SUBJECT:

PHYSICS

CLASS:

SENIOR SECONDARY SCHOOL 1

TERM:

SECOND

SCHEME OF WORK

WEEK	TOPIC
1	Heat Energy – Concept of Heat and Temperature, Effect of Heat, Temperature expansion, Sources/Uses of heat
2	Thermometer – Types and Simple calculations
3	Expansivity – expansion of solids, effects and application
4	Expansivity – Linear, Area, Volume, Anomalous expansion of water, Real and apparent
5	Heat transfer – Conduction, Convection, Radiation, and their applications and sea breeze, thermo flask
	Mid-term project
6	Electric charges production – types, Distribution, and Storage
7	Gold leaf electroscope – its uses
8	Field – Concept and types of field
9	Electric field – Lines of force, properties of line of force and properties of force field
10	Production of continuous Electric Current – Via Chemical, Heat, Mechanical and Solar energy
11	Revision
12	Examination
13	Examination

WEEK ONE

HEAT ENERGY

- Concept of Heat and Temperature
- Effect of Heat
- Temperature expansion
- Sources and Uses of heat

Concept of Heat and Temperature

Heat is a concept of physics that deals with the study of relative motion of fluid (liquid and gas) from one body to another. It is a form of energy that can be transferred from one body due to temperature differences.

Effect of Heat

When heat is applied to a body the following effect may occur

1. Expansion: when heat is applied, volumes increases while density decreases.
2. Change in temperature: When heat is added on a body, the temperature increases
3. Change of state: melting, freezing, condensation, evaporation etc
4. Thermion emission : Addition of heat on metal may result in the emission of electron from the surface of the metal

Photo electric emission: The emission of electron when sufficient light of high frequency is illuminated on a metal surface e.g. zinc plate.

Temperature expansion

Temperature is the degree of hotness and coldness of a body or an object. It is a scalar quantity, measured in Kelvin. Heat and Temperature are similar but not the same

Differences between Heat and Temperature

1. Heat is a measure of the total internal energy of a body while temperature is the degree of hotness or coldness of the body.
2. Heat takes place due to temperature difference while temperature occurs due to slight change of substance.
3. Heat is measured in joules while temperature is measured in Kelvin / Celsius.

Sources and Uses of heat

CLASSWORK 1

1. Define heat?
2. What is the SI unit of heat energy
3. Highlight three usefulness of heat

ASSIGNMENT 1

SECTION A

1. Which of these is odd? (a) Kelvin (b) Joules (c) Celsius (d) Fahrenheit
2. Which of these is the correct SI unit of heat? (a) joule (b) watt (c) newton (d) Pascal
3. Which of these is not true of heat (a) exposure to heat causes warmth (b) heat can cause change of state (c) heat can cause chemical change (d) decrease in temperature can bring about decrease in heat
4. The degree of hotness and coldness of a body is (a) heat (b) temperature (c) boiling (d) evaporation
5. Which of these statements is true of temperature? (a) temperature is another word for heat (b) temperature is inversely proportional to heat (c) Fahrenheit is one of the units of temperature (d) temperature does not exceed 100^0C

SECTION B

1. Enumerate five effect of heat
2. Using kinetic theory, explain heat

WEEK TWO

THERMOMETER

- ❖ Meaning
- ❖ Types
- ❖ Simple calculations

Meaning

A thermometer is an instrument for measuring temperature.

Thermometric substances are substances which changes in proportion to temperature

Types of thermometer

S/N	THERMOMETER	THERMOMETRICAL SUBSTANCE	PHYSICAL PROPERTIES
1.	Liquid in glass	Mercury or alcohol	Change in volume with temperature
2.	Constant volume gas thermometer	Gas	Change in pressure with temperature
3.	Thermoelectric thermometer	Two different metal (iron and copper)	Change in potential difference due to temperature difference
4.	Resistant thermometer	Resistant wire	Change in resistant with temperature
5.	Bimetallic thermometer	Two dissimilar metal (bras and iron)	Differential expansion of two metals of the bimetallic stripes

ADVANTAGES OF MERCURY AS A THERMOMETRIC SUBSTANCE

1. Mercury does not wet glass
2. Mercury response quickly to slight change in temperature
3. The liquid does not vaporize easily
4. Mercury is opaque Hence, it can be seen easily
5. It has a regular or uniform expansion.

