SSLC
PHYSICS - EM

9447107327

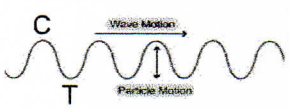
MEMORY MODULE

WAVE MOTION

Wave motion is the propagation of disturbances, produced on one part of a medium by the vibration of its particles, to all its other parts. It can be classified into two types:

1. Mechanical waves: The presence of a medium is required. Eg: Waves formed on water surface, sound waves
2. Electromagnetic waves: The presence of medium is not essential. Eg: Radio waves, light waves

Mechanical waves are classified into two types

Transverse wave	Longitudinal wave
• Particles vibrate in a direction perpendicular to the direction of propagation of the wave • Crests and Troughs are formed • Formed on the surface of solids and liquids  C = Crest, T = Trough	• Particles vibrate in a direction parallel to the direction of propagation of the wave • Compressions and Rarefactions are formed • Formed in solid, liquid and gases  C = Compressed area, R = Rarefaction area

Characteristics of waves

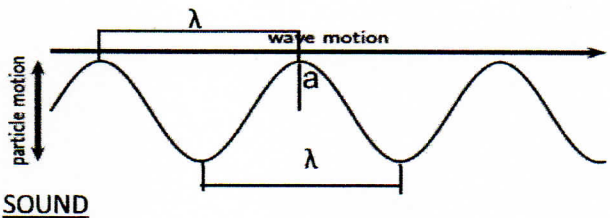
Amplitude (a): is the maximum displacement of a particle from its mean position. Unit: meter (m)

Wavelength (λ): distance between two consecutive particles which are in the same phase of vibration. Unit meter (m)

Frequency (f): is the number of vibrations in one second. Unit Hz

Velocity (v): is the distance travelled by the wave in one second. Unit m/s. It can be calculated by using

$v = f\lambda$



SOUND

✓Sound is a kind of energy which makes us her

✓Sound is produced by the vibration of physical objects

Sound Transmission

Sound needs a material medium like solid, liquid or gas to travel. Astronauts in space or on the moon use radio system to talk to each other, because the moon has no air or atmosphere at all.

Medium	Velocity (m/s) (at 20^0C)
Aluminium	6420
Steel	5941
Water	1482
Air	343

We can hear sounds from a longer distance during the monsoon season

Factors influencing the speed of sound through air: Humidity, Density, Pressure, Temperature and Wind

Characteristics of sound

✓Intensity: The amount of sound energy passing each second through unit area. While increasing the amplitude of the vibrating object, intensity also increases. Unit: W/m^2

✓Loudness: The intensity of sound produced in the ear. It depends on the intensity, amplitude and efficiency of the ear. It unit is dB(decibel). Sounds higher than 120dB are painful to our ear.

✓Pitch: Shrillness of a sound felt by the ear. If vibrating frequency of a body increases, the pitch are also increases.

Natural Frequency: is the frequency at which it vibrates freely. Eg: Vibration of tuning fork while it exciting.

Forced Vibration: A body undergoing vibration under the influence of a vibrating body, with the same natural frequency as that of the influencing body. Eg: Press the stem of an excited tuning fork on a table, the sound increased as the table had a larger surface area.

Resonance: The natural frequency of the body undergoing forced vibration becomes equal to the frequency of the impressed vibration; the body undergoing forced vibration will vibrate with greater amplitude. In this state the two objects are said to be in resonance. Sonometer and Resonance Column are used to explain Resonance.

Reflection of Sound

Sound can change its direction and bounce back when it hits on hard surface, it is reflection.

Multiple Reflection of Sound: Sound getting reflected repeatedly from different objects is multiple reflections.

Situations making use of multiple reflections

Megaphone, Air horns, Loudspeaker, Stethoscope, Musical instruments like Shehnai and Trumpets, Sound boards in guitar, violin etc.

Reverberation: is the persistence of sound (boom sound) as a result of multiple reflections.

Persistence of audibility: The sensation of hearing produced by sound is retained for a period of 1/10 second. This peculiarity of the ear is persistence of audibility. If another sound reaches the ear with in this time interval of the time, simultaneous hearing is experienced.

Echo: The phenomenon of hearing a sound by reflection from a obstacle, after hearing the original sound. Echo formed only when the distance between sound source and reflecting surface is more than 17m (if the medium is air)

Acoustics of building

Branch of science deals with the conditions to be fulfilled in the construction of a hall for clear audibility.

Possible effects of reflection in a big hall

- Cannot hear the sound properly
- The sound is heard repeatedly
- The sweetness of music is lost
- Loudness is insufficient
- Sound cannot be heard uniformly at all places in the hall.

Methods to minimize the above disadvantages

- A large number of ventilators and windows are provided.
- Curtains having many folds are used
- Rough carpets are used
- Walls are made rough
- Cushions of the seat are made of rough material

Seismic waves: Waves travelling through layers of the earth due to big explosions, earthquakes and volcanic explosions are seismic waves. Using hydrophone and seismometer, we can study these waves. Richter scale is used to measure the intensity of earthquake. Seismology is the branch of science that deals with study of seismic waves.

