NAME (Please Print)_____

Circle the correct answer, to the nearest number for the quantitative questions.
Maximum total points are 15.
Part 1. Each Question worths 1 point except.

1. Two objects, **A** and **B**, are rubbed together. As a result, object **A** acquires an excess negative charge while object **B** becomes positively charged. In comparison to their masses before the charging process, you can say that

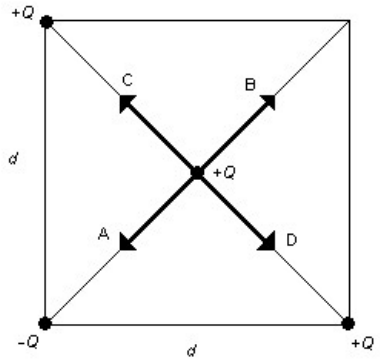
A) the mass of both objects increased.
B) the mass of **A** increased and that of **B** decreased.
C) the mass of **A** decreased and that of **B** increased.
D) the mass of both objects decreased.
E) none of the other choices is correct.

2. Two charges, $\boldsymbol{Q_1}$ and $\boldsymbol{Q_2}$, are separated by a certain distance ***R***. If the magnitudes of the charges are doubled and their separation is also doubled, then what happens to the electrical force between these two charges?

A) It is doubled. B) It changes by a factor of **3**. C) it is quadrupled.
D) reduced by a factor of $\sqrt{2}$. E) it remains the same.

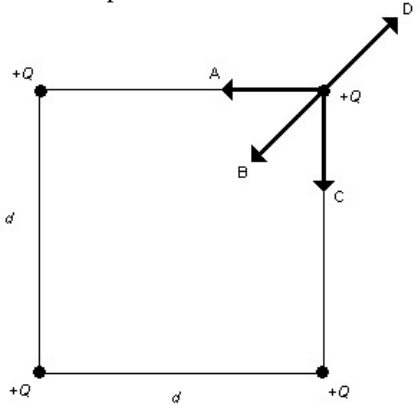
3. Four point charges of **equal** magnitudes but with **varying signs** are arranged on three of the corners and at the center of the square of side ***d*** as shown below. Which of the arrows shown represents the **net force** acting on the **center charge**?

A) A
B) B
C) C
D) D
E) none of the above.



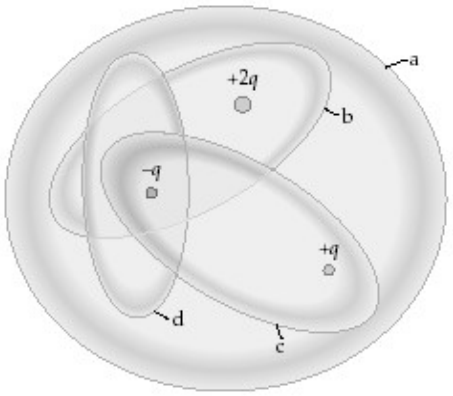
4. Four point charges of **equal magnitude and sign** are arranged on three of the corners of the square of side ***d*** as shown below. Which of the arrows shown represents the **net force** acting on the charge at the upper right hand corner of the square?

A) A
B) B
C) C
D) D
E) none of the above.



5. The Figure below shows four Gaussian surfaces surrounding a distribution of charges. Which Gaussian surfaces have an electric flux of $+q/\varepsilon_O$ through them?

A) a
B) b
C) b and d
D) b and c
E) c

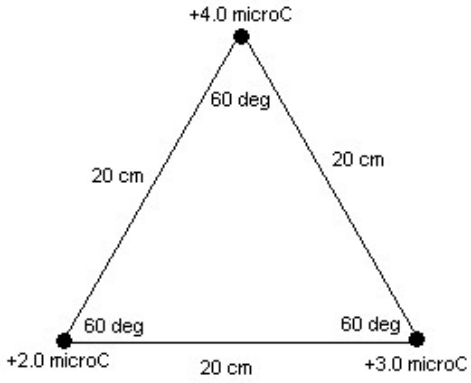


6. Two point charges, initially **2.0 cm** apart, experience a **1.0 N** force. If they are moved to a new separation of **8.0 cm**, what is the electric force in **N** between them?

A) 2.0 B) 4.0 C) 6.0 D) 1/4 E) 1/16

7. Three point charges of magnitude **+2.0 μC**, **+3.0 μC, +4.0 μC** are located at the corners of a triangle as shown below. The resultant force acting on the **+4.0 μC** charge is given by

A) 1.8 N at 97° with the +*y*−axis.
B) 2.7 N at 97° with the +*x*−axis.
C) 2.7 N at 97° with the +*y*−axis.
D) 3.9 N at 97° with the +*y*−axis.
E) 3.9 N at 97° with the +*x*−axis.



8. Which of the following will increase the capacitance between the plates of a parallel plate capacitor?

A) Increase the charge on the plates. B) Decrease the potential between the plates.
C) Increase the potential between the plates.
D) Introduce a dielectric material between the plates. E) None of the above.

9. When a dielectric material is introduced between the plates of a parallel plate capacitor the capacitance increases by a factor of **4**. What is the dielectric constant of the material introduced between the plates?

A) 0.4 B) ¼ C) 2 D) 4 E) None of the above.

10. An electron, initially at rest is accelerated through a potential difference of **550 V**. What is the speed of the electron due to this potential difference?

A) 1.44×10^6 m/s B) 1.59×10^6 m/s C) 6.10×10^6 m/s
D) 18.7×10^6 m/s E) 14.2×10^6 m/s

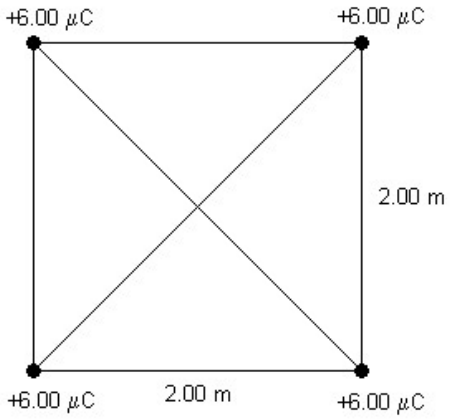
11. The potential difference between the plates of a parallel plate capacitor is **35 V** and the electric field between the plates has a strength of **750 V/m**. If the plate area is $\mathbf{4.0 \times 10^2\ m^2}$, what is the capacitance of this capacitor?

A) 7.6×10^{-14} F B) 7.6×10^{-12} F C) 7.6×10^{-11} F D)7.6×10^{-10} F
E) None of the above.

Part 2 . Please show your work in the space provided.

11. Four equal point charges of magnitude **6.00 μC** are placed at the corners of a square **2.00 m** on each side, as shown below. What is the electric potential of these charges at the center of this square?

(2 points)



12. A **4.0 μC** charge is situated at the origin of an ***xy***−coordinate system. What is the potential difference ($\mathbf{V_{x1} - V_{x2}}$) between a point $\boldsymbol{x_1}$ **= 2.0 m** and another point $\boldsymbol{x_2}$ **= 5.0 m** because of this charge? ***(2 points)***

Some useful constants: $e^{--} = 1.60 \times 10^{-19}$ C., $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/(N.m^2)$,
$k = (1/4\pi\varepsilon_o) = 8.99 \times 10^9\ N.m^2/C^2$, $m_e = 9.11 \times 10^{-31}$ kg, $m_p = 1.67 \times 10^{-27}$ kg.

Good Luck