

1. The speed of sound in aluminum is about
 (1) 1000 m/s **(2) 6420 m/s** (3) 5444 m/s (4) 1500 m/s
 Ans: (2)

Speeds of Sound

<u>Material</u>	<u>Speed of Sound</u>
Rubber	60 m/s
Air at 40°C	355 m/s
Air at 20 °C	343 m/s
Water	1483 m/s
Sea water	1522 m/s
Lead	1210 m/s
Gold	3240 m/s
Glass	4540 m/s
Copper	4600 m/s
Brass	4700 m/s
Aluminum	6320 m/s
Steel	5790 m/s
Structural steel	4512

<http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/souspe2.html>

<https://www.ndeed.org/EducationResources/HighSchool/Sound/speedinmaterials.ht>

2. The electromagnetic induction was invented by
 (1) Kirchhoff (2) Fleming (3) Lenz **(4) Faraday**
 Ans: (4)
3. Laws of electrolysis were postulated by
 (1) Kirchhoff (2) Fleming (3) Lenz **(4) Michael Faraday**
 Ans: (4)
4. are unaffected by electric and magnetic fields
 (1) Alpha rays (2) Beta rays **(3) Gamma rays** (4) None
 Ans: (3)

5. The electron configuration of silicon is
 (1) 2,8,4 (2) 2,6 (3) 2,8 (4) 2,8,1
 Ans: (1)
6. The ratio of the density of the substance to the density of water is called
 (1) specific volume (2) specific heat (3) specific weight (4) **specific Gravity**
 Ans: (4)
7. The scientist who had devised master plan for Atomic energy in India was
 (1) Dr Raja Ramanna (2) HN Sethna (3) **Homi Baba** (4) None
 Ans: (3)
8. The velocity of sound in dry air at sea level is about
 (1) 230 m/sec (2) 130 m/sec (3) 100 m/sec (4) **320 m/sec**
 Ans: (4)
9. The maximum number of electrons that can be held in the 'N' shell of an atom is
 (1) 2 (2) 18 (3) **32** (4) 8
 Ans: (3)

Silicon Electron Configuration: Silicon is the chemical element with atomic number 14. It is a semiconductor and tetravalent metalloid. The symbol of silicon is "Si" and belongs to the 14th group of periodic table. Electron configuration is the distribution of electrons in the shells or orbits of the atoms and molecules. An electronic configuration describes how many electrons are in an elements shells. The closest shell to the nucleus is called the "1 shell" (also called the "K shell"), followed by the "2 shell" (or "L shell"), then the "3 shell" (or "M shell"), and so on farther and farther from the nucleus. The shells correspond to the principal quantum numbers ($n = 1, 2, 3, 4 \dots$) or are labeled alphabetically with the letters (K, L, M, ...).

Each shell can contain only a fixed number of electrons: The first shell can hold up to two electrons, the second shell can hold up to eight ($2 + 6$) electrons, the third shell can hold up to 18 ($2 + 6 + 10$) and so on. The general formula is that the n th shell can in principle hold up to $2(n^2)$ electrons. 1st shell K = 2, 2nd shell L = 8, 3rd shell M = 18, 4th shell N = 32 and 5th shell

O = 50.

https://en.wikipedia.org/wiki/Electron_shell#:~:text=The%20general%20formula%20is%20that,one%20or%20more%20atomic%20orbitals.

10. A conductor having 5 ohm of resistance, when 2.5 A of current flowing through it in 4 seconds. The electrical energy is

- (1) 250 Joule **(2) 125 Joule** (3) 15 Joule (4) 750 Joule

Ans: (2)

Note: Heat generated, $H = I^2 R t$

11. Which of the following process will give more energy?

- (1) Nuclear fission **(2) Nuclear fusion** (3) Solar radiation (4) induction

Ans: (2)

12. In India, cooking gas/LPG cylinder mainly contains

- (1) low pressure gas
(2) low petroleum gas
(3) least petroleum gas
(4) Butane (about 65%) and balance propane and minor gases

Ans: (4)

LPG IS MADE UP OF A NUMBER OF GASES UNDER THE LPG PRODUCTS LABEL, INCLUDING PROPANE, BUTANE, ISOBUTANE AND MIXTURES OF THESE GASES AND ARE ALSO REFERRED TO AS NATURAL GAS LIQUIDS – NGL. NATURAL GAS IS LIQUEFIED CRYOGENICALLY.

