3RD HIGH SCHOOL PHYSICS – CHAPTER 1

QUESTION 1

Fill in the missing words from the following text so that the resulting sentences are scientifically correct:

a. Between two charged bodies is exerted either ……………………. power either ……………………. power. Two charged bodies interact without necessarily being in ……………………. between them. The electric force acts from ……………………………. .

[distance, attractive, contact, repulsive]

b. Two types of charged bodies occur in nature, the …………………… and the …………………………. charged. Two ……………………. charged bodies repel, while two …………………………. charged bodies attract.

[homonyms, positive, antonyms, negative]

c. When a material is charged by contact throughout its entire extent we call it ……………………………, while when it is charged only locally we call it ………… ………. . Plastic and glass are …………………., while metals are ……………………. The ……………………. allow the movement of charged particles inside them, while the ……………………………. No.

[conductor, insulator, conductors, insulators]

QUESTION 2

In the following questions, choose the letter that corresponds to the correct answer:

A. Atoms are electrically neutral because they consist of equal numbers of protons and electrons which
a. they have no electric charge
b. have the same electric charge
c. have opposite electrical charges
d. are fewer than neutrons

B. Friction loading is achieved by convection
a. only protons
b. only electrons
c. and protons and electrons
d. only neutrons

C. Rub an ebonite rod vigorously with a silk or woolen cloth. The load that the rod will acquire is:
a. a few coulombs (C)
b. a few millimeters of Coulomb (C)
c. a few millionths of a Coulomb (C)
d. a few billionths of a Coulomb (C)

QUESTION 3

In the following questions, choose the letter that corresponds to the correct answer:

A. Rub a glass rod with silk cloth. The rod is positively charged because:
 a. picked up charged particles from the atmosphere
 b. protons were transferred from the fabric to the rod
 c. electrons were transferred from the rod to the fabric
 d. the electrons of the rod were converted due to friction into protons.

B. Two insulated metal spheres have charges of 2 μ C and 3 μ C respectively. We bring them into contact and remove them, making sure they remain electrically isolated from their environment. Based on the principle of conservation of electric charge after their contact the spheres have charges respectively:
 a. 2 μ C and 2 μ C ,
 b. 1 μC and 4 μC ,
 c. 5 μC and 1 μC ,
 d. 3 μ C and 3 μ C .

QUESTION 4

Two positively charged spheres are placed a certain distance apart. Mark with Σ the sentences whose content is scientifically correct and with Λ those whose content is scientifically incorrect.

a. The electric forces between the spheres are repulsive.

b. The magnitude of the force exerted by the first sphere on the second is equal to the magnitude of the force exerted by the second on the first.

c. When we increase the distance between the spheres, the forces increase.

d. When we halve the distance between the spheres, the forces quadruple.

e. When we double the distances of the spheres, the forces remain constant.

f. When we double the charge on a sphere, the forces double.

g. When we double the charge on both spheres, the forces quadruple.

QUIZ

1. How many types of cargo are there in nature?
   3
   1
   2

2. If I approach two magnets, an electric force is exerted between them.
   Right
   Error

3. If I bring a magnet near the electric pendulum, it is repelled.
   Error
   Right

4. The different types of cargo are called
   Positive negative
   Up and down
   North South

5. If I approach these two identically charged bodies
   does not affect each other
   they are attracted
   they repel each other

6. If I bring a charged rod near the electric pendulum it will
   is attracted
   is repelled
   it stays still
   depending on its charge it is attracted or repelled

7. Which of the following measurement units measures load?
   1mA
   1µC
   1V

8. Electric charge is denoted by
   q
   f
   C

9. 1µC=
   $10^{-6}C$
   $10^{6}C$
   $10^{-9}C$

10. A charge of +5µC and a charge of -8µC have a total charge of:
    -13 µC
    -3 µC
    3 µC
    13 µC

11. The atom is the smallest particle in nature.
    Error
    Right

12. The mass of protons is about the same as the mass of
    of neutrons
    of electrons
    none of the other particles

13. At the core they are
    protons and neutrons
    protons and electrons
    neutrons and electrons

14. They have a positive charge
    protons
    neutrons
    electrons

15. In an electrically neutral atom, there are as many protons as
    electrons
    neutrons
    none of the above

16. Ions are
    electrically neutral atoms
    subatomic particles
    individuals who have shed or gained electrons

17. Charging is sometimes achieved by proton transfer and sometimes by electron transfer
    Right
    Error

18. Due to which property of the charge, the charge 4 10-19 C cannot exist in nature?
    Of charging
    The principle of conservation of charge
    The quantization of the charge