Distance between sound source and the obstacle can be calculated by using the equation $D = v \times t$ (where v=velocity of sound through the medium, t = time in second)

EFFECTS OF ELECTRIC CURRENT

Energy changes

Electric stove: Electrical Energy → Heat Energy
Iron box: ..... → .....
Electric Bulb: ..... → .....
Electric Fan: ..... → .....
Microphone: ..... → .....
Loudspeaker: ..... → .....
Battery (Charging): ..... → .....

Heating Effect of electric current

Heating coil is the main part of heat producing instrument. Nichrome (alloy of Nickel, Chromium, Iron, Manganese) is used to manufacture heating coil. **High resistivity, High melting point, ability to remain in red hot condition for long time without getting oxidized** are the advantages of nichrome.

Factors affecting the heat generated in a current carrying conductor:

Electric Current (I)
Resistance of the conductor (R)
Time of flow of current (t)

Jouls's Law: The heat generated in a current carrying conductor is the product of the square of the current, the resistance of the conductor and the time of flow of current. i.e $H = I^2Rt$

If we substitute the value of $\frac{V}{I}$ for R in $H = I^2Rt$ we get $H = IVt$

If we substitute the value of $\frac{V}{R}$ for I in $H = I^2Rt$ we get $H = \frac{V^2t}{R}$

Safety Fuse: is a device that works on the heating effect of electric effect. Kit Kat Fuse and Cartridge Fuse are two types. The main part of safety fuse is a fuse wire. It is an alloy of suitable metals (Tin+Lead). It has a low melting point. It is a device which protects us and the appliances from danger when an excess current flows through the circuit. Intensity of current differs from one appliance to another. Hence fuse wires of appropriate amperage should be selected.

Short Circuit	Overload	Amperage
The two wires from the mains come into contact without the presence of a resistance in between, they are said to be short-circuited.	A circuit is said to be overloaded if the total power of all the appliances connected to it is more than what the circuit can withstand	Is the ratio of the power of equipment to the voltage applied. It increases with the thickness of the conductor

Lighting Effect of electric current

✓ Filament Lamp/Incandescent Lamp: Filament is the main part. Tungsten metal is used as filament because it has high resistivity, high melting point, high ductility, ability to emit white light in the white hot condition. It produces light when the filament is highly heated. Nitrogen (behaves as an inert gas at ordinary temperature) is used to fill the bulb in order to avoid oxidation of tungsten and it increases the efficiency and life time of bulb. Major part of the electrical energy supplied to an incandescent lamp is lost as heat.

✓ Discharge Lamp: Two metallic rods and a gas filled glass tube are the main parts. When high voltage is applied on the electrodes, the gas gets ionized. As a result of the collision of ionized atoms with unionized atoms, energy stored and this will be radiated as light. The colour of the light depends on the gas. Eg: Hydrogen: Blue, Sodium: Yellow, Nitrogen: Red, Chlorine: Green, Neon: Orange red.

easy@memory: നിമ്മോ സോമ, ക്ലോപ മൈച്ചു ഹൈനീ

✓ Fluorescent Lamp: Heating coil coated with Thorium Oxide (increases the emission of electrons), Fluorescent paint coated glass tube, Mercury vapour are the main parts. Due to the flow of current, the coils become very hot and emit electrons. They collide with unionized molecules of the mercury vapour and Ultra Violet rays are produced. These rays are absorbed by the fluorescent material and re-emitted as visible light. UV rays along with blue light are produced by some lamps and are used as traps for flies and in banks for detecting fake notes.

✓ Compact Fluorescent Lamp (CFL): Work at low power. The working of CFL is similar to fluorescent lamp.

[Both the fluorescent lamp and CFL contain mercury vapour which is harmful to environment. Hence it should not be thrown out carelessly after use.]

✓ Light Emitting Diode (LED): Gives more light but consumes less electrical energy.

Advantages:

No filament → No loss of energy

No mercury → not harmful to environment

It requires only a small quantity of power.

✓ Arc Lamp: Carbon rods kept at a fixed distance in an evacuated glass tube. Electric discharge produced when a high voltage is applied between them gives bright light to the arc lamp. Used in search lights, film shooting, projectors and for rescue wok.

Electric Power

The amount of energy consumed by an electrical appliance in unit time is its power. $P = \frac{H}{t}$

If $H = I^2Rt$, $P = I^2R$

If $H = IVt$, $P = IV$

Power

If $H = \frac{V^2t}{R}$, $P = \frac{V^2}{R}$

Unit of Power is Watt (w)

ELECTROMAGNETIC INDUCTION

✓ELECTROMAGNETIC INDUCTION: When a magnet moves towards the solenoid, there is a flow of electric current. Increasing the number of turns in the solenoid and using magnets of high strength, the current increases.

