ELECTRICITY

- The term electric is derived from the Greek word electron.
- There are two types of charges : positive and negative charge.
- Two like charges repel each other and two unlike charges attract each other.
- The unit of charge is coulomb.

DEFINITION

- A fundamental form of energy observable in positive and negative forms that occurs naturally (as in lightning) or is produced (as in a generator) and that is expressed in terms of the movement and interaction of electrons.
- The flow of electric charge in a conductor is called an electric current.
- The unit of current is ampere(A).

RESISTANCE

- Resistance is the property of a conductor by which it opposes the flow of current.
- It is defined as the ratio between the potential difference and current of the conductor.
- The unit of resistance is ohm(Ω).

POTENTIAL

- The space around a charge in which its influence is left , is known as electric field.
- The unit of potential is volt.
- If the work done in moving a unit charge from one point to other is 1 J.

ELECTROMAGNET

- An **electromagnet** is a special type of temporary magnet that only generates a magnetic field when electric current is flowing. This makes electromagnets very convenient because they can easily be turned on or off, and can create very strong magnetic fields.

ELECTRIC CURRENT

- When a lot of free electrons are all moving in the same direction, we call it an **electric current**. The amount of electric current refers to the number of electrons (to be precise, their charges) passing through an area per unit of time, and is measured in **amperes** (usually called **amps** for short, abbreviated with a capital A).
- Because the electron has such a small charge, the **coulomb** (abbreviated with a capital C) is often used as unit of charge for electrons. In these units, 1 ampere (A) is a current created by 1 coulomb (C) passing per second.

DESCRIPTION

Variable	Description	Unit	Unit Abbreviation
Charge	Quantity of electricity; can be positive, negative, or neutral.	Coulomb	C
Voltage	Also called electric potential, or the "pressure" that makes current flow.	Volt	V
Power	Energy used or produced per second.	watt	W

ELECTRIC POTENTIAL

- Just like water needs a pressure difference to start flowing, electrons require an **electric potential difference** to make them move.
- The potential difference provides the energy to create movement.
- Electric potential difference is also called **voltage** and it is measured in **volts** (abbreviated V).

FLOW OF CURRENT IN SOLIDS.

- **Conduction in solids:**
- Among solids, metals are good conductors of electricity. In metals, some electrons are not very tightly bound to the atoms. They move about randomly in different directions within the metal.
- When a voltage is applied across a piece of a metal, these electrons move in an orderly fashion in one direction. This flow of electrons is the current in the metal. In most other solids, electrons are tightly bound to the atoms and are not easily available to flow. So, they do not conduct electricity well.

FLOW OF CURRENT IN LIQUIDS.

CONDUCTION IN LIQUIDS:

- Molten metal's and mercury (a liquid metal) conduct electricity. The current through them is constituted by the flow of electrons. Other liquids conduct electricity because they have ions.
- The atom that loses an electron (or electrons) has more protons than electrons. So, it becomes positively charged. And the atom that gains the electrons has more electrons than protons. So, it becomes negatively charged.

FLOW OF CURRENT IN GASES

- Current in gases and liquids generally consists of a flow of positive ions in one direction together with a flow of negative ions in the opposite direction.
- A current of negative charge moving in the opposite direction is equivalent to a positive charge of the same magnitude moving in the conventional direction.
- Current in semiconductors consists of the motion of holes in the conventional direction and electrons in the opposite direction

HEARING EFFECT

- When electric current flows through a conductor having a resistance , a certain amount of electrical energy is converted into heat energy.
- The heat is produced by the free electrons as they move through the metal.
- The atoms which gains the kinetic energy , generates heat in the conductor.

FARADY'S LAWS OF ELECTROLYSIS

- The mass(m) of the ion liberated from an electrolyte at the respective electrode is directly(Q) proportional to the quantity of electricity which passes through it.
  - $m \propto Q$ or $m=Z.I.t.$
  - Z is a constant , I is current , t is the time.

ELECTRO CARDIOGRAM (ECG)

- **Electrocardiography** (**ECG** or **EKG**) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin.
- A conventional 12-lead ECG, ten electrodes are placed on the patient's limbs and on the surface of the chest. The overall magnitude of the heart's electrical potential is then measured from twelve different angles ("leads") and is recorded over a period of time (usually ten seconds).
- In this way, the overall magnitude and direction of the heart's electrical depolarization is captured at each moment throughout the cardiac cycle.

