9th Science Lesson 4 Questions in English

4] Electric Charge And Electric Current

1. Which of the following statement is correct?

1) Atoms have particles like electrons, protons and neutrons.
2) Neutrons has both positive and negative charge
3) An electric current consists of moving electric charges.

a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

Like mass and length, electric charge also is a fundamental property of all matter. We know that matter is made up of atoms and molecules. Atoms have particles like electrons, protons and neutrons. By nature, electrons and protons have negative and positive charge respectively and neutrons do not have charge. An electric current consists of moving electric charges. Electricity is an important source of energy in the modern times.

2. Which of the following are present in a nucleus of an atom?

1) Electron
2) Neutron
3) Proton

a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

Inside each atom there is a nucleus with positively charged protons and chargeless neutrons and negatively charged electrons orbiting the nucleus. Usually there are as many electrons as there are protons and the atoms themselves are neutral.

3. Assertion (A): An electron is removed from the atom is called a positive ion.

Reason (R): If an electron is removed from the atom, the atom becomes positively charged

a) Both (A) and (R) are correct, but (R) does not explain (A)

b) Both (A) and (R) are wrong

c) **Both (A) and (R) are correct and (R) explains (A)**

d) (A) is Correct and (R) is wrong

Explanation

If an electron is removed from the atom, the atom becomes positively charged. Then it is called a positive ion. If an electron is added in excess to an atom then the atom is negatively charged and it is called negative ion.

4. When the comb is rubbed against hair which of the following acquires negative charge?

a) Hair
b) Comb
c) Both a and b
d) None

Explanation

When you rub a plastic comb on your dry hair, the comb obtains power to attract small pieces of paper, is it not? When you rub the comb vigorously, electrons from your hair leave and accumulate on the edge of the comb. Your hair is now positively charged as it has lost electrons and the comb is negatively charged as it has gained electrons.

5. Which of the following statement is correct?

1) Electric charge is measured in coulomb and the symbol for the same is C
2) The charge of an electron (represented as e) is the fundamental unit with a charge equal to 1.6 × 10^19 C.
3) Any charge (q) has to be an integral multiple (n) of this fundamental unit of electron charge (e).
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

Electric charge is measured in coulomb and the symbol for the same is C. The charge of an electron is numerically a very tiny value. The charge of an electron (represented as e) is the fundamental unit with a charge equal to 1.6 × 10^−19 C. This indicates that any charge (q) has to be an integral multiple (n) of this fundamental unit of electron charge (e). q = ne. Here, n is a whole number.

6. How many electrons will be there in one coulomb of charge?

a) 1.6 x 10^-19
b) 6.25 x 10^18
c) 6.25 x 10^20

d) 6.25 x 10^28

Explanation

Problem 1

How many electrons will be there in one coulomb of charge?

Solution:

Charge on 1 electron, $e = 1.6 \times 10^{-19}$ C

$q=ne$ or $n=q/e$

∴ number of electrons in 1 coulomb

$$= \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18} \text{ electrons}$$

7. Electrostatic forces between two-point charges obey____

a) **Newton's third law**
b) Newton's second law
c) Newton's first law
d) Coulomb's law

Explanation

Electrostatic forces between two-point charges obey Newton's third law. The force on one charge is the action and on the other is reaction and vice versa.

8. Which of the following statement is correct?

1) Electric charge is additive in nature
2) Practically, we have µC (micro coulomb), nC (nano coulomb) and pC (pico coulomb) as units of electric charge.
    a) 1 alone
    b) 2 alone
    c) 1, 2
    d) None

Explanation

Practically, we have µC (micro coulomb), nC (nano coulomb) and pC (pico coulomb) as units of electric charge. 1 µC = 10-6 C, 1nC=10-9 and 1pC = 10-12C Electric charge is additive in nature. The total electric charge of a system is the algebraic sum of all the charges located in the system. For example, let us say that a system has two charges +5C and −2C. Then the total or net charge on the system is, (+5C) + (−2C) = +3C.

9. Assertion(A): Two charges are not in contact they experience electric force

Reason(R): Electric force can be experienced even when the charges are not in contact.

a) Both (A) and (R) are correct, but (R) does not explain (A)

b) Both (A) and (R) are wrong

c) **Both (A) and (R) are correct and (R) explains (A)**

d) (A) is Correct and (R) is wrong

Explanation

Among electric charges, there are two types of electric force (F): one is attractive and the other is repulsive. The like charges repel and unlike charges attract. The force existing between the charges is called as 'electric force'. These forces can be experienced even when the charges are not in contact.

