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Your Personal Exams Guide

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RRB ALP 2019 (CBT 2) (Electrician Previous) Previous Year Papers (22 Jan 2019) Shift 2

Total Time: 1 Hour **Total Marks:** 75

Instructions

Sl No.	Section Name	No. of Question	Maximum Marks	Negative Marks	Positive Marks
1	Part B	75	75	0.33	1

1.) A total of 60 minutes is allotted for the examination.

2.) The server will set your clock for you. In the top right corner of your screen, a countdown timer will display the remaining time for you to complete the exam. Once the timer reaches zero, the examination will end automatically. The paper need not be submitted when your timer reaches zero.

3.) There will, however, be sectional timing for this exam. You will have to complete each section within the specified time limit. Before moving on to the next section, you must complete the current one within the time limits.

Part B

1. Which is the insulation material used in an electric iron? **(+1, -0.33)**

   a. Plastic

   b. Rubber

   c. Silica

   d. Mica

---

2. The protective equipment used to protect equipment against lightning stroke is: **(+1, -0.33)**

   a. shunt reactors

   b. Circuit breaker

   c. Isolator

   d. Lightning arrester

---

3. The _ _ _ _ _ _ _ of a motor depends on the loading of the motor. **(+1, -0.33)**

   a. power factor

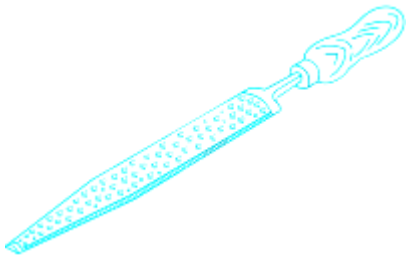
   b. voltage rating

   c. winding

   d. efficiency

---

4. Identify the type of file shown in the below figure. (+1, -0.33)



a. RASP cut file

b. Double cut file

c. Single cut file

d. Curved cut file

---

5. The protection system of the household circuit that trips if someone receives a shock is: (+1, -0.33)

a. ELCB

b. MCB

c. HRC fuse

d. MCCB

---

6. Which of the following meters are not used on D.C. circuit (+1, -0.33)

a. Commutator motor meters

b. Mercury motor meters

c. Induction meters

d. None of the above

---

7. Resistance can be measured using: (+1, -0.33)

a. Voltmeter

b. Wattmeter

c. Ammeter

d. Ohmmeter

---

8. Which part of the motor confirms that it is a DC motor? (+1, -0.33)

a. Frame

b. Commutator

c. Shaft

d. Stator

---

9. What does the symbol shown below represent? (+1, -0.33)

a. Heater

b. Blower

c. Fan

d. Heat

10. The current on a high voltage line is measured using: (+1, -0.33)

a. Current shunt

b. Voltage transformer

c. Load resistor

d. Current transformer

11. In a universal motor, normally the ratio of width of brush to the width of commutator segments is: (+1, -0.33)

a. 2 : 1

b. 1 : 2

c. 1 : 1

d. 4 : 1

12. The minimum clearance distance that equipment should be kept away from 50 kV power lines is: (+1, -0.33)

a. 20 feet

b. 10 feet

c. 15 feet

d. 5 feet

13. Which among the below is not generally used for distribution systems? (+1, -0.33)

a. 1 phase, 3 wire system

b. 3 phase, 3 wire system

c. 3 phase, 4 wire system

d. 1 phase, 4 wire system

---

14. In which type of motor a fly wheel is used during heavy loads? (+1, -0.33)

a. DC Series motor

b. AC series motor

c. DC Shunt motor

d. AC shunt motor

---

15. Latches are _ _ _ _ _ _ _ circuits. (+1, -0.33)

a. edge triggered

b. pulse triggered

c. count triggered

d. level triggered

---

16. _ _ _ _ _ _ _ is unlikely to cause an electric shock while doing electric work. (+1, -0.33)

a. Wet wood

b. Metal rod

c. Wet rope

d. Dry wood

---

17. Which one of the following is a ferromagnetic material? (+1, -0.33)

a. Nickel

b. Lead

c. Platinum

d. Copper

---

18. The visor of a halogen flood lamp is made of: (+1, -0.33)

a. Mica

b. Glass

c. Polycarbonate

d. Silica

---

19. In a delta to star connection of transformer one of the following is true (+1, -0.33)

a. used for large HV transformers

b. Used for applications where voltages need to be stepped down

c. line voltage is equal to phase voltage

d. Used for applications where voltages need to be stepped up

---

20. The direction of a force in a current-carrying conductor can be determined using: **(+1, -0.33)**

a. Fleming's Left-Hand Rule

b. Faraday's Law

c. Fleming's Fist Rule

d. Fleming's Right-Hand Rule

---

21. Which is the DC motor whose speed is independent of armature current? **(+1, -0.33)**

a. Series motor

b. Compound motor

c. Brushless motor

d. Shunt motor

---

22. The type of connection commonly used in low voltage distribution systems is: **(+1, -0.33)**

a. Star / Star

b. delta / delta

c. Star / delta

d. Delta/ star

---

23. PVC insulated non sheathed single core cables are most preferably used in: (+1, -0.33)

a. Domestic and industrial wiring

b. Hazardous locations

c. Dry locations and underground systems

d. Wet locations

---

24. What is the type of cell used for building a laptop battery pack? (+1, -0.33)

a. Nickel cadmium

b. Lithium ion

c. Zinc silver oxide

d. Lead acid

---

25. Boost charging is the process of charging on _____. (+1, -0.33)

a. Low current for short time

b. High current for a short time

c. Low current for a long time

d. High current for a long Time

---

26. An alternator provides maximum power when the load angle is: (+1, -0.33)

a. 180°

b. 90°

c. 120°

d. 45°

---

27. Star to delta transformer works properly when: (+1, -0.33)

a. Voltage is high

b. Load is unbalanced

c. Current is high

d. The load is balanced as well as unbalanced

---

28. Which of the following is an example for non-conventional energy resource? (+1, -0.33)

a. petrol

b. diesel

c. wind

d. coal

---

29. A three-phase star configuration motor has: (+1, -0.33)

a. 4 hot wires and 1 neutral wire

b. 3 hot wires and 1 ground wire

c. 3 hot wires , 1 neutral and 1 ground wires

d. 3 hot wires and 1 neutral wire

---

30. Which among the following is not a passive component? **(+1, -0.33)**

a. Capacitor

b. Resistor

c. Inductor

d. Diode

---

31. What is represented by the below symbol? **(+1, -0.33)**

a. Battery

b. Capacitor

c. capacitor polarized

d. Resistor

---

32. When a capacitor load is connected, the power factor is: **(+1, -0.33)**

a. Leading

b. Infinite

c. Unity

d. Lagging

---

33. The starter which can be used to reduce the voltage during starting of an induction motor is: (+1, -0.33)

a. Star starter

b. Delta starter

c. Star Delta starter

d. Delta Star starter

---

34. What is the use of a static frequency changer in a motor? (+1, -0.33)

a. To achieve direction reversal

b. To achieve speed regulation

c. To control power factor

d. To control cooling

---

35. What is the advantage of armored cable? (+1, -0.33)

a. It has higher insulation resistance

b. It can sustain high voltage

c. It can smoothly travel through gland

d. It can sustain higher impact

---

36. Which one of the following is not the speed control technique of squirrel cage induction motor? (+1, -0.33)

a. frequency control

b. stator voltage control

c. stator resistance control

d. rotor resistance control

---

37. If the nominal voltage of a given battery is 1.2 V, what is the type cell of used? **(+1, -0.33)**

a. Lithium ion

b. Lead acid

c. Nickel cadmium

d. Zinc silver oxide

---

38. What is another name for Eddy Currents **(+1, -0.33)**

a. Foucault Currents

b. Faculty Currents

c. Faulty Currents

d. Berry Currents

---

39. What is meant by line voltage? **(+1, -0.33)**

a. The voltage available between any two phases

b. The voltage available between ground and neutral

c. The voltage available between phase and neutral

d. The voltage available between the three phases

---

40. The number of poles of a three phase induction motor running at 750 rpm with 50Hz frequency is (+1, -0.33)

a. 4

b. 8

c. 6

d. 2

---

41. The type of motor commonly used in washing machines and mixers is: (+1, -0.33)

a. DC shunt motor

b. Reluctance motor

c. synchronous motor

d. universal motor

---

42. Constant loss in a three-phase induction motor is determined by: (+1, -0.33)

a. Two wattmeter test

b. Load test

c. Physical test

d. No load test

43. The current drawn by a motor is determined by the stator impedance and _ _ _ _ _ _ _ applied across the terminals. (+1, -0.33)

