SELF ASSESSMENT QUESTIONS (SAQS)

Activity 1 Electrostatics

1.1. Calculate the. Distance between point charges $q_x = 26.0\ \mu C\ and\ q_z = 47.0\ \mu C$, if the magnitude of the electrostatic force between them is 5.70 N.

1.2. Two charges of $2 \times 10^{-6} C$ each are $60\ cm$ apart. Find the magnitude of the force exerted by these charges on a third charge of magnitude $4 \times 10^{-6}\ C$ that is 50 cm away from each of the first two charges.

1.3. How many excess electrons must be placed on each of two small spheres spaced 3cm apart if the force of repulsion between the spheres is to be $10^{-19} N$?

1.4. Two charges are located on the positive x-axis of a coordinate system. Charge $q_1 = 2 \times 10^{-9}\ C$ is $2\ cm$ from the origin, and charge $q_2 = 3 \times 10^{-9}\ C$ is 4 cm from the origin. What is the magnitude of the total force exerted by these two charges on a charge $q_3 = 5 \times 10^{-9}\ C$ located at the origin?

1.5. What is the total positive charge in Coulombs, of all the protons in 1 mol of Hydrogen and atoms?

1.6. An $\alpha - \text{particles}$ is a nucleus of doubly ionized helium. It has a mass of 6.69 x 10‘^{27} kg and a Charge q of $-2e$ or $3.2 \times 10^{-19} C$. Compare the force of electrostatic repulsion between two $\alpha - \text{particles}$ with the force of gravitational attraction between them, i.e. evaluate F_e/F_g

1.7. Two positively charged spheres have confined charge of $4.0 \times 10^{-8}\ C$. Calculate the charge on each sphere if they are repelled with a force of $27.0 \times 10^{-5} N$ when placed $0.1\ m$ apart?

1.8. The electron and proton of a hydrogen atom are separated (on average) by a distance of approximately 5.3 x 10^{11} m. Find the magnitudes of the electric force and the gravitational force between the two particles.

1.9. Calculate the resultant force on the charge q_1 due to the other charges. Given that all the six charges have the same magnitude $q = 2.0nC;\ a = 3.0\ cm$ and $\theta = 30^o$

1.10. A small object carrying a charge of $5 \times 10^{-9} C$. Experiences a downward force of $20 \times 10^{-9} N$ when placed at a certain point in an electric field. What is the electric field at the point?

1.11. A charge $q_1 = +8nC$ is at the origin, and a second charge $q_2 = +12nC$ is on the positive x axis 4m away from the origin. Find (a) the net electric field at a point **p** on the x-axis at $x = 7m$ and the (b) the electric field at a point Q on the y-axis at $y = 3m$ due to the charges.

1.12. Three charges are positioned at vertices of a triangle as shown in the figure above. If $Q_1 = Q_2 = 8\mu C$ and $a = 0.5m$, determine the Q if the electric field at P is zero.

1.13. Calculate the electric field at one corner of a square 80 cm on a side if the other three corner are occupied by each charges of magnitude $18.2 \times 10^{-4} C$.

1.14. Three-point charges are held at the corner of a triangle as shown in the figure below, if the $q_1 = 6.0\mu C, q_2 = 1.0\mu C \; and \; q_3 = 5.0\mu C$, what is the resultant force on the q_3 charge?

1.15. The fission of U_{92}^{236} can produce the fragments of Ba_{56}^{146} and Kr_{36}^{90}. These nuclei have $+56e \; and \; +36e$ respectively. Determine the coulomb's force acting on each just after their formation, when their centre are separated by $1.6 \times 10^{-14}m$.

1.16. Two charges of equal magnitude $Q_1 = Q_2 = 6\mu C$ are on the y-axis at $y_1 = 3 \; cm$ and $y_2 = -3 \; cm$. Calculate the force on a charge $2.0\mu C$ placed on the positive x-axis at 4 cm away from the origin.

1.17. The magnitude of charge on two different particles are $1.5 \times 10^{-17}C$ and $3.2 \times 10^{-19}C$. What is the magnitude of the electro-static force between the two particles separated by $1.0 \times 10^{-13}m$?

1.18. Calculate the force on the charge at $Z(+1 \times 10^{-8}C)$ due to the charge at $X(+2 \times 10^{-8}C)$ and $Y(-5 \times 10^{-8}C)$.

1.19. Two-point charges $30nC \; and \; -40nC$ are held at the origin and at $x = 0.72 \; m$. Respectively. A particle $q = 42\mu C$ is released from rest at $x = 0.82m$. if the initial acceleration of the particle has a magnitude of $1 \times 10^5 m/s$, what is its mass?

1.20. A particle X of charge $3.2 \times 10^{-19}C$ and mass $6.8 \times 10^{-27}kg$ is travelling with a velocity of $1.0 \times 10^7 ms^{-1}$ directly towards another particle Y of charge $+11.2 \times 10^{-19}C$. Calculate the closest distance of approach of X to Y.