"Whenever there is a change in the magnetic flux linked with the coil, electricity is induced in the coil. This phenomenon is electromagnetic induction." The current thus induced is the induced current and the voltage induced is the induced **emf**. Generators (Mechanical Energy converts to Electrical Energy) and Moving Coil Microphone (Sound Energy converts to Electrical Energy) are worked on the basis of this theory.

Fleming's Right Hand Rule: Stretch the forefinger, middle finger and the thumb of the right hand in mutually perpendicular directions. If the fore finger represents the direction of the magnetic field, and the thumb represents the direction of motion of the conductor, then the middle finger represents the direction of the induced current.

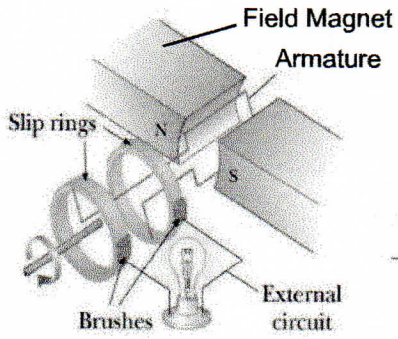
MC ഓഡിലെ
Traffic Man
Firoz Mandan Firoz ആണ്

AC and DC

AC (Alternating Current)	DC (Direct Current)
•The direction of current changes at regular intervals of time, it is an Alternating Current (AC).	•A current that flows only in one direction continuously is the Direct Current (DC).

AC GENERATOR

•AC generator is used to generate AC.
•Field Magnet, Armature coil, Slip rings, Brushes are the main parts.
•By the to and fro motion of the magnet or coil continuously AC is produced.
•The frequency of AC generated for distribution in our country is 50Hz (50 cycles per second)



Power Generator: The generators used at power stations (centres that generate and distribute large quantities of electricity).

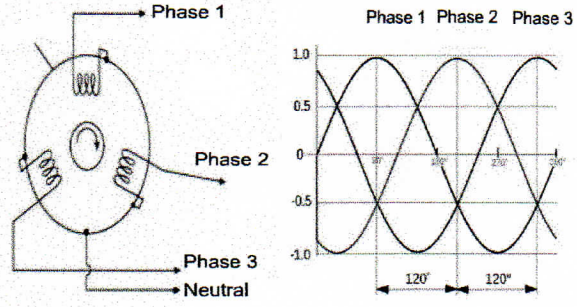
Rotor: Rotating part of the generator (Field Magnet in Power Generator)

Stator: Static part of the generator (Armature in Power Generator)

[The weight of armature is higher in power generator and the graphite brush can be avoided, thereby avoiding sparks. So the armature is used as the stator]

Exciter: Provides DC to the electromagnets working as field magnets in power generator. In modern age, big batteries are used instead of exciters.

Single Phase Generator	Three Phase Generator
•Each field magnet, there is only one armature. •Used to produce electricity on a small scale.	•There are three sets of armature for each field magnet. •Used to produce electricity on a large scale. •Three armature coils are arranged around the field magnet at an angle 120^0 •Three Alternating Currents (AC) of different phase are generated simultaneously



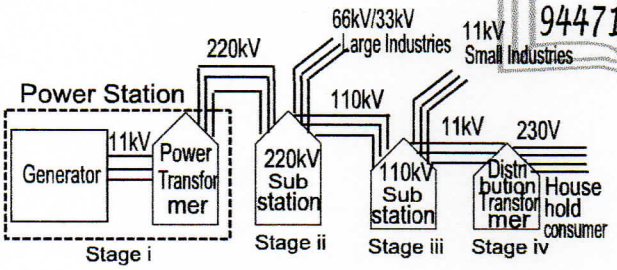
POWER TRANSMISSION & DISTRIBUTION

Power Station: are centres generating large amounts of energy for the purpose of distribution. Classified on the basis of energy sources.

Power station	Energy change	Examples
Hydroelectric [Reservoir, Penstock pipe, Turbine, Generator]	P.E→K.E→M.E→E.E	Pallivasal, Moolamattom
Thermal [Fuels (coal, naphtha, lignite), boiler, turbine, generator]	C.E→H.E→M.E→E.E	Neyveli, Kayamkulam
Nuclear (Nuclear fuel, boiler, turbine, generator)	N.E→H.E→M.E→E.E	Kalpakkam, Koodamkulam

Power transmission and transmission loss

Power transmission is the process of sending electricity to distant places through wires from the power station.



In our country, electricity is generated at 11kV and is supplied to household users at 230V. A step up transformer is used at power station to increase AC voltage from 11kV to 220kV. Step down transformers are used in all other stages.

Problems faced at the time of power transmission

- **Voltage drop**
- **Energy loss**

Solution

By reducing the resistance and the strength of current, energy loss can be minimized. By transmitting high voltage, voltage drop can be minimized.