a. force

b. power

c. current

d. voltage

44. The flow rate of a single-phase pump can be changed by (+1, -0.33)

a. Changing I/P voltage

b. Controlling the valve

c. Reducing the pipe size

d. Changing I/P frequency

45. In star delta motor, the starting current is: (+1, -0.33)

a. Reduced approximately by 1/3 times as compared to the original

b. Reduced approximately by 1/4 times as compared to the original

c. Increased approximately by 1/3 times as compared to the original

d. Increased approximately by 14 times as compared to the original

46. Aquadag coating is most commonly used in CROs to: (+1, -0.33)

a. absorb moisture

b. absorb the extra electrons emitted

c. absorb and emit the rays

d. absorb the rays emitted

---

47. When an inductive load is connected, the power factor is: (+1, -0.33)

a. Unity

b. Infinite

c. Lagging

d. Leading

---

48. In the DC motor, iron losses occur in (+1, -0.33)

a. Field

b. Armature

c. Brushes

d. Commutator

---

49. HP is equivalent to how many watts? (+1, -0.33)

a. 743

b. 746

c. 745

d. 744

---

50. Which among these is the heating element used in a steam iron? **(+1, -0.33)**

a. Sealed tungsten tube

b. Mica press tungsten strip

c. Copper coil

d. Open tungsten coil

---

51. Which of the below emits nearly monochromatic light? **(+1, -0.33)**

a. Mercury vapor lamp

b. Bulb

c. Tubelight

d. Sodium vapor lamp

---

52. The minimum insulation resistance value for a system running at a maximum voltage of 250 V is: **(+1, -0.33)**

a. 1000 MΩ

b. 25 MΩ

c. 100 MΩ

d. 1000 GΩ

53. Identify the type of lug used for connecting aluminium cable to copper bus bar from the given options. (+1, -0.33)

a. Insulated sleeve lug

b. Bi-metallic cable lug

c. Bi-metallic cable connector

d. Copper lug

54. Which of the following is not an essential part of motor meter? (+1, -0.33)

a. Operating torque system

b. Revolution registering system

c. Inductive pickup

d. Braking system

55. For household wiring and small units, the following should be used as a safety measure: (+1, -0.33)

a. MCB

b. OCB

c. ACB

d. MCCB

56. What is the insulation resistance test voltage required for an equipment running on maximum voltage of 600 V? (+1, -0.33)

a. 300 V

b. 1000 V

c. 500 V

d. 100 V

---

57. Ohm's law can be applied to (+1, -0.33)

a. Resistor

b. Rectifier

c. Transformer

d. Zener Diode

---

58. The temperature setting for a bi-metallic strip can be changed by: (+1, -0.33)

a. Changing the current

b. Moving it close and away from a heating element

c. Changing I/P voltage

d. changing the frequency

---

59. The alternators are rated as_ _ _ _ _ _ _ _ (+1, -0.33)

a. kW

b. kVAR

c. kVA

d. kWh

---

60. To find real power, the apparent power has to be multiplied by: **(+1, -0.33)**

a. Supply factor

b. Scaling factor

c. Resonance frequency

d. Power factor

---

61. For a system with 230 V AC, 5 A current and lag of 30°, what's the reactive power? **(+1, -0.33)**

a. 275 VAR

b. 675 VAR

c. 175 VAR

d. 575 VAR

---

62. What is the relation between line voltage and phase voltage in a delta connection? **(+1, -0.33)**

a. Line voltage = √2 phase voltage

b. Line voltage = √3 phase voltage

c. Line voltage = phase voltage

d. Line voltage = 1/2 phase voltage

---

63. What is the allowable frequency variation as per IE rule of safety? **(+1, -0.33)**

a. 10%

b. 3%

c. 5%

d. 8%

---

64. The majority charge carriers in n-type semiconductors are **(+1, -0.33)**

a. Holes

b. Electrons

c. Neutrons

d. Protons

---

65. For a given output and speed, a universal motor as compared to 220 V, 50 Hz supply will require **(+1, -0.33)**

a. Less voltage at low frequency

b. Less voltage at high frequency

c. High voltage at high frequency

d. High voltage at low frequency

66. KVAR meters are used to measure the _ _ _ _ _ _ _ component of KVA in a three-phase circuit. (+1, -0.33)

a. Faraday

b. Lorentz

c. Biot-Savart's

d. Wattless

67. Which transformer (from the below) is used in a servo stabilizer? (+1, -0.33)

a. Step-up transformer

b. Step-down transformer

c. Multi-tap transformer

d. Auto transformer

68. A voltmeter provides the path for: (+1, -0.33)

a. Minimum current

b. Minimum voltage

c. Maximum voltage

d. Maximum current

69. Which tool is used for finishing a circular hole? (+1, -0.33)

a. Chisel

b. Half round file

c. Drill

d. Flat file

---

70. The starting torque of an induction motor is _ _ _ _ _ _ _ when rotor resistance equals rotor reactance. (+1, -0.33)

a. Minimum

b. Constant

c. Maximum

d. Zero

---

71. Soldering iron bit is made up of: (+1, -0.33)

a. Tin

b. Steel

c. Brass

d. Copper

---

72. What is the use of extended cable of an end pole? (+1, -0.33)

a. Excess wire tie-up

b. Preventing the pole from bending

c. Earthing line

d. Voltage testing

---

73. The function of a trigger level knob on a CRO is: **(+1, -0.33)**

a. To change the sweep speeds of time base

b. To change the length of time base

c. To change the intensity of the trace

d. To change the level of the input signal required to get stable display on the scope of the selected channel

---

74. The principle of solar power is based on: **(+1, -0.33)**

a. Hydroelectric effect

b. Thermoelectric effect

c. Photovoltaic effect

d. Fission

---

75. Which lamp has the best Colour Rendering Index (CRI)? **(+1, -0.33)**

a. Fluorescent

b. Incandescent

c. LED

d. High-pressure sodium vapor

Answers

1. **Answer: d**

Explanation:

- **Mica is a good insulator of both electricity as well as heat and can withstand high temperatures.**
- **It is also transparent.**
- **These properties were found suitable to use mica as an insulating material in an electric iron .**
- Plastic, rubber & silica do not have the above-mentioned properties.
- Mica electrically insulates the filament from the body of the iron, which can become accidentally live if there is a breakdown of insulation.
- Mica transmits the heat from the filament to the front plate of the iron. At this point, it is worth mentioning here that the heat is transmitted by radiation and not by conduction.
- Radiation follows the laws of optics. Though mica is a thermal insulator, it permits transmission of heat through radiation on account of it being transparent.

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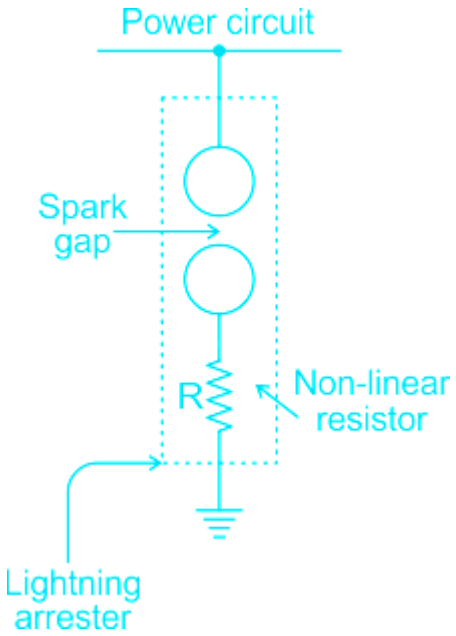
2. **Answer: d**

Explanation:

The most commonly used devices for protection against lightning surges are

Lightning arresters or surge diverters:



- A lightning arrester or a surge diverter is a protective device which conducts the high voltage surges on the power system to the ground
- It consists of a spark gap in series with a non-linear resistor
- The length of the gap is so set that normal line voltage is not enough to cause an arc across the gap, but a dangerously high voltage will break down the air insulation and form an arc
- The property of the non-linear resistance is that its resistance decreases as the voltage (or current) increases and vice-versa
- One end of the diverter is connected to the terminal of the equipment to be protected and the other end is effectively grounded

---

3. **Answer: a**

Explanation:

- **The power factor of a motor closely depends upon the loading of the motor.**

Power factor = cosϕ = (Reactive power)/(Active power)

- When the load on a motor increases, the active power increases while the reactive power remains constant. Thus, the angle of ϕ decreases and the power

factor (cos ϕ) improves slightly.

- The PF of a motor is lower when the motor is under-loaded and is significantly reduced when the motor load is less than 70%.
- Closely matching the motor to the load is the best way to keep the power factor close to the motor design rating, which is typically 80% to 85% PF.

---

4. Answer: a

Explanation:

The teeth of a file are formed by cuts made on its face. Files have cuts of different types.

Types of cut:

Basically, there are four types: Single cut, Double cut, Rasp cut, and Curved cut.

Single cut File:

- A single cut file has rows of teeth cut in one direction across its face.
- The teeth are at an angle of 60° to the centre line.
- It can cut chips as wide as the cut of the file.
- Files with this cut are useful for filing soft metals like brass, aluminium, bronze, and copper.

Double cut file:

- A double cut file has two rows of teeth cut diagonal to each other.
- The first row of teeth is known as OVERCUT and they are cut at an angle of 70 °.
- The other cut, made diagonal to this, is known as UPCUT. and is at an angle of 51°.
- This removes stock faster than the single cut file.