<https://www.elgas.com.au/blog/492-what-is-lpg-lpg-gas-lp-gas>

Liquefied Petroleum Gas (LPG) is a blend of light hydrocarbon compounds. It mainly consists of butane (C_4H_{10}) or propane (C_3H_8) or a mixture of both. At room temperature, both gases are colourless and odourless. Propane has its boiling point at $-42^\circ C$ and butane at $-0.5^\circ C$. Under modest pressure or in cooler conditions, LPG transforms into a liquid state. LPG in domestic cylinders used for cooking generally comprises more butane than propane, because the fuel value per kilogram of butane is higher than propane and it liquefies under much lower pressure than propane and thus the handling is safer. National and international standards specify the minimum content of butane and a maximum LPG vapor pressure. When liquefied under pressure, the volume of butane and propane is reduced to around

1/260 of the gaseous aggregate state. The specific calorific value of LPG is around 46 MJ/kg or 12.78 kWh/kg depending on the composition of LPG. In comparison, wood has an energy content in the range of 14-18 MJ/kg or 3.89 - 5 kWh/kg (depending of the type of wood and the moisture content).

Liquefied Gas is heavier than air and can therefore accumulate above the ground. It is common practice to add a foul smelling odorant to the gas in order to detect leaks and reduce the risk of explosions.

[https://energypedia.info/wiki/Liquefied_Petroleum_Gas_\(LPG\)#::~:~:text=Liquefied%20Petroleum%20Gas%20\(LPG\)%20is,butane%20at%20%2D0.5%20%C2%B0C.](https://energypedia.info/wiki/Liquefied_Petroleum_Gas_(LPG)#::~:~:text=Liquefied%20Petroleum%20Gas%20(LPG)%20is,butane%20at%20%2D0.5%20%C2%B0C.)

13. Cathode rays are composed of

- (1) positively charged particles **(2) negatively charged particles**
(3) neutral particles (4) none of these

Ans: (2)

14. The only non-metal which conducts electricity is

- (1) sodium (2) chlorine **(3) graphite** (4) potassium

Ans: (3)

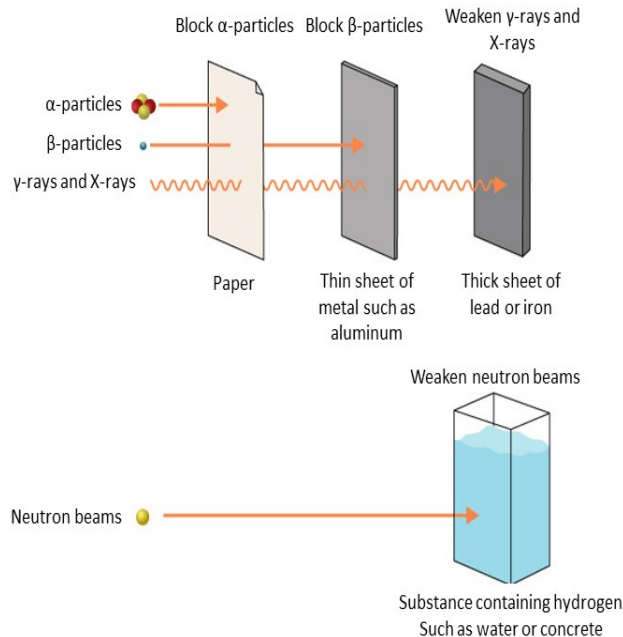
15. The rays having the maximum penetrating power are

- (1) Alpha rays (2) Beta rays **(3) Gamma rays** (4) X- rays

Ans: (3)

There is a great difference in the penetrating powers for alpha, beta, and gamma rays. Of the three types of radiation, alpha particles are the easiest to stop. A sheet of paper is all that is needed for the absorption of alpha rays. However, it may take a material with a greater thickness and density to stop beta particles. Gamma rays have the most penetrating powers of all three radiation sources.

