Module 1: Electric charges and forces

Q1. Which of the following statements regarding the electric force is incorrect?

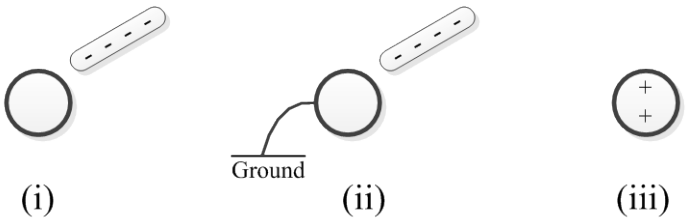
A between a proton and an electron is much stronger than the gravitational force between them (Correct statement, $F_e = k\frac{q_p q_e}{r^2}$ where k = 9×10^{9} Nm^2/C^2, $q_p = q_e = 1.6\times10^{-19}$ C and $F_g = G\frac{m_p m_e}{r^2}$ where G = 6.67×10^{-11} Nm^2/kg^2, $m_p = 1.67\times10^{-27}$ kg & $m_e = 9.11\times10^{-31}$ kg)

B decreases with the inverse of the square of the distance between two charged particles (Correct statement, $F_e = k\frac{q_p q_e}{r^2}$)

C between two electrons separated by a distance d is larger than that between two protons **(BRAVO! an electron carries the same amount of charge as a proton)**

D may be either repulsive or attractive (Correct statement, review lecture 1.2_Electric Force)

Q2. A negatively charged rod is placed close to an isolated metal ball as shown in (i). After grounding the opposite side of the ball for a short time (ii), the ball becomes positively charged (iii). Based on this information, which of the following statement regarding conductor is true?



A both positive and negative charges move freely (False, review properties of conductors)

B only positive charges move freely (False, review properties of conductors)

C only negative charges move freely (We can't reach this conclusion by this experiment)

D we can't conclude anything **(BRAVO! the same result is achieved regardless of whether the charge carriers are positive or negative or both)**

Q3. The total amount of charge before and after a reaction involving charged particles, is always the same. This principle is based on

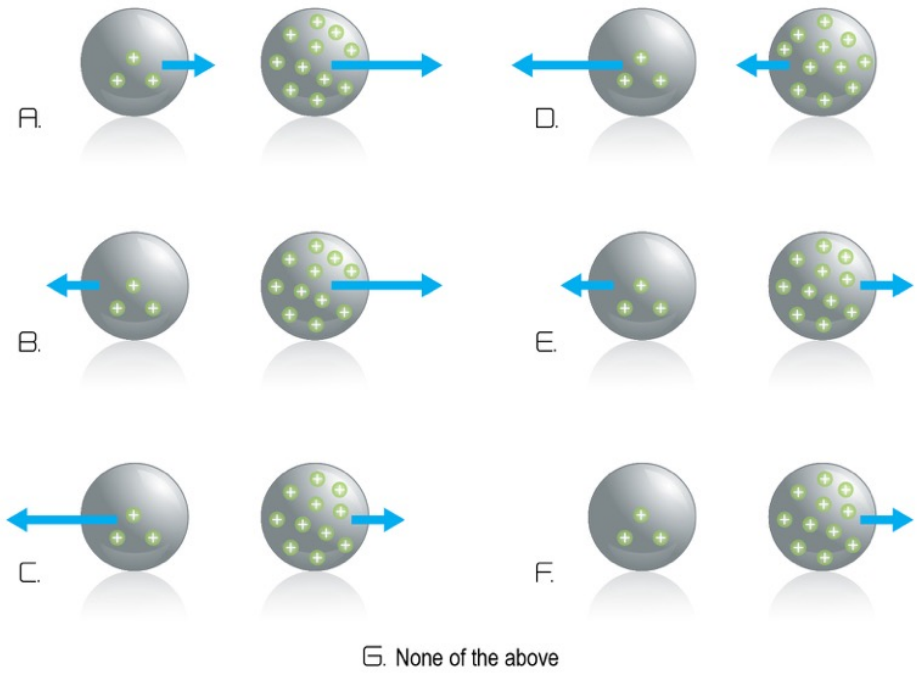
A quantization of charge (False, review properties of charges)

B conservation of charge **(BRAVO!)**

C the law of motion (False, not related to motion of the particles)

D conservation of energy (False, review properties of charges)

Q4. Which of the following diagrams correctly represents the magnitude and direction of the electric forces acting on each of the charged spheres?



A, B, C, D, F, G (Incorrect, review lecture 1.2_Electric Force)

E **(BRAVO! like charges repel each other)**

Q5. If the electric charge on each of two charged particles is doubled, the electric force between the two charges would be

A the same as before (False, review lecture 1.2_Electric Force)

B doubled (False, review lecture 1.2_Electric Force)

C quadrupled **(BRAVO!** $\boldsymbol{F = k\frac{q_1 q_2}{r^2}}$ **)**

D none of the above (False, review lecture 1.2_Electric Force)

Q6. Which of the following are the correct expressions for the electrical forces experienced by the positive charge q:

	Force due to +Q	Force due to -Q
A	$kQ^2/4d^2$	$-kQ^2/2d^2$
B	$kQ^2/16d^2$	$kQ^2/4d^2$
C	$kQq\ \ /16d^2$	$-kQq\ \ /4d^2$
D	$kQq\ \ /4d^2$	$-kQq\ \ /4d^2$