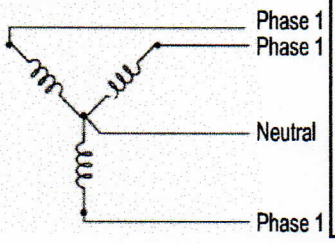
Power grid: The different power generating centres and distribution systems are connected by a network. This network is the power grid.

Power distribution

A step down transformer (distribution transformer) is used to transmit power for household purpose. There are 3 lines in its input and four lines in its output.

Star Connection

The method of connecting the secondary coils of a distribution transformer.



Potential Differences (Voltages)
Phase & Phase: 400V
Phase & Neutral: 230V
Phase & Earth: 230V
Neutral & Earth: 0V
Phase: 0V
Neutral: 0V

Distribution of electricity for household purposes is done by using one phase line and neutral. But the distribution for industrial purpose is done using the three phase lines.

Household electrification

Electrification is in the order: KWh meter, Main fuse, Main switch, ELCB, MCB, Switch board, instruments.

Parallel method is used for household electrification. Because

- All bulbs burn as per the power marked on them.
- The same voltage is available for all the bulbs.
- Bulbs can be controlled individually, using switches.

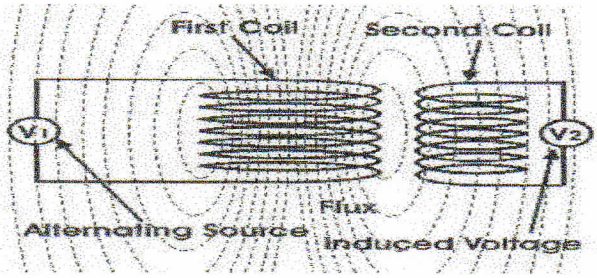
Watt hour meter: is the instrument which is used for measuring the energy consumed in kilowatt hour (kWh)

Moving Coil Microphone

Parts: Diaphragm, permanent magnet, voice coil

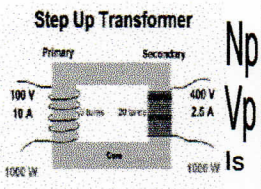
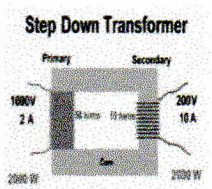
Working: The Diaphragm connected to the voice coil vibrates in accordance with the sound waves falling on it. As a result, electric signals corresponding to the sound waves are generated. In microphone, M.E is converted into E.E. In addition to this Carbon microphones, Crystal and ceramic microphones, Ribbon microphones and Capacitor microphones are different types.

✓MUTUAL INDUCTION: Consider two coils of wire kept side by side. When the strength or direction of the current in one coil changes, the magnetic flux around it changes. As a result, an emf is induced in the secondary coil. This phenomenon is the mutual induction. Transformer is a device that works on this principle.



Transformer

Device for increasing or decreasing the voltage of an AC without any change in electric power. Two types.

Step up transformer	Step down transformer
•Increases AC voltage •Number of turns in secondary coil is greater than that of primary coil •Thick wire is used in primary coil and thin wire in the secondary coil.	•Decreases AC voltage •Number of turns in secondary coil is less than that of primary coil. •Thin wire is used in the primary coil and thick wire in the secondary coil.
Ns Vs Is  Np Vp Is	Np Vp Is  Ns Vs Is

The relation connecting voltage and the number of turns in the primary and secondary coil

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

The relation connecting voltage and current in the primary and secondary coil is $V_p \times I_p = V_s \times I_s$

N_p = Number of coils in primary,

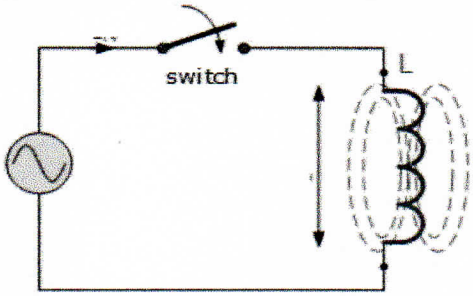
N_s = Number of coils in secondary

V_p = Voltage in primary, V_s = Voltage in secondary

I_p = Current in primary, I_s = Current in secondary

The power in the primary and in the secondary is equal in a transformer.

✓SELF INDUCTION: The change in magnetic flux due to the flow of an AC in a solenoid will generate a back emf in the same solenoid in a direction opposite to that applied to it. This phenomenon is the self induction. The back emf reduces the effective voltage in the circuit and reduces the intensity of instrument connected in this circuit.



Inductors: are coils used to oppose the changes in electric current (AC) in a circuit. They are used to reduce current in a circuit without energy loss.

