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Your Personal Exams Guide

- NDA
- CDS
- SSC CGL
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RRB ALP 2019 (CBT 2) (Electrician) Previous Year Papers (22 Jan 2019) Shift 3

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 of the following devices protects a motor from receiving wrong voltage levels? **(+1, -0.33)**

   a. Phase sequence detector

   b. Control relay

   c. Contractor

   d. Fuse

---

2. _ _ _ _ _ _ _ _ are loops of electric current induced within conductors by changing magnetic field. **(+1, -0.33)**

   a. Electric currents

   b. Eddy currents

   c. Berry currents

   d. Faulty currents

---

3. The strongest half lap joint is **(+1, -0.33)**

   a. T half lap joint

   b. Corner half lap joint

   c. Cross half lap joint

   d. Dovetail half lap joint

---

4. What is the Ingress Protection Rating of an outdoor light housing? (+1, -0.33)

a. IP65

b. IP67

c. IP55

d. IP20

---

5. A DC generator works on the principle of: (+1, -0.33)

a. Electro Magnetic Field

b. Magnetic Field

c. Electro Magnetic Induction

d. Thermal Electric Field

---

6. The number of parallel paths in an 8 pole, simplex lap wound armature in DC generator is: (+1, -0.33)

a. 16

b. 2

c. 8

d. 4

---

7. Grid synchronization failure can cause _ _ _ _ _. (+1, -0.33)

a. Higher power noise

b. Lower power factor

c. Heavy harmonics

d. Burnt generator

---

8. Which circuit breaker is used for 1.5 T air conditioner? **(+1, -0.33)**

a. 20 A

b. 2 A

c. 1 A

d. 5 A

---

9. Wire connected to bypass a protective circuit is known as: **(+1, -0.33)**

a. Contractor

b. ELCB

c. Jumper

d. MCB

---

10. The type of transformer used in battery charger is **(+1, -0.33)**

a. Step-down transformer

b. Current transformer

c. Step-up transformer

d. Pulse transformer

---

11. While using stator resistance starter with 3 phase induction motor, the resistances of the starter are kept at: **(+1, -0.33)**

a. Minimum

b. ¾ of maximum

c. Half of maximum value

d. Maximum

---

12. How can the speed of a table fan be controlled? **(+1, -0.33)**

a. By controlling Frequency

b. By controlling I/P voltage

c. By increasing the frequency.

d. By controlling wave shape

---

13. The output of half wave rectifier is: **(+1, -0.33)**

a. AC

b. Pulsating DC

c. Filtered DC

d. DC

14. The type earthing suitable for sandy areas is (+1, -0.33)

a. Horizontal strip earthing

b. Rod

c. Plate

d. Pipe

15. Over speed protection of a generator is done by (+1, -0.33)

a. Governor

b. Differential protection

c. Over current relay

d. Alarm

16. You are testing an energy meter of 240 V, 50 Hz, 5A, 750 rev/kWh, for its performance with some load. When the disc rotates 100 revolutions in 10 minutes, what is the energy supplied? (+1, -0.33)

a. 13.33 kWh

b. 0.0133 kWh

c. 0.8 kWh

d. 1.33 kWh

17. The nominal voltage for lead-acid cells is: (+1, -0.33)

a. 24 V

b. 2 V

c. 1.4 V

d. 12 V

---

18. If series winding is connected in series with the armature and then the shunt winding is put in parallel to the combination, then such a combination will form which kind of a generator? **(+1, -0.33)**

a. Long series compound Generator

b. Long shunt compound Generator

c. Long Closet compound Generator

d. Short shunt compound Generator

---

19. What should be the height of a single pole switch? **(+1, -0.33)**

a. 1.3 m

b. 1.5 m

c. 2.75 m

d. 0.33 m

---

20. Which of the following is used as the heating unit of an electric kettle? **(+1, -0.33)**

a. Inductive filament

b. Concealed wire in metal tube

c. Flat wire sealed

d. Open filament

---

21. In CTS wiring system, CTS stands for: **(+1, -0.33)**

a. Cable type sheathed

b. Core type sheathed

c. Cable tyre sheathed

d. Core tyre sheathed

---

22. Ground resistance should be designed such that: **(+1, -0.33)**

a. Grounding resistance should be as low as possible

b. Grounding resistance should be as high as possible

c. Grounding resistance should be always zero

d. None of the above

---

23. Before commissioning or installing a water heater, the insulation resistance should not be less than _ _ _ _ _. **(+1, -0.33)**

