1. The voltage at the receiving (load) end of a transmission line can be higher than the sending end if-

(1) The load is largely inductive
(2) The load is largely resistive
(3) The load is highly capacity
(4) None of the above

Ans: 3

2. The insulation resistance of a cable is given as 300 Megohms per kilometer. Its value for

250 m length will be-

(1) 1200 Megohm
(2) 75 Megohm
(3) 600 Megohm
(4) 150 Megohm

Ans: 1

3. Separate earthed metallic screens are provided over each of the individual phases in a three phase AC high voltage cable to-

(1) Reduce ratio interference
(2) Increase the thermal dissipation
(3) Make the electric field radial in the insulating material
(4) Prevent mechanical damages to the insulating material

Ans: 3

4. Bundle conductors are used in EHV transmission lines-

(1) To reduce corona and radio interference
(2) Because they are easier to fabricate and erect
(3) To increase the current carrying capacity
(4) To reduce the transmission line vibration

Ans: 1

Bundled conductor are **those conductors which form from two or more stranded conductors, bundled together to get more current carrying capacity**. By using bundle conductors instead of the single conductor in the transmission line increases the GMR of the conductors.

……..

Single stranded conductors are used in transmission system usually up to 220 KV. But it is not possible to use single-stranded conductor for the voltage above 220 KV systems. For very high voltage system, hollow conductor can be used to optimize the flow of current through it. But erection and maintenance of hollow conductors in the ∑HV system are not economical. The problem can be solved by using *bundled conductors* instead of hollow conductor in the electrical transmission system above 220 KV voltage level.

WHAT IS BUNDLED CONDUCTOR?

We call **bundled conductor** to those conductors which form from two or more stranded conductors, bundled together to get more current carrying capacity.

https://www.electrical4u.com/bundled-conductors-used-in-transmission-line/

5. While jointing H.T cables it important to ensure there are no voids in the insulation layer to avoid-

(1) Partial discharges
(2) Moisture condensation
(3) Uneven thickness of insulation
(4) Corona discharges

Ans: 1

6. The rating of capacitor required to raise the power factor of a 1000 kW load from 0.6 (lag)

to 0.8 (lag) will be

(1) 500 kVAr
(2) 200 kVAr
(3) 654 kVAr
(4) 583 kVAr

Ans: 4

7. Ferranti effect on long overhead lines is experienced when-

(1) The power factor is unity
(2) The power factor is leading
(3) The power factor is lagging
(4) The line is lightly loaded

Ans: 4

Ferranti effect: **The effect in which the voltage at the receiving end of the transmission line is more than the sending voltage** is known as the "Ferranti effect. " This type of effect mainly occurs because of light load or open circuit at the receiving end.

……..

FERRANTI EFFECT

- Under the Ferranti effect, no-load and light load conditions make the receiving end voltage greater than the sending end voltage. If the receiving voltage exceeds the limit, it damages the connected load, which is why reducing the Ferranti effect is essential.
- The influence of inductance and capacitance on the receiving end voltage of AC transmission lines at light load conditions is the root cause of the Ferranti effect.
- Shunt compensation and series compensation can be employed in transmission lines to reduce the Ferranti effect.

Electrical transmission lines are subjected to various effects such as the skin effect, proximity effect, corona discharge, and the Ferranti effect. Specific conditions and circumstances lead to these effects in the transmission line.

The influence of inductance and capacitance on the receiving end voltage of AC transmission lines at light load conditions is the root cause of the Ferranti effect. Under this effect, no-load and light load conditions make the receiving end voltage greater than the sending end voltage. If the receiving voltage exceeds the limit, it damages the connected load. This is why it is so essential to learn how to reduce the Ferranti effect, which is what we will be discussing in this article.

HVDC Transmission

High voltage DC (HVDC) transmission is free from the Ferranti effect, as there are no frequency components to cause capacitance and inductance active in the transmission line. This is considered one of the advantages of HVDC transmission.

The Disadvantages of the Ferranti Effect

The Ferranti effect is an undesirable effect in electrical AC power systems. All power systems follow the specifications for receiving end voltage with some tolerance level. The loads connected to the system are usually rated for this voltage and safely operate under normally loaded conditions.

Potential Damage Caused by the Ferranti Effect

Under light load conditions, the Ferranti effect introduces temporary overvoltage at the receiving end. These overvoltages are capable of limiting the performance of transmission lines and damaging the loads and equipment connected to the receiving

end. The damage of voltage-sensitive process controls, controllers, and automated systems leads to a loss of utility and temporary shutdowns. The impact of monetary losses associated with the Ferranti effect can also be extremely damaging to a project's budget.

https://resources.system-analysis.cadence.com/blog/msa2021-how-to-reduce-the-ferranti-effect-in-ac-transmission-lines

8. Temperature increase produces the following effect on an overhead transmission line-

(1) Increase in conductor tension and sag
(2) Decrease in conductor sag and tension
(3) Decrease in conductor tension and increase in sag
(4) Increase in conductor tension and decrease in sag

Ans: 3

9. Swing diagram for a power system indicates the variation of-

(1) Torque angle with respect to power
(2) Torque angle with respect to time
(3) Power with respect to time
(4) Voltage with respect to power

Ans: 2

Power swing

Low value of Impedance Z arise due to voltage instability or transients associated with electromechanical oscillations of rotors of synchronous machines after a major disturbance like the faults. This can introduce nuisance tripping. Such tripping is known as tripping on **Power Swings.** In this post we will discuss on Power Swing in detail.