DISADVANTAGES MERCURY AS A THERMOMETRIC SUBSTANCE

1. Mercury is expensive
2. Mercury cannot be used to measure very low temperature because it's freezing point 39˚C

ADVANTAGES OF ALCOHOL AS A THERMOMETRIC SUBSTANCE

1. Alcohol is less expensive than mercury
2. It has larger expansion on heating than mercury (it expands 6 times more than mercury).
3. It can be used to measure very low temperature.

DISADVANTAGES OF ALCOHOL AS A THERMOMETRIC SUBSTANCE

1. It is not opaque and so must be coloured
2. It vaporizes easily
3. It wet glass
4. It has an irregular expansion
5. It has low boiling point of 78˚C

ADVANTAGES OF CONSTANT VOLUME GAS THERMOMETER

1. It gives more accurate measurement of temperature than any other thermometer
2. It is very sensitive and can measure wider range of temperature

DISADVANTAGES OF CONSTANT VOLUME GAS THERMOMETER

1. It is very expensive and so require handling with special care
2. It is very cumbersome

WHY WATER IS NOT USED AS A THERMOMETRIC

1. Water wet glass

2. They are colourless
3. It does not expand uniformly
4. It has small range of expansion (0˚C to 100˚C)

CLINICAL THERMOMETER

It is used for measuring the temperature of human body. The body temperature ranges from (35˚C to 45˚C). It is not advisable to sterilize a clinical thermometer in boiling water because a short range of 35˚C to 43˚C which shall result to

i. Cracking or breaking of thermometer due to excessive expansion of the mercury.
ii. De-malfunction of the thermometer due to over expansion of the capillary tube and the mercury inside the bulb.

Evaporation and Boiling

Evaporation is the process where a liquid turns into vapour below its boiling point. Evaporation takes place at all temperature. Wind assist evaporation

Boling is the change from liquid to vapour at the boiling point. It occurs throughout the entire volume of the liquid. Wind has no effect on boiling

Simple calculations

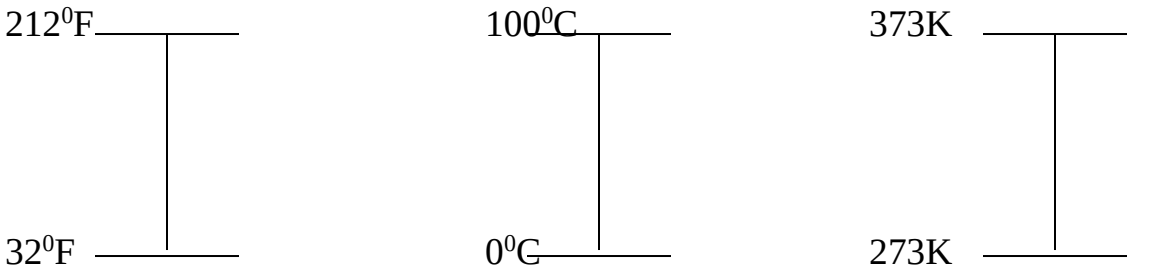
FIXED POINT OF THERMOMETER

Fixed temperature/points are two reference temperature (usually upper and lower fix point) chosen, when preparing a scale for reading temperatures.

Upper Fixed Point: is the temperature of steam from pure water at the normal atmospheric pressure.

Lower Fixed Point: is the temperature of mixture of pure ice and water at normal pressure.

Fundamental Intervals: is the interval between the upper and lower fixed point.



Fahrenheit scale Celsius scale Kelvin scale

CLASSWORK 2

1. What is thermometric property?
2. Mention three types of thermometer, their thermometric substance and physical property
3. Differentiate between evaporation and boiling

ASSIGNMENT 2

SECTION A

1. The ice and the steam points of a certain thermometers are -20^0 and 100^0 respectively. Calculate the Celsius temperature corresponding to 70^0 on the thermometer (a) 84.0^0C (b) 75.0^0C (c) 64.0^0C (d) 58.0^0C
2. The best thermometer used for measuring the temperature of human body is ……. (a) Resistant (b) Clinical (c) Thermoelectric (d) Bimetallic thermometer
3. Mercury has an advantage over other liquids as thermometric liquid because it (a) has low expansively (b) has higher conductivity (c) vaporizes easily(d) has relatively low freezing point
4. Convert 7^0C to kelvin (a) 290K (b) 300K (c) 280K (d) 310K
5. Which of the following have effect on boiling? (a) solar energy (b) wind (c) volume of the liquid (d) thickness of the container

SECTION B

1. Explain absolute zero temperature?
2. Why is it not advisable to sterilize a clinical thermometer in boiling water?
3. Mention five types of thermometer, their thermometric substance and physical property
4. Why is water not used as a thermometric substance?

