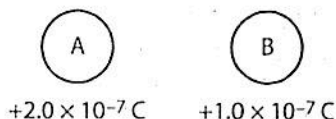


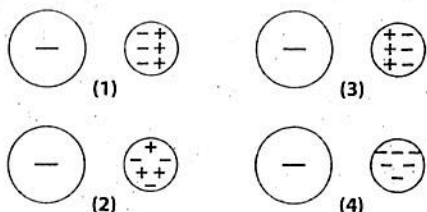
# Electrostatics

3. State *both* the sign and magnitude of the charge on a proton, an electron, and a neutron in terms of  $e$ , the elementary charge.
4. The diagram below represents two electrically charged identical-sized metal spheres, A and B.



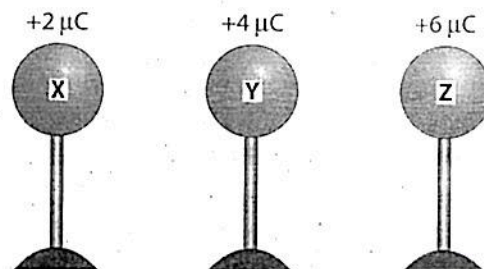
If the spheres are brought into contact, which sphere will have a net gain of electrons?

- (1) A, only                                      (3) both A and B  
 (2) B, only                                      (4) neither A nor B
5. A small, uncharged metal sphere is placed near a large, negatively charged sphere. Which diagram best represents the charge distribution of the smaller sphere?



6. Which net charge could be found on an object?
- (1)  $8.00 \times 10^{-20} \text{ C}$   
 (2)  $2.40 \times 10^{-19} \text{ C}$   
 (3)  $3.20 \times 10^{-19} \text{ C}$   
 (4)  $6.25 \times 10^{-18} \text{ C}$
7. A positively charged glass rod attracts object X. The net charge of object X
- (1) may be zero or negative  
 (2) may be zero or positive  
 (3) must be negative  
 (4) must be positive
8. After two neutral solids, A and B, were rubbed together, Solid A acquired a net negative charge. Solid B, therefore, experienced a net
- (1) loss of electrons  
 (2) increase of electrons  
 (3) loss of protons  
 (4) increase of protons
9. A rod and a piece of cloth are rubbed together. If the rod acquires a charge of  $+1 \times 10^{-6}$  coulomb, the cloth acquires a charge of
- (1) 0 C                                      (3)  $-1 \times 10^{-6} \text{ C}$   
 (2)  $+1 \times 10^{-6} \text{ C}$                       (4)  $+1 \times 10^{+6} \text{ C}$
10. Two identical spheres, A and B, carry charges of +6 microcoulombs and  $-2$  microcoulombs, respectively. If these spheres touch, what will be the resulting charge on sphere A?

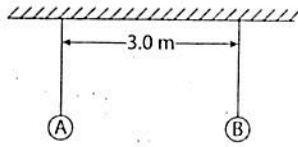
11. The diagram below shows the initial charges and positions of three identical metal spheres, X, Y, and Z, which have been placed on insulating stands. All three spheres are simultaneously brought into contact with each other and then returned to their original positions.



Which statement best describes the charge of the spheres after this procedure is completed?

- (1) All the spheres are neutral.  
 (2) Each sphere has a net charge of  $+4 \mu\text{C}$ .  
 (3) Each sphere retains the same charge that it had originally.  
 (4) Sphere Y has a greater charge than sphere X or sphere Z.
12. Two oppositely charged metal spheres are brought toward each other. Which graph best represents the relationship between the magnitude of the electrostatic force one sphere exerts on the other sphere and the distance between their centers?
- 
13. The electrostatic force of attraction between two small spheres that are 1.0 meter apart is  $F$ . If the distance between the spheres is decreased to 0.5 meter, the electrostatic force will be
- (1)  $\frac{F}{2}$                                       (3)  $\frac{F}{4}$   
 (2)  $2F$                                       (4)  $4F$
14. Two identical small spheres possessing charges  $q_1$  and  $q_2$  are separated by distance  $r$ . Which change would produce the greatest increase in the magnitude of the electrostatic force that one sphere exerts on the other?
- (1) doubling charge  $q_1$   
 (2) doubling  $r$   
 (3) doubling  $r$  and charge  $q_1$   
 (4) doubling  $r$  and charges  $q_1$  and  $q_2$

15. The diagram below shows two metal spheres suspended by strings and separated by a distance of 3.0 meters. The charge on sphere A is  $+5.0 \times 10^{-4}$  coulomb, and the charge on sphere B is  $+3.0 \times 10^{-5}$  coulomb.



What forces does sphere A exert on sphere B?

- (1) an attractive gravitational force and a repulsive electrostatic force of 15 N
- (2) an attractive gravitational force and a repulsive electrostatic force of 45 N
- (3) a repulsive gravitational force and an attractive electrostatic force of 15 N
- (4) a repulsive gravitational force and an attractive electrostatic force of 45 N

16. If the charge is doubled on each of two small spheres having a fixed distance between their centers, the magnitude of the electrostatic force that one sphere exerts on the other will be

- (1) halved
- (2) doubled
- (3) quartered
- (4) quadrupled

17. A point charge A of  $+3.0 \times 10^{-7}$  coulomb is placed  $2.0 \times 10^{-2}$  meter from a second point charge B of  $+4.0 \times 10^{-7}$  coulomb. Calculate the magnitude of the electrostatic force that charge A exerts on charge B.

## Review Questions

1. What is the charge of a proton?

- (1)  $9.11 \times 10^{-31}$  C
- (2)  $1.67 \times 10^{-27}$  C
- (3)  $1.60 \times 10^{-19}$  C
- (4)  $6.25 \times 10^{18}$  C

2. A charge of 100 elementary charges is equivalent to

- (1)  $1.60 \times 10^{-21}$  C
- (2)  $1.60 \times 10^{-17}$  C
- (3)  $6.25 \times 10^{16}$  C
- (4)  $6.25 \times 10^{20}$  C

116 · Topic 4: Electricity and Magnetism

is zero.