Power swings is defined as oscillation in active and reactive power flows on a transmission line consequent to a large disturbance like a fault.

https://electricalbaba.com/power-swing/

……

Power Swings in Power System Protection

Power Swings in Power System Protection are surges of power due to the oscillation of generators with respect to each other which may occur because of changes in load, switching or faults. The presence of a power swing does not necessarily mean that the system is unstable. It is of paramount importance therefore that the relay must distinguish between a fault and a power swing, and respond correctly.

https://www.eeeguide.com/power-swings-in-power-system-protection/

10. The tripping time of an IDMTL relay is-

(1) Directly proportional to the magnitude of the fault current
(2) Inversely proportional to the magnitude of the fault current
(3) Directly proportional to the square root of the value of fault current
(4) Preset minimum time lag, irrespective of the magnitude of fault current

Ans: 2

11. HRC fuses have-

(1) High restriking capacity (2) High rupturing capacity
(3) High residual charge (4) Hard resonant core

Ans: 2

https://www.elprocus.com/what-is-hrc-fuse-working-its-applications

WORKING PRINCIPLE OF HRC FUSE

In normal conditions, the flow of current through the fuse doesn't provide sufficient energy to soften the element. If the huge current flows through the fuse then it melts the element of the fuse before the fault current achieves the climax.

When the fuse is in an overload condition, then the element of the fuse will not blow-off however if this condition exists for an extended period, then the material like Eutectic will dissolve & break the element of the fuse. When the fuse is in short circuit condition, then the thin parts of the fuse element is less area will dissolve quickly & will smash before the eutectic material. So this is the reason to provide the limitations within the element of HRC Fuse.

HRC FUSE : WORKING & ITS APPLICATIONS

The flow of current in an electrical network is within a fixed limit. Once the flow of current in the network crosses the fixed limit, a fault occurs within the network like phase to ground or phase to phase short circuit. When the flow of current may have a high thermal effect then pieces of equipment that are connected to the network will be damaged permanently. To overcome this damage from faults, an electrical fuse is used. A fuse is an electrical device that includes a conductor. This conductor easily melts & splits the circuit connection once the flow of current exceeds the fixed value. So this is the weakest part of an electrical circuit. There are different types of fuses available in the market. So this article discusses an overview of what is HRC fuse, working principle, construction, and its applications.

What is HRC Fuse?

Definition: HRC fuse (high rupturing capacity fuse) is one kind of fuse, where the fuse wire carries a short circuit current in a set period. If the fault occurs in the circuit then it blows off. The HRC fuse is made with glass otherwise some other kind of chemical compound.

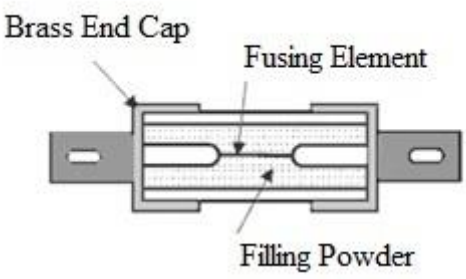
HRC Fuse Type

The enclosure of the fuse can be closed tightly to avoid the air from the atmosphere. At both sides of the fuse, the ceramic enclosure is made with a metal cap which is welded with fusible silver wire. Its enclosure includes some space that is surrounding by wire otherwise element of the fuse.

HRC fuse is consistent & it has the feature like if it has a high fault current then break time is low. Similarly, if the fault current is not high, then break time is long.

CONSTRUCTION OF HRC FUSE

The construction of HRC fuse includes a material that has high heat resistant body like ceramic. This ceramic body includes metal-end caps that are welded through an element that carries silver-current.



Fuse Construction

The internal space of the fuse body is filled by a filling powder material. Here the material used in this is quartz, plaster of Paris, dust, marble, chalk, etc. So this is the reason the flow of current cannot overheat. The generated heat vaporizes the melted element. The chemical reaction will occur between filling power and silver vapor to result in high resistance material to help in reducing the arc within the fuse.

Generally, copper or silver is used as the fuse element because of its low specific resistance. This element has normally two or more sections. The fuse element normally has two or more sections that are connected through tin joints. The melting point of tin is 2400 C that is lesser than silver's melting point of 980^{o}C. Thus the

melting point of tin joints stops the fuse from getting high temperatures in the short circuit and overload conditions.

12. For differential protection of a three phase transformer, the number of current transformers required are-

(1) One (2) Three
(3) Six (4) Twelve

Ans: 3

13. The rated making capacity of a circuit breaker is equal to-

(1) 1.414 times its symmetrical breaking current
(2) 2.55 times its symmetrical breaking current
(3) its symmetrical breaking current
(4) None of the above

Ans: 2

14. The surge impedance of a 100 km long cable is 50 ohms. The surge impedence of a line using a similar cable, but 40 km long will be-

(1) 50 ohms (2) 20 ohms
(3) 313 ohms (4) 125 ohms

Ans: 1

15. The amount of active power transmitted over a transmission line is proportional to-

(1) The sending end voltage only
(2) The receiving end voltage only
(3) Torque angle between sending end and receiving end voltages
(4) Difference in magnitude between sending end and receiving end voltages

Ans: 3

16. While calculating the fault current in a power system network, the reactances of machines connected to the system are taken as-

(1) Constant (2) Zero
(3) Increasing with load (4) Decreasing with load

Ans: 1

17. The Kelvin's Double Bridge is used for measuring-

(1) High resistance (2) Low resistance
(3) Four (4) One

Ans: 2

A **Kelvin bridge** is a measuring instrument used to measure unknown electrical resistors below 1 ohm. It is specifically designed to measure resistors that are constructed as four terminal resistors. Before we introduce **Kelvin Bridge**, it is very essential to know what is the need of this bridge, though we have Wheatstone bridge which is capable of measuring electrical resistance accurately (usually an accuracy of around 0.1%). To understand the need of Kelvin bridge we must first recognize 3 important ways to categorize electrical resistance:

1. **High Resistance**: Resistance that is greater than 0.1 Mega-ohm.
2. **Medium Resistance**: Resistance that ranges from 1 ohm to 0.1 Mega-ohm.
3. **Low Resistance**: Under this category resistance value is lower than 1 ohm.