10. Which of the following statement is correct?

1) The region in which a charge experiences electric force forms the 'electric field' around the charge
2) The direction of the electric field is the direction of the force that would act on a small positive charge
3) The electric lines of force are straight or curved paths along which a unit positive charge tends to move in the electric field.
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

The region in which a charge experiences electric force forms the 'electric field' around the charge. Often electric field (E) is represented by lines and arrowheads indicating the direction of the electric filed. The direction of the electric field is the direction of the force that would act on a small positive charge. Therefore, the lines representing the electric field are called 'electric lines of force'. The electric lines of force are straight or curved paths along which a unit positive charge tends to move in the electric field. Electric lines of force are imaginary lines.

11. For an isolated negative charge electric lines of force are radially_____

a) Outwards
b) Inwards
c) Around it
d) None

Explanation

The strength of an electric field is represented by how close the field lines are to one another. For an isolated positive charge, the electric lines of force are radially outwards and for an isolated negative charge they are radially inwards.

12. _____at a point is a measure of force acting on a unit positive charge placed at that point.

a) Electric wave
b) Electric charge
c) Electric field
d) All the above

Explanation

Electric field at a point is a measure of force acting on a unit positive charge placed at that point. A positive charge will experience force in the direction of electric field and a negative charge will experience in the opposite direction of electric field.

13. _____ is a measure of the work done on unit positive charge to bring it to that point against all electrical forces

a) Electric charge
b) Electric current
c) Electric potential
d) Electric field

Explanation

Though there is an electric force (either attractive or repulsive) existing among the charges, they are still kept together. We now know that in the region of electric charge there is an electric field. Other charges experience force in this field and vice versa. There is a work done on the charges to keep them together. This results in a quantity called 'electric potential'. Electric potential is a measure of the work done on unit positive charge to bring it to that point against all electrical forces.

14. Which of the following statement is correct?

1) When the charged object is provided with a conducting path, electrons start to flow through the path from lower potential to higher potential region
2) Potential difference is produced by a cell or battery.
3) Electric current is formed by moving electrons.

a) 1, 2
b) 1, 3
c) 2, 3

d) All the above

Explanation

When the charged object is provided with a conducting path, electrons start to flow through the path from higher potential to lower potential region. Normally, the potential difference is produced by a cell or battery. When the electrons move, we say that an electric current is produced. That is, an electric current is formed by moving electrons.

15. Assertion(A): In electrical circuits the positive terminal is represented by a long line and negative terminal as a short line

Reason(R): The movement of the positive charge is called as 'conventional current'

a) **Both (A) and (R) are correct, but (R) does not explain (A)**

b) Both (A) and (R) are wrong

c) Both (A) and (R) are correct and (R) explains (A)

d) (A) is Correct and (R) is wrong

Explanation

Before the discovery of the electrons, scientists believed that an electric current consisted of moving positive charges. Although we know this is wrong, the idea is still widely held, as the discovery of the flow of electrons did not affect the basic understanding of the electric current. The movement of the positive charge is called as 'conventional current'. The flow of electrons is termed as 'electron current'. In electrical circuits the positive terminal is represented by a long line and negative terminal as a short line. Battery is the combination of more than one cell.

16. Which of the following is/are unit of current?

1) A
2) V
3) Cs^-1

a) 1 alone
b) 1, 3
c) 2, 3
d) All the above

Explanation

If q is the quantity of charge passing through a cross section of a wire in time t, quantity of current (I) is represented as, I = q/t The standard SI unit for current is ampere with the symbol A. Current of 1 ampere means that there is one coulomb (1C) of charge passing through a cross section of a wire every one second (1 s). 1 ampere = 1 coulomb / 1 second (or) 1 A = 1 C / 1 s = 1Cs^-1.

17. _____ is an instrument used to measure the strength of the electric current

a) Ammeter
b) Voltmeter
c) Galvanometer
d) All the above

Explanation

Current is the rate at which charges flow past a point on a circuit. Ammeter is an instrument used to measure the strength of the electric current in an electric circuit.

18. Ammeter should be connected_____ in a circuit

a) Parallel
b) Series
c) Anywhere
d) Near to battery/cell only

Explanation

The ammeter is connected in series in a circuit where the current is to be found. The current flows through the positive (+) red terminal of ammeter and leaves from the negative (–) black terminal.

19. If, 25 C of charge is determined to pass through a wire of any cross section in 50 s, what is the measure of current?

a) 1 A
b) 0.5 A
c) 5 A
d) 50 A

Explanation

Problem 2

If, 25 C of charge is determined to pass through a wire of any cross section in 50 s, what is the measure of current?