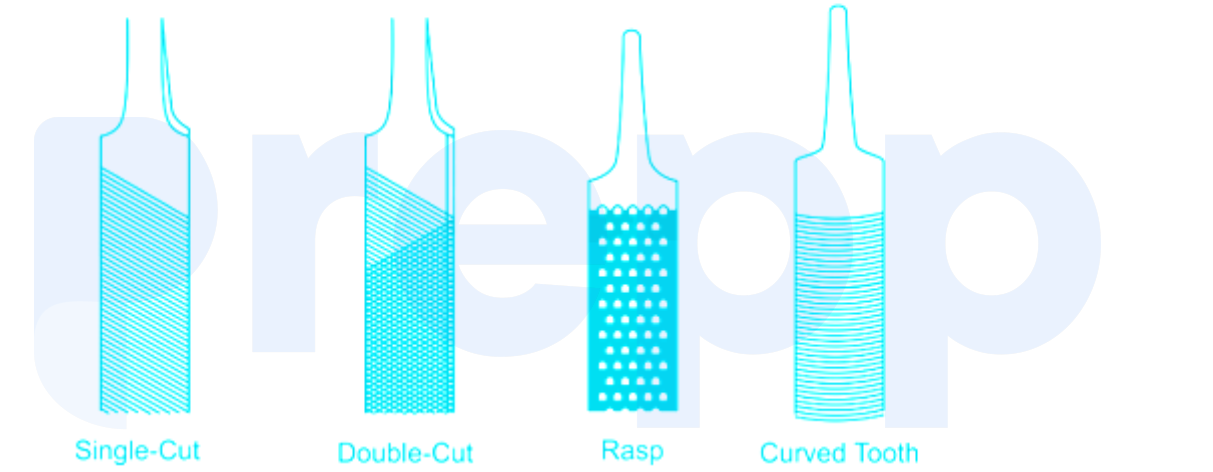
Rasp Cut File:

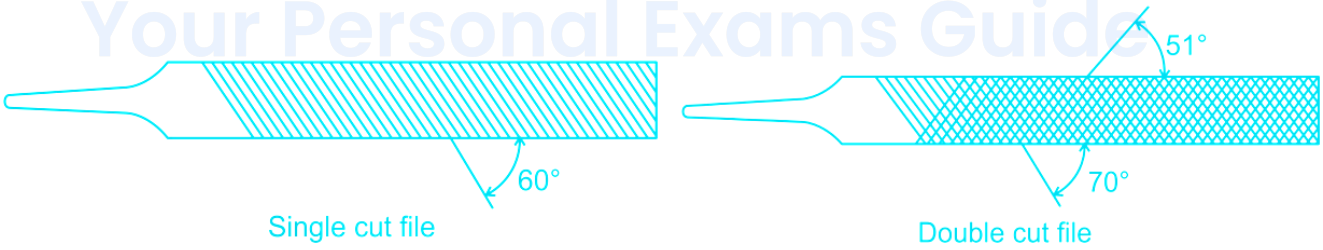
- The rasp cut has individual, sharp, pointed teeth in a line, and is useful for filing wood, leather and other soft materials.

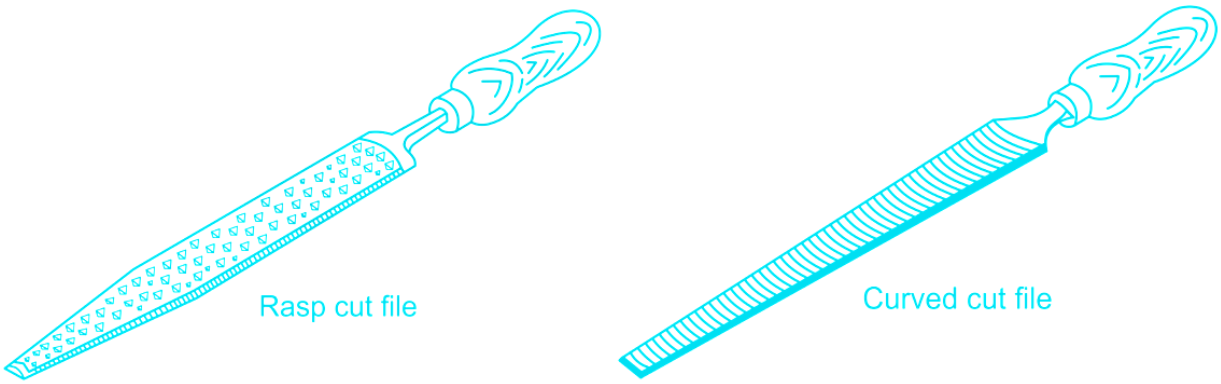
- These files are available only in half round shape.

Curved cut file:

- These files have deeper cutting action and are useful for filing soft materials like- aluminium, tin, copper, and plastic.
- The curved cut files are available only in a flat shape.







5. **Answer: a**

Explanation:

- The sensation of electric shock is caused by the flow of electric current through the human body to the earth.
- When a person comes in contact with electrically live objects like water heaters, washing machines electric iron, etc., the extent of damages caused by this current depends on its magnitude and duration.
- This kind of current is called the leakage current which comes in milli-amps.
- These leakage currents being very small in magnitude, hence undetected by the fuses/MCBs are the major cause for the fires due to electricity.
- Residual current operated circuit breakers provide maximum protection from electric shocks and fires caused due to earth leakage current and also prevents the waste of electrical energy.
- These residual current circuit breakers (RCCB) are popularly called as earth leakage circuit breakers (ELCB).

6. **Answer: c**

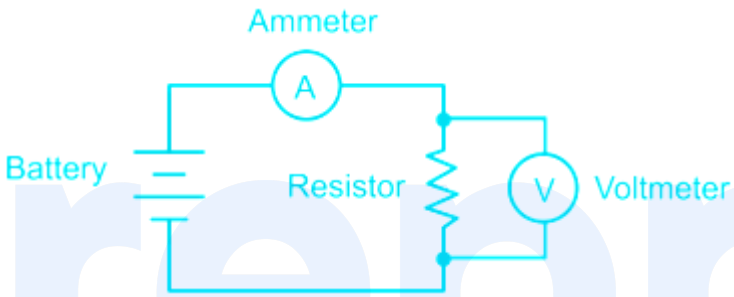
Explanation:

- Mercury motor meters and commutator motor meter are used on DC circuit.
- In mercury motor meter the speed of motor is directly proportional to the circuit current.
- A counting mechanism is attached to the rotor which record the number of revolution of the rotor in the given time.
- The counting mechanism consists of worm wheel, spindle and gears.
- **Induction motor meter are used on AC circuit only.**

7. **Answer: d**

Explanation:

- Voltmeter is an instrument which is used to measure the potential difference. The voltmeter is always connected in parallel across the points between which the potential difference is to be measured.
- Ammeter is an instrument which is used to measure electric current in a circuit. It is always connected in series in a circuit through which the current is to be measured.



- Ohmmeter is an instrument for measuring electrical resistance, which is expressed in ohms.
- Wattmeter is an instrument for measuring the electric power (or the supply rate of electrical energy) in watts of any given circuit.

---

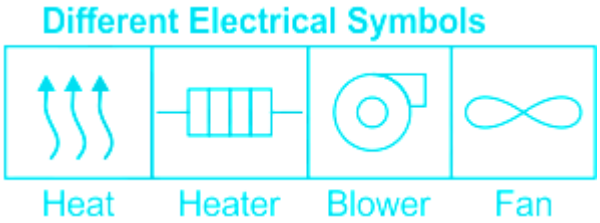
8. **Answer: b**

Explanation:

- Based on construction, the basic difference between DC & AC motor is the commutator.
- **The commutator is only present in DC motor, which performs the commutation phenomenon.**
- Commutation can be defined as the reversal of current (AC to DC or DC to AC).
- In DC motor commutator converts AC to DC (Rectifier function)
- In DC generator commutator converts DC to AC (Inverter function).

9. **Answer: d**

Explanation:



10. **Answer: d**

Explanation:

Transformers used in conjunction with measuring instruments for measurement purposes are called instrument transformers. The actual measurements are done by the measuring instruments only.

Where the current and voltage are very high, direct measurements are not possible as these current and voltage are too large for reasonably sized instruments and the cost of the meter will be high.

The solution is to step-down the current and voltage with instrument transformers , so that, they could be metered with instruments of moderate size.

Instrument transformers are two types: potential transformer and current transformer.

The potential transformer is used to step down the high voltages and **current transformer** s are used to step down the **high currents** .

11. **Answer: a**

Explanation:

Commutator:

- It is used to collect the current from the armature winding. It changes the form of AC to DC or DC to AC depending upon the requirement.
- It consists of some segments which are arranged in series to which the ends of armature winding are connected.
- These divided segments are termed as the commutator segments.
- These segments are laminated by a thin layer of Mica with a thickness of 0.6 to 0.8mm.
- The dielectric strength of these segments is nearly 30V to 40V.
- The segments are made of hard drawn copper of high conductivity. Each segment consists of two coil sides (as one coil contains two coil sides).

Brushes:

- It is the small part of the motor that conducts electrical current between the stationary wires (stator) and the rotating wires (rotor) of a motor or generator.
- The brush is typically made up of one or more carbon blocks and can come with one or more shunts or terminals.

Normally the ratio of width of brush to the width of commutator segments is 2: 1.

---

12. Answer: b

Explanation:

The minimum clearance distance that equipment should be kept away from power lines of different voltage levels is shown in below table.

Voltage	Minimum clearance distance (feet)
Up to 50 kV	10
50 to 200 kV	15
200 to 350 kV	20
350 to 500 kV	25
500 to 750 kV	35
750 to 1000 kV	45
Over 1000 kV	50

13. **Answer: d**

Explanation:

Primary transmission :

The electric supply (132 kV, 220 kV, 500 kV or greater) is transmitted to load center by three-phase three-wire (3 phase - 3 wires) overhead transmission system.