WEEK THREE

EXPANSIVITY

- Expansion of solids
- Effects and application

Expansion of solids

1. When hot water is poured in a glass tumbler, it might crack due to the uneven expansion of the inner wall of the tumbler.
2. The cracking noise of zinc roof during the day and night
3. Thermal expansion of solid is used in the construction of bridges in which one side is fixed and the other is placed on rollers to allow for expansion
4. The stopper of a bottle can be removed due to the expansion of the glass.
5. In the construction of concrete pavement, little spaces are left within the concrete to allow for expansion
6. Gaps are left in the construction of railway tracks to give room for expansion
7. Bimetallic stripes are use in thermostat for controlling or regulating the flow of electric current.

Effects and application

Advantages of Thermal Expansion of Solid

1. Fire alarm e.g. electric bell
2. The fittings of wheels in rims
3. Bimetallic thermometer
4. Red hot rivet in ship building
5. Bimetallic stripes used in thermometer e.g. electric cooker etc

Disadvantages of Thermal Expansion of Solid

1. Cracking of drinking glass when hot liquid poured inside

2. If the balance wheel of a watch expands the time will be fast and if the balance wheel of a watch contrasts the time will be slow
3. Expansion of metal of concrete bridges which can lead to eventual after a long period
4. Sagging of overhead wire due to contraction in winter season
5. Expansion of railway tracks thereby forming distant railway tracks.
6. Bursting of water metal pipes.

CLASSWORK 3

1. Mention four effect of thermal expansion of solid
2. Mention four the advantages and disadvantages of thermal expansion of solid

ASSIGNMENT 3

SECTION A

1. If hot water is poured into a thick glass cup, the cup cracks because (a) the glass cannot withstand high temperatures (b)glass is an amorphous substance (c) the inner and the outer walls of the cup expands at different rates (d) coefficient of expansion of glass is high (e) none of the above
2. Gaps are left in the construction of railway tracks to give room for ……. (a) contraction (b) evaporation (c) expansion (d) vaporization (e) none of the above
3. The stopper of a bottle can be removed due to the …… of the glass (a) contraction (b) expansion (c) evaporation (d) condensation (e) none of the above
4. The following are advantages of thermal expansion of solids except (a) bimetallic thermometer (b) fire alarm (c) sagging of overhead wire (d) fitting of wheels in rims (e) none of the above
5. If heat is removed from solids they (a) contract (b) evaporate (c) expand (d) condense (e) none of the above

SECTION B

1. Mention four effect of thermal expansion of solid
2. Mention four the advantages and disadvantages of thermal expansion of solid

WEEK FOUR

EXPANSIVITY

- ❖ Linear Expansivity
- ❖ Area Expansivity
- ❖ Volume Expansivity
- ❖ Anomalous expansion of water
- ❖ Real and apparent

Linear Expansivity

Linear expansivity of a solid can be defined as increase in length per unit length, per unit degree rise in temperature. It is denoted by (α) and measure in per Kelvin or per degree Celsius.

Mathematical representation

$$linear\ expansivity = \frac{increase\ in\ length}{original\ length\ \times change\ in\ temperature}$$

$$\alpha = \frac{L_2 - L_1}{L_1(\Theta_2\ -\ \Theta_1)}$$

$L_1 = the\ original\ length$

$\Theta_1 = the\ original\ length$

$L_2 = thefinal\ length$

$\Theta_2 = final\ temperature$

$\Delta L\ =\ L_2 - L_1\ =\ change\ in\ length$

$\Delta\theta\ =\ \theta_2\ -\ \theta_1 =\ change\ in\ temperature$

$$\alpha\ = \frac{\Delta L}{L_1 \Delta\Theta}$$

$$\alpha = \frac{L_2 - L_1}{L_1 \Delta\theta}$$

$$L_2 = L_1 + \alpha L_1 \Delta\theta$$

$$L_2 = L_1 (1 + \alpha \Delta\theta)$$

EXPANSION IN SOLID

EXAMPLE

1. A brass rod is 2m long at a certain temperature. What will be the length for a temperature rise of 100K , if the linear expansivity of brass 18 x$10^{-6}K^{-1}$