Radiation can be blocked by various substances.

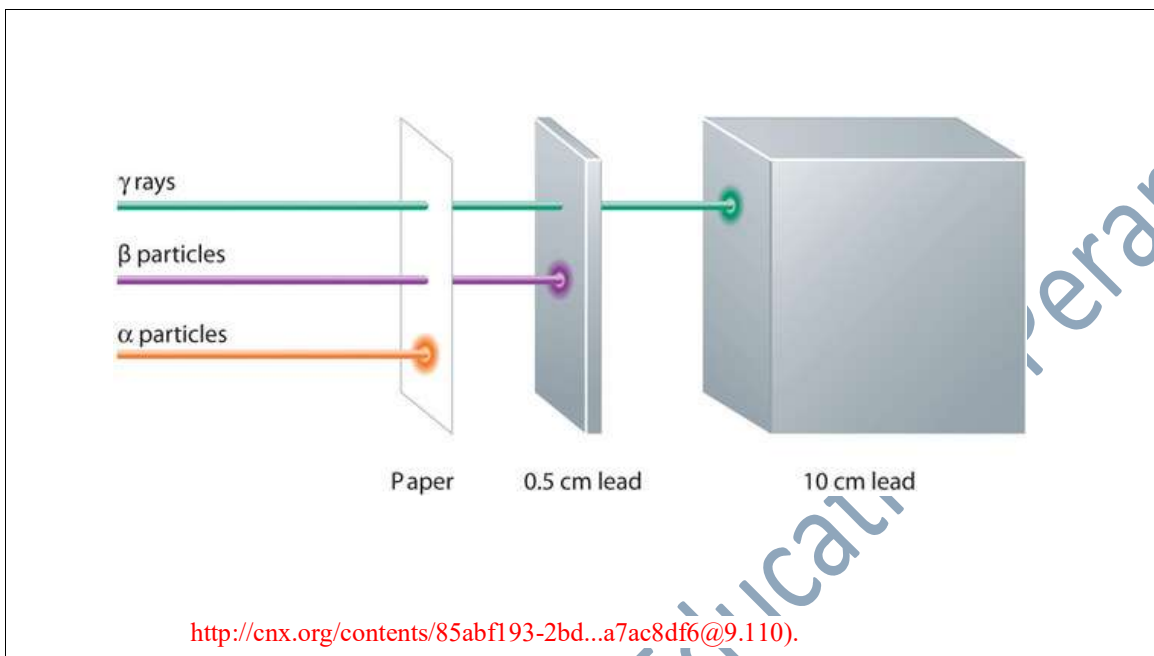


Charged particles or electromagnetic waves interact with a substance, lose their energy (speed), and eventually stop.

Since α -particles cause a large amount of ionization, a sheet of paper is enough to stop them. β -particles travel several meters in the air, and a 1 cm thick plastic sheet or a 2-4 mm thick aluminum plate is enough to stop them, depending on how much energy they have.

γ -rays and X-rays have higher penetrating power than α -particles or β -particles, travel several tens to hundreds of meters in the air (depending on their energy) and gradually lose their energy as they collide with atoms in the air. As γ -rays and X-rays can be shielded using thick plates of high-density lead or iron, those from radiation generators can be blocked using iron and the like.

<https://www.env.go.jp/en/chemirhm/basic-inf//1st/01o-03-08.html>



16. Rusting of steel is a

(1) chemical change

(2) physical change

(3) mechanical change

(4) none of these

Ans: (1)

17. Corrosion of steel is a

(1) chemical change

(2) physical change

(3) mechanical change

(4) none of these

Ans: (1)

18. The rays having a high ionising power are

(1) Alpha rays

(2) Beta rays

(3) Gamma rays

(4) Infra-red rays

Ans: (1)

NON-IONIZING AND IONIZING RADIATION

There are two kinds of radiation: non-ionizing radiation and ionizing radiation.

Non-ionizing radiation has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons from atoms. Examples of this kind of radiation

are radio waves, visible light and microwaves.

