

# Physics 12

Assignment #2 - Electrostatics

Due Friday, March 20<sup>th</sup>, 2020 (Late assignments received without prior arrangement will only be collected)

**Multiple Choice (You will need to look up the electrostatic charge of a proton and a charge of an electron)**

The questions are on [www.schoolology.com](http://www.schoolology.com)

**Problems (Do Any of the Four Questions Below – You can do all the questions and I will mark them, but I am only counting the first four you do)**

1. A small sphere is given a charge of  $-32.4 \mu\text{C}$ , and a second identical sphere is given a charge of  $+12.4 \mu\text{C}$ . The two spheres start 10 inches apart, are allowed to touch and then separated, what force will exist between the two spheres when they are 20 inches apart? Does the force weaken by  $\frac{1}{4}$ ? Explain your answer
2. Three charged spheres are placed in a vertical line. The distance between each pair is 20cm. The first sphere has a charge of  $10\mu\text{C}$ , the second has a charge of  $24 \mu\text{C}$  and the third has an unknown charge. The net force is  $+8\text{N}$  on the middle sphere. What is the charge of the unknown sphere?
3. Determine the electric field intensity at a point  $9.0 \times 10^1 \text{nm}$  from the center of the Oxygen ion. What is the direction of the field?
4. If the gravitational field intensity at a distance of 1000km above an unnamed planet is  $10.0\text{N/kg}$  and the mass is  $5.00 \times 10^{26} \text{kg}$ , what is the radius of the planet?
5. What is the gravitational field intensity at a height of 1.0Mm above the surface of Mars if an object, with a mass of 0.85slugs, feels a gravitational force of 46.87N on the surface? What is the direction of the field?
6. What force would a 200kg satellite feel at a height of 300km above the surface of Earth? What would its mass be on the surface of Earth?

## Practice Problems

7. A planet with twice the mass and twice the radius of Earth has a  $g$   
a) 4 times that of Earth    b) 2 times that of Earth    c)  $\frac{1}{2}$  that of Earth    d)  $\frac{1}{4}$  that of Earth
8. An object near the surface of Saturn would experience an acceleration of gravity of  $10.4\text{m/s}^2$ . a) What is the mass of an object that weighs 800N on the surface of Saturn? b) What would be the mass of the same object on Earth? c) What would the mass be in slugs? **(76.92kg, 76.92kg, 5.25 slugs)**
9. You have become the first person in the world to reach of wonderful and glorious new planet (which will be named after me!). You have decided to put some of this Physics stuff to use. You drop a 3.0kg ball onto the surface and it takes 2.60 seconds to cover a distance of 6 feet. The planet has already been determined to have a radius of 8.40 million meters (making it bigger than Pluto and therefore an official planet). What is the mass of the planet? **(5.71x10<sup>23</sup>kg)**
10. What is the field intensity and direction directly in the middle of two charged sources that are 50cm apart? The left side source has a charge of  $-55\mu\text{C}$  and the right side source has a charge of  $-60\mu\text{C}$ . **(0.72MN/C at 0°)**
11. What force would an oxygen ion charge feel at the point in question 16? **(1.14x10<sup>-13</sup>N)**
12. An object has a weight of 160N when it is at a location exactly one full Mars radius away from the surface of Mars. What is its weight at a location exactly one full Saturn radius from the surface of Saturn? **(457N)**

13. Three charged spheres are placed in a vertical line. The distance between each pair is 20cm. The first sphere has a charge of  $12\mu\text{C}$ , the second has a charge of  $20\mu\text{C}$  and the third has an unknown charge. The resultant force is  $+6\text{N}$ . What is the charge of the unknown sphere? **(13.33 $\mu\text{C}$ )**
14. The moon is about 382500 km from the Earth (give or take depending on its orbit). Would a 1000kg object be pulled to the moon or the Earth if it is  $3.725 \times 10^8\text{m}$  from the Earth's surface? **(moon)**
15. A small sphere is given a charge of  $-17\mu\text{C}$ , and a second identical sphere is given a charge of  $+37\mu\text{C}$ . If the two spheres are 254mm apart, find the force between the two spheres. **(87.75N)**
16. If the two spheres in question 14 are allowed to touch and then separated, what force will exist between the two spheres when they are 50.8cm apart? **(3.49N)**
17. Three charged spheres are located at the vertices of a right triangle. Charge A ( $76\mu\text{C}$ ) is at (0,80); charge B ( $96\mu\text{C}$ ) is at (0,0); charge C ( $-80\mu\text{C}$ ) is at (-60,0). All distances are in centimeters. Determine the resultant force on A. **(67N at 119.16°)**
18. Determine the magnitude and direction of the electric field intensity at point P given the following coordinates : (Coordinates are in cm)  
Point P (20,20)  
Source 1:  $+25\mu\text{C}$  (40,5)  
Source 2:  $-50\mu\text{C}$  (-10,0)  
(Show all you work) **(147N at 322.74°)**