حل أوراق عمل الدرس الثاني charges Electric الشحنات الكهربائية من الوحدة الأولى

تاريخ إضافة الملف على موقع المناهج: 2024-10-10 11:24:55

المزيد من مادة فيزياء:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

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المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة فيزياء في الفصل الأول

1	ملخص وتدريبات الوحدة الثالثة potential Electric الجهد الكهربائي
2	حل أوراق عمل الدرس الأول energy Potential Electric الطاقة الكامنة الكهربائية من الوحدة الثالثة
3	حل أوراق عمل الدرس الثاني charges Electric الشحنات الكهربائية من الوحدة الأولى
4	ملخص الوحدة الثانية المجالات الكهربائية وقانون جاوس الجزء الثالث

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة فيزياء في الفصل الأول

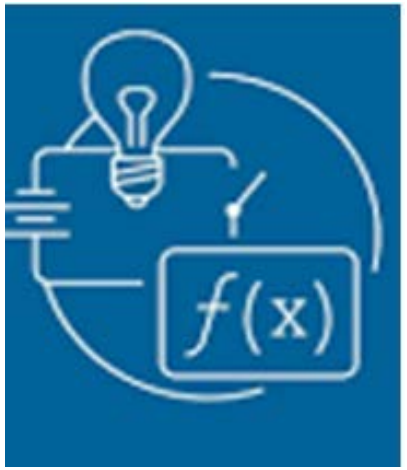
5	ملخص الوحدة الثانية المجالات الكهربائية وقانون جاوس الجزء الثاني

G12 ADV Physics :
Electricity and Magnetism

مؤسسة الإمارات للتعليم المدرسي
EMIRATES SCHOOLS ESTABLISHMENT

unit 1 | *Electrostatics*

2. Electric Charges



Mutasem Jarwan

Learning objectives:

Textbook Chapter	Ch 1 - Electrostatics

Performance Indicators	*Electric Charge*
	1- Identify the two types of electric charge in nature- positive and negative 2- Describe the electrical properties of the particles inside an atom 3- Distinguish between being electrically neutral, negatively charged, and positively charged, and identify excess charge 4- Identify conduction electrons and explain their role in making a conducting object negatively or positively charged 5- State and demonstrate the law of electric charges-unlike charges attract and like charges repel 6- Identify the unit of electric charge as coulomb (C) 7- Identify the elementary charge 8- State the law of conservation of charges 9- Solve problems related to how charge is conserved 10- Show that charges are quantized 11- Solve problems related to how charge is quantized

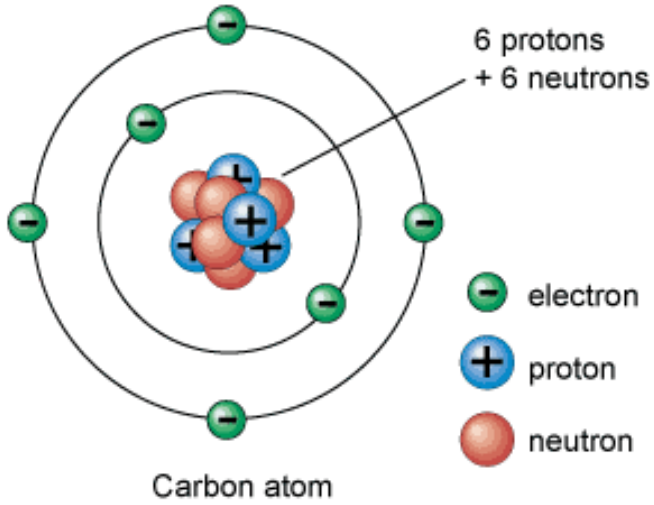
The Structure of Atom

Describe the electrical properties of the particles inside an atom

All matters consist of atoms, atom is responsible for chemical and electrical properties.