   Solution

$L_1 = 2m, L_2 = ?, \Delta\theta = 100K$, $\alpha = 18x10^{-6}k^{-1}$

$$L_2 = L_1 (1 + \alpha \Delta\theta)$$

$$L_2 = 2\left(1 + (18 \times 10^{-6} \times 100)\right)$$

$$L_2 = 2(1 + 0.00018)$$

$$L_2 = 2(1.00018)$$

$$L_2 = 2.0036m$$

Area Expansivity

The area/superficial expansivity is the increase in area of per unit area per degree rise in temperature. It is donated by (β) and measured in per Kelvin and per ^{0}C

$$\beta = \frac{A_2 - A_1}{A_1(\theta_2 - \theta_1)}$$

Recall

$$L_2 = L_1 + \alpha L_1 \Delta\theta$$

$$L_2 = L_1 (1 + \alpha \Delta\theta)$$

Similarly

$b_2 = b_1 + \alpha b_1 \Delta\theta$

$b_2 = b_1 (1 + \alpha\Delta\theta)$

$A_2 = L_1 (1 + \alpha\Delta\theta) \times b_1 (1 + \alpha\Delta\theta)$

$A_2 = L_1 b_1 (1 + \alpha\Delta\theta)(1 + \alpha\Delta\theta)$

$A_2 = A_1 (1 + 2\alpha\Delta\theta + (\alpha\Delta\theta)^2$

Where: $(\alpha\Delta\theta)^2 is\ neglible\ and\ \beta = 2\alpha$

$A_2 = A_1 (1 + 2\alpha\Delta\theta)$

$A_2 = A_1 (1 + \beta\Delta\theta)$

Volume Expansivity

It is denoted by (γ). It is the increase in volume per unit volume per degree rise in temperature

$$\gamma = \frac{V_2 - V_1}{V_1(\theta_2 - \theta_1)}$$

$\gamma = 3\alpha$

Relationship between α: β: γ: = 1: 2: 3.

Expansion in Liquid

If the temperature of a liquid increases the volume of liquid is affected

Real and apparent

Real or absolute cubic expansivity (γ_r): The real / absolute of the liquid is the increase in volume by unit volume per degree rise in temperature

Apparent Cubic Expansivity (γ_a)

The apparent cubic expansivity is the increase in volume per unit rise when heated in an expansible vessel.

$(\gamma_r) = (\gamma_a) + ɣ$

Anomalous expansion of water

Most liquid except water expand when heated. This abnormal behaviour of water is what is referred to as anomalous expansion of water. When water is heated from 0^0C, it contracts until it reaches 4^0C and beyond this point, water expands normally. The anomalous expansion of water takes place between 0^0C and 4^0C.

CLASSWORK 4

1. Define these: (i) linear expansivity (ii) area expansivity (iii) cubic expansivity
2. What do you understand by the term anomalous behaviour of water?
3. (a) A brass rod is 2m long at a certain temperature. What will be its length for a temperature rise of 90K , if the linear expansivity of brass is 1.8 x 10-6K^{-1}

ASSIGNMENT 4

SECTION A

1. A metal of length 15.01m is heated until its temperature rises by 60^0C. If it's new length is 15.05, calculate its linear expansivity (a) 0.0004/K (b) 0.00004/K (c) 0.004/K (d) 0.04/K
2. The increase in volume of 10cm^3 of mercury when the temperature rises by 100^0C is 0.182cm^3. What is the cubic expansivity of mercury? (a) 0.000182/K (b) 0.0000182/K (c) 0.000187/K (d) 0.000178/K
3. When water is heated between 0^0C and 4^0C, its density (a) increases for a while and then decreases (b) decreases for a while and then increases (c) increases (d) decreases (e) remains constant
4. A metal bar 50cm long at 15^0Cis heated to 85^0C. If it expands by 0.088cm, determine its linear expansivity (a) 4.0×10^{-5} ^{0}C (b) 2.5×10^{-5} ^{0}C (c) 6.3×10^{-2} ^{0}C (d) 1.2×10^{-1} ^{0}C (e) none of the above
5. If the linear expansivity of a solid is 1.8 X 10^{-6}, the area expansivity will be (a) 0.9 X 10^{-6} (b) 3.6 X 10^{-6} (c) 1.8 X 10^{-6} (d) 5.4 X 10^{-6}