a. 2 mΩ

b. .25 MΩ

c. 1 MΩ

d. .5 MΩ

---

24. The efficiency of direct coupled class B Power amplifier is **(+1, -0.33)**

a. 5%

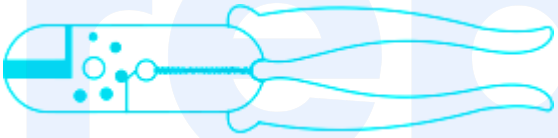
b. 50%

c. 25%

d. 78.5%

---

25. What is the name of tool shown in figure? **(+1, -0.33)**



a. Bent snip

b. Side cutting plier

c. Hand crimping plier

d. Straight snip

---

26. The barrier potential for silicon diode at forward bias is **(+1, -0.33)**

a. 0.5 volt

b. 0.3 volt

c. 0.7 volt

d. 1.1 volt

27. Which material is used for the construction of the power transformer core? (+1, -0.33)

a. Mild steel

b. High carbon steel

c. Silicon steel

d. Copper

28. The net reduction in effective core area due to the lamination and insulation is approximately: (+1, -0.33)

a. 20%

b. 40%

c. 30%

d. 10%

29. Which of the following is a small DC shunt or compound dynamo fixed at one end of an alternator shaft? (+1, -0.33)

a. Exciter

b. Stator

c. Caged rotor

d. Salient-pole rotor

30. Flemings left hand rule does not indicate **(+1, -0.33)**

a. The direction of current flow in the conductor

b. The voltage in the conductor

c. The direction of the magnetic flux

d. The direction motion of the conductor

---

31. DOL Starter is used for motors having capacity: **(+1, -0.33)**

a. Less than 5 HP

b. Less than 10 HP

c. Greater than 10 HP

d. Grater than 15 HP

---

32. The reciprocal of frequency is known as _ _ _ _ _ _. **(+1, -0.33)**

a. Time period

b. Time constant

c. Resonance

d. Amplitude

---

33. Current transformer uses: **(+1, -0.33)**

a. Toroidal transformer

b. Step-up transformer

c. Centre-tap transformer

d. Step-down transformer

---

34. Speed control of universal motor is not done by: **(+1, -0.33)**

a. Phase angle control method

b. Flux control method

c. Armature control method

d. Rheostat control method

---

35. In a pure inductor the voltage waveform "leads" the current by **(+1, -0.33)**

a. 180°

b. 120°

c. 90°

d. 60°

---

36. Insulating material of a cable should have **(+1, -0.33)**

a. Low melting point

b. High dielectric strength

c. Low dielectric strength

d. Low mechanical strength

---

37. Potential Transformer uses: **(+1, -0.33)**

a. Step-up transformer

b. centre tap transformer

c. step-down transformer

d. toroidal transformer

---

38. The form factor of sinusoidal waveform is: **(+1, -0.33)**

a. 1.11

b. 3.14

c. 1.57

d. 1.414

---

39. In a DC motor back emf is directly proportional to: **(+1, -0.33)**

a. No. of armature conductors

b. No. of poles

c. Speed

d. Flux

---

40. For an NPN transistor, if the Base Emitter junction is in forward biased and Base collector junction is in reverse biased, the mode of operation is: **(+1, -0.33)**