Solution:

$I = q / t = (25\ C) / (50\ s) = 0.5\ C/s = 0.5\ A$

20. The current flowing through a lamp is 0.2A. If the lamp is switched on for one hour, what is the total electric charge that passes through the lamp?

a) 72 C
b) 720 C
c) 7.2 C
d) 0.72 C

Explanation

Problem 3

The current flowing through a lamp is 0.2A. If the lamp is switched on for one hour, what is the total electric charge that passes through the lamp?

Solution:

$I = q / t; q = I \times t$

$1hr = 1 \times 60 \times 60\ s = 3600\ s$

$q = I \times t = 0.2\ A \times 3600\ s = 720\ C$

21. Which of the following energy can be converted from electric energy?

1) Light
2) Heat
3) Mechanical

a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

One does not just let the circuit connect one terminal of a cell to another. Often we connect, say a bulb or a small fan or any other electrical device in an electric circuit and use the electric current to drive them. This is how a certain amount of electrical energy provided by the cell or any other source of electrical energy is converted into other form of energy like light, heat, mechanical and so on.

22. What is the SI unit of e.m.f?

a) V/s
b) V
c) V/m
d) qs

Explanation

For each coulomb of charge passing through the light bulb (or any appliances) the amount of electrical energy converted to other forms of energy depends on the potential difference across the electrical device or any electrical component in the circuit. The potential difference is represented by the symbol V.

V = W/q

where, W is the work done, i.e., the amount of electrical energy converted into other forms of energy measured in joule and q is amount of charge measured in coulomb. The SI unit for both e.m.f and potential difference is the same i.e., volt (V).

23. A charge of 2 x 10^4 C flows through an electric heater. The amount of electrical energy

converted into thermal energy is 5 3 10^6 J. What is the potential difference?

a) 220 V
b) 250 V
c) 440 V
d) 330 V

Explanation

Problem 5

A charge of 2×10^4 C flows through an electric heater. The amount of electrical energy converted into thermal energy is 5×10^6 J. Compute the potential difference across the ends of the heater.

Solution:

V = W/q that is 5×10^6 J / 2×10^4 C = 250 V

24. In a circuit Voltmeter should be connected in___

a) Parallel
b) Series
c) Anywhere
d) Near to battery/cell only

Explanation

Voltmeter is an instrument used to measure the potential difference. To measure the potential difference across a component in a circuit, the voltmeter must be connected in parallel to it. Note the positive (+) red terminal of the voltmeter is connected to the positive side of circuit and the negative (–) black terminal is connected to the negative side of the circuit across a component

25. Which of the following has negligible resistance to electric current flow?

1) Copper
2) Aluminium
3) Nichrome
    a) **1, 2**
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

The Resistance (R) is the measure of opposition offered by the component to the flow of electric current through it. Different electrical components offer different electrical resistance. Metals like copper, aluminium etc., have very much negligible resistance. That is why they are called good conductors. On the other hand, materials like nichrome, tin oxide etc., offer high resistance to the electric current. We also have a category of materials called insulators; they do not conduct electric current at all (glass, polymer, rubber and paper). All these materials are needed in electrical circuits to have usefulness and safety in electrical circuits.

26. Which of the following statement is correct?

1) The SI unit of resistance is ohm with the symbol (Ω).
2) The resistors can be fixed or variable
3) One ohm is the resistance of a component when the potential difference of one volt applied across the component drives a current of one ampere through it
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) **All the above**

Explanation

The SI unit of resistance is ohm with the symbol (Ω). One ohm is the resistance of a component when the potential difference of one volt applied across the component drives a current of one ampere through it. We can also control the amount of flow of current in a circuit with the help of resistance. Such components used for providing resistance are called as 'resistors'. The resistors can be fixed or variable. Fixed resistors have fixed value of resistance, while the variable resistors like rheostats can be used to obtain desired value of resistance.

27. Assertion(A): As both e.m.f and potential difference are measured in volt, they may appear the Same

Reason(R): e.m.f refers to the voltage developed across the terminals of an electrical source and potential difference refers to the voltage developed between any two points (even across electrical devices) in an electric circuit

a) Both (A) and (R) are correct, but (R) does not explain (A)

b) Both (A) and (R) are wrong

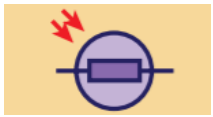
c) **Both (A) and (R) are correct and (R) explains (A)**

d) (A) is Correct and (R) is wrong

Explanation

As both e.m.f and potential difference are measured in volt, they may appear the same. But they are not. The e.m.f refers to the voltage developed across the terminals of an electrical source when it does not produce current in the circuit. Potential difference refers to the voltage developed between any two points (even across electrical devices) in an electric circuit when there is current in the circuit.