Ionizing radiation has so much energy it can knock electrons out of atoms, a process known as ionization. Ionizing radiation can affect the atoms in living things, so it poses a health risk by damaging tissue and DNA in genes. Ionizing radiation comes from x-ray machines, cosmic particles from outer space and radioactive elements. Radioactive elements emit ionizing radiation as their atoms undergo radioactive decay.

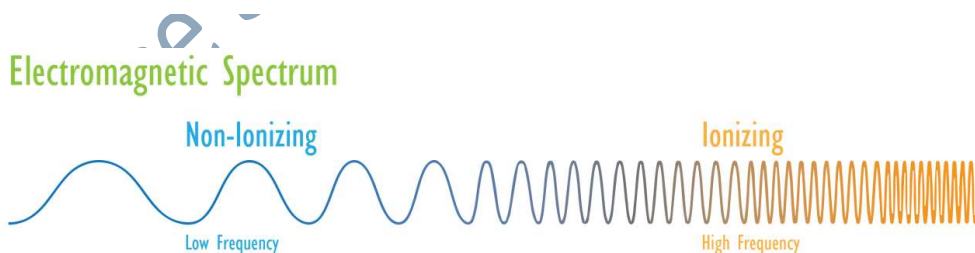
Radioactive decay is the emission of energy in the form of ionizing radiation. The ionizing radiation that is emitted can include alpha particles, beta particles and/or gamma rays. Radioactive decay occurs in unstable atoms called radionuclides.

Alpha particles (α) are positively charged and made up of two protons and two neutrons from the atom's nucleus. Alpha particles come from the decay of the heaviest radioactive elements, such as uranium, radium and polonium. Even though alpha particles are very energetic, they are so heavy that they use up their energy over short distances and are unable to travel very far from the atom

Beta particles (β) are small, fast-moving particles with a negative electrical charge that are emitted from an atom's nucleus during radioactive decay. These particles are emitted by certain unstable atoms such as hydrogen-3 (tritium), carbon-14 and strontium-90.

Gamma rays (γ) are weightless packets of energy called photons. Unlike alpha and beta particles, which have both energy and mass, gamma rays are pure energy. Gamma rays are similar to visible light, but have much higher energy. Gamma rays are often emitted along with alpha or beta particles during radioactive decay.

X-rays are similar to gamma rays in that they are photons of pure energy. X-rays and gamma rays have the same basic properties but come from different parts of the atom. X-rays are emitted from processes outside the nucleus, but gamma rays originate inside the nucleus. They also are generally lower in energy and, therefore less penetrating than gamma rays. X-rays can be produced naturally or by machines using electricity.



<https://www.epa.gov/radiation/radiation-basics>

19. Substances whose electrons are rigidly held to their atoms are termed as

(1) insulators (2) good conductor (3) semi conductor (4) none of these

Ans: (1)

Insulators

Most materials, including plastics, ceramics, rubber, paper, and most liquids and gases, fall into that category. There are many practical uses for insulators in the electrical and electronic industries, including wire coatings, safety enclosures, and power-line insulators. The criteria for selecting a given material are generally dependent upon the voltage rating of the cable, the flexibility requirements, the temperature to which the insulating material will be subjected, and the environmental conditions. Some of the more common insulating materials Polyvinyl chloride (PVC), Polycarbonate, Rubber compounds, Ceramics, Glass, Air, mineral oil, etc.

20. The electrolyte of a lead acid battery is

- (1) dilute nitric acid (2) ammonium chloride solution
(3) dilute sulphuric acid (4) distilled water

Ans: (3)

21. In a step-up transformer the ratio of output voltage to input voltage or turns ratio is

- (1) less than one (2) one **(3) greater than one** (4) none of these

Ans: (3)

22. The electrolyte of a dry cell/battery is

- (1) dilute nitric acid **(2) ammonium chloride solution**
 (3) dilute sulphuric acid (4) distilled water

Ans: (2)

23. The unit of electric charges is

- (1) Ampere **(2) Coulomb** (3) Volt (4) Watt

Ans: (2)

