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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) Which of the following in **not a property** of electric charges?
 - a) Charge is conserved.
 - b) Charge is quantized.
 - c) There are 3-kinds of charges, positive, negative and neutral.
 - d) Like charges repel each other and unlike charges attract each other.

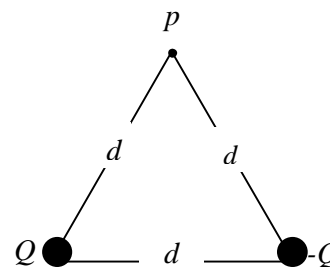
- 2) Which of the following is **incorrect** concerning the force between two point charges?
 - a) It is inversely proportional to the distance between them.
 - b) It is directly proportional to the magnitudes of the two charges.
 - c) It is directed along the line joining them.
 - d) It is conservative force.

- 3) Object *A* has a charge *Q* and object *B* has a charge *3Q*. Which of the following is correct?
 - a) $\vec{F}_{AB} = 3\vec{F}_{BA}$
 - b) $\vec{F}_{AB} = -3\vec{F}_{BA}$
 - c) $\vec{F}_{AB} = \vec{F}_{BA}$
 - d) $\vec{F}_{AB} = -\vec{F}_{BA}$

- 4) A test charge q_0 is at a point *P* where an external electric field *E* is directed to the right. If the test charge is replaced with another test charge $-2q_0$, the external electric field at *P* is
 - a) unaffected
 - b) reversed
 - c) increased
 - d) decreased

- 5) Which of the following statements about electric field lines associated with electric charges is false?
 - a) Electric field lines can be either straight or curved.
 - b) Electric field lines begin on positive charges and end on negative charges.
 - c) Electric field lines can form closed loops.
 - d) Electric field lines can never cross.

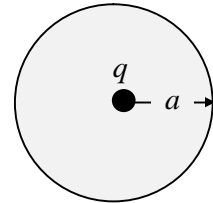
- 6) Two similar positive charges are arranged as shown. The direction of the electric field at point *p* is
 - a) up
 - b) down
 - c) left
 - d) right



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

- a) E must be due to the charge inside the Gaussian surface only. b) q_{in} is the net charge inside the Gaussian surface.
c) A is area of the Gaussian surface. d) The law applied for any closed surface.

8) A point charge q is placed at the center of a spherical shell of radius a . If the radius of the sphere is doubled what happens to the electric field on the surface of the shell and to the electric flux through the surface?



- a) Both the field and the flux unchanged. b) Both the field and the flux increased.
c) The flux is changed but the field is not. d) The field is changed but the flux is not.

9) The unit of the electric flux is

- a) V.m b) N.m/C c) V.m² d) N/C

10) The electric potential at point P is given to be 120 V. The work required to bring a unit charge from ∞ to P is

- a) -120 J b) 120 J c) 120 V d) -120 V

11) A conducting sphere is charged with Q . The work required to transfer a charge q from the center of the sphere to a point inside the sphere is

- a) positive b) negative c) depends on the potential difference between the two points. d) zero

12) In a certain region of space the electric field is zero. The electric potential in this region is

- a) constant b) zero c) positive d) negative

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

- a) increasing the charge Q b) increasing the voltage V
c) increasing the plates separation d d) increasing the plates area A

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

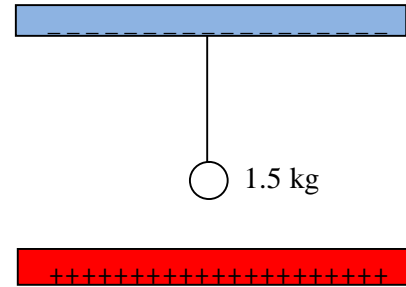
15) A capacitor of 2 μF is connected to a 12-V battery. The maximum energy stored in the capacitor is

- a) 2.88×10^{-4} J b) 1.44×10^{-4} J c) 288 J d) 144 J

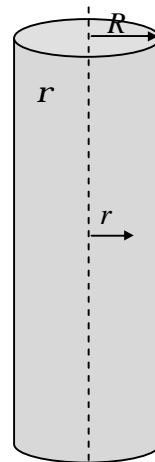
PART II: Solve the following problems

(4×10=40 pts)

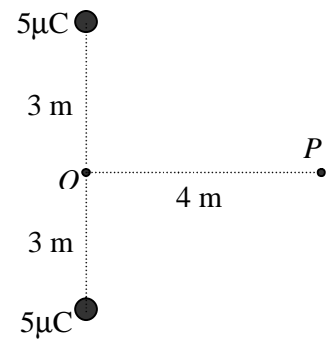
Q1) A ball of mass 1.5 kg and charge $2\mu\text{C}$ is suspended by a string in a uniform electric field of $5.0 \times 10^5 \text{ N/C}$. Calculate the tension in the string.



Q2) A very long solid cylinder of radius R has a uniform charge distribution ρ . Find the electric field inside the cylinder, ($r < R$).



Q3) Two point charges each of $5\ \mu\text{C}$ are separated by a distance of $6\ \text{m}$, as shown in the figure. Calculate the work required to bring a third charge of $2\ \mu\text{C}$ from point O to point P .



Q4) Consider the circuit shown in the figure. find the charge in the $4\text{-}\mu\text{F}$ capacitor.