28. Match the following:

I. 

II. 

III. 

IV. 

1. Earth connector

2. Bell

3. LDR

4. Light Bulb

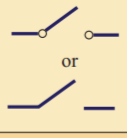
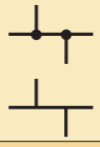
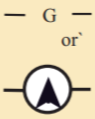
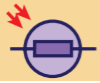
a) 2, 1, 3, 4

b) 1, 2, 4, 3

c) **3, 4, 2, 1**

d) 3, 2, 4, 1

Explanation

Symbol	Device	Symbol	Device	Symbol	Device
	Switch		Wires joined		galvanometer
	Cell		Wires crossed		ammeter
	Battery		Fixed resistor		Voltmeter
	D .c . power` supply		variable resistor` (rheostat)		Two-way switch
	A.c. power supply		fuse		Earth connector
	Light bulb		Coil of wire		capacitor
	Potentiometer		transformer		thermistor
	light-depemdent resistor (LDR)		Semiconductor diode		bell

29. Which of the following statement about series network is correct?

1) In a series circuit the components are connected one after another in a single loop
2) From the above we can know that the current I all along the series circuit remain same
3) In a series circuit the current in each point of the circuit is same
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

In a series circuit the components are connected one after another in a single loop. In a series circuit there is only one pathway through which the electric charge flow. From the above we can know that the current I all along the series circuit remain same. That is in a series circuit the current in each point of the circuit is same.

30. How many minimum loops are required for parallel circuit?

a) 1
b) 3
c) 4
d) 2

Explanation

In parallel circuits, the components are connected to the e.m.f source in two or more loops. In a parallel circuit there is more than one path for the electric charge to flow. In a parallel circuit the

sum of the individual current in each of the parallel branches is equal to the main current flowing into or out of the parallel branches. Also, in a parallel circuit the potential difference across separate parallel branches are same.

31. Which of the following are effects of electric current?

1) Heating effect
2) Chemical effect
3) Magnetic effect
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

When current flows in a circuit it exhibits various effects. The main effects are heating, chemical and magnetic effects.

32. Which of the following statement is correct?

1) When the flow of current is 'resisted' generally heat is produced
2) Work has to be done to overcome the resistance which is converted in to heat energy.
3) This conversion of electrical energy into heating energy is called 'Joule heating'
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

When the flow of current is 'resisted' generally heat is produced. This is because the electrons while moving in the wire or resistor suffer resistance. Work has to be done to overcome the resistance which is converted in to heat energy. This conversion of electrical energy into heating energy is called 'Joule heating' as this effect was extensively studied by the scientist Joule. This forms the principle of all electric heating appliances like iron box, water heater, toaster etc. Even connecting wires offer a small resistance to the flow of current. That is why almost all electrical appliances including the connecting wires are warm when used in an electric circuit.

33. The process of conduction of electric current through solutions is called_____

a) Electron transfer
b) Electrolysis
c) Electrolyte
d) All the above

Explanation

So far, we have come across the cases in which only the electrons can conduct electricity. But, here when current passes through electrolyte like copper sulphate solution, both the electron and the positive copper ion conduct electricity. The process of conduction of electric current through solutions is called 'electrolysis'

34. The positive terminal inserted in to the solution is called_____

a) Cathode
b) Anode
c) Anion
d) Cation

Explanation

The positive terminal inserted in to the solution is called 'anode' and the negative terminal 'cathode'. In the above experiment, copper wire is anode and carbon rod is cathode.

35. Extremely weak electric current is produced in the human body are called_____

a) Synaptic signal
b) Asynaptic signal
c) Electrode signal
d) None

Explanation

Extremely weak electric current is produced in the human body by the movement of charged particles. These are called synaptic signals. These signals are produced by electro-chemical process. They travel between brain and the organs through nervous system.

36. A wire or a conductor carrying current develops a magnetic field___ to the direction of the flow of current.

a) Parallel
b) Perpendicular
c) Adjacent
d) All the above

Explanation

A wire or a conductor carrying current develops a magnetic field perpendicular to the direction of the flow of current. This is called magnetic effect of current. The discovery of the scientist Oersted and the 'right hand thumb rule' are detailed in the chapter on Magnetism and Electromagnetism.

Direction of current is shown by the right-hand thumb and the direction of magnetic field is shown by other fingers of the same right hand.