19. With friction two initially uncharged bodies acquire an equal and opposite charge due to it
    The quantization of the charge
    The principle of conservation of charge
    Of induction

20. Which bodies allow the charge to be spread over their entire length?
    The insulators
    The conductors
    None of the above

21. The value of the ratio constant K in Coulomb's law is $K=9 \ 10^{9} \ N \ m^{2}/C^{2}$
    Right
    Error

22. I bring my finger to a charged straw and it comes closer. This way of electrification is called
    electrification
    with friction
    by induction
    with contact

23. Two small spheres are attracted by a force F. What will happen to the force when I double the
    charge on one?
    will quadruple
    will be doubled
    will sub-quadruple
    will double
    will remain constant

24. Two small spheres are attracted by a force F. What will happen to the force when I double
    their distance?
    will be doubled
    will sub-quadruple
    will remain constant
    will double
    will quadruple

25. Two small spheres are attracted by a force F. What will happen to the force when I double the
    charge on both spheres?
    will remain constant
    will be doubled
    will sub-quadruple
    will double
    will quadruple

26. Two small spheres are attracted by a force F. What will happen to the force when I quadruple
    the charge on one sphere and double their distance?
    will sub-quadruple
    will be doubled
    will quadruple
    will remain constant
    will double

27. Two metal spheres A and B are charged with charges of -1μC and +4μC respectively. Their
    centers are 2m apart. How much force does one exert on the other?
    4 10 $^{-3}$
    9 10 ^{9}
    0.009N

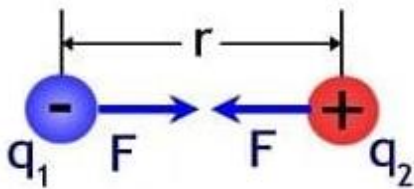# 3RD HIGH SCHOOL PHYSICS – CHAPTER 1

EXERCISE 1

Two metal spheres A and B are charged with charges of -1µ C and _4µ C respectively and are placed 2 m apart .
Draw the electric force exerted by one sphere on the other and calculate its value.

Solution

Data
q_1 = -1 µ C
q_2 = +4m C
r = 2 m
Wanted
F = ;

We start by converting the unit of measurement from µC to C (Coulomb) .

$$q_1 = -1\mu C = -10^{-6}C$$
$$q_2 = 4\mu C = 4 \cdot 10^{-6}C$$

Coulomb law equation .
$$F = K\frac{q_1 q_2}{r^2}$$

Since we are looking for the magnitude of the force, we do not consider the signs.

$$F = K\frac{|q_1 q_2|}{r^2} = 9 \cdot 10^9 \frac{10^{-6} \cdot 4 \cdot 10^{-6}}{2^2}N = \frac{9 \cdot 4 \cdot 10^{9-6-6}}{4}N = 9 \cdot 10^{-3}N$$

Based on Newton's 3rd law, the force exerted by the first load on the second is of equal magnitude and opposite direction to the force exerted by the second on the first.

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EXERCISE 2

Two electric charges are separated by r_1 = 24 cm . They are attracted by an electric force of magnitude F_1 = 0.036 N.
At what distance r_2 must they be placed so that the force between them becomes F_2 = 0.004 N ?

Solution

Data
r_1 = 24 cm
F_1 = 0.036N
F_2 = 0.004N

Wanted
r_2 = ;

Coulomb's law to each case:

$$F_1 = k \cdot \frac{q_1 \cdot q_2}{r_1{}^2}$$

$$F_2 = k \cdot \frac{q_1 \cdot q_2}{r_2{}^2}$$

I divide by members

$$\frac{F_1}{F_2} = \frac{0{,}036N}{0{,}004N} \quad \rightarrow \quad \frac{k \cdot \dfrac{q_1 \cdot q_2}{r_1{}^2}}{k \cdot \dfrac{q_1 \cdot q_2}{r_2{}^2}} = 9 \quad \rightarrow \quad \frac{r_2{}^2}{r_1{}^2} = 9 \quad \rightarrow \quad \frac{r_2}{r_1} = 3 \quad \rightarrow r_2 = 3 \cdot r_1$$

That is, they must be separated by three times the distance.