SECTION B

1. Establish the relationship: $A_2 = A_1(1 + \beta\Delta\theta)$
2. The real and apparent cubic expansivities of a liquid in an expansible container are $3.0\times10^{-6}\,K^{-1}$ and $1.8\times10^{-6}\,K^{-1}$ respectively. Calculate the expansivity of the container
3. The linear expansivity of a metal P is twice that of another metal Q. When these materials are heated to the same temperature change, their increase in length is the same. Calculate the ratio of the original length of P and Q

WEEK FIVE

HEAT TRANSFER

- Conduction
- Convection
- Radiation
- Applications - sea breeze, thermo flask

Heat can be transferred by conduction, convection or radiation

Conduction

This is the process of transfer of heat through a material by vibration of the molecules fixed in position. N.B. Metals that allow heat to pass through them are said to be good conductors of heat. Though all metals are classified as good conductors, they differ in an ability to conduct heat. Non-metal (wood / plastic) is a bad conductor that does not allow heat to pass through it. Thermal conductivity is simply the ability of a metal to conduct heat.

PRACTICAL CONDUCTION OF HEAT

1. Kettle, pans and other utensils made of metals are provided with wooden or ebonite utensils so that heat from to utensils is not conducted
2. house old source pans are made of metals because metals are good conductors of heat and electricity
3. Thick brick walls are used in the construction of storage rooms. Bricks are bad conductors of heat, so it will not allow heat to enter the storage room.
4. A stone floor feels cold to the feet than a rug or a carpet on the same floor feels warm

Convection

Convection is the process by which heat energy is transferred in a fluid (liquid or gas) by actual movement of the heated fluid. The direction of the motion of a filter paper indicates the circulation of heated water. Circulation of a liquid is called **CONVECTION CURRENT**.

Radiation

Radiation is the process by which heat is transferred or conveyed from one place / point to another without heating the interview medium. In radiation molecules are not involved, it differs from another method because it does not require a medium for heat to be transferred. Heat from the sun reaches us by this method. The energy given out as radiant heat is known as **RADIANT ENERGY.** This energy displaces electrical and magnetic properties and it said to be electromagnetic radiation and the name is **INFARED.**

RADIATION CAN BE DETECTED BY

1. Radiometer
2. Thermo pile
3. Leslie cube

Dark surface are good absorber of heat and poor he meter of radiation. Highly polished surface are good he meter of radiation and poor he meter of heat.

APPLICATION OFRADIATION

1. It is not advisable to wear a dark shirt in the tropical sun
2. Roofs of factories are coated with aluminum paint.
3. Shinning roofs and outside walls are painted with light colour in hot climate to keep the house cool.

Cooking utensils are darkening at the bottom and polished in the upper surface. The blacking surface will allow the heat while the silver surface won't allow heat to go out

Applications - sea breeze, thermo flask

Land and sea breeze

Heat energy from the sun is absorbed by the land and sea equally in the daytime. The air close to the surface of the land is warmed by the land because the land conducts better than the sea water. The warmed air becomes less dense, rises and move towards the sea. Cold hair from the sea moves towards the land to replace the rising warm air. This circulation of hot and cold air continues.

The cold breeze from the sea towards the land is called ***sea breeze.***

Thermos Flask

A thermos flask is used to keep the temperature of its content constant. The essential features of a thermos flask are as follows:

1. Cork stopper – Prevent heat loss by conduction, conduction and Evaporation

2. Vacuum in the double wall – Reduce heat loss or gain by conduction and convection

3. Silvered wall surface – Minimise heat loss by radiation

4. Cork support – Prevent heat loss by conduction

Thermos flask is also known as vacuum flask.

CLASSWORK 5

1. Define the following terms (a) conduction (b) Convection (c) Radiation
2. Differentiate between convection and radiation
3. Differentiate between conduction and convection

ASSIGNMENT 5

SECTION A

1. When heat is applied to one end of a metal rod, molecules at the other end begin to vibrate with greater amplitude than before because heat has been transferred by (a) radiation (b) convection (c) conduction (d) radiation (e) none of the above
2. Which of the following phenomena explains the fact that a house whose roof is coated with white will be cooler in the hot season than one coated with black paint? (a) conduction (b) convection (c) refraction (d) radiation (e) none of the above
3. Which of the following colours of surfaces ill radiate heat energy best? (a) red (b) white(c) black (d) yellow (e) blue