Kilowatt hour (kWh): is the commercial unit of consumption of electrical energy. Commonly it is called "unit"

Electrical energy consumed can be calculated as:

Energy (in kWh) = power in watt × time in hours

Three pin plug

In some case there is any leakage of current, if any one happens to touch it may get on electric shock. To avoid this we can use three pin plug system. The earth pin is thicker (to decrease resistance) and longer (to contact with the circuit first when connecting and break the contact last when disconnecting) than the other two. It is connected to the metallic covering of the appliances. If by chance the phase wire touches the metal case of the appliance which has been earthed, then the current passes directly to the earth through this low resistance earth wire. It gives safety for the consumers from electric shock.

First aid in the case of electric shock

- Raise the body temperature by massaging
- Give artificial respiration
- Apply pressure on the chest regularly
- Take the person to the nearest hospital immediately.

HEAT

Kinetic Theory: At any state, their molecules are always in a state of motion. Hence they possess kinetic energy.

Solid: High intermolecular attractive force, difficult to move the molecules.

Liquid: Medium intermolecular attractive force, the molecules can move.

Gas: Low intermolecular attractive force, the molecules can move very easily.

[When any substance is heated, the speed of molecules in it increases.]

Heat and Temperature: Heat of a substance is the total kinetic energy of the molecules in it. Temperature is the average kinetic energy of the molecules in it.

Units: Heat: joule (J) or Calorie [1 calorie = 4.2J]

Temperature: ^{0}C (degree Celsius)/^{0}F (degree Fahrenheit)/ SI Unit - K (Kelvin)

Relationship b/w the Celsius scale and Fahrenheit scale

$C = \frac{5}{9}[F-32]$ $F = \frac{9}{5}[C+32]$

^{0}C can be converted into K by adding 273 to it.

ie, $t^0C = t+273K$, $30^0C = 30+273 = 310K$

Heat Capacity: The heat energy required to raise the temperature of a substance by 1K is the heat capacity of that substance. Unit: J/K

Specific Heat Capacity: The heat energy required to raise the temperature of a substance of mass 1kg by 1K is the specific heat capacity of that substance. Unit: J/kg/K. Water – 4186, Ice – 2130, Lead – 120

Specific heat capacity = $\frac{\text{The amount of heat energy given}}{\text{Mass} \times \text{increase in temperature}}$

Life situations based on the high specific capacity of water:

- The variations in atmospheric temperature do not affect our body instantly.
- Water is used as a coolant in the radiator of engines.

The quantity of heat can be calculated as **Q = mcθ**, where m is the mass c is the specific heat capacity and θ is the quantity of heat required to raise the temperature of the substance.

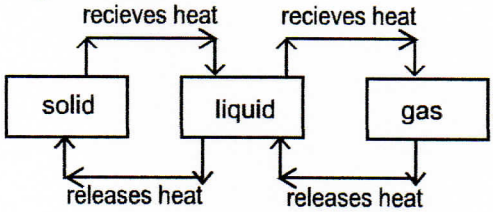
?Calculate the quantity of heat required to raise the temperature of 5kg iron from 303K to 343K (Specific heat capacity of iron is 460J/kg/K)

Principle of method of mixtures

When a hot body is in contact with a cold body, heat flows from the hot body to the cold body, till both the bodies attain the same temperature. The heat lost by the hot body = heat gained by the cold body.

?In a bucket there is 8kg of water at 298K. To this 2kg of water at 353K is added. Calculate the resultant temperature assuming that the bucket and the surroundings do not receive any heat.

Change of state:



A body undergoes a change of physical state by receiving or losing heat.

The fixed temperature at which a solid changes into its liquid state under normal atmospheric pressure is the melting point. A liquid changes into its solid form at the same temperature. This temperature is its freezing point. Both these are equal.

Latent heat of fusion (L_f): of a solid is the quantity of heat absorbed by 1kg of the solid to change into its liquid state at its melting point without change in temperature.

Eg:

Substance	MP	L_f (Unit: J/kg)
Ice	0	335×10^3
Silver	962	88×10^3

Life situations based on the high L_f of ice:

- Glaciers do not melt as a whole at the same time.
- Ice cream does not melt fast.
- It feels much colder when an ice piece at 0^0C is placed in the mouth than when drinking water that is at 0^0C

Quantity of heat required to convert a substance of mass m kg completely into its liquid form at its melting point is $Q = mL_f$

Vaporisation: is the process by which a liquid changes into its gaseous state at its boiling point.

Latent heat of vaporization (L_v): of a substance is the quantity of heat absorbed by 1kg of the liquid to change into its gaseous state at its boiling point without change in temperature.

Eg:

Substance	BP	L_v (Unit: J/kg)
Water	100^0C	226×10^4
Methanol	64^0C	112×10^4

Life situations based on the high L_v :

- Cooking of food is faster when it is done in steam.
- Steam is used for the working of a thermal power station.
- The blister caused by steam is said to be more severe than that caused by boiling water at the same temperature.

Evaporation: is the process by which a liquid changes into its vapour form by absorbing heat from the surroundings.

Life situations from our day to day life in which evaporation is made use are:

- Water kept in an earthen pot cools well.
- A sweating person feels colder if he is sitting under a fan.
- A wet hand feels cold when it is waved.