Secondary transmission :

At the receiving station, the level of voltage reduced by step-down transformers up to 132 kV, 66 or 33 kV and electric power is transmitted by three-phase three-wire (3 phase - 3 wires) overhead system to different substations.

Primary distribution :

At a substation, the level of secondary transmission voltage (132KV, 66 or 33KV) is reduced to 11 kV (in a three-phase three-wire overhead system) by step down transformers.

Secondary distribution :

- Electric power is given to (from primary distribution line (i.e.) 11 kV) distribution substation.
- This substation is located nearby consumers area where the level of voltage reduced by step down transformers is 415 V.
- In a 3 phase four wire system (3 phase - 4 wires), there are 415 volts (Three-phase supply system) between any two phases and 230 volts (single-phase supply) between neutral and any one of the phases (lives) wire.
- Residential load (i.e. Fans, light, and TV, etc) may be connected between any one phase and neutral wires, while three-phase loads may be connected directly to the three-phase lines.
- A three-phase 415V, supply is used for supplying small industrial and commercial loads such as garages, schools, and blocks of flats. A single-phase 230 V supply is usually provided for individual domestic consumers.

---

14. Answer: c

Explanation:

- A flywheel is a big wheel that is mounted on the same shaft of the motor, if the speed of the motor is not to be reversed. It is used in the load equalization process.
- To operate flywheel efficiently, the driving motor should have drooping characteristics

- The flywheel is not used with motors having constant speed motors. Hence, we can't use flywheel along with synchronous motor as it is a constant speed motor.
- **However, DC shunt motor is sometimes considered as a constant speed motor but is has slightly drooping characteristics. So flywheels may be used with DC shunt motor during heavy loads.**
- Hence from the given options, DC shunt motor is the best suitable option as DC series & Ac series motors have raising characteristics.

Note:

- For fluctuating loads, flywheels can't be used with DC shunt, synchronous, DC & AC series motors.
- It can use it along with DC cumulative compound motors and three-phase induction motors.

---

15. **Answer: d**

Explanation:

- Latches are level-triggered (outputs can change as soon as the inputs changes)
- Flip-Flop is edge-triggered (only changes state when a control signal goes from high to low or low to high).
- Edge triggering is a type of triggering that allows a circuit to become active at the positive edge or the negative edge of the clock signal.
- Level triggering is a type of triggering that allows a circuit to become active when the clock pulse is on a particular level.

---

16. **Answer: d**

Explanation:

- **Dry wood comes under the category of insulator hence it avoids electrical shock during electrical work .**
- While wet wood and wet rope have electrical current conducting properties due to the presence of water molecules or moisture.
- The metal rod itself considered as a conductor of electricity.
- So that wet wood, wet rope & metal rod do not avoid electrical shock during electrical work.

---

17. **Answer: a**

Explanation:

Ferromagnetic Substances: The substances which are strongly magnetized when placed in an external magnetic field in the same direction to the applied field are called ferromagnetic substances.

Example: Iron, nickel, cobalt

Properties:

- These are characterized by parallel alignment of magnetic dipoles
- These substances are strongly attracted by a magnet
- It develops strong magnetization in the direction of the applied magnetic field
- By removing magnetizing filed, it does not lose its magnetization
- Magnetic susceptibility is much greater than 1
- Relative permeability is much greater than 1
- Magnetic permeability is much larger compared to free space

Material	Magnetic Susceptibility (X m)	Relative Permeability (K m = 1 + X m)	Magnetic Permeability (μ m = K mμ 0)
Diamagnetic	-10 -5 to -10 -9	< 1	μ m < μ 0
Paramagnetic	10 -5 to 10 -3	> 1	μ m > μ 0
Ferromagnetic	≫ 1	≫ 1	μ m ≫ μ 0

---

18. **Answer: b**

Explanation:

- **The visor of a halogen flood lamp is made of glass.**
- The bulb material is either quartz (fused silica) or alumina-silicate glass.
- Quartz glass has the appropriate temperature resistance for the tungsten-halogen cycle, which produces bulb temperatures of up to 1,652°F (900°C).
- For lamps of low wattage up to about 120 watts, alumina-silicate glass can be used.
- Either glass comes in the form of cylindrical tubes that are pre-cut to the desired length or cut to length by the lamp manufacturer.

---

19. **Answer: d**

Explanation:

Delta – star connection type three-phase transformer is used for both large and low voltage rating transformers.

Delta – star transformer is used at the generator side to step up the voltage levels and Star – delta transformer is used at the load side of distribution systems to step down the voltage levels.

Star – star connection transformers are used for small, high voltage transformers.

Delta – delta connection transformers are used for large, low voltage transformers.

---

20. Answer: a

Explanation:

- Whenever a current-carrying conductor is placed in a magnetic field, the conductor experiences a force which is perpendicular to both the magnetic field and the direction of the current.
- According to **Fleming's left-hand rule** , if the thumb, forefinger and middle finger of the left hand are stretched to be perpendicular and **if the forefinger represents the direction of the magnetic field, the middle finger represents the direction of the current, then the thumb represents the direction of a force** .
- According to **Fleming's right-hand rule** , if the forefinger, thumb, and the central finger of the right hand are kept perpendicular to each other, such that the thumb points in the direction of motion of the conductor and the forefinger points in the direction of the magnetic field, then the central finger points in the direction of the induced current.
- This rule is used to determine the direction of flow of induced current in a conductor that is moved inside a magnetic field in a direction perpendicular to the direction of the magnetic field, this can be done when the direction of motion of the conductor and the direction of a magnetic field is known.
- **Faraday's first law** of electromagnetic induction states that whenever a conductor is placed in a varying magnetic field, emf is induced which is called induced emf. If the conductor circuit is closed, the current will also circulate through the circuit and this current is called induced current.

- **Faraday's second law** of electromagnetic induction states that the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of the number of turns in the coil and flux associated with the coil.

---

21. **Answer: d**

Explanation:

- In dc shunt motor flux produced by field winding is proportional to field current. Here the input voltage is constant so field current and flux is also constant.
- So dc shunt motor is also called a constant flux or constant speed motor.
- Hence the speed of DC shunt motor is independent of armature current.

---

22. **Answer: d**

Explanation:

Delta – star connection type three-phase transformer is used for both large and low voltage rating transformers.

Delta – star transformer is used at the load side of distribution systems to step down the voltage levels to provide a neutral connection.

Star – star connection transformers are used for small, high voltage transformers.

Delta – delta connection transformers are used for large, low voltage transformers.

---

23. **Answer: a**

Explanation:

- **PVC insulated non sheathed single-core cables are most preferably used in domestic and industrial wiring.**
- PVC or highly insulated metal-sheathed cables are preferred in hazardous locations.
- Type AC (Armored cable) are used at dry locations and underground systems.
- Type MC (Metal-clad cable) are used at wet locations.

---

24. **Answer: b**

Explanation:

- **Lithium-ion type of cell used for building a laptop battery pack and in mobile phones** .
- The lead-acid batteries are used in vehicles.
- Zinc silver oxide batteries are used in watches, calculators, photoelectric exposure devices, hearing aids, and electronic instruments.
- Nickel-cadmium batteries are used in portable power tools, photography equipment, flashlights, emergency lighting, hobby R/C, and portable electronic devices.

---

25. **Answer: b**

Explanation:

- Boost charging involves a high current for short period of time to charge the battery.
- It is generally used when the battery has been discharged heavily.
- Boost charge is given to a battery in danger of becoming over-discharged during a working shift

---

26. Answer: b

Explanation:

An alternator power output is directly proportional to the sine of its load angle.

$P = \frac{EV}{X} sin\theta$

Where,

P = Power output of the alternator

E = Sending voltage of the alternator

V = Receiving voltage of the alternator

X = Rectance of alternator

θ = Load angle

- The maximum power output from the alternator would occur when the load angle is 90 degrees.
- But still, the load angle is maintained between 20 and 30 degrees.
- This is done to ensure the stability of the power system in which the alternator is connected.
- The load angle of 90 degrees is known as the point of critical stability, if the load angle exceeds this value then the alternator will become unstable and its speed can go out of control.
- To ensure that this situation never occurs the alternator is always operated at a load angle of 20-30 degrees.

---

27. Answer: d

Explanation:

- **Large unbalanced and balanced loads can be handled satisfactorily by a star to delta transformer .**

- The star-delta connection has no problem with third harmonic components due to circulating currents in the delta.
- It is also more stable to unbalanced loads since the delta connection partially redistributes any occurred imbalance.

---

28. Answer: c

Explanation:

Non-conventional system :

- Natural resources like wind, tides, solar, biomass, etc generate energy which is known as non-conventional resources
- These are pollution-free and hence we can use these to produce a clean form of energy without any wastage

Types of Non-convention sources:

- Solar Energy system
- Wind Energy system
- Tidal Energy system
- Geothermal Energy system
- Biomass system

---

29. Answer: c

Explanation:

- **A three-phase star configuration motor has 3 hot, 1 neutral and 1 ground wires.**
- A typical office wall outlet has three electrical connections, which are the hot, neutral and ground wires.
- All office equipment requires only the hot and neutral wires to function. The third or grounding wire is connected to exposed metal parts on the equipment.