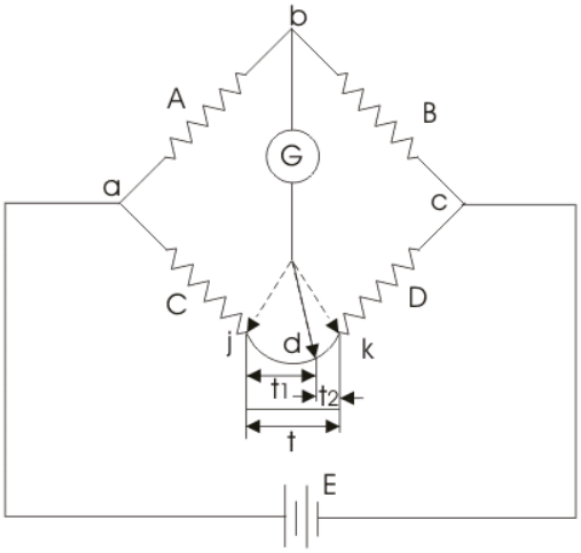
The logic of doing this classification is that if we want to measure electrical resistance, we have to use different devices for different categories. It means if the device is used in measuring the high resistance gives high accuracy, it may or may not give such high accuracy in measuring the low value of resistance.

One of the major drawbacks of the **Wheatstone bridge** is that although it can measure the resistance from few ohm to several mega ohm – it gives significant errors when measuring low resistances. So, we need some modification in Wheatstone bridge itself, and the modified bridge so obtained is **Kelvin bridge**, which is not only suitable for measuring low value of resistance but has wide range of applications in the industrial world.

Kelvin Bridge

Bridge's usually consists of four arms, balance detector and source. They work on the concept of null point technique. They are very useful in practical applications because there is no need of making the meter precise linear with an accurate scale. There is no requirement of measuring the voltage and current, the only need is to check the presence or absence of current or voltage. However the main concern is that during the null point meter must be able to pick up fairly small current. A bridge can be defined as the voltage dividers in parallel and the difference between the two dividers is our output. It is highly useful in measuring components like electrical resistance, capacitance, inductor and other circuit parameters. Accuracy of any bridge is directly related to bridge components.

Kelvin Bridge Circuit



https://www.electrical4u.com/kelvin-bridge-circuit-kelvin-double-bridge/

18. A trivector meter indicates-

(1) KVA, KW and power factors (2) KWh, KVAr and power factor
(3) KW, KVA and KWh (4) KVAh, KWh and KVrh

Ans: 4

TRIVECTOR METER

Trivector meter is an energy meter which accurately measures all the parameters of supply such as voltage, current, power factor, active load, reactive load, apparent load etc., nowadays static electronic meters are used for commercial and industrial applications. These electronic meters use micro controllers with their own programming language. The following Measurement Values can be obtained using Trivector meter.

1. Active Energy in MWh
2. Reactive Energy in MVArh
3. Apparent Energy in MVAh
4. Maximum Demand in MVA
5. Voltages of all the phases
6. Currents of all the phases
7. Power factor of all the phases

https://electengmaterials.com/working-of-trivector-meter/

19. A milliammeter can be used to measure voltages by-

(1) Connecting a high external resistance across it
(2) Connecting a proper shunt resistance
(3) Connecting a high external resistance in series with it
(4) None of the above

Ans: 3

https://courses.lumenlearning.com/boundless-physics/chapter/voltmeters-and-ammeters/

KEY POINTS

- A voltmeter is an instrument used for measuring electrical potential difference between two points in an electric circuit.
- An ammeter is a measuring device used to measure the electric current in a circuit.
- A voltmeter is connected in parallel with a device to measure its voltage, while an ammeter is connected in series with a device to measure its current.
- At the heart of most analog meters is a galvanometer, an instrument that measures current flow using the movement, or deflection, of a needle. The needle deflection is produced by a magnetic force acting on a current-carrying wire.
- A Wheatstone bridge is an electrical circuit used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg of which includes the unknown component.
- **null measurements**: methods of measuring current and voltage more accurately by balancing the circuit so that no current flows through the measurement device
- **potentiometer**: an instrument that measures a voltage by opposing it with a precise fraction of a known voltage, and without drawing current from the unknown source.
- **Wheatstone bridge**: An instrument used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg of which includes the unknown component.

AMMETERS

In order for an ammeter to measure a device's current, it must be connected in series to that device. This is necessary because objects in series experience the same current.

VOLTMETERS

A voltmeter is an instrument that measures the difference in electrical potential between two points in an electric circuit. An analog voltmeter moves a pointer across a scale in proportion to the circuit's voltage; a digital voltmeter provides a numerical display.

In order for a voltmeter to measure a device's voltage, it must be connected in parallel to that device. This is necessary because objects in parallel experience the same potential difference.

GALVANOMETERS AS VOLTMETERS

A galvanometer can function as a voltmeter when it is connected in series with a large resistance ***R***. The value of ***R*** is determined by the maximum voltage that will be measured.

GALVANOMETERS AS AMMETERS

The same galvanometer can also function as an ammeter when it is placed in parallel with a small resistance ***R***, often called the shunt resistance. Since the shunt resistance is small, most of the current passes through it, allowing an ammeter to measure currents much greater than those that would produce a full-scale deflection of the galvanometer.