Factors influencing rate of evaporation:

- Nature of substances
- Atmospheric temperature
- Wind
- Surface area

Global Warming: is the phenomenon by which the temperature of the earth's surface and the atmosphere increases due to excess of green house gases.

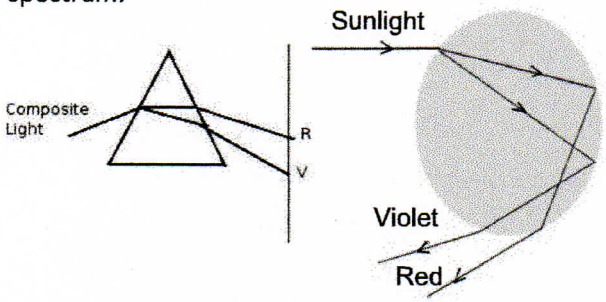
Suggestions to prevent global warming:

- Avoid the excessive use of fossil fuels
- Reduce the use of CFC (Chloro Fluoro Carbon)
- Reduce the further production of green house gases
- Find out an effective method to use hydrogen as a fuel.

COLOURS OF LIGHT

✓**Composite Light:** Any light, which is the combination of more than one colour. Eg: Sunlight, torch light, candle light

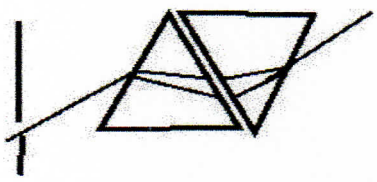
✓**Dispersion:** Splitting up of a composite light into its component colours (VIBGYOR). The difference in wavelength of component colours is the reason for dispersion. Violet (low wavelength) gets deviated the most and Red (high wavelength) the least. Laser light can't be dispersed because it is not a composite light. The arrangement of colours due to dispersion is called spectrum.



✓**Rainbow:** Refraction of light in the water drop two times and due to total internal reflection, sun light splits into its component colours. Red is in the outer edge and violet is in the lower edge.

The Arc shape of rainbow: The line of joining the centre of rainbow and the observer is the line of vision. Each coloured ray makes a definite angle with the line of vision (violet-40.8^0 and red-42.7^0). These angles cause rainbow seen in the form of an arc.

✓**Recombination of component colours using two prisms:** Two prisms are oppositely arranged their bases and pass the visible light we get the same visible light. That is we can split a composite light and re-join the same. Like that we can create the white colour from the colour disc by rotating it. This is due to the persistence of vision.



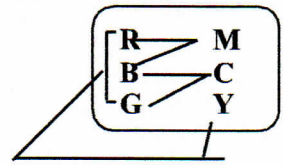
✓**Persistence of vision:** When a person sees an object its image remains in the retina of the eye for a time interval of 1/16 second. In TV and the theatre screen the pictures are seemed to be moving is due to the persistence of vision.

✓**Primary and Secondary Colours**: Any colour, which cannot be obtained by mixing other colours of light are called primary colours. Eg: Red, Blue and Green. Any colour, which can be produced by mixing any two primary colours of light, is called secondary colours. Eg: Magenta, Cyan and Yellow

Red+Blue=Magenta

Blue+Green=Cyan

Red+Green=Yellow



✓**Complementary colours:** The pair of colour combined with a primary to get white light

Primary	Complementary	Colour of light obtained
Red	Cyan	White
Blue	Yellow	White
Green	Magenta	White

The following discs with colour combination become white when it rotates fast are:

Red+Cyan, Blue+Yellow, Green+Magenta,

Red+Blue+Green, Magenta+Cyan+Yellow

✓**Opaque objects:** The objects resist light to pass through them. The colour of this object depends upon the colour of light it reflects. It reflects its colour only.

✓**Transparent objects:** The objects allow light to pass through them. The colour of this object depends upon the colour of light it passes through them.

Colour of opaque	Colour of transparent	Colour see through transparent object
Primary	Primary	Dark
Primary	Secondary	Common in both
Secondary	Secondary	Common in both
Eg: Red flower	Blue glass	Dark
Green leaf	Yellow(R+G) glass	Green
Yellow(R+G) lemon	Magenta(R+B) glass	Red

✓**Solar spectrum:** The series of rays from sun light including visible light.

Ray	Properties and Uses
Gamma	Decomposition of cells, Emits from atomic explosion, Used in cancer treatment
X ray	Causes to cancer, Used to understand bone fracture
UV ray	Produces Vitamin D in skin, Destroys the ozone layer. Causes to cancer and blindness
Visible light	Creates vision experience, Used for photosynthesis and in solar cell
IR ray	Heat ray, Used in TV remote and night vision camera
Microwave	Used in Radar, Mobile phone, Oven
Radio wave	Very High Frequency(VHF) is used in radio and Ultra High Frequency (UHF) in TV

✓**Scattering:** Irregular and partial reflection of light during its passage through a medium. The size of the particle increases, the rate of scattering increases. If the size of particle is greater than the wavelength of light then scattering is same for all colours. Red colour (higher wavelength) occurs minimum scattering while violet (lower wavelength) occurs maximum scattering. Colour of sky-Blue, Deep sea appear blue, Colour of rising/setting sun-Orange red, Colour of accident signal-Red, Headlight colour in smog season-Yellow Colour of sky in Moon – Dark etc. are explained on the basis of scattering.