- Within the building, the grounding connections of all electrical receptacles are wired to one another and are connected to the water piping.
- This ensures that all electrical equipment with exposed metal parts has these parts electrically connected and to exposed metal fixtures in the building such as water fixtures
- The hot and neutral wires are interchangeable as far as the equipment is concerned. Both are power carrying wires.
- One of the power carrying wires is grounded at the source for reasons of safety (the origin of the 3-wire system). The only reason why the two wires are differentiated (hot and neutral) is to identify which of the wires is grounded (neutral wire).
- The 3-wire system is derived from three-phase distribution, which uses a 5-wire system. In the 5-wire system, there are 3 hot wires, 1 neutral wire, and 1 ground wire.

---

30. **Answer: d**

Explanation:

Passive Element:

- The element which receives or absorbs energy and then either converts it into heat (R) or stored it in an electric (C) or magnetic (L) field is called passive element
- Do not need any form of electrical power to operate
- Not able to control the flow of charge
- Cannot amplify, oscillate, or generate an electrical signal
- Used for energy storage, discharge, oscillating, filtering and phase shifting applications
- Examples: Resistor, inductor, capacitor

Important:

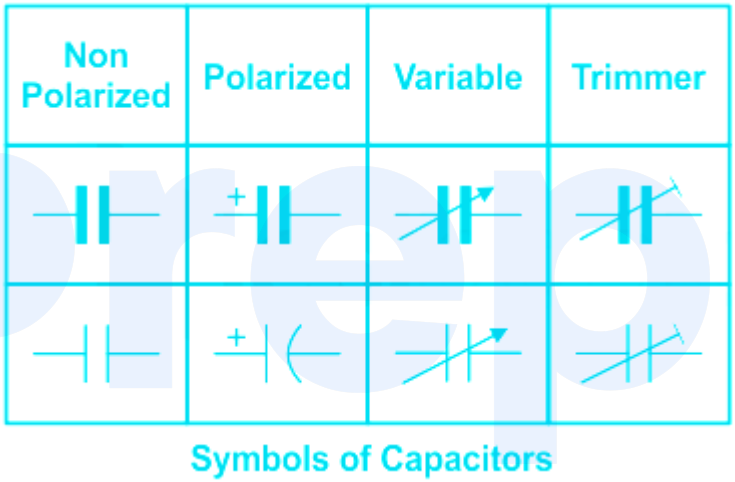
Active Element:

- The elements that supply energy to the circuit is called an active element
- These have an ability to control the flow of charge
- Used for current control and voltage control applications
- Examples: Battery, voltage source, current source, diode

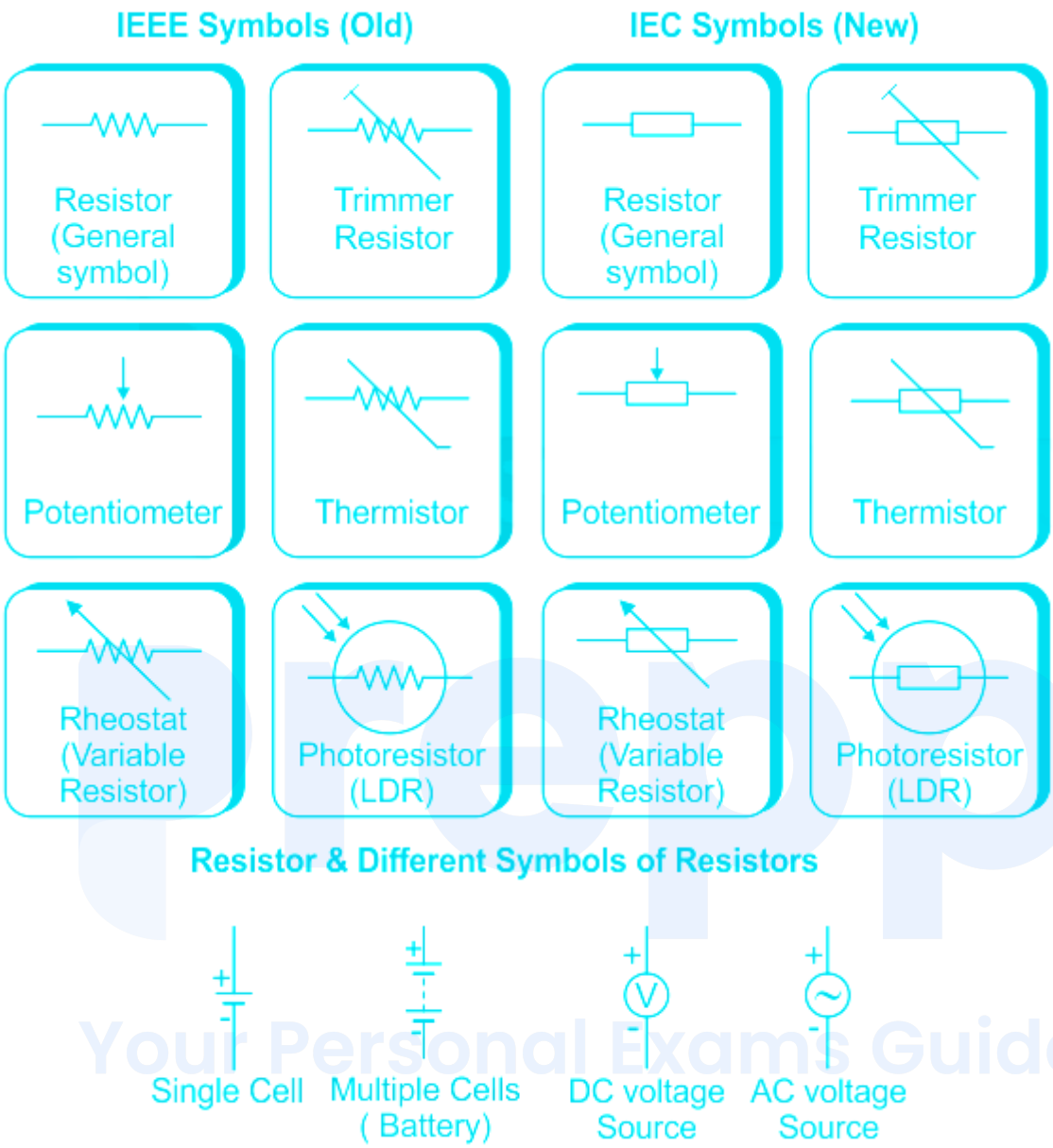
---

31. **Answer: c**

Explanation:



Symbols of Capacitors



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32. Answer: a

Explanation:

- The overall power factor is defined as the cosine of the angle between the phase voltage and phase current.
- In AC circuits, the power factor is also defined as the ratio of the real power flowing to the load to the apparent power in the circuit.

- Hence power factor can be defined as watts to volt-amperes.

  Power factor = cos ϕ

  ϕ is the angle between the voltage and the current.

- For a purely resistive circuit, the angle between the voltage and current is 0°

  So power factor for a purely resistive circuit is:

  P.F. = cos 0°

  P.F. = 1 (unity)

- In a purely inductive circuit, the current lags the voltage by 90° and the power factor is zero lagging
- In a purely capacitive circuit, the current leads the voltage by 90° and the power factor is zero leading

---

33. **Answer: c**

Explanation:

- In the star-delta starting method of induction motor, a two-way switch is used to connect the stator winding in star while starting and in delta while running at normal speed.
- **During starting the stator winding is star connected, so that voltage over each phase in the motor will be reduced by a factor of 1/√3 of that would be for delta connected winding** .
- The starting torque will 1/3 times that it will be for delta connected winding.
- Hence a star-delta starter is equivalent to an auto-transformer of ratio 1/√3 or 57.73 % reduced voltage.

---

34. **Answer: b**

Explanation:

- A static frequency converter or changer is a device that alters the frequency of the input signal according to the input set point. It consists of solid-state switching devices which are either on or off according to the input control signal.
- **A static frequency changer is a type of frequency changer used for speed control of AC motors such as used for pumps and fans.**
- The speed of an AC motor is dependent on the frequency of the AC power supply, so changing frequency allows the motor speed to be changed.
- This allows fan or pumps output to be varied to match process conditions, which can provide energy savings.

---

35. **Answer: d**

Explanation:

- **In armored cable, Steel Wire Armour (SWA) used for higher mechanical protection. So that the cable can withstand higher stresses or impact.**
- It can be buried directly and used in external or underground projects.
- The armored cable can withstand extreme temperature conditions up to 15000°C.
- Using armored cables helps in insulating the transmission components from emitting the interference and also from being affected by interferences that are being emitted from neighboring cables and also appliances.

---

36. **Answer: d**

Explanation:

- **The rotor conductors of the SCIM is short-circuited by end rings. The rotor connections are not brought out at the outside, it is short-circuited inside of the**

motor.