NULL MEASUREMENTS

Standard measurements of voltage and current alter circuits, introducing numerical uncertainties. Voltmeters draw some extra current, whereas ammeters reduce current flow. Null measurements balance voltages, so there is no current flowing through the measuring device and the circuit is unaltered. Null measurements are generally more accurate but more complex than standard voltmeters and ammeters. Their precision is still limited.

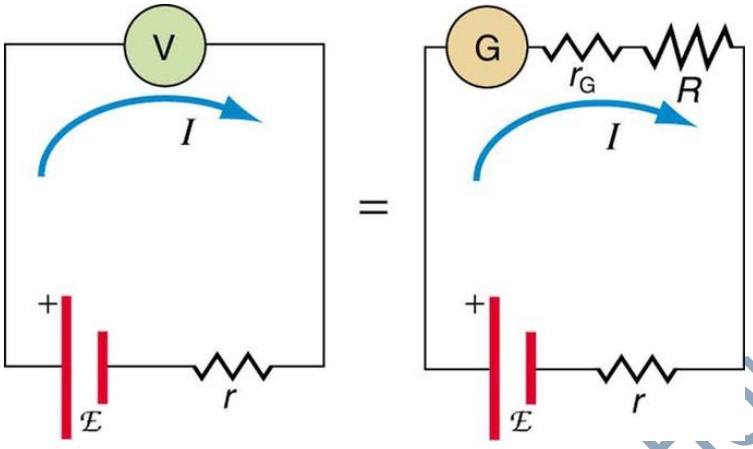
RESISTANCE MEASUREMENTS

Many so-called ohmmeters measure resistance. Most common ohmmeters apply a voltage to a resistance, measure the current, and calculate the resistance using Ohm 's law. The Wheatstone bridge is a null measurement device for calculating resistance by balancing potential drops in a circuit. The device is called a bridge because the galvanometer forms a bridge between two branches

A potentiometer is a null measurement device for measuring potentials (voltages). A voltage source is connected to resistor ***R,*** passing a constant current through it. There is a steady drop in potential (IR drop) along the wire, so a variable potential is obtained through contact along the wire

THE POTENTIOMETER

When measuring the EMF of a battery and connecting the battery directly to a standard voltmeter, as shown in, the actual quantity measured is the terminal voltage ***V***. Voltage is related to the EMF of the battery by ***V=emf−Ir***, where ***I*** is the current that flows and ***r*** is the internal resistance of the battery.



Voltmeter Connected to Battery: An analog voltmeter attached to a battery draws a small but nonzero current and measures a terminal voltage that differs from the EMF of the battery. (Note that the script capital E symbolizes electromotive force, or EMF.) Since the internal resistance of the battery is not known precisely, it is not possible to calculate the EMF precisely.

20. "Creeping" is a phenomenon observed in

(1) Voltmeters (2) Ammeters
(3) Watt meters (4) Energy meters

Ans: 4

Creeping in Energy Meters

November 5, 2017

Creeping in energy meters is phenomena due to which the disc of energy meter rotates even in absence of any load current in the current coil (CC) and only pressure coil (PC) is energized. The necessary condition for creeping is that PC must be energized. This is required as the friction compensating device is voltage actuated and therefore the friction compensating torque is independent of load current flowing in CC.

Method of Prevention of Creeping

To prevent creeping, two diametrically opposite holes are drilled in the disc of energy meters. Due to this hole, the disc will come to rest when the hole comes under the edge of pole of shunt magnet. Thus creeping is limited to a maximum of half of the rotation.

https://electricalbaba.com/creeping-in-energy-meters/

21. Thermocouples are used for measuring-

(1) Electromagnetic induction (2) Electrostatic induction
(3) Temperature (4) Colour rendering index

Ans: 3

22. Sensitivity of voltmeter is expressed in-

(1) Volts per milliampere (2) Volts per ampere
(3) Volts per ohm (4) Ohms per volt

Ans: 4

SENSITIVITY OF VOLTMETER

The sensitivity of a voltmeter is defined as the reciprocal or inverse of the full-scale deflection current (I_{fsd}) of the basic movement. It is denoted by the symbol S and expressed in Ω/V.

$$Voltmeter\ Sensitivity, S = \frac{1}{I_{fsd}}\ \Omega/V$$

where I_{fsd} is the amount of current required to deflect the pointer of the basic meter to its full-scale position.

Voltmeter sensitivity is also known as ohms-per-volt rating of the voltmeter.

https://www.electricaldeck.com/2021/04/sensitivity-of-voltmeter-and-loading-effect-of-voltmeter.html

23. A linear variable differential transformer is used for converting which one of the following into an electrical signal?

(1) Linear displacement (2) Angular displacement
(3) Linear velocity (4) Linear acceleration

Ans: 1

https://www.omega.co.uk/technical-learning/linear-variable-displacement-transducers.html

WHAT IS A LVDT?

An LVDT (linear variable differential transformer is an electromechanical sensor used to convert mechanical motion or vibrations, specifically rectilinear motion, into a variable electrical current, voltage or electric signals, and the reverse. Actuating mechanisms used primarily for automatic control systems or as mechanical motion sensors in measurement technologies. The classification of electromechanical transducers includes conversion principles or types of output signals.

In short, a linear transducer provides voltage output quantity, related to the parameters being measured, for example, force, for simple signal conditioning. LVDT Sensor devices are sensitive to electromagnetic interference. Reduction of electrical resistance can be improved with shorter connection cables to eliminate significant errors. A linear displacement transducer requires three to four connection wires for power supply and output signal delivery.