a. Reverse cutoff

b. Cutoff

c. Saturation

d. Forward active

---

41. An reactive power in an A.C. circuit is given by the expression **(+1, -0.33)**

a. $V_{rms}.I_{rms}\ \cos\phi$

b. $V_{av}I_{av}$

c. $\frac{V_{max}.I_{max}}{2}$

d. $V_{rms}.I_{rms}\sin\phi$

---

42. Distribution panel is used to: **(+1, -0.33)**

a. Provide longer power backup

b. Segregate the power line according to their characteristics

c. Provide higher power capacity

d. Provide less fluctuation in power

---

43. The instantaneous voltage across a pure resistor is _ _ _ _ _ _ with current **(+1, -0.33)**

a. leads

b. out of phase

c. lags

d. in- phase

---

44. The type of connection generally used at the beginning of high tension transmission line is: (+1, -0.33)

a. delta-delta

b. Start-star

c. star-delta

d. delta-star

---

45. The two methods of synchronising an alternator are? (+1, -0.33)

a. Loading effect and phase sequence

b. Lamp method and synchoroscope method

c. Two bright and one dark lamp method

d. Hysteresis loss and friction loss method

---

46. Running motor is connected in Delta to provide _ _ _ _ _ _. (+1, -0.33)

a. Low power consumption

b. High torque

c. Low speed

d. Low voltage to armature

---

47. Abnormal rubbing sound of induction motors can be prevented by: (+1, -0.33)

a. Replacing winding regularly

b. Proper and regular lubrication

c. Cleaning the rotor regularly

d. Regular starter check

---

48. What is the work of the contractor coil of a DOL starter? (+1, -0.33)

a. Controlling the running current

b. Stopping the motor

c. Starting the motor

d. Holding the On state

---

49. What happens to the time of charge in constant voltage system as compared to constant current system? (+1, -0.33)

a. It stays the same

b. It is almost reduced to half

c. It is increased by half

d. It varies

50. Which BIS symbol does represent the main fuse board without switches (Lighting circuit fuse board)? **(+1, -0.33)**

a. 

b. 

c. 

d. 

51. If the inputs of the 'AND' gate are "A & B", then the output (Y) = **(+1, -0.33)**

a. Y = A . B

b. Y = A – B

c. Y = A + B

d. $Y = \overline{AB}$

52. Which of the following is a suitable wire for copper carrying a current of 50A? **(+1, -0.33)**

a. 12 mm^2

b. 16 mm^2

c. 8 mm^2

d. 4 mm^2

---

53. The size of the earth wire is based on the: **(+1, -0.33)**

a. Maximum fault current carrying through the ground wire

b. Rated current carrying capacity of the service line

c. Depends on the soil resistance

d. Both (a) and (c)

---

54. What does NVR Coil Stand for? **(+1, -0.33)**

a. Non-Volatile reaction Coil

b. Non-Volatile Release Coil

c. No-Volt Reaction Coil

d. No-Volt Releases Coil

---

55. The approximate runtime of a battery lamp containing 10 × 0.25 W LED. Running on a 6 v-6 AH is: **(+1, -0.33)**

a. 14 hours

b. 16 hours

c. 12 hours

d. 10 hours

---

56. The colour of light depends on **(+1, -0.33)**

a. Wavelength

b. Frequency

c. Speed of light

d. Both (1) and (2)