- So that it is not possible to connect external resistances to rotor conductors, thus **we don't have control over the speed of induction motor in squirrel cage type.**
- The speed of the induction motor can be controlled by the following methods:

1. V/f control (or) frequency control
2. Changing the number of stator poles
3. Controlling supply voltage
4. Changing winding resistance by adding rheostat in the stator circuit

---

37. Answer: c

Explanation:

Cell	Classification	Positive electrode (Anode)	Negaitive electrode (Cathode)	Electrolyte	Rated output voltage
Carbon-Zinc (Leclanche cell)	Primary	Zinc	MnO 2 / C	Mixture of NH 4Cl and ZnCl 2	1.5 V
Carbon-Zinc (Zinc chloride cell)	Primary	Zinc	MnO 2 / C	Zinc chloride	1.5 V
Alkaline-Manganese cell	Primary and Rechargeable	Zinc	Manganese dioxide	Aqueous solution of potassium hydroxide	1.5 V
Mercuric oxide cell	Primary	Zinc	Mercuric oxide	Aqueous solution of potassium hydroxide or sodium hydroxide	1.35 V
Silver oxide cell	Primary	Zinc	Ag 2O	Aqueous solution of potassium hydroxide or	1.5 V

				sodium hydroxide	
Nickel-cadmium	Rechargeable (Secondary)	Cadmium	Nickel hydroxide	Aqueous solution of potassium hydroxide	1.2 V
Lithium Manganese	Primary	Lithium	Iodine/metallic oxides, sulphides	Organic, inorganic water	3 V to 6 V

---

38. Answer: a

Explanation:

- When a conductor is placed in a magnetic field with changing magnetic flux, induced currents are produced in the conductor. These currents are called eddy currents.
- They are called eddy currents as they look like eddies or whirlpools.
- These currents are also called Foucault's currents as they were discovered by Foucault.

---

39. Answer: a

Explanation:

- Line voltage (line-to-line voltage) in a poly-phase system is the voltage between any two given phases.
- While the phase voltage is the voltage between any given phase and neutral.

- In delta connected circuits,

1. Line voltage is equal to phase voltage
2. Line current is equal to √3 times the phase current with a lag of 30°.

- In star connected circuits,

1. Line voltage is equal to √3 times the phase voltage with a lead of 30°.
2. Line current is equal to phase current.

- Note that neutral is available in star connection but not in delta connection.

---

40. Answer: b

Explanation:

Concept:

$N_s = \frac{120f}{P}$

Where,

N_s = Synchronous speed in rpm

f = Supply frequency in Hz

P = number of poles

Calculation:

Given that, speed (N_S) = 750 rpm

$750 = \frac{120 \times 50}{P}$

$\Rightarrow P = \frac{120 \times 50}{750} = 8$

---

41. Answer: d

Explanation:

Motor	Application
Universal motor	Mixers, blenders, vacuum cleaners, **washing machines** and hairdryers where high speed and lightweight are desirable.
Reluctance motor	Constant speed applications such as timing devices, signaling devices, recording instruments, phonographs, control apparatus, etc.
Induction motor	Three-phase motors used for industrial drives, Single-phase motors are used extensively for smaller loads, such as household appliances like fans.
Permanent magnet synchronous motor	Commonly used in industrial automation for traction, robotics or aerospace, battery-powered applications.

---

42. Answer: d

Explanation:

- **No-load test gives information regarding no-load losses also known as constant losses such as core loss, friction loss, and windage loss.**
- The no-load test is performed when the rotor rotates with synchronous speed and there is no load torque.

- Rotor copper loss at no load is very less than its value is negligible.
- In this test, a small current is required to produce adequate torque.
- This test is used to evaluate the resistance and impedance of the magnetizing path of induction motor or shunt branch parameters.
- During the no-load test of a 3 phase induction motor, the motor draws power for core loss and windage-friction loss.

---

43. Answer: d

Explanation:

- The current drawn by a motor is determined by the stator impedance and voltage applied across the terminals.
- Let the applied voltage is V_S and stator impedance is Z_m, then current (I_m) drawn by motor is

$$I_m = \frac{V_S}{Z_m} = \frac{V_S}{R+jX_m}$$

Where R & X_m are stator resistance and reactance respectively.

- The current drawn by the machine causes a stator-impedance drop and the balance voltage is applied across the magnetizing branch.
- However, since the magnetizing branch impedance is large, the current drawn is small and hence the stator impedance drop is small compared to the applied voltage (rated value).

---

44. Answer: c

Explanation:

- The size of the output pipe has a significant influence on the efficiency and performance of the single-phase pump performance.

- **By changing the size of the pump will cause changes in flow velocity and fluid pressure on the pipe** .
- The variation in the length of the pipe causes the variation of the head because the friction of fluid with the pipe surface is wider. While the pipe size change that will cause fluid flow rate change.

---

45. Answer: a

Explanation:

- In the star-delta starting method of induction motor, a two-way switch is used to connect the stator winding in star while starting and in delta while running at normal speed.
- **In the star-delta starting method of induction motor, the starting current is reduced approximately by 1/3 times as compared to the original.**
- The starting torque will 1/3 times that it will be for delta connected winding.
- During starting the stator winding is star connected, so that voltage over each phase in the motor will be reduced by a factor of 1/√3 of that would be for delta connected winding.
- Hence a star-delta starter is equivalent to an auto-transformer of ratio 1/√3 or 57.73 % reduced voltage.

---

46. Answer: b

Explanation:

Aquadag:

- The bombarding electrons, striking the screen, release **secondary emission electrons**
- These secondary electrons are collected by an **aqueous solution of graphite called Aquadag** which is connected to the second anode

- It is the conductive coating on the screen
- **Collection of secondary electrons** is necessary to keep the CRT screen in a state of electrical equilibrium

---

47. **Answer: c**

Explanation:

- The overall power factor is defined as the cosine of the angle between the phase voltage and phase current.
- In AC circuits, the power factor is also defined as the ratio of the real power flowing to the load to the apparent power in the circuit.
- Hence power factor can be defined as watts to volt-amperes.

  Power factor = cos ϕ

  ϕ is the angle between the voltage and the current.

- For a purely resistive circuit, the angle between the voltage and current is 0°

  So power factor for a purely resistive circuit is:

  P.F. = cos 0°

  P.F. = 1 (unity)

- In a purely inductive circuit, the current lags the voltage by 90° and the power factor is zero lagging
- In a purely capacitive circuit, the current leads the voltage by 90° and the power factor is zero leading

---

48. **Answer: b**

Explanation:

In the DC motor, iron losses occur in armature because the armature core is made of iron and it rotates in a magnetic field. Hence a small current gets induced in the core. Due to this current, eddy current losses and hysteresis losses occurs in the armature iron core. These eddy current losses and hysteresis losses collectively known as core losses or iron losses.

---

49. **Answer: b**

Explanation:

The horse power (HP) is a unit in the foot-pound-second (fps) or English system, sometimes used to express the rate at which the mechanical energy is expended.

It was originally defined as 550 foot pounds per second (ft-lb/s).

A power level of 1 HP is approx equivalent to **746 watt s (W)** or 0.75 Kilowatt s (kW) .

---

50. **Answer: b**

Explanation:

- There are two types of heating elements used in an electric iron. **One is made of a ribbon resistance wire wound around a sheet of mica. Which is Mica press tungsten strip & most commonly used in the steam iron.**
- This type of element is placed on the top of the sole-plate.
- The other type of element is made up of a round resistance wire (Nichrome), coiled on a ceramic form and cast directly into the sole-plate which is most commonly used in dry iron.
- Electrically there is no difference between steam irons and dry irons. A steam iron has a small reservoir mounted above the heating element.
- A control valve on this allows the water to drip slowly into recesses in the sole-plate.

51. Answer: d

Explanation:

Sodium vapour lamp:

It is low intensity so that the length of the lamp should be more. In order to get the desired length, it is made of a U-shaped tube.

This long U-tube consists of a small amount of neon gas and metallic sodium.

At the time of start, the neon gas vaporizes and develops enough heat to vaporize metallic sodium in the U-shaped tube.

Initially, the sodium is in the form of a solid, deposited on the walls of the inner tube.

When enough voltage is impressed across the electrodes, the discharge starts in the inert gas; it operates as a low-pressure neon lamp with pink colour.

The temperature of the lamp increases gradually, and the metallic sodium vaporizes and then ionizes thereby producing monochromatic yellow.

Important:

Advantages:

- Good efficiency
- Colour rendering is better than that of high-pressure sodium street lights
- Some lamps last far longer than the 24000-hour mark, sometimes 40 years

Disadvantages:

- Like many lamps, it contains traces of mercury which must be disposed of properly
- Human skin looks green under the light, it is poor for colour film/photography
- The warm-up time required to start the lamp

Applications:

Large areas like parks, street lighting, high ceiling buildings, and gyms

---

52. Answer: b

Explanation:

Different Insulation resistance (IR) Values for Electrical Apparatus & Systems are given below:

Maximum Voltage Rating of Equipment	Megger size	Minimum IR value
250 volts	500 volts	25 MΩ
600 volts	1000 volts	100 MΩ
5 kV	2500 volts	1000 MΩ
8 kV	2500 volts	2000 MΩ
15 kV	2500 volts	5000 MΩ
25 kV	5 kV	20,000 MΩ
35 kV	15 kV	100,000 MΩ

---

53. **Answer: b**

Explanation:

- **Bimetallic Lugs are mostly useful where an aluminum cable has to be terminated by a copper bus bar or copper contact.**
- If Cable Lugs of only copper or aluminum are used, a galvanic action occurs due to dissimilar contact. The use of bimetallic lugs thus ensures a technically sound and durable joint.
- The Aluminium barrel is friction welded to the copper palm thereby achieving the best possible transition between barrel & palm.
- Copper lugs (cable lugs) are devices used for connecting cables to electrical appliances, other cables, surfaces, or mechanisms.
- The clamps that connect wires to an automotive battery are a common example of copper lugs, as are the ends of battery jumper cables

---

54. **Answer: c**

Explanation:

A motor meter is Induction type energy meter which consists of the following components

Operating torque system (driving system), moving system, braking system, registering system.