24. A device that converts physical/electrical parameter into electrical signals is called-

(1) A rheostat (2) An oscillator
(3) A transducer (4) A variac

Ans: 3

A **transducer** is a device that converts energy from one form to another. Usually a transducer converts a signal in one form of energy to a signal in another.

Transducers are often employed at the boundaries of automation, measurement, and control systems, where electrical signals are converted to and from other physical quantities (energy, force, torque, light, motion, position, etc.). The process of converting one form of energy to another is known as transduction

Types

Transducers that convert physical quantities into mechanical quantities are known as mechanical transducers; transducers that convert physical quantities into electrical quantities are known as electrical transducers. Examples are a thermocouple that changes temperature differences into a small voltage, or a linear variable differential transformer (LVDT) used to measure displacement.

ACTIVE VS PASSIVE SENSORS

- *active* sensors require an external power source to operate, which is called an excitation signal. The signal is modulated by the sensor to produce an output signal.
- *passive* sensors, in contrast, generate electric current in response to an external stimulus which serves as the output signal without the need of an additional energy source. Such examples are a photodiode, and a piezoelectric sensor, thermocouple.

https://en.wikipedia.org/wiki/Transducer

25. Active elements in an alkaline battery are-

(1) Lead peroxide and sponge lead
(2) Manganese dioxide and carbon
(3) Nickel and cadmium
(4) Nickel hydrate and iron oxide

Ans: 4

26. Distilled water only is to be used for topping up of lead-acid cells because it-

(1) Prevents polarization
(2) Prevents local action
(3) Accelerates the electrochemical reaction
(4) Improves specific gravity of the electrolyte

Ans: 2

27. Which of the following gives the best indication of the condition of charge of a battery?

(1) One-circuit cell voltage (2) Level of electrolyte
(3) Specific gravity of electrolyte (4) Temperature of electrolyte

Ans: 3

28. The sealed maintenance-free batteries now being used employ-

(1) Nickel-iron technology (2) Dry cell technology
(3) Nickel-cadmium technology (4) Lead-acid technology

Ans: 4

SYSTEM CONFIGURATION

JAMES W. CLARK, in AC Power Conditioners, 1990

BATTERY CHARACTERISTICS

Sealed batteries are, as their description implies, sealed against spilling or loss of electrolyte, when operated within specification. The construction will allow operation in any position. Generation of gas within the battery is controlled to allow

recombination of over 99% of the gas generated during normal use. These batteries are equipped with a low pressure venting system that will release excess gas and reseal automatically in the event that gas pressure rises to a level above the normal rate. While the sealed battery is typically considered safe to operate within enclosed areas, the low-pressure venting capability will still allow some gas to escape under certain conditions. Therefore, it is important to observe all the same safety considerations that must be observed when normal wet-cell batteries are used, particularly during charging. These batteries are particularly suited to UPS service, where deep discharge and cyclic use are common, because of the use of heavy lead calcium-alloy grids.

Typically the manufacturers of sealed batteries will specify a life of 3–5 years in float service, and depending on the depth of discharge, well over 1000 discharge and recharge cycles can be expected. High temperature is a real killer of batteries.

https://www.sciencedirect.com/topics/engineering/sealed-battery

SMF (Sealed Maintenance Free) batteries also known as the Valve Regulated Lead Acid (VRLA) batteries is a type of lead–acid battery and the presence of a relief valve that retains the battery contents independent of the position of the cells.

These flat plate batteries that do not require topping-up and normally do not emit any fumes or gases on a continuous basis. They are completely sealed and therefore eliminate the risk of acid spillage during transportation. Due to their construction these can be mounted in any orientation and do not require constant maintenance. These are used for high end applications of standby power like UPS, Electric Converter, Railway Communications, Security Systems etc.

VRLA batteries are considered "maintenance free" and require no addition of electrolyte or water. The name "valve regulated" does not wholly describe the technology. These are really "recombinant" batteries, which means that the oxygen evolved at the positive plates will largely recombine with the hydrogen ready to evolve on the negative plates, creating water and preventing water loss.

While these batteries are often called *sealed* **lead–acid batteries**, they always include a safety pressure relief valve. As opposed to ***Vented*** (also Called ***Flooded***) batteries, a VRLA cannot spill its electrolyte if it is inverted. The valve is a safety feature in case the rate of hydrogen evolution becomes dangerously high. In flooded cells, the gases escape before they can recombine, so water must be periodically added.

https://www.exponentialpower.com/products-services/by-product/batteries/valve-regulated-batteries.html

29. Sulphation of a battery is a process by which-

(1) Active material gets coated to the plates in stable crystalline form
(2) Battery terminals get coated with lead sulphate formation
(3) Padding pulsed current, rn down batteries can be revived
(4) None of the above

Ans: 4

https://www.crownbattery.com/news/sulfation-and-battery-maintenance

WHAT IS A SULFATED BATTERY AND HOW TO PREVENT IT
Posted by Crown Battery on Jun 22, 2017 12:10:00 PM

A Sulfated battery has a buildup of lead sulfate crystals and is the number one cause of early battery failure in lead-acid batteries. The damaged caused by battery sulfation is easily preventable and in some cases, can be reversible.

HOW DOES BATTERY SULFATION OCCUR

Sulfation occurs when a battery is deprived of a full charge, it builds up and remains on battery plates. When too much sulfation occurs, it can impede the chemical to electrical conversion and greatly impact battery performance.