Each atom is composed of:

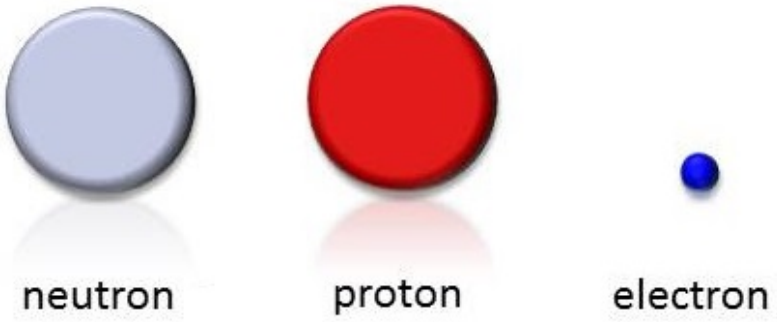
protons	positive charge (+)	mass: 1.673×10^{-27} kg
neutrons	no charge, neutral (0)	mass: 1.675×10^{-27} kg
electrons	negative charge (–)	mass: 9.109×10^{-31} kg



In normal situation, atoms are neutral, because number of electrons equal to number of protons.

Electrons are the least mass particle, so they are most able to move and escape from atom.

Acquiring a charge is a process of transferring electrons.



Identify the two types of electric charge in nature- positive and negative

Neutral object: the number of electrons and number of protons are equal.

Positively charged object: the number of electrons is less than the number of protons.

Negatively charged object: the number of electrons is greater than the number of protons.

There are two types of charges:

Positive charge: when object loses electrons.

Negative charge: when object gains electrons.

conventionally, electron has a negative charge

Type of charges

Note:

charge is a scalar quantity, so the negative sign of charge represents the type of charge not its direction. Moreover, the sign is not satisfied to calculate vector quantities (such as force and field). However, it is satisfied to calculate scalar quantities (such as potential energy and voltage).

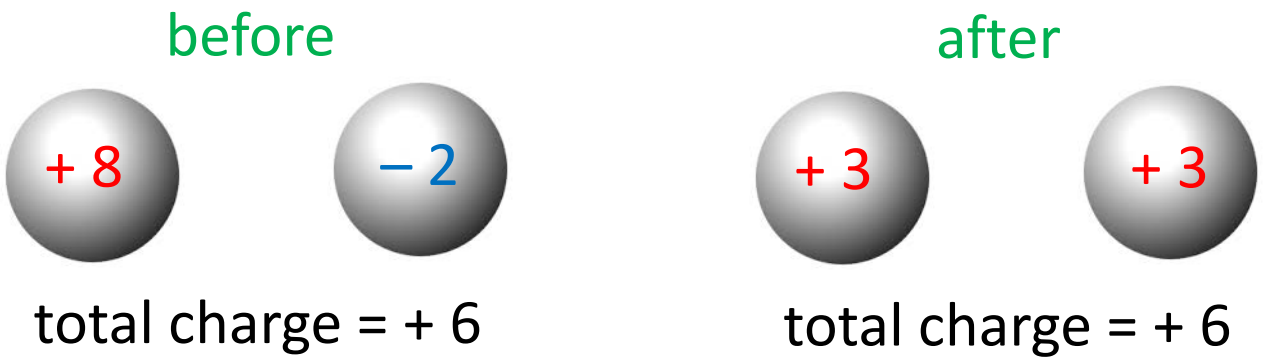
Distinguish between being electrically neutral, negatively charged, and positively charged, and identify excess charge

Conservation of Charge:

"charges cannot be created nor destroyed, rather transfer from atom to another."

This indicates when an object loses some electrons there is another object gains these electrons.

As two charged objects are in contact, the charges transferred between them, till both objects have the same potential difference.
If the two objects have the same volume (size), they will have the same amount of charge.



two identical objects (same size) have same charge after connected.

Identify the unit of electric charge as coulomb (C)
State the law of conservation of charges

Quantization of Charge:

"charges transfer as a multiple of the charge of electron."