4. Which part of a vacuum flask prevents heat loss by radiation? (a) The cork (b) the vacuum (c) the silvered surfaces (d) the pad at the bottom (e) none of the above
5. The heat from fire in a closed room reaches someone far away in the room mainly by (a) reflection (b) diffusion (c) conduction (d) radiation (e) convection

SECTION B

1. Draw and label a diagram showing the essential parts of a thermos flask
2. Explain land and sea breezes

MID-TERM PROJECT

Using a white cardboard, answer the question below:

GIRLS:

- Draw a well-labelled diagram of a vacuum flask and explain the function

BOYS:

- Draw a well-labelled diagram of a gold-leaf electroscope and explain the function

WEEK SIX

ELECTRIC CHARGES PRODUCTION

- Electric charges
- Types of charges
- Distribution of charges
- Storage of charges

Electric charges

If a plastic pen is rub vigorously on the hair or on a coat and it is hold near a very small piece of paper, the paper will be attracted by the pen. Some substances are found to poses the ability to attract light objects once they are rubbed. The light object as well as the rubbed material are said to be charged or electrified with static electricity.

Types of charges

There are two types of charges- positive and negative charges. An ebonite rod rubbed with fur has a negative charge, but a glass rod rubbed with silk has a positive charge.

The fundamental law of static electricity or electrostatic states that like charges repel will unlike charges attract.

Distribution of charges

Charges are unusually concentrated at places where the surface is sharply curved. The charge density i.e. charge per unit area is highest at the sharpest point of the conductor.

Storage of charges

The electrophorus is a device for transferring and storing charges. It produces electric charges by electrostatic induction. Another device for the storage of electric charges is the capacitor

CLASSWOR 6

1. State the fundamental law of electrostatic
2. What is electrostatic

ASSIGNMENT 6

SECTION A

1. The ebonite rod in question 2 becomes (a) positively charge (b) negatively charge (c) neutral (d) none of the above
2. Like charges (a) attract (b) repel (c) disappear (d) evaporate(e) none of the above
3. Charges are usually concentrated at places where the surface is ……. (a) straight (b) sharply curved (c) oval in shape (d) rectangular (e) none of the above
4. When a biro rubbed on dry silk cloth is moved very close to a piece of paper on dry table, the pen is found to pick up the paper. This is because (a) both the pen and the paper are magnetized (b) the pen is magnetized but the paper is not (c) the pen is charged while the paper is magnetized (d) both the pen and the paper are charged (e) none of the above
5. When an ebonite rod is rub with fur, the fur becomes (a) positively charge (b) negatively charge (c) neutral (d) none of the above

SECTION B

1. State the fundamental law of electrostatic
2. With the aid of a diagram, explain charge distribution

WEEK SEVEN

GOLD LEAF ELECTROSCOPE

- ❖ Gold leaf electroscope
- ❖ Uses of Gold leaf electroscope

Gold leaf electroscope

An electroscope is a device which can detect electric charges. The casing is earthed so as to screen the leaf from outside interference of influence. The leaf is the sensitive or moving part of the instrument.

Uses of Gold leaf electroscope

1. It is used to test whether a material is a conductor or an insulator. The material is made to touch the cap. Rapid collapse means that the charges escape easily and hence the material concerned is a good conductor. A slow collapse means that it is a poor conductor. No collapse means that it is an insulator.
2. Use to test charges weather the charge is positive or negative. The gold leaf electroscope to test the sign of the charge of an object. If an unknown charge is brought near to a charged electroscope and the leaf diverges more, the unknown charge is similar to the charge on the electroscope.

Lighting and Lighting Conductor

The atmosphere is known to contain ions or charged particles, which have been produced by radiation from the sun and by what is known as cosmic radiation, which enters the atmosphere from outer space.

Lighting is a sudden discharge or neutralizing of electric charges, and it occurs when charges build up in a cloud.

A lighting conductor is used to protect a building from lighting damage.