WHAT CAUSES SULFATED BATTERIES

All lead acid batteries will accumulate sulfation in their lifetime as it is part of the natural chemical process of a battery. But, sulfation builds up and causes problems when;

- A battery is overcharged
- A battery is stored above 75 degrees
- A battery is stored without a full charge

30. What is achieved by heating the electrodes of a fluorescent lamp?

(1) Thermionic emission of electrons
(2) Photo-emission of electrons
(3) Heating up of gas to facilitate current passage between electrodes
(4) Heating up of gas to induce fluorescence in the coating

Ans: 1

A **fluorescent lamp**, or **fluorescent tube**, is a low-pressure mercury-vapor gas-discharge lamp that uses fluorescence to produce visible light. An electric current in the gas excites mercury vapor, which produces short-wave ultraviolet light that then causes a phosphor coating on the inside of the lamp to glow. A fluorescent lamp converts electrical energy into useful light much more efficiently than incandescent lamps. The typical luminous efficacy of fluorescent lighting systems is 50–100 lumens per watt, several times the efficacy of incandescent bulbs with comparable light output. In comparison, the luminous efficacy of an incandescent bulb is only 16

lumens per watt. Because they contain mercury, many fluorescent lamps are classified as hazardous waste.

https://en.wikipedia.org/wiki/Fluorescent_lamp

31. Incandescent lamp filaments are enclosed in a vacuum bulb to-

(1) Insulate the filament
(2) Increase the lumen output
(3) Prevent oxidation of the filament
(4) Reduce the heat loss from the filament

Ans: 3

32. In some fluorescent lamp installations, wheels rotating machinery appear to be stationary because of-

(1) Magnetostriction effect (2) Photo-voltaic effect
(3) Phosphorescence effect (4) Stoboscopic effect

Ans: 4 (The Stroboscopic Effect in Fluorescent lamp is a phenomenon which causes running or moving equipment to appear stationary or appear to be operating slower than they actually are.)

The **stroboscopic effect** is a visual phenomenon caused by aliasing that occurs when continuous rotational or other cyclic motion is represented by a series of short or instantaneous samples (as opposed to a continuous view) at a sampling rate close to the period of the motion. It accounts for the "wagon-wheel effect", so-called because in video, spoked wheels (such as on horse-drawn wagons) sometimes appear to be turning backwards.

https://en.wikipedia.org/wiki/Stroboscopic_effect

Methods to Reduce Stroboscopic Effect

The stroboscopic effect is less marked when a choke is used than with a resistance for the ballast. The luminescence of phosphorus powders persists for a short time and bridges the short intervals when no arc current flows. Therefore, fluorescent lamps exhibit fewer flickers than pure gas discharge lamps. Flicker is also more pronounced at 25 c/s than at 50 c/s and is almost completely absent at a higher frequency like 400 c/s.

https://www.electrical2z.com/stroboscopic-effect/

33. How is the illumination of a surface from a light source related to the distance between the light source and the surface

(1) Directly proportional to the distance
(2) Inversely proportional to the distance
(3) Inversely proportional to the square of the distance
(4) Inversely proportional to the square root of the distance

Ans: 3

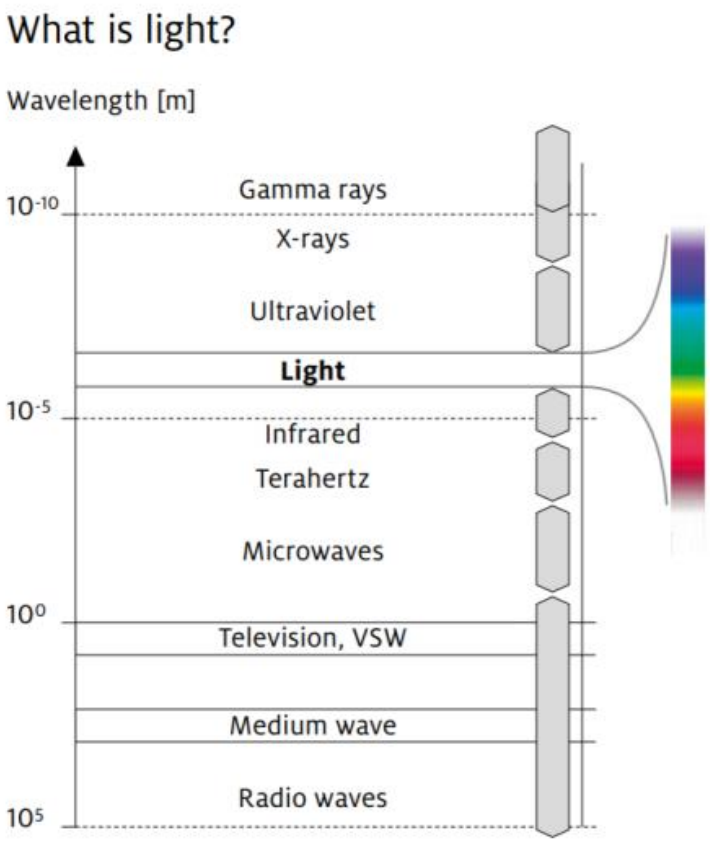
Laws of Illumination

1. Illumination is directly proportional to the luminous intensity of the source.

2. Inverse square law – The illumination of a surface receiving its flux from a point source is inversely proportional to the square of the distance between the surface and the source.

3. Lambert's cosine law – The illumination of a surface at any point is proportional to the cosine of the angle θ between the direction of the incident light and the surface normal; $I = I_o \cos$

…….
https://www.zumtobel.com/PDB/teaser/EN/lichthandbuch.pdf



Light is that part of the electromagnetic spectrum that is perceived by our eyes.The wavelength range is between 380 and 780 nm. The cones come on during the day and we see colours, whereas at night the rods take over and we only see shades of grey.

Luminous flux

The luminous flux describes the quantity of light emitted by a light source. The luminous efficiency is the ratio of the luminous flux to the electrical power consumed (lm/W). It is a measure of a light source's economic efficiency.