24. The metal having least electrical resistance is

- (1) Aluminium (2) Copper (3) Gold **(4) Silver**

Ans: (4)

25. Chemical energy is transferred into electric energy in
(1) Fuel cell (2) Battery (3) **Both (1) and (2)** (4) None

Ans: (3)

26. Light energy is transferred into electric energy in
(1) LED light (2) **Photo-voltaic cell or solar cell** (3) Fuel cell (4) None

Ans: (2)

27. The purpose of using bearings in a Fan is
(1) to reduce heat (2) **to reduce friction between rotating parts**
(3) to hold the fan (4) To circulate more air

Ans: (2)

28. The heating effect in a conductor due to passage of electric current is known as
(1) Coulomb effect (2) Ohm's law
(3) Faraday's law (4) **Joule's Effect.**

Ans: (4)

29. Among the following liquids which has maximum viscosity?
(1) Alcohol (2) **Castor oil** (3) Kerosene (4) Water

Ans: (2)

30. The final image formed by a compound microscope is
(1) **real and inverted** (2) virtual and erect
(3) magnified and inverted (4) diminished and real

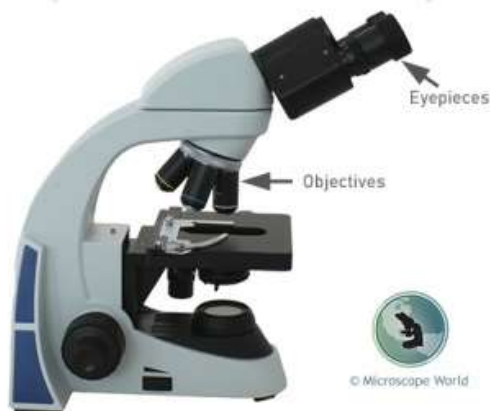
Ans: (1)

WHAT IS A COMPOUND MICROSCOPE?

A compound microscope is a high power (high magnification) microscope that uses a compound lens system. A compound microscope has multiple lenses: the **objective lens** (typically 4x, 10x, 40x or 100x) is compounded (multiplied) by the **eyepiece lens** (typically 10x) to obtain a high magnification of 40x, 100x, 400x and 1000x. Higher magnification is achieved by using two lenses rather than just a single magnifying lens. While the eyepieces and the objective lenses create high magnification, a condenser beneath

the stage focuses the light directly into the sample.

Compound Microscope



Compound microscopes are used to view small samples that cannot be identified with the naked eye. These samples are typically placed on a slide under the microscope. When using a stereo microscope, there is more room under the microscope for larger samples such as rocks or flowers and slides are not required.

<https://www.microscopeworld.com/p-3470-what-is-a-compound-microscope.aspx>

31. The quantity of heat generated due to heating effect of current in a conductor is given by known as

- (1) I^2Rt (2) VIt (3) IRt (4) None.

Ans: (1)

32. In an electric heater, the heating element is made of

- (1) alnico (2) **nichrome** (3) lump stun (4) german silver

Ans: (2)

33. The main component of cooking gas in India is

- (1) acetylene (2) **butane** (3) ethane (4) propane

Ans: (2) (about 65% and the balance propane)

34. is the capacity to do work

- (1) **Energy** (2) Current (3) Power (4) Force

Ans: (1)

35. is the rate of doing work
(1) Energy (2) Current **(3) Power** (4) Force
Ans: (3)
36. is a good conductor of heat and electricity
(1) Copper (2) Nickel (3) Zinc (4) Iron
Ans: (1)
37. is a good conductor of heat and electricity
(1) Graphite (2) Nickel (3) Zinc (4) Iron
Ans: (1)
38. Domestic supply voltage and frequency in India is
(1) 110 V, 50 Hz (2) 215 V, 60 Hz **(3) 230 V, 50Hz** (4) 400 V DC
Ans: (3)
39. In an electric motor
(1) input is mechanical and output is electrical
(2) input is hydraulics and output is pneumatics
(3) input is electrical energy and output is mechanical energy
(4) none of these
Ans: (3)
40. Fuse is used for
(1) measurement **(2) protection of the electrical circuit** (3) gauging
(4) none of these
Ans: (2)

Note: A **fuse** is an electrical safety device that operates to provide overcurrent protection of an electrical circuit. The functions of a fuse is to carry the normal working current without interrupting and to break the circuit when the current exceeds the limiting current. It consists of a metal wire or strip that melts when too much current flows through it, thereby stopping or interrupting the current; once a fuse has operated it is an open circuit, and must be replaced or rewired, depending on its type.