CLASSWORK 7

1. State two uses of an electroscope

2. What is the function of lighting conductors

ASSIGNMENT 7

SECTION A

1. Capacitor is a device that ……. charges (a) produces (b) emits (c) store (d) accelerate (e) none of the above
2. The casing is earthed so as to screen the leaf from outside interference (a) positively charge (b) negatively charge (c) neutral (d) none of the above
3. In using a gold leaf electroscope to determine the nature of electric charge on a body, it is observed that hen the charges on the body and electroscope are the same, the divergence of the leaves (a) decreases (b) increases (c) cannot say (d) remains unchanged (e) disappears
4. Which of the following device is used to detect charge (a) Electrophorus (b) Capacitor (c) Electroscope (d) Inductor (e) none of the above
5. A rod is brought near the cap of negatively charged electroscope. It is observed that the leaf of the electroscope diverges farther showing that the rod is (a) positively charged (b) not charged (c) an insulator (d) negatively charged (e) none of the above

SECTION B

1. What is lighting?
2. Draw a well label diagram of an electroscope

WEEK EIGHT

FIELD

- Concept of field
- Types of field

Concept of field

Field can be defined as the region or space under the influence of some physical agency such as gravitational, electricity and magnetism.

Types of field

Fields are of various types namely: gravitational, magnetic and electric field.

1. Gravitational Field

Gravitational field is any region or space around a mass in which the gravitational force of the mass is felt. Gravitational field always point inwards to the mass producing it.

Acceleration due to gravity

The magnitude of acceleration due to gravity is approximately $10 m/s^2$. Ancient Greek thought bigger masses fell faster than smaller masses when dropped from the same height at the same time. This was first proven wrong by Galileo Galilei and later by Isaac Newton. It was concluded that if objects of different masses are dropped in a vacuum from same height and at the same time, they will land at the same time on the ground. Thus, the non-landing at the same time is observed to have been caused by air resistance.

In trying to determine the acceleration due to gravity of a falling object, the formula below was experimentally arrived at:

$$g = \frac{2h}{t^2}$$

CLASSWORK 8

1. Define field
2. Mention three types of field known to you

ASSIGNMENT 8

SECTION A

1. In a vacuum, when an iron ball and a paper is released at the same time (a) the iron reaches the ground earlier before the paper (b) the paper reaches the ground earlier before the iron (c) the iron and the paper reaches the ground at the same time (d) no concrete conclusion can be made (e) none of the above
2. Acceleration can be calculated using which of these formulas (a) $g = \frac{2h}{t^2}$ (b)$g = \frac{2h}{R^3}$ (c)$g = \frac{h}{t^2}$ (d)$g = \frac{h}{2t^2}$ (e)$g = \frac{2h}{t}$
3. A region or space under the influence of some physical agency or force is called (a) force station (b) field (c) gravitational field (d) field station (e) none of the above
4. The unit of force is (a) Joules (b) Watt (c) Newton (c) Tesla (e) All of the above
5. Which of these is not a type of field? (a) gravitational field (b) electric field (c) magnetic field (d) metallic field (e) none of the above

SECTION B

1. Explain why a stone will reach the ground first when dropped from a height with a feather at the same time
2. Explain gravitational field

WEEK NINE

ELECTRIC FIELD

- Electric field
- Lines of force
- Properties of line of force
- Properties of force field

Electric field

It is simply the space or region around an electric charge where a force is experienced. There are two types of charges namely: positive and negative charges.

Lines of force

Lines of force are imaginary lines that shows or indicate in the path of fore in a field

Properties of line of force

1. They are imaginary
2. They do not cross each other
3. They begin with a positive charge and end with a negative charge.
4. Electric flux representing uniform field are straight parallels and uniformly space
5. While the one representing in non-uniform field are curves

Electric field pattern

a. Electric field pattern of an isolated positive and negative charges
b. Electric field pattern of two charges
c. Electric field pattern between two parallel plates

CLASSWORK 9

1. Define electric line of force
2. Draw a field pattern of two negative point charges
3. State four properties of line of force

ASSIGNMENT 9

SECTION A

1. The direction of positive electric charge is (a) inward (b) outward (c) at a fixed point (d) unnoticed (e) none of the above
2. The direction of negative electric charge is (a) inward (b) outward (c) at a fixed point (d) unnoticed (e) none of the above
3. A force of repulsion was experienced when a charge P was brought close to charge S. which of the following statements is correct? (a) P is positively charged while S is negatively charged (b) S is positively charged while P is negatively charged (c) both P and S are negatively charged (d) P is uncharged while S is negatively charged (e) none of the above
4. Which of these is correct about electric lines of force? (a) They do not cross each other (b) they are not imaginary (c) They can cross each other (d) they are unnoticed (e) all of the above
5. The space surrounding and electric charge in which electric force is experienced is called (a) electric field (b) electric flux (c) electric point (d) electric pole (e) none of the above