Illuminance Illuminance describes the quantity of luminous flux falling on a surface. Relevant standards specify the required illuminance (e.g. EN 12464 "Lighting of indoor workplaces"). Illuminance: E(lx) = luminous flux (lm)/ area (m2)

Luminous intensity

The luminous intensity describes the quantity of light that is radiated in a particular direction. This is a useful measurement for directive lighting elements such as reflectors. It is represented by the luminous intensity distribution curve (LDC).

Illuminance

Illuminance describes the quantity of luminous flux falling on a surface.

Luminance. Luminance is the only basic lighting parameter that is perceived by the eye. It describes on the one hand a light source's impression of brightness, and on the other, a surface and therefore depends to a large extent on the degree of reflection (colour and surface).

34. A control system has some roots with real parts equal to zero, but none with positive real parts is-

(1) Absolutely stable (2) Relatively stable

(3) Marginally stable (4) Absolutely unstable

Ans: 3

35. Which of the following is used for a Nyquist plot?

(1) Open loop function (2) Characteristic equation

(3) Closed loop function (4) None of the above

Ans: 1

36. In a critically damped system, if the loop gain is increased, then the system-

(1) Becomes over-damped (2) Becomes under-damped

(3) Remains critically damped (4) Becomes oscillatory

Ans: 2

37. A 30 V zener diode is connected in zener conduction mode in series with a 4 K resistance across a 50 V DC supply. The current throught the diode will be-

(1) 5 milliamperes (2) Zero

(3) 20 milliamperes (4) 12.4 milliamperes

Ans: 1

38. The maximum reverse voltage that can be applied to an ordinary semiconductor diode without causing permanent damage is called-

(1) Cut-off voltage (2) Zener breakdown voltage

(3) Avalanche breakdown voltage (4) Peak inverse voltage

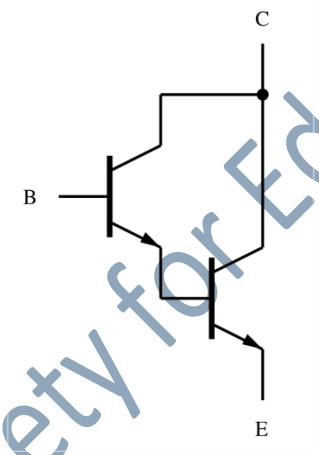
Ans: 4

In semiconductor diodes, **peak reverse voltage** or **peak inverse voltage** is the maximum voltage that a diode can withstand in the reverse direction without breaking down or avalanching. If this voltage is exceeded the diode may be destroyed. Diodes must have a peak inverse voltage rating that is higher than the maximum voltage that will be applied to them in a given application.

39. A Darlington pair transistor circuit is used for-

(1) Obtaining a high input impedance
(2) Obtaining a low input impedance
(3) High frequency operation
(4) Switching operation

Ans: 1



https://en.wikipedia.org/wiki/Darlington_transistor#/media/File:Darlington_pair_diagram.svg

In electrical and electronic circuits, Darlington transistor or Darlington transistor pair is an essential component. It consists of two bipolar transistors, that are connected in such a way that the current amplifies by the first transistor then by the second transistor. The configuration of the Darlington transistor gives a much higher current gain than a single transistor taken individually.

DARLINGTON TRANSISTOR PAIR APPLICATIONS

The applications of Darlington transistor pair involve where a high gain is required at a low frequency like Power regulators, Audio amplifier output stages, Display drivers, Motor controllers, Touch and light sensors and solenoid control.

https://www.elprocus.com/darlington-transistor-pair-circuit-with-working/

40. A Triac is equivalent to-

(1) Two SCRs connected in parallel
(2) Two SCRs connected antiparallel
(3) One SCR and one diode connected in parallel
(4) One SCR and one diode connected in anti-parallel

Ans: 2

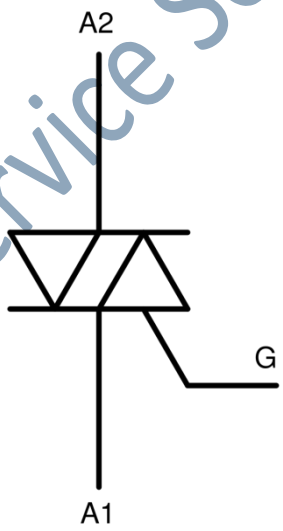
A **TRIAC** (**triode for alternating current**; also **bidirectional triode thyristor** or **bilateral triode thyristor**[1]) is a three terminal electronic component that conducts current in either direction when triggered. The term TRIAC is a genericised trademark.

TRIACs are a subset of thyristors (analogous to a relay in that a small voltage and current can control a much larger voltage and current) and are related to silicon controlled rectifiers (SCRs). TRIACs differ from SCRs in that they allow current flow in both directions, whereas an SCR can only conduct current in a single direction. Most TRIACs can be triggered by applying either a positive or negative voltage to the gate (an SCR requires a positive voltage). Once triggered, SCRs and TRIACs continue to conduct, even if the gate current ceases, until the main current drops below a certain level called the holding current.

Gate turn-off thyristors (GTOs) are similar to TRIACs but provide more control by turning off when the gate signal ceases.