The fuse should be connected in series to the supply. A fuse consists of two main components: one is a fusible element in the form of a metal conductor along with a set of contacts between which it is fixed and the other is a case or cartridge to hold the fusible element. A cartridge is sometimes provided with arc extinction arrangements within it.

41. Friction can be reduced by changing over from
(1) sliding contact to rolling contact (2) rolling to sliding contact
 (3) dynamic to static friction (4) None

Ans: (1)

42. What is the unit of electric charge?
 (1) Volt-ampere (VA) (2) Henry (H)
 (3) Farad (F) **(4) Coulomb(C)**

Ans: (4)

43. What will be the capacity of four capacitors of equal capacity 'C' when connected in parallel ?

(1) **4C** (2) C/4 (3) 3/4C (4) C

Ans: (1)

44. What will be the capacity of four capacitors of equal capacity 'C' when connected in series ?

(1) 4C **(2) C/4** (3) 3/4C (4) C

Ans: (2)

45. Paper condenser is a type of
 (1) variable condenser (2) electrolytic condenser
(3) fixed condenser (4) None of these

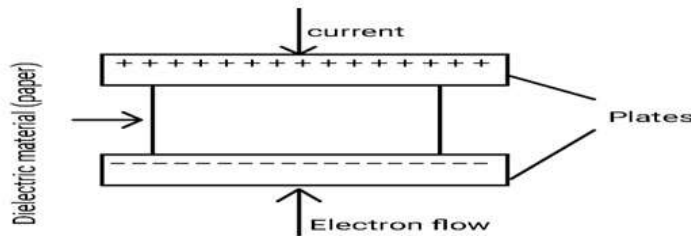
Ans: (3)

In every electronic circuit, inductors and capacitors are used as a passive component to resist flow of current and store electrical energy. Generally, paper capacitor is made up of two conducting surfaces separated paper as an insulating material. This material is called the dielectric. Capacitors offer a low resistance path to A.C voltage and high resistance to D.C voltage from one circuit to another circuit. This capacitance of the circuit is stored in the form of an electric field. It opposes the flow of voltage in any electronic circuit and blocks the flow of direct current passing through it. Capacitors are manufactured with different packages, various types, and values based on the application.

WHAT IS THE PAPER CAPACITOR?

Definition: Paper capacitor is also known as a Fixed capacitor, in which paper is used as a dielectric medium, that stores energy in the form of the electrical field. These capacitors are used at power line frequency with a capacitance value of 1nF to 1uF. It stores a fixed amount of electric charge.

A **paper capacitor** is made up of two metallic plates with a dielectric material paper between them. It has positive and negative plates. When a small amount of electric charge is applied over the plates, the positive charge is attracted to one plate and a negative charge is attracted to another plate. This electrical energy is stored in the form of the electrical field. This stored electrical energy is used by the discharging of a capacitor. These are available in the range of 500pF to 50nF. These offer high leakage currents.



Advantages & Disadvantages

The advantage of using a paper capacitor is that provides a fixed value of capacitance. The value of the capacitance is fixed during manufacturing. The main disadvantage is, it absorbs moisture in the air and decreases the insulation resistance of the dielectric. As it absorbs moisture in the air, the dielectric medium is affected.

<https://www.elprocus.com/what-is-a-paper-capacitor-construction-working-applications/#:~:text=Definition%3A%20Paper%20capacitor%20is%20also,fixed%20amount%20of%20electric%20charge.>

46. The sure test to sense or ensure the presence of electricity is

- (1) induction (2) friction **(3) repulsion** (4) attraction

Ans: (3)

A test light, test lamp, voltage tester, or mains tester is a piece of electronic test equipment used to determine the presence of electricity in a piece of equipment under test. A test light is simpler and less costly than a measuring instrument such as a multimeter, and often suffices for checking for the presence of voltage on a conductor. Non-contact test lights can detect voltage on insulated conductors.