USES OF ECG

- Heart rate
- Heart rhythm
- Conduction abnormalities
- Heart orientation in the chest cavity
- Evidence of increased thickness of heart muscle (hypertrophy)
- Evidence of damaged heart muscle
- Acutely impaired blood flow to heart muscle
- Warning signs of abnormal cardiac rhythm disturbances

CONTI……

- Fast or irregular heart rhythms
- Abnormally slow heart rhythms
- Abnormal conduction of cardiac electrical impulses, which are symptoms for cardiac or metabolic disorders
- Prior heart attacks (myocardial infarction)
- Reduced blood flow during heart attack (unstable angina).

WAVES ON A E C G

- The P wave represents atrial depolarization.
- The QRS complex represents ventricular depolarization.
- The T wave represents ventricular repolarization.
- The U wave represents papillary muscle repolarization.
- ST segment elevation represent the heart muscle damage .

EEG

- EEG is an electroencephalography used in the study of epilepsy and to find out seizure disorders.
- This instrument is attached to the scalp by means of an adhesive material such as collodion and to improve contact.
- Patients are usually examined with the eyes closed and relaxed in a comfortable chair or bed for 30 to 90 minutes.

EMG

- Electromyogram measures the electrical impulses of muscles at rest and during contraction.
- This test detects the presence , location ,and extent of diseases that damage muscle tissue or nerves.
- To evaluate the cause of weakness , paralysis , involuntary muscle twitching or other symptoms.
- In this a needle has been injected into the specific muscles to be tested and attached by wires to a recording machine. This takes 1 hour to complete the procedure.

ECT

- This is a procedure in which a brief application of electric current to the brain through the scalp , induces a seizures.
- Used in some of the psychiatric disorders.
- General anesthesia is given prior to the procedure.
- Short time memory loss is a severe side effect of ECT.

ELETROMAGNETISM

- The current can be produced in a closed conductor , whenever there is a change in the magnetic flux passing through the conductor.
- The current produced in this conductor is called is induced current.
- The electromotive force producing the current is called an induced emf . This whole phenomenon is called as electromagnetic induction.

LAWS OF ELECTROMAGNETIC INDUCTION

- FARADY'S LAW
- LENZ LAW
- FLEMINGS RIGHT HAND RULE
  - In this rule ones right hand is arranged so that the thumb , the forefinger , the middle finger are all being at right angles to each other .
  - If the thumb denotes the motion of the conductor , the forefinger denote the magnetic field , then the middle finger will denote the direction of the induced emf .

CT SCANNING

- CT is a special type of scanning in which a computer is used to make a mathematical reconstruction of a tomographic plane or slice.

PRINCIPLE.

The basic principle is that the internal structure of an object can be reconstructed from multiple projections of the object.

SCANNING

An x ray tube emitting fan beam from a small focus is coupled to a radiator detector . These two move together on a carriage so that a plane of interest is scanned.

CONTI…..

- When a patient is scanned , the diameter of the area being scanned is called as field of view.
- The organ is divided into number of matrix elements and each matrix element is called a pixel.
- The reconstructed image is displaced on a CRT monitor, by allotting the shades of gray to each CT number.
- There are 258 shades of gray in the system.
- The CT image quality is characterized by the terms of contrast , noise and spatial resolution.

MAGNETIC RESONANCE IMAGING

- Resonance refers to the change of energy states of nuclei caused by absorption of a specific radio frequency radiation.
- Water molecules (H_2O) contain hydrogen nuclei (protons), which become aligned in a magnetic field. An **MRI** scanner applies a very strong magnetic field (about 0.2 to 3 tesla , or roughly a thousand times the strength of a typical fridge magnet), which aligns the proton "spins.“
- Tesla defines the magnitude of the field.

APPLICATIONS IN NURSING

- There are two types of potentials in human body.
  - ❑ Resting potential
  - ❑ Acting potential

A. The resting potential exists between anterior and exterior of the cells like injured or normal parts of the body and tissue cells.

B. The action potential is connected with impulses over nerves , muscles and other cells , this potential exists for longer period.