Driving system: the driving system of the meter consists of two electromagnets. The core of these electromagnets is made up of silicon steel lamination.

Moving system: this consist of an aluminium disc mounted on a light alloy shaft. This disc is positioned in the air gap between series and shunt magnets

Braking system: A permanent magnet positioned near the edge of the aluminium disc forms the braking system. The aluminium disc moves in the field of this magnet and thus provides a braking torque.

Registering system: The function of a registering or counting mechanism is to record continuously a number which is proportional to the revolutions made by the moving system.

---

55. **Answer: a**

Explanation:

Miniature circuit breaker (MCB):

A miniature circuit breaker is a compact mechanical device for making and breaking a circuit both in normal condition and in abnormal conditions such as those of over current and short circuit.

It is used for household wiring and in small units as a safety measure. All residential premises can have incoming protection after energy meter instead of fixing fuse and main switch.

---

56. **Answer: b**

Explanation:

- All the given test voltages in the question except 1000 V are less than the equipment maximum voltage of 600 V.
- Hence **the insulation resistance test voltage required for equipment running on a maximum of 600 volts is 1000 V.**
- The test voltages are usually of order 500, 1000, or 2500 V are generated by the hand-driven generator.
- The insulation resistance test is an electrical test that uses a certain type and level of voltage to measure insulation resistance in Ohms.
- The table below shows the required test voltage and the minimum required resistance in accordance with BS 7671.

Normal circuit voltage	Test voltage	Minimum resistance
Between 0 V to 50 V AC	250 V DC	0.5 MΩ
Between 50 V to 500 V AC	500 V DC	1 MΩ
Between 500 V to 1000 V AC	1000 V DC	1 MΩ

---

57. **Answer: a**

Explanation:

Ohm's law: Ohm's law states that at a constant temperature, the current through a conductor between two points is directly proportional to the voltage across the two points.

Voltage = Current × Resistance

$V = I \times R$

V = voltage, I = current and R = resistance

The SI unit of resistance is ohms and is denoted by Ω.

It helps to calculate the power, efficiency, current, voltage, and resistance of an element of an electrical circuit.

Limitations of ohms law:

- Ohm's law is not applicable to unilateral networks . Unilateral networks allow the current to flow in one direction. Such types of networks consist of elements like a diode, transistor, etc.

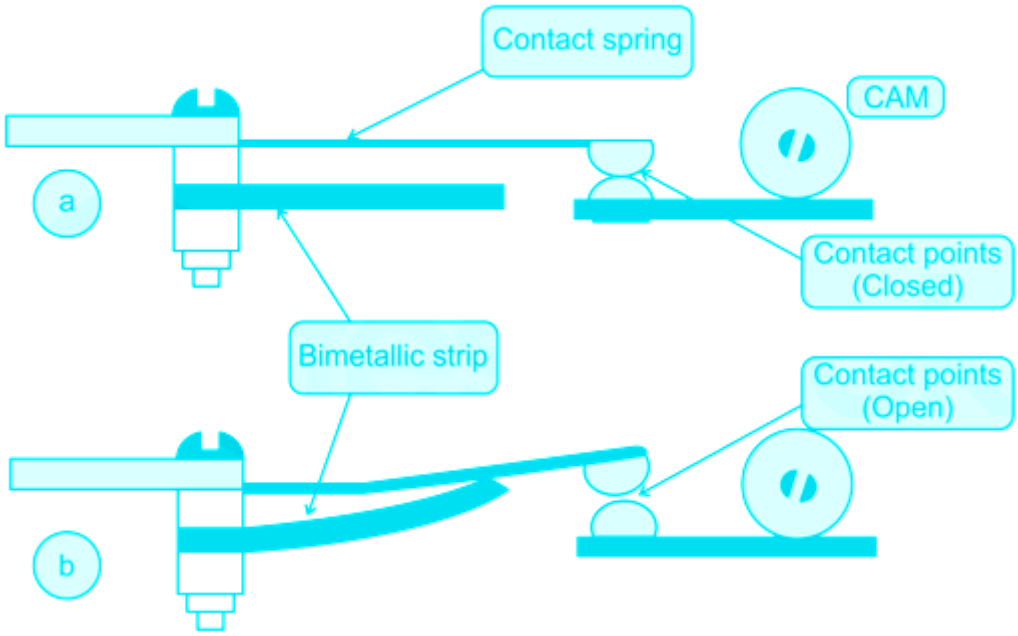
- Ohm's law is also not applicable to non – linear elements . Non-linear elements are those which do not have current exactly proportional to the applied voltage that means the resistance value of those elements changes for different values of voltage and current. An example of a non-linear element is thyristor.
- Ohm's law is also not applicable to vacuum tubes .

---

58. Answer: b

Explanation:

- The bimetallic strip is used by the thermostat of many devices like electric iron.
- The bimetallic strip is made up of two different types of metals (brass and iron) with a different coefficient of expansion bonded together.
- **Hence in the presence of heat, the bimetallic strip expands differently. The metallic strip is connected to a contact spring through small pins. So that the temperature setting for a bi-metallic strip can be changed by moving it close and away from a heating element**
- The bimetallic strip remains in physical contact with a contact point at a moderate temperature. However, at a temperature of the iron above a certain limit, the strip tends to bend towards the metal with a lower coefficient of expansion. At this point, the strip stops to be physically connected to the contact point and current stops flowing because of an opening of the circuit.
- Position (a) is when the iron is at a normal temperature.
- Position (b) is when the iron becomes too hot.



59. **Answer: c**

Explanation:

The losses in the alternator are included both copper losses and core losses.

As the losses of the alternator are independent of electrical power factor, hence power factor does not come into picture while we calculate and estimate the power rating of an alternator.

The rating of alternator generally given in the order of VA or kVA or MVA.

60. **Answer: d**

Explanation:

In AC circuits, the power factor is defined as the ratio of the real power flowing to the load to the apparent power in the circuit.

Hence power factor can be defined as watts to volt-amperes

Power factor = cosϕ

Where ϕ is the angle between voltage and current.

If the current lags the voltage, the power factor will be lagging.

If the current leads the voltage, the power factor will be leading.

1) The ratio of real power to apparent power

2) P/VI represents the ratio of the real power to apparent power, it is known as power factor

3) R/Z also represents the power factor from the impedance triangle

---

61. **Answer: d**

Explanation:

Concept:

Reactive power (Q) = V I sinϕ

Where,

V = Voltage in volt

I = Current in ampere

ϕ = phase difference between voltage & current

Calculation:

Voltage (V) = 230 V

Current (I) = 5 A

Phase difference (ϕ) = 30°

Q = 230 × 5 × sin30°

Q = 575 VAR

---

62. Answer: c

Explanation:

In a three-phase load, three different impedances are connected together in a star or delta fashion.

The delta in a three-phase system is formed by connecting one end of the winding to the starting end of other winding and the connections are continued to form a closed loop.

The star in the three-phase system is formed by connecting one end of all three impedances are connected together.

Important Points:

In a star-connected three-phase system,

V L = √3 × V ph

And I L = I ph

$I_{ph} = \frac{V_L}{\sqrt{3}Z}$

In a delta connected three-phase system,

V L = V ph

I L = √3 × I ph

$I_{ph} = \frac{V_L}{Z}$

Where,

V L is line voltage

V ph is phase voltage

I L is line current

I ph is the phase current

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63. **Answer: b**

Explanation:

- **As per the Indian Electricity Rules 1956 (amended up to 25th Nov 2000), the permissible range for grid frequency is ± 3 % of nominal i.e. 48.5 Hz to 51.5 Hz.**
- The nominal frequency of operation in the Indian grid is 50.0 Hz and the permissible frequency band specified by Indian Electricity Grid Code (IEGC) is 49.5 Hz to 50.2 Hz with reference to 3rd May 2010.

Some important I.E. rules are given below

IE Rule 50: Supply and use of energy.

IE Rule 54: Declared voltage of supply to the consumer.

IE Rule 55: Declared frequency of supply to the consumer.

IE Rule 30: Service Lines and apparatus on consumer's premises.

IE Rule 39: Cables protected by bituminous materials.

IE Rule 51: Provisions applicable to medium, high or extra-high voltage installations.

IE Rule 73: Supply to X-ray and high-frequency installation.

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64. **Answer: b**

Explanation:

- Extrinsic conductors are those which have added impurities in them, like p-type and n-type semiconductors.
- The n-type conductors have electrons as major charge carriers.
- This is because n-type conductors have pentavalent (5 valence electrons) impurities like phosphorous, etc.
- Elements of Group 5 have five valence electrons, i.e. 1 extra from the Group 4 elements. 4 out of 5 electrons get bonded with the neighbouring Silicon atoms and 1 electron per atom remains extra with the Group 5 elements.
- Thus, electrons are the major charge carriers in n-type semiconductors .
- p-type semiconductors have impurities of elements from Group 3 and holes are majority charge carriers in them.

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65. **Answer: a**

Explanation:

For a given output and speed, a universal motor as compared to 220 V, 50 Hz supply will require less voltage at low frequency.