✓**Tindal Effect:** When rays of light pass through a colloidal fluid or suspension, the particles get illuminated due to scattering. This makes the path of light visible.

✓**Infrared Photography:** Used for long range photography. Infrared filter is used because infrared and visible light are sensitive. These filters absorb visible light and emit infrared.

ELECTRONICS AND MODERN TECHNOLOGIES

Benefits of technologies that effects human life:

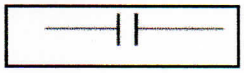
- Electricity
- Wireless communication
- Remote sensing
- Thermal photography
- Internet

Electronics: is the study about the characteristics, control and uses of electrons. Radio, TV, LED, Digital meter, Mobile phone, Computer etc. are electronic devices.

Electronic components:

Name	Symbol	Usage	Unit
1.Resistor	 Variable resistor 	Regulating the current and supply necessary potential difference to the components	Ohm (Ω)
2. Inductor	  Variable inductor	Resist the variation of electric current without energy loss.	Henry (H) or milli Henry (mH)

3. Capacitor: Store electric charges and release when necessary. Two parallel metallic plates and an insulator (called dielectric) between the plates are the parts of it.



Eg: Paper, Polyester, Ceramic, Mica etc. are used as dielectrics.

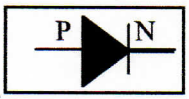
Unit: Farad (F)/microfarad/Nano Farad/Pico Farad [$1\mu F=10^{-6}F$, $1nF=10^{-9}F$, $1pF=10^{-12}F$]

Electrolytic capacitor: An electrolyte is used as dielectric; the polarity of this capacitor is marked on them.

Semiconductors: The conductivity of semiconductors is higher than that of insulators, but lower than that of conductors. Eg: Germanium, Silicon

Conductivity of a semiconductor can be increased by adding some impurities into it.(Process is called doping). By doping we get p-type and n-type semiconductors.

4. Diode: An electronic component by doping one part with p-type and the other with n-type.

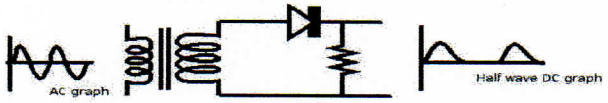


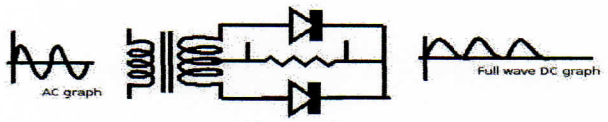
LED (Light Emitting Diode): Light emitted while passing electricity. Colour of light depends upon the material used. Small, minimum energy utilisation, long lasting, cheap etc. are the features of LED.

Uses of Diode: Rectification (AC→DC): Mainly three types

a) Half wave rectification: using one diode. Rectified output DC is only for half of the input AC.

b) Full wave rectification: output is connected by centre tapping method of 2 diodes. Rectified output DC gets on both cycles of input AC. Difficulty in locating centre tap and low output voltage are drawbacks of Full wave.

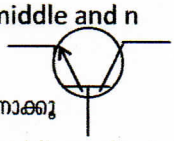




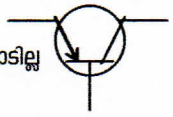
c) Bridge Rectification: Using 4 diodes. Overcomes centre tap locating problem and low voltage

5. Transistor: 3 terminals/2 types

a) npn transistor: p type is on the middle and n types are on each side



b) pnp transistor: n type is on the middle and p types are on each side.



Use of Transistor: Amplification

Amplification is the process of increasing the strength of a signal. By this amplitude of a signal is increasing not the frequency.

6. IC (Integrated Circuit): It is the combined simple circuit of several resistors, capacitors, diodes and transistors.

Advantages: High efficiency, Low energy utilisation, Long lasting, Low cost, More reliable, lesser weight.