The bidirectionality of TRIACs makes them convenient switches for alternating-current (AC). In addition, applying a trigger at a controlled phase angle of the AC in the main circuit allows control of the average current flowing into a load (phase control). This is commonly used for controlling the speed of a universal motor, dimming lamps, and controlling electric heaters. TRIACs are Bipolar devices.

https://en.wikipedia.org/wiki/TRIAC



By Unknown author - Unknown source, Public Domain, https://commons.wikimedia.org/w/index.php?curid=865915

https://en.wikipedia.org/wiki/TRIAC#/media/File:Triac.svg

41. For a three phase full wave rectifier, the average output voltage in terms of the peak value of input voltage V_m will be-

(1) $\frac{3\sqrt{3}V_m}{2\pi}$ (2) $\frac{3V_m}{\pi}$ (3) $\frac{3\sqrt{2}V_m}{\pi}$ (4) $\frac{3\sqrt{3}V_m}{\pi}$

Ans: 2

42. In a two-input gate circuit, when one input is high and the other low, the output is high. the gate circuit is-

(1) A "NOR" gate (2) An "OR" gate
(3) An "AND" gate (4) An "OR" or "NAND" gate

Ans: 4

https://www.allaboutcircuits.com/textbook/digital/chpt-3/multiple-input-gates/
https://whatis.techtarget.com/definition/logic-gate-AND-OR-XOR-NOT-NAND-NOR-and-XNOR

43. The hexadecimal equivalent of decimal number 1000 is-

(1) 4 E 8 (2) 3 C F
(3) 3 E 7 (4) 3 E 8

Ans: 4

Decimal base 10	**Hex base 16**
90	5A
100	64
200	C8
1000	**3E8**

HOW TO CONVERT FROM DECIMAL TO HEX

CONVERSION STEPS:

1. Divide the number by 16.
2. Get the integer quotient for the next iteration.
3. Get the remainder for the hex digit.
4. Repeat the steps until the quotient is equal to 0.

https://www.rapidtables.com/convert/number/decimal-to-hex.html

44. The binary coded decimal (BCD) equivalent of decimal number 147

$147)_{10} = (10010011)_2$

STEP BY STEP SOLUTION

Step 1: Divide $(147)_{10}$ successively by 2 until the quotient is 0:

147/2	=	73,	remainder	is	1
73/2	=	36,	remainder	is	1
36/2	=	18,	remainder	is	0
18/2	=	9,	remainder	is	0
9/2	=	4,	remainder	is	1
4/2	=	2,	remainder	is	0
2/2	=	1,	remainder	is	0

1/2 = 0, remainder is 1

Step 2: Read from the bottom (MSB) to top (LSB) as 10010011.

So, 10010011 is the binary equivalent of decimal number 147 (Answer).

https://coolconversion.com/math/binary-octal-hexa-decimal/Convert_decimal_number_147_in_binary_

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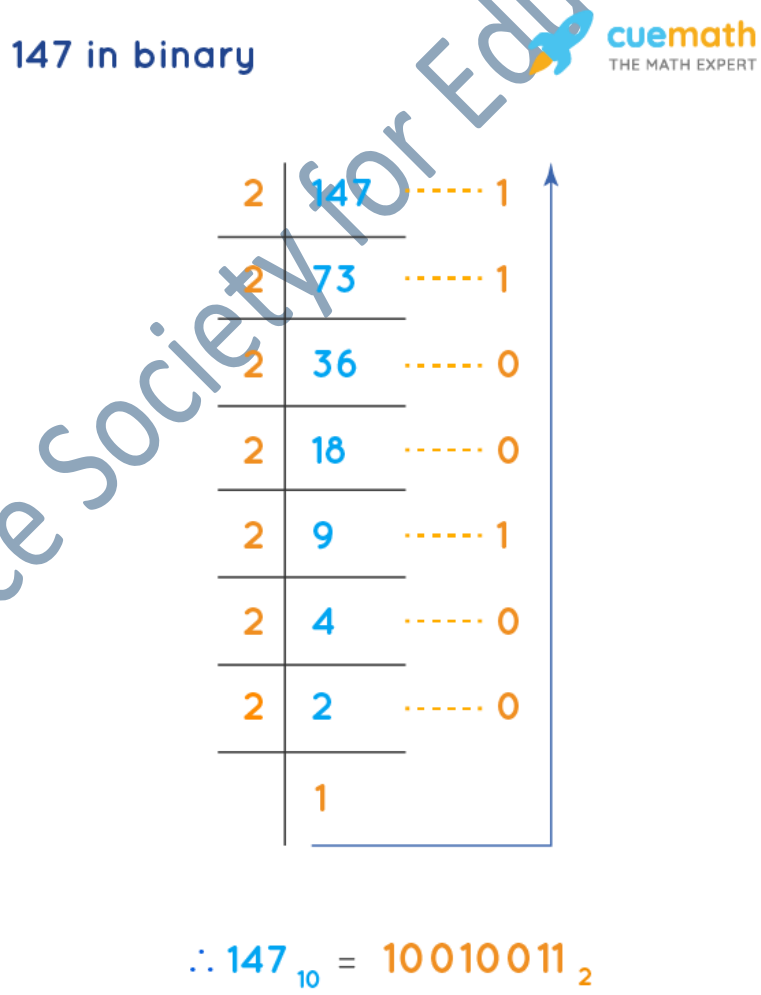

Note:

- 247 in Binary - 11110111
- 82 in Binary - 1010010
- 14 in Binary - 1110
- 2000 in Binary - 11111010000
- 162 in Binary - 10100010
- 158 in Binary - 10011110
- 4 in Binary - 100

https://www.cuemath.com/numbers/147-in-binary/

45. The ALU of a computer contains a large number of storage devices called-

(1) Hard disks (2) Semiconductor memory
(3) Magnetic drives (4) Registers

Ans: 4

The Arithmetic and Logic Unit (*ALU*), i.e., the ALU is the computational center of the CPU. It performs all the mathematical and logical operations.

46. A single bus structure is normally found in-

(1) Super computers (2) Main frame machines
(3) Micro and mini computers (4) High performance machines

Ans: 3