37. Which of the following statement is correct?

1) There are two distinct types of electric currents that we encounter in our everyday life: direct current (dc) and alternating current (ac).
2) Electrons move from negative terminal of the battery to positive of the battery
3) Some other sources of dc are solar cells, thermocouples etc
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

There are two distinct types of electric currents that we encounter in our everyday life: direct current (dc) and alternating current (ac). We know current in electrical circuits is due to the motion of positive charge from higher potential to lower potential or electron from lower to higher electrical potential. Electrons move from negative terminal of the battery to positive of the battery. Battery is used to maintain a potential difference between the two ends of the wire. Battery is one of the sources for dc current. The dc is due to the unidirectional flow of electric charges. Some other sources of dc are solar cells, thermocouples etc.

38. Which of the following works on DC?

1) Cell phones
2) Radio
3) Electric vehicles
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

Many electronic circuits use dc. Some examples of devices which work on dc are cell phones, radio, electric keyboard, electric vehicles etc.

39. Which of the following statement is correct?

1) If the direction of the current in a resistor or in any other element changes its direction alternately, the current is called an alternating current
2) The alternating current varies sinusoidally with time.

3) Frequency is the number of complete cycle of variation, gone through by the ac in one second
    a) 1, 2
    b) 1, 3
    c) 2, 3
    d) All the above

Explanation

If the direction of the current in a resistor or in any other element changes its direction alternately, the current is called an alternating current. The alternating current varies sinusoidally with time. This variation is characterised by a term called as frequency. Frequency is the number of complete cycle of variation, gone through by the ac in one second. In ac, the electrons do not flow in one direction because the potential of the terminals vary between high and low alternately. Thus, the electrons move to and fro in the wire carrying alternating current.

40. The device used to convert ac to dc is called_____

a) DC convertor
b) Rectifier
c) Invertor
d) Adaptor

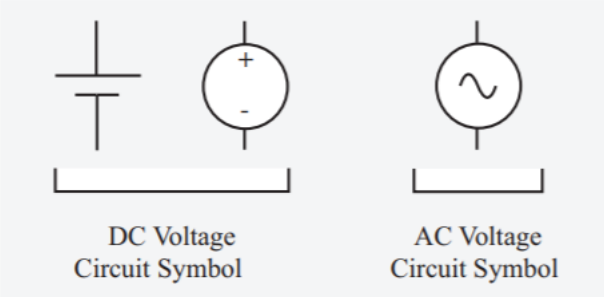
Explanation

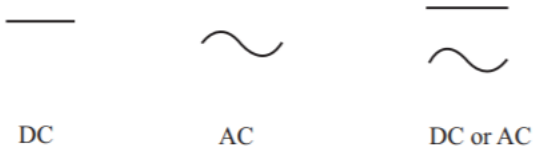
Domestic supply is in the form of ac. When we want to use an electrical device in dc, then we have to use a device to convert ac to dc. The device used to convert ac to dc is called rectifier. Colloquially it is called with several names like battery eliminator, dc adaptor and so on. The device used to convert dc into ac is called inverter.

41. What does the symbol represent?

a) AC
b) DC
c) AC or DC
d) None

Explanation





42. Which of the following statement is correct?

1) The voltage of ac can be varied easily using a device called transformer.
2) The ac can produce electromagnetic induction which is useful in several ways.
3) The dc can be easily converted into ac and generating dc is easier than ac.

a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

The voltage of ac can be varied easily using a device called transformer. The ac can be carried over long distances using step up transformers. The loss of energy while distributing current in the form of ac is negligible. Direct current cannot be transmitted as such. The ac can be easily converted into dc and generating ac is easier than dc. The ac can produce electromagnetic induction which is useful in several ways.

43. Which of the following can be done only using dc?

1) Electroplating
2) electro refining
3) electrotyping

a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

Electroplating, electro refining and electrotyping can be done only using dc. Electricity can be stored only in the form of dc.

44. What is the frequency of ac used for domestic purpose in USA?

a) 50 Hz
b) 60 Hz
c) 30 Hz
d) 55 Hz

Explanation

In India, the voltage and frequency of ac used for domestic purpose is 220 V and 50 Hz respectively where as in United States of America it is 110 V and 60 Hz respectively.

45. What is the Resistance of a dry human body?

a) 1,00,000 ohm
b) 1,000 ohm
c) 100 ohm
d) 10,000 ohm

Explanation

Resistance of a dry human body is about 1,00,000 ohm. Because of the presence of water in our body the resistance is reduced to few hundred ohm. Thus, a normal human body is a good conductor of electricity. Hence, precautions are required while doing electrical work.