This indicates that there is a smallest amount of charge, which no object can have less charge than this, and, therefore, the charge on any object must be an integer multiple of this amount (cannot be fractions).

The smallest amount of charge is the elementary charge which is the charge of electron.

$$q = \pm n q_e$$

q: amount of charge (C)
q_e: elementary charge (C)
n: number of charges (#)

$$q_e = 1.6 \times 10^{-19}\ \text{C}$$

Charge of proton = + q_e
Charge of electron = – q_e

Charge: is a property of subatomic particles. It is scalar quantity.

Ex: How many electrons have been removed from a positively charged electroscope if it has a net charge of 9.612×10^{-11} C?

$$q = \pm n q_e \quad \Rightarrow 9.612\times 10^{-11} = -n(-1.602\times 10^{-19}) \quad \Rightarrow n = \frac{9.612\times 10^{-11}}{1.602\times 10^{-19}} \quad \Rightarrow n = 6\times 10^{8}\ electrons$$

Ex: What is the charge on an electroscope that has an excess of 4.8×10^{10} electrons?

$$q = \pm n q_e \quad \Rightarrow q = -(4.8\times 10^{10})(-1.602\times 10^{-19}) \quad \Rightarrow q = -7.7\times 10^{-9}\ \mathrm{C}$$

Ex: is it possible to find an object with a net charge of $3\times 10^{-19}\ C$?

$$n = \frac{q}{q_e} \quad \Rightarrow n = \frac{3\times 10^{-19}}{1.602\times 10^{-19}} \quad \Rightarrow n = 1.87\ electrons$$

No, because Electric charge is quantized, the number of electrons can't be a fraction

Ex: A piece of a metal with a charge of (-6.4C) contains $(2.0 \times 10^{20}$ protons). What is the number of electrons in this piece?

A- 1.6×10^{20} electron

B- 2.0×10^{20} electron

C- 4.0×10^{19} electron

D- 2.4×10^{20} electron

$$q = (N_e - N_p)q_e$$

$$-6.4 = -(N_e - 2.0 \times 10^{20})(1.602 \times 10^{-19})$$

$$\frac{6.4}{1.602 \times 10^{-19}} = (N_e - 2.0 \times 10^{20})$$

$$0.4 \times 10^{20} = (N_e - 2.0 \times 10^{20})$$

$$N_e = 2.0 \times 10^{20} + 0.4 \times 10^{20}$$

$$N_e = 2.4 \times 10^{20}$$

Q1.30 How many electrons are required to yield a total charge of 1.00 C?

$$q = \pm n q_e \quad \Rightarrow 1 = -n(-1.602 \times 10^{-19}) \quad \Rightarrow n = \frac{1}{1.602 \times 10^{-19}} \quad \Rightarrow n = 0.624 \times 10^{19}\ electrons$$

Practice question

Ex: An object has a net positive charge. Which statement is correct about the object:

(A) The object had gained protons.

(B) The object had lost electrons.

(C) The object had lost neutrons.

(D) The object has only protons inside it.

Ex: The particle which is responsible for an object charge is:

(A) proton

(B) neutron

(C) electron

(D) atom

Ex: Which of the following is incorrect amount of charge:

(A) 8.0×10^{-20} C

(B) 1.6×10^{-19} C

(C) 6.4×10^{-19} C

(D) 1.6×10^{-16} C

$$n = \frac{q}{q_e} = \frac{8 \times 10^{-20}}{1.6 \times 10^{-19}} = 0.5\ electrons$$

Q1.1 When a metal plate is given a positive charge, which of the following is taking place?

a) Protons (positive charges) are transferred to the plate from another object.

b) Electrons (negative charges) are transferred from the plate to another object.

c) Electrons (negative charges) are transferred from the plate to another object, and protons (positive charges) are also transferred to the plate from another object.

d) It depends on whether the object conveying the charge is a conductor or an insulator.