---

57. Ceramic rings are used as _ _ _ _ _ _ _. **(+1, -0.33)**

a. Bonding agent

b. Strong coupler

c. Impedance regulator

d. Insulator

---

58. Wind energy is harnessed by using _ _ _ _ _ _ _. **(+1, -0.33)**

a. Electron generator

b. Turbine generator

c. Vapor generator

d. Steam generator

---

59. The number 1100101 is a **(+1, -0.33)**

a. Hexa-decimal number

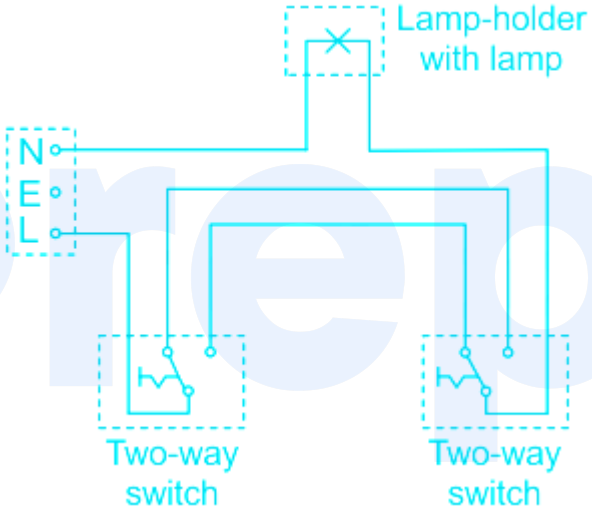
b. Binary number

c. Decimal number

d. Octal number

---

60. The given figure shows the wiring diagram of _ _ _ _ _ _. (+1, -0.33)



a. Staircase wiring

b. Go-down wiring

c. Hostel wiring

d. Tunnel wiring

---

61. Which type of DC motor is used in railway locomotives due to its high stalling torque? (+1, -0.33)

a. Shunt motor

b. Universal motor

c. Compound motor

d. Series motor

---

62. In a 3 – phase motor, the voltage and current measured are as given below. **(+1, -0.33)**

L1 : 230 V, 5 A

L2: 230 V, 4.5 A

L3: 230 V, 5.5 A

What's the input power, assuming power factor of 1?

a. 1,150 Watt

b. 1,265 Watt

c. 1,035 Watt

d. 3,450 Watt

---

63. _ _ _ _ _ instruments may be used as standard instruments for calibrating deflection instruments. **(+1, -0.33)**

a. Analog

b. Mechanical

c. Digital

d. Secondary

---

64. The conductor used in wiring should be of: (+1, -0.33)

a. Steel

b. tin

c. Iron

d. Copper

---

65. The basic difference in 4 point starter when compared to 3 point starter is: (+1, -0.33)

a. The holding coil is removed from the shunt field circuit

b. The overcurrent release is connected in supply line

c. Field circuit is completed through starting resistance

d. The starting resistance is gradually cut out till, when the armature reaches the running position

---

66. Star Delta starter has an advantage of _ _ _ _ _ _ _. (+1, -0.33)

a. Low starting current

b. High starting voltage

c. High starting torque

d. Slow starting

---

67. In LC transistor oscillator, the active component used is: (+1, -0.33)

a. Inductor

b. Capacitor

c. Resistor

d. Transistor

---

68. When reading wire sizes, which number indicates the number of conductors in the wire? (+1, -0.33)

a. Third

b. First

c. Fourth

d. Second

---

69. High-pressure mercury- vapour lamp emits: (+1, -0.33)

a. Red colour light

b. Yellow colour light

c. White colour light

d. Bluish White colour light

---

70. When the stop button is pressed on a motor controller, it _ _ _ _ _ _. (+1, -0.33)

a. Trips the I/P MCB

b. Releases the contractor coil

c. Dis-engages the overload relay

d. Creates a short circuit tripping the overload relay

---

71. Earth wire is made of: (+1, -0.33)

a. Copper

b. Aluminium

c. Iron

d. Galvanized steel

---

72. The electromotive force E or e.m.f is the energy provided by a cell per coulomb of charge passing through it is measured in _ _ _ _ _ _ _ _ (+1, -0.33)

a. Joules

b. Volts

c. Tesla

d. Amperes

---

73. What type of starter is used in a high rating slip ring induction motor? (+1, -0.33)

a. Rotor resistance starter

b. DOL starter

c. Star starter

d. Auto transformer starter

74. The principle behind the process of electrolysis is: (+1, -0.33)

a. Coulomb's law

b. Lenz's law

c. Faraday's law

d. Ohm's law

75. Consider two alternators running in parallel. Now if the excitation of the one of the alternators is changed, then: (+1, -0.33)

a. Frequency will change

b. Power factor will change

c. Speed will reduce

d. Load demand will change

Answers

1. **Answer: a**

Explanation:

- **A phase sequence detector protects a motor from receiving wrong voltage levels.**
- The phase-sequence detector or phase-sequence checker for a three-phase supply is a device used for testing the three-phase sequence of supply in an electrical circuit or at the input of the electrical motors such as a three-phase induction motor, a three- phase-energy meter, etc.
- The control of the motor operation happens in such a way that the protection circuit switches off the motor during under-voltage and overload conditions and corrects the phase sequence during phase reversal conditions.
- There are generally two types of the phase sequence detector

1. Static type phase sequence detector

2. Rotating type phase sequence detector

---

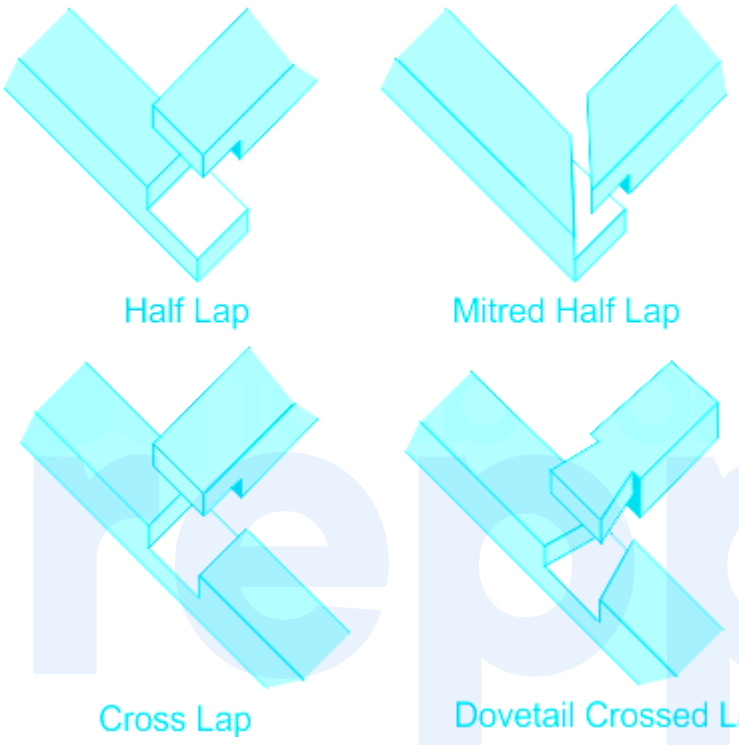
2. **Answer: b**

Explanation:

- **Eddy currents (also called Foucault currents) are loops of electrical current induced within conductors by a changing magnetic field in the conductor according to Faraday's law of induction.**
- Eddy currents flow in closed loops within conductors, in planes perpendicular to the magnetic field.
- The eddy currents cause energy to be lost from the transformer as they heat up the core i.e. electrical energy is being wasted as unwanted heat energy.
- So that core is laminated to reduce eddy current to a minimum as they interfere with the efficient transfer of energy from the primary coil to the secondary one.

3. **Answer: d**

Explanation:



- In a half lap joint or halving joint, the material is removed from both of the members so that the resulting joint is the thickness of the thickest member.
- Most commonly in half-lap joints, the members are of the same thickness and half the thickness of each is removed.
- **Dovetail half-lap joint** is a joint in which the housing has been cut at an angle which resists withdrawal of the stem from the cross-piece.
- **The half-lap dovetail is a remarkably strongest and versatile joint** .
- Its most common application is joining top rails to the sides of a carcass or the legs of a table.
- Due to its wedge shape, the dovetail is extremely effective at locking parts together.
- Because of its great mechanical integrity, a well-fitted, unglued half-lap dovetail can be an ideal joint for knockdown furniture.
- In **cross half-lap joint** , the joint occurs in the middle of one or both members, rather than at the end. The two members are at right angles to each other and

one member may terminate at the joint, or it may carry on beyond it.

- When one of the members terminates at the shin, it is often referred to as a tee lap or middle lap. In a cross lap where both members continue beyond the joint, each member has two shoulders and one cheek.
- Cross half-lap joint used for internal cabinet frames, simple framing and bracing.
- The **mitered half lap** is the weakest version of the joint because of the reduced gluing surface.
- It is used for visible framing applications where a mitered corner is desired.