A, B, D (Incorrect, review 1.2.1_Force Easy Example)

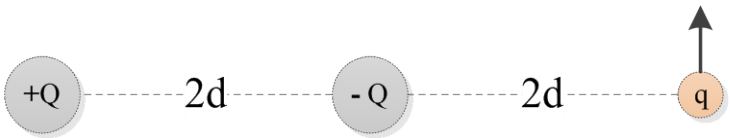
C **(BRAVO!)**

Q7. The net electric force experienced by the positive charge q due to both +Q and –Q is

A The net force is pointing to the left **(BRAVO!)**

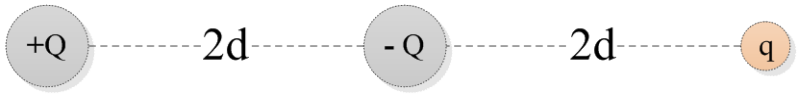
B There net force is zero (Incorrect, review 1.2.1_Force Easy Example)

C The net force is pointing up (Incorrect, review 1.2.1_Force Easy Example)



D The net force is pointing to the right (Incorrect, review 1.2.1_Force Easy Example)

Q8. In the following diagram, if Q = 2 C, q = 1 C and d = 1 m, what is the value of the net force experienced by q:



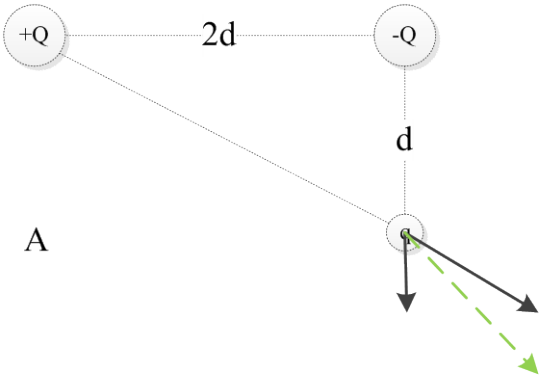
A 0 N (Incorrect, review 1.2.1_Force Easy Example)

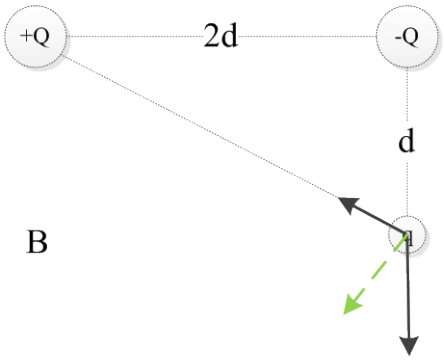
B -3k/8 N **(BRAVO!)**

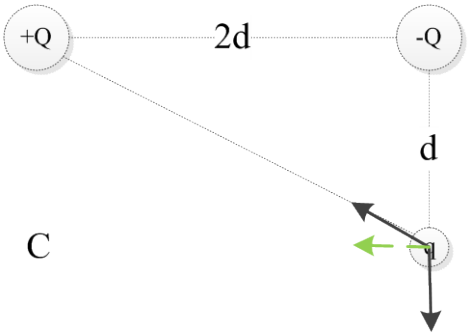
C -k/2 N (Incorrect, review 1.2.1_Force Easy Example)

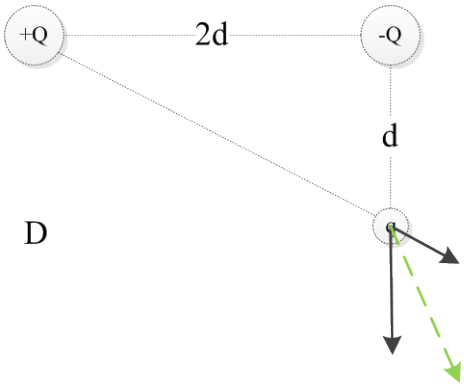
D k/2 N (Incorrect, review 1.2.1_Force Easy Example)

Q9. Select the diagram that correctly represents the individual forces experienced by the **negative** charge q, as well as the net force (---->) on it:





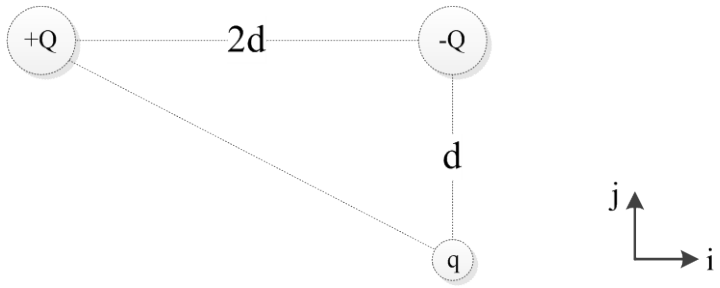




A, C, D **(**Incorrect, review 1.2.1_Force Easy Example)

B **(BRAVO!)**

Q10. What is the magnitude of the net force on the **negative** charge q:



A $kQq/d^2(0.821\,j)$ N (Incorrect, review 1.2.1_Force Easy Example)

B $kQq/d^2(-0.894\,i + 0.911j)$ N (Incorrect, review 1.2.1_Force Easy Example)

C $kQq/d^2(-0.179\,i - 0.553j)$ N (Incorrect, review 1.2.1_Force Easy Example)

D $kQq/d^2(-0.179\,i - 0.911j)$ N **(BRAVO!)**