shown in the figure.
- find the equivalent capacitance between a and b .
 - If $V_{ab}=12\text{ V}$, find the charge in the $6\text{-}\mu\text{F}$ capacitor.