PATIENT CARE IN M.R.I

- Patients for MRI has to be avoided if the patient has got the cardiac pace makers and internal drug infusion pumps.
- Careful screening of the patients, workers and visitors having assess to the MRI room is required.
- The nurse should pay attention to the above said things in order to take care of the patient.

PACEMAKER

- *pacemaker is a small device that's placed in the chest or abdomen to help control abnormal heart rhythms.*
- *This device uses low-energy electrical pulses to prompt the heart to beat at a normal rate.*
- *Pacemakers are used to treat arrhythmias.*
- *Arrhythmias are problems with the rate or rhythm of the heartbeat.*
- *During an arrhythmia , the heart can beat too fast, too slow, or with an irregular rhythm.*

WORKING OF PACEMAKER

- *A pacemaker is an electrically-charged medical device.*
- *Modern pacemakers have two parts.*
- *One part, called the pulse generator, contains the battery and the electronics that control your heartbeat.*
- *The other part is one or more leads to send electrical signals to your heart. Leads are small wires that run from the pulse generator to your heart.*

CONTI…..

- Pacemakers generally treat two types of arrhythmias:
- tachycardia, a heartbeat that's too fast
- bradycardia, a heartbeat that's too slow
- Some people need a special type of pacemaker called a biventricular pacemaker, or bi vent.
- You may need a bi vent if you have severe heart failure.
- A bi vent makes the two sides of the heart beat in sync. This is known as cardiac resynchronization therapy (CRT).

COMPLICATIONS

- an allergic reaction to anesthesia
- bleeding
- bruising
- damaged nerves or blood vessels
- an infection at the site of the incision
- a collapsed lung, which is rare
- a punctured heart, which is also rare.

PACEMAKER COMPONENTS

- A pacemaker consists of a battery, a computerized generator, and wires with sensors at their tips.
- The battery powers the generator, and both are surrounded by a thin metal box. The wires connect the generator to the heart.
- A pacemaker helps monitor and control your heartbeat.
- The electrodes detect your heart's electrical activity and send data through the wires to the computer in the generator.
- If your heart rhythm is abnormal, the computer will direct the generator to send electrical pulses to your heart.
- The pulses travel through the wires to reach your heart.

DEFIBRILLATOR

- **Defibrillation** is a treatment for life-threatening cardiac dysrhythmias, specifically ventricular fibrillation (VF) and non professing tachycardia(VT).
- A defibrillator delivers a dose of electric current to the heart. This depolarizes a large amount of the heart muscle, ending the dysrhythmia.

MANUAL EXTERNAL DE-FIBRILLATOR.

- Manual external defibrillators require the expertise of a healthcare professional.
- They are used in conjunction with an electrocardiogram, which can be separate or built-in.
- A healthcare provider first diagnose the cardiac rhythm and then manually determine the voltage and timing for the electrical shock.
- These units are primarily found in hospitals and on some ambulances.

TYPES

- **Manual internal defibrillator.**
- Manual internal defibrillators delivers the shock through paddles placed directly on the heart.
- They are mostly used in the operating room and, in rare circumstances, in the emergency room during an open heart procedure.
- **Automated external defibrillators** are designed for use by untrained or briefly trained laypersons.
- AEDs contain technology for analysis of heart rhythms.
- By making these units publicly available, AEDs have improved outcomes for sudden out-of-hospital cardiac arrests.

PLACEMENT OF DEFIBRILLATOR.

- **METHOD OF USE**
- There are two accepted positions to optimize current delivery to the heart.
- (1) Antero apical – one pad/paddle is placed to the right of the sternum just below the clavicle, and the other is centerd lateral to the normal cardiac apex in the anterior or midaxillary line (V5–6)
- (2)Anteroposterior – the anterior pad/paddle is placed over the pericardium or apex, and the posterior pad/paddle is placed on the back in the left or right infra scapular region.

NURSES RESPONSIBILITY IN DEFIBRILLATION

- The time taken to initiate early defibrillation is crucial to improve survival, prevent neurological deficit and improve the quality of life of patients suffering from sudden cardiac arrest.
- Despite the extension of training and the authorization of nurses to perform early defibrillation (advocated by the American Heart Association), such practice has not been widely adopted in hospitals.