SECTION B

1. Draw a field pattern of two positive point charges
2. Draw the field patter for an isolated positive point charge and an isolated negative point charge

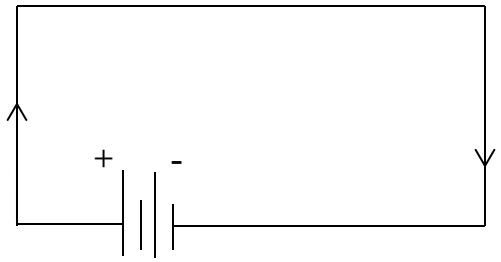
WEEK TEN

PRODUCTION OF CONTINUOUS ELECTRIC CURRENT

- Production of continuous Electric Current
- Electric Current from Chemical Energy
- Electric Current from Heat Energy
- Electric Current from Mechanical Energy
- Electric Current from Solar energy

Electric current

Electric current is the continuous flow or drift of electric charges due to potential difference between two points of a conductor. Electrons move from the negative terminal to the positive terminal of the cell.



Current and quantity of charge

$$\text{Electric current} = \frac{Quantity\ of\ charge}{time}$$

$$I = \frac{Q}{t}$$

$$Q = It$$

The unit of current is Ampere (A)

The electromotive force (emf)

This is the work done by the cell in moving one coulomb of charge or electron round a closed circuit. It is measure in Volts. The emf is the force that is needed to move electron from the negative terminal of a cell or battery to the positive

terminal. It is the voltage measure across the terminal of a cell when it is not supplying current to an external load.

Potential difference (Pd)

This is the work done in moving a unit charge from a region of lower potential to a region of higher potential.

$$potential\ difference = \frac{workdone}{charge\ moved}$$

$$V = \frac{W}{Q}$$

$$W = QV$$

The unit of potential difference is volts (V)

Production of continuous Electric Current

Electric Current from Mechanical Energy

The continuous production of electric current can be achieved with a conductor in form of loop turning in a magnetic field. A practical machine which produces electric current this way is the generator. It converts mechanical energy (rotation of the conductor) to electrical energy

Electric Current from Chemical Energy

A cell is a device for converting chemical energy into electrical energy. A cell consists of two dissimilar metals separated by solution of various acids or salt. The metals are known as the electrodes and the solutions are the electrolyte. The positive electrode is known as the anode. The negative electrode is the cathode.

Electric Current from Heat Energy

A thermocouple is used to convert heat energy to electrical energy. It has two dissimilar wires (e.g. copper and iron). The ends of these dissimilar metals are joined together. One end is inserted in cold water and another in hot water. A galvanometer is placed in between to detect the flow of current. Current flows due

to temperature difference at both ends. The greater the difference in the temperature between the two ends, the greater the current flow.

Electric Current from Solar energy

Energy from the sun can be converted to electrical energy. This is made possible by the use of photovoltaic or solar cell. If solar energy is made to fall on a photo electric cell, solar energy will be converted to electric energy directly by photo electric effect.

CLASSWORK 10

1. What is electric current?
2. What is a cell?
3. Briefly explain how you can generate electrical energy from chemical energy
4. Mention two types of cell that you know

ASSIGNMENT 10

SECTION A

1. Which of the following is a correct representation of current? (a) $I = \frac{VQ}{t}$ (b) $I = \frac{t}{Q}$ (c) $I = \frac{2Q}{t}$ (d) $I = \frac{Q}{t}$ (e) $I = \frac{Q}{2t}$
2. The work done by the cell in moving one coulomb of charge or electron round a closed circuit (a) electromotive force (b) potential difference (c) current (d) power of the well (e) none of the above
3. In a thermocouple, increase in the temperature difference at the two terminals will lead to (a) increase in the flow of current (b) decrease in the flow of current (c) the current flow is unaffected (d) termination of the current flow (e) none of the above
4. Cell convert chemical energy into _____ energy (a) mechanical (b) electrical (c) solar (d) atomic (e) heat
5. DC generator converts (a) electric to mechanical energy (b) mechanical to electric energy (c) solar to electrical energy (d)mechanical to chemical energy (e) none of the above

SECTION B

1. With the aid of a diagram, describe how heat energy is converted to electrical energy
2. Write short note on (a) electromotive force (b) potential difference

WEEK ELEVEN

Revision

WEEK TWELVE

Examination

WEEK THIRTEEN

Examination