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66. **Answer: d**

Explanation:

- KW is Working Power also known as Actual Power or Active Power or Real Power. It is the power that powers the equipment and performs useful work.
- Active power is measured by kW or MW meter.
- **KVAR is Reactive Power also known as watt less power.** It is the power that magnetic equipment (transformer, motor, relay e.t.c.) needs to produce the magnetizing flux.
- **Reactive power is measured by kVAR or MVAR meter.**
- KVA is Apparent Power. It is the vectorial summation of KVAR and KW.
- Apparent power is measured by kVA or MVA meter.

67. **Answer: d**

Explanation:

- **A Servo Stabilizer is a Servo motor controlled stabilization system that performs optimum voltage supply using a Dimmer (Autotransformer), Buck\Boost transformer booster that captures voltage fluctuations from the input and regulates current to the correct output.**
- An AC synchronous motor adjusts voltage in a clockwise or anticlockwise direction and manages the output voltage with components like control card, dimmer, comparator, transistors, etc.
- There are seven main components in a servo voltage stabilizer:-
  1. Dimmer (Variable Transformer)
  2. Carbon Brush
  3. Servomotor (Synchronizing Motors)
  4. Buck Boost Transformer (Series Transformer)
  5. Contactor or Relay
  6. MCB, MCCB
  7. Electronic Circuit

68. **Answer: a**

Explanation:

Voltmeter:

- It is used to measure the voltage.
- An ideal voltmeter has infinite resistance and thus it provides the path for minimum current.
- It is always connected in parallel as it measures voltage.
- The range of voltmeter can be extended by using a high series resistance.

Ammeter:

- It is used to measure the current.
- An ideal ammeter has zero internal resistance and thus it provides the path for maximum current.
- It is always connected in series as it measures current.
- The range of ammeter can be extended by using a low shunt resistance.

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69. **Answer: b**

Explanation:

- **The half-round file is used for finishing a circular hole.**
- One typical series for hole making can be - (i) Centering, (ii) Drilling, (iii) Boring, (iv) Reaming and (v) Honing.
- **Centering** is carried out to locate the hole by using **chise** l for easy and accurate alignment of a drill. Although it is optional, centering can improve precision. Drilling is a process of originating a hole, while boring enlarges the diameter of an existing hole. Reaming and honing are used to improve the surface finish and tolerance of the existing hole.
- **Drilling** : Drilling is a cutting process that uses a **drill bit** to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool.
- **Boring** : Boring is an operation to enlarging of an existing hole, which may have been made by a drill or maybe the result of a core in a casting.
- **Reaming** : Reaming is a sizing operation that removes a small amount of metal from a hole already drilled. It is done for two purposes: to bring holes to a more exact size and to improve the finish of an existing hole.
- **Honing** is a superfinishing process carried out using abrasive sticks or **half-round file** for the removal of stock from metallic and non-metallic surfaces. This process produces a high surface finish, corrects the profiles of cylindrical surfaces, removes taper.

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70. **Answer: c**

Explanation:

Torque equation:

The torque equation of a three-phase induction motor is given by,

$T = \frac{180}{2\pi N_s}\left(\frac{sV^2R_2}{\left(R_2^2+s^2X_2^2\right)}\right)$

Where N s is the synchronous speed

V = supply voltage

R 2 = rotor resistance

X 2 = rotor reactance

s is the slip

By the above expression, we can say that the torque of an induction motor depends on rotor resistance and slip.

Condition for maximum torque:

The condition to get the maximum torque at starting is,

$s_m = \frac{R_m}{X_m} = 1$

X m = R m

Where,

R m = Motor resistance per phase

X m = Motor reactance per phase

At the starting of the three-phase slip ring induction motor

Slip (s) = 1 (At the starting $N_r = 0$)

Therefore, $s_m = \frac{R_m}{X_m} = 1$

$\Rightarrow X_m = R_m$

Hence the starting torque of an induction motor is maximum when rotor resistance equals rotor reactance.

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71. Answer: d

Explanation:

Soldering is the process by which metallic materials are joined with the help of another liquified metal (solder).

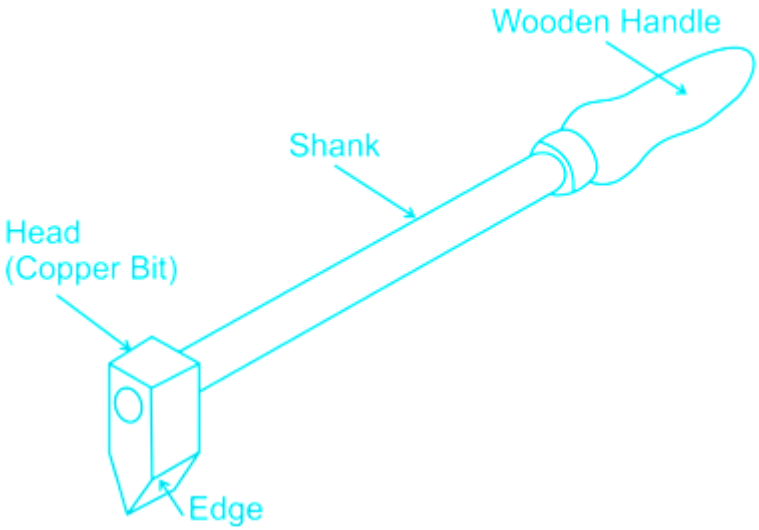
Soldering iron is used to melt the solder and heat the metal that are to be joined together.

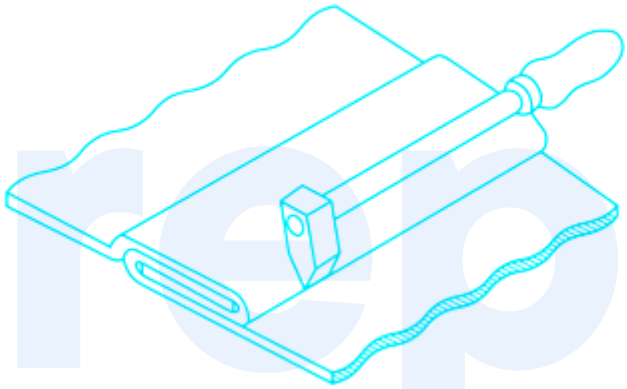
A soldering iron has the following parts

- Head (copper bit)
- Shank
- Wooden handle
- Edge

The head of the iron is made of forged copper . This is because copper has good heat conductivity and has a strong affinity for the solder so that solder melts easily and sticks to the bit.

A hatchet type soldering has shank fitted at 90° to the head. The soldering edge is 'V' shaped. This type is used for straight soldering joints.





72. **Answer: b**

Explanation:

- Guy wire or extended cable is needed on some poles to support unbalanced lateral loads due to the utility wires attached to them or to resist ground movement.
- **Guy wire or extended cable is particularly needed on dead-end (anchor) poles, where a long straight section of wireline ends, or angles off in another direction and hence prevent the pole from bending.**
- To protect the public against faults that might allow the extended cable to become electrified, utility guy cables usually either have a ceramic strain insulator ("Johnny ball"), or a fiberglass guy strain insulator inserted near the top.

- To ensure that any dangerous voltages do not reach the lower end of the wire accessible to the public. The lower end where the cable enters the ground is often encased in a length of the yellow plastic reflector to make it more visible so that people or vehicles do not run into it.

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73. Answer: d

Explanation:

Trigger (Gate amplifier output) :

- In CRO, the measuring signal-wave form is connected to Y-input, which appears on the screen.
- **In order to make the waveform stationary on the screen, it is required that the starting point of the time base signal has to be fixed related to the signal connected to the Y-input and this is known as synchronization.**
- The functional stage which performs synchronization is the trigger.
- The trigger will produce a pulse or impulse for triggering the time base. Every time the time-base is triggered, one saw-tooth waveform is produced.

Trigger level :

- It selects the mode of triggering.
- In the AUTO position, the time-base line is displayed in the absence of the input signal.
- When the input signal is present, the display is automatically triggered.

Intensity :

- It controls the trace intensity from zero to maximum.
- It controls the sharpness of the trace.
- A slight readjustment of this control may be necessary after changing the intensity of the trace.

X-Magnification :It expands the length of the time-based from 1 to 5 times continuously, and makes the maximum time-base to 40ns/cm.

74. **Answer: c**

Explanation:

Solar or photovoltaic cell:

- **The working principle of solar cells is based on the photovoltaic effect.**
- The photovoltaic cell utilizes sunlight in a direct fashion.
- A photovoltaic cell converts solar radiation into electric energy.
- The process of conversion of solar energy into electric energy is called a Photovoltaic Effect.
- Biogas is produced naturally from the decomposition of natural waste.
- It primarily consists of Methane and Carbon dioxide.

⭐ Important Points

- Chemical energy into electrical energy is done by Battery .
- Solar radiation to thermal energy is done by the Solar electricity generation system.
- Thermal energy to electrical energy is done by Thermoelectric generator.

75. **Answer: b**

Explanation:

- **The most useful measure of a light source's color characteristics is the colour rendering index (CRI).**
- CRI is a measure of a light source's ability to show object colors "realistically" or "naturally" compared to a familiar reference source, either incandescent light or daylight.
- **The color rendering index (CRI) is measured as a number between 0 and 100.**
- At zero (0), all the colours look the same.

- A CRI of 100 shows the true colors of the object.
- **Incandescent and halogen light sources have a CRI of 100.**
- Typically, light sources with a CRI of 80 to 90 are regarded as good and those with a CRI of 90+ are excellent.
- Higher the CRI, the better the color rendering capacity.