---

4. **Answer: a**

Explanation:

- An IP rating is also known as Ingress Protection or International Protection ratings which are defined to the international standard of EN 60529 (British BS EN 60529:1992).
- This standard is used to define the levels of sealing effectiveness of electrical enclosures against intrusion from foreign bodies such as tools, dirt, and moisture.
- The minimum IP rating for a garden light is IPX3 (normally IP43), which protects against rain or spraying water at a 60° angle from vertical.
- **The Ingress Protection Rating of an outdoor light housing IP65, as it indicates a dust-tight housing as well as resistance to jets of water.**
- IP Rating Reference Chart

IP Rating	First Digit - SOLIDS	Second Digit - LIQUIDS
IP20	Protected from touch by fingers and objects greater than 12 millimeters.	Not protected from liquids
IP55	Protected from limited dust ingress.	Protected from low-pressure water jets from any direction.
IP65	Protected from total dust ingress.	Protected from low-pressure water jets from any direction.
IP67	Protected from total dust ingress.	Protected from immersion between 15 centimeters and 1 meter in depth.

5. **Answer: c**

Explanation:

- A DC generator works on the principle of **Electro Magnetic Induction.**
- When a DC current passes through a long straight conductor a magnetizing force and a static magnetic field are developed around it.
- If the wire is then wound into a coil, the magnetic field is greatly intensified producing a static magnetic field around itself and forming the shape of a bar magnet giving a distinct North and South pole.
- Then by either moving the wire or changing the magnetic field a voltage and current can be induced within the coil and this process is known as

Electromagnetic Induction, which is the basic principle of operation of DC generators.

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 number of turns in the coil and flux associated with the coil.

These laws are related to the emf of a generator.

---

6. **Answer: c**

Explanation:

- **The number of parallel paths in an 8 pole, simplex lap wound armature in DC generator is 8 .**
- Armature windings are mainly of two types – lap winding and wave winding
- **Lap winding** is the winding in which successive coils overlap each other. It is named "Lap" winding because it doubles or laps back with its succeeding coils.
- In this winding, the finishing end of one coil is connected to one commutator segment and the starting end of the next coil situated under the same pole and connected with the same commutator segment.
- Lap winding are of two types – Simplex Lap Winding & Duplex Lap Winding
- **A winding in which the number of parallel paths between the brushes is equal to the number of poles is called simplex lap winding.**
- A winding in which the number of parallel paths between the brushes is twice the number of poles is called **duplex lap winding.**
- **Wave winding** is the armature winding in which two coils are connected in series and follow each other on the surface of the armature like waves such that there

are only two paths for the current flow irrespective of the number of poles in the circuit.
- In this winding number of parallel paths between the brushes is **always 2** .

---

7. **Answer: a**

Explanation:

- Grid synchronization failure occurred when the voltage and frequency of the grid are beyond the acceptable limits.
- **This condition causes higher power noise.**
- There are several power generation units such as hydro, thermal, solar, etc connected to the grid to supply power to the load.
- These generating units need to supply power according to the rules of the grid. These rules involve maintaining a voltage variation within limits and also the frequency.
- If any deviation from the acceptable limit of the grid it is mandatory that the same feeder should automatically get disconnected from the grid, which is termed as islanding.
- This prevents large scale brownout or blackout of the grid power.
- So it is preferable to have a system that can warn the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure.

---

8. **Answer: a**

Explanation:

Ratings of circuit breaker for air conditioner of different capacity

Capacity	Current (Amp)	Circuit breaker size
0.75 T	5 – 6 A	Upto 16 A
1.0 T	6 – 7 A	16 – 20 A
1.5 T	**8 – 10 A**	**20 – 32 A**
2.0 T	15 – 16 A	>32A

---

9. **Answer: c**

Explanation:

- **A wire connected to bypass a protective circuit is known as Jumper** .
- A jumper wire is simply a piece of wire with alligator clips or special terminals on each end.
- Jumper wires are best used to bypass a portion of the circuit (such as a stretch of wire or a switch) that does not contain a resistor and is suspected to be bad.