47. The amount of Impulse of a moving body when it collides with an another object is given by

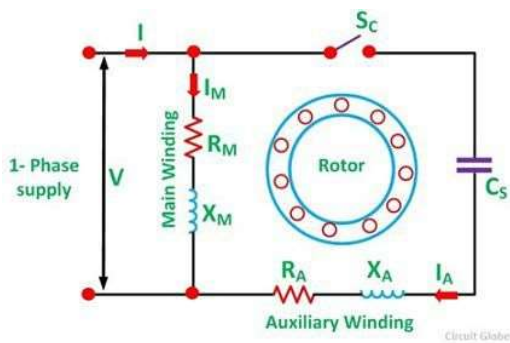
- (1) **Force x time** (2) Work done/time
 (3) Force/time (4) None.

Ans: (1)

Start capacitors briefly increase motor starting torque and allow a motor to be cycled on and off rapidly. A start capacitor stays in the circuit long enough to rapidly bring the motor up to a predetermined speed, which is usually about 75% of the full speed, and is then taken out of the circuit, often by a centrifugal switch that releases at that speed. Afterward the motor works more efficiently with a run capacitor.

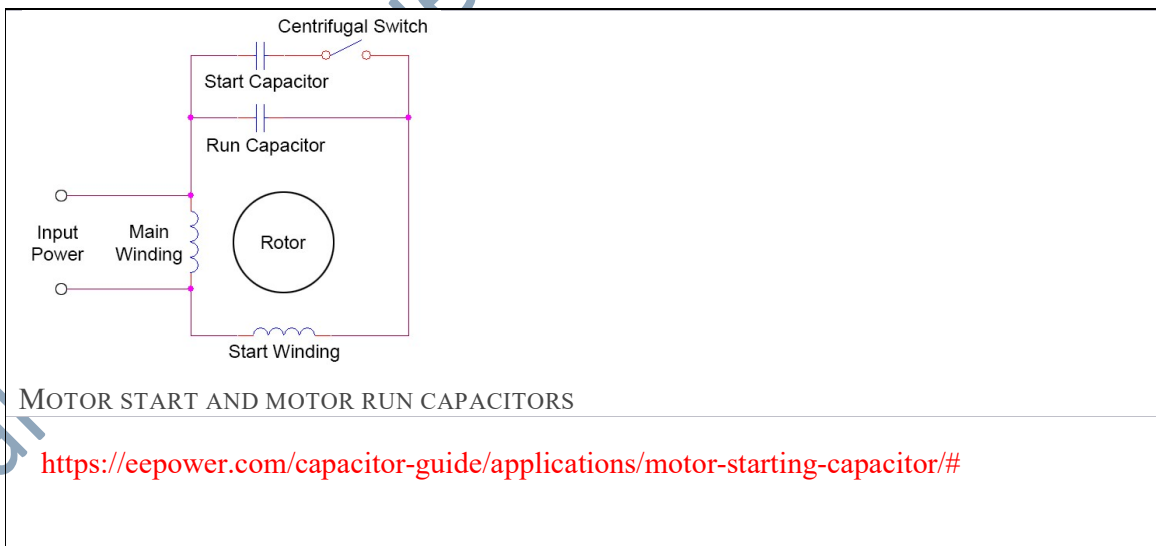
CAPACITOR START INDUCTION MOTOR

A **Capacitor Start Motors** are a single phase Induction Motor that employs a capacitor in the auxiliary winding circuit to produce a greater phase difference between the current in the main and the auxiliary windings. The name capacitor starts itself shows that the motor uses a capacitor for the purpose of the starting. The figure below shows the connection diagram of a Capacitor Start Motor.



<https://eepower.com/capacitor-guide/applications/motor-starting-capacitor/#>

Box.2



MOTOR START AND MOTOR RUN CAPACITORS

<https://eepower.com/capacitor-guide/applications/motor-starting-capacitor/#>