7. Microprocessors: A small chip includes lakh of transistors.

Modern Technologies

1. Communication: Mobile phone, Internet, TV etc.
2. Photonics: The branch of science that deals with the study of the nature, control and use of photons which are the particles in light. Eg: Laser optics, Fibre Optics
3. Wi-Fi (Wireless Fidelity): is the method in which data transferred using radio waves to link equipment without connecting wires.
4. Digital Camera: A device which converts figures and scenes directly into digital signals. The clarity of picture decides according to the number of pixels. Used in Mobile phone, Drone, CCTV.
5. HD (High Definition): The number of pixels in each frame. Eg: Around 2,73,600 pixels in each frame. Used in TV, Mobile phone
6. Nano Technology: is the branch of science that makes new substances and parts of devices using particles of size from 1 nm to 100 nm (1 nm = 10^{-9}m). Used in bandage, efficient battery, paint, varnish, display screen
7. Robotics: Robots are machines which controls the duties with or without the external control of man. Robotics is the branch of science which deals the production and usage of Robots. Uses:
   Industry: to handle harmful chemicals
   Medical: For rare surgery
   Educational and Military fields etc.
8. Drone: Flying Robot. The flying controls with GPS (Global Positioning System)
9. Magnetic Resonance Imaging (MRI Scanner), Ultra Sound Scanner (US Scan), Electro Cardio Gram (ECG) and Electro Encephalo Gram (EEG) is the modern technologies used in the medical field.

Control of e-wastes: The wastes thrown out from damaged electric and electronic devices causes' environmental pollution. It gives a threat to health and spoils water resources. Control the e-wastes scientifically.

ENERGY MANAGEMENT

Fuels: Any objects which produces heat while burning

Eg: Solid: Firewood, Coal

Liquid: Kerosene, Petrol

Gas: Biogas, LPG

Combustion: Reaction with oxygen. Two types

a) Partial Combustion: Combustion of an object without sufficient oxygen. Due to this Smoke, CO are produced. Time and energy lose occurred.

b) Complete Combustion: Combustion of an object with sufficient oxygen. Smoke is less and CO_2 is produced.

Fossil Fuels: The fuels formed in the geological past from the remains of living organisms. These fuels can't reproduce. So it is called non-renewable energy sources. Eg: Petroleum, Coal

Petrol, Diesel, Kerosene, Naphtha, Paraffin wax, Petroleum gas, Natural gas are products when Petroleum is purified with fractional distillation.

▪LPG (Liquefied Petroleum Gas): No colour and odour. Ethyl Mercaptan is used as smelling agent in domestic gas. Main Content: Butane

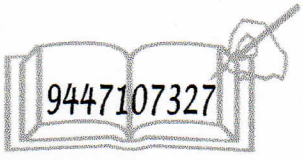
▪CNG (Compressed Natural Gas) & LNG (Liquefied Natural Gas): Extracted from natural gas. Main content: Methane.

▪Coal: Most abundant fossil fuel. Main content: Carbon. Classified into Peat, Lignite, Bituminous Coal and Anthracite according to the percentage of carbon. Ammonia, Coal gas, Coal tar and Coke are obtained by purifying Coal.

Fuel Efficiency: Efficiency of a fuel is explained on the basis of heat energy released at the time burning.

Calorific Value: The quantity of heat liberated by the complete combustion of 1 kg of a fuel. Unit: kJ/kg

Eg: Hydrogen: 150000 kJ/kg
CNG: 50000 kJ/kg
Petrol: 45000 kJ/kg
LPG: 55000 kJ/kg



Hydrogen – Future fuel: High calorific value but highly explosive. Now a days Hydrogen fuel cell is used to produce electricity.

Characteristics of an efficient fuel:

1. Most abundant
2. Low cost
3. High calorific value
4. Non pollutant
5. Non explosive
6. Storage and distribution capability

Biomass & Biogas: Biomass is organic matter derived from living, or recently living organisms. Eg: cow dung. Direct combustion of biomass produces CO (poison gas), large amount of smoke, carbon and foul smell.

Biogas is a gas produced by the bacterial decomposition of biomass. Used as cooking fuel. Main content: Methane

Sun – Energy Source

1. Solar cell: Light converts to Electrical energy by photo voltaic effect.
2. Solar Panel: The arrangement of more solar cells to produce high voltage and current
3. Solar water heater/Solar cooker: Some system which uses solar energy directly.
4. Solar thermal power plant: Electricity generated from sun light. Eg: Gurgaon in Haryana (500kW)

Wind – Energy source

Electricity is generated from wind by using windmill. Eg: Kanjikkode, Palakkad (750kW)

Energy from Nucleus: 2 methods

a) Nuclear Fission: Splitting of a big nucleus into small nucleus by using neutron.

b) Nuclear Fusion: Combining of small nucleus into a big nucleus.

Nuclear Reactor is the system which generates electrical energy from nuclear energy. Enriched Uranium is used as fuel in nuclear reactors.

Conventional energy sources	Non-conventional energy sources
• Fossil fuels • Biomass • Hydroelectric power station	• Solar energy • Nuclear energy • Wind energy

Green energy/Clean energy: Energy which produces from eco-friendly energy sources without environmental pollution. Eg: Solar energy, Wind, Tide etc. (Renewable energy sources)

Energy Crisis: Increase in the need of energy and decrease the availability. **Reasons:** Lavish use of vehicles, Urbanisation, Industrialisation, Food, Shelter

Solutions: Scientific usage reduces the water wastes, use most efficient electrical appliances, use public transport system.