---

10. **Answer: a**

Explanation:

- The method of charging a battery employs a transformer, bridge rectifier circuit, and ammeter.
- **The transformer is used to step down voltage know as a step-down transformer** .

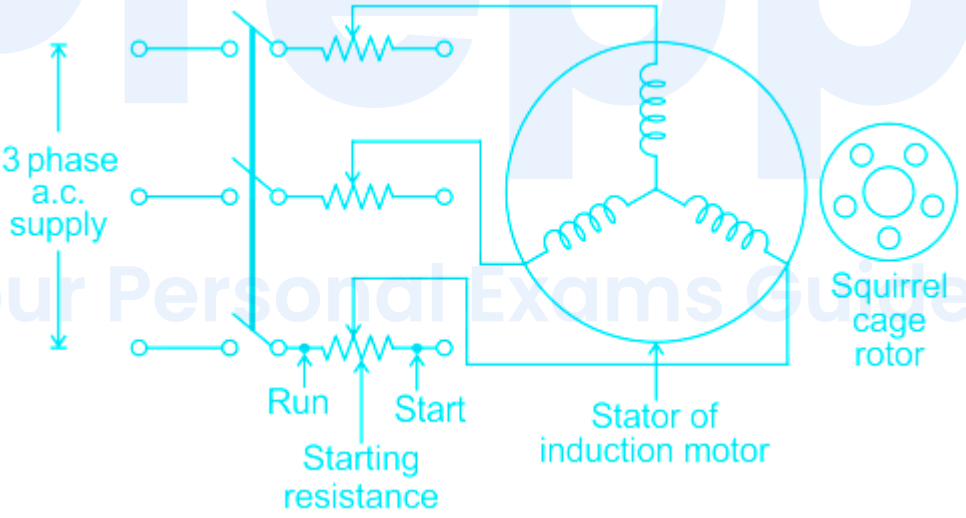
- While bridge rectifier converts AC to DC which is used to charge the battery.
- This charging method is known as a rectifier battery charging method.

---

11. Answer: d

Explanation:

- In the stator resistance starting method of 3 -ϕ induction motor, starter resistance is connected in each line series with each phase winding of the stator.
- **Initially, all the starter resistances are kept in the 'Start' position so that they offer their maximum resistance.**
- The switch is turned on to connect the three-phase ac supply to the stator winding of 3-ϕ induction motor.
- As the motor accelerates, the starter resistance is reduced by moving the variable contact of the resistance towards the 'Run' position.



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12. Answer: b

Explanation:

- Voltage control is the most popular method of speed control of induction motor-driven fans such as table fans.

- This method controls the input voltage appearing across the fan terminals. Theoretically, fan torque is proportional to the square of the voltage applied.

Popular three methods of voltage control are listed.

Resistive/Rheostat control:

- In this method, a variable resistor is connected in series with the fan. At full speed, the resistance is zero.
- The speed can be varied by varying the resistance by turning the knob (Usually by steps).
- This will cause some voltage variation across the resistor and the fan will rotate at a different speed.
- This method is not used now a days due to resistors are bulky & high-power wastage across resistors.

Capacitor Control :

- It is becoming popular now a days. It is very similar to resistive control but less bulky and energy-efficient.
- A variable capacitance in series (usually few capacitors connected together with some tapping corresponding to each step) is used in this regulator.
- As we turn the knob the capacitance changes and it varied the voltage available to the fan. This will change the fan speed.
- There are no heating problems and the capacitor improves the power factor of the circuit.

Electronic regulator :

- This utilizes power electronic devices such as Diac and Triac (they are essentially semiconductor switches).
- They chop the supply voltage waveform and reduces the effective voltage. It is like turning on/off the circuit at regular intervals (100/120 times in a second).
- These controllers are termed as AC full-wave regulators.
- They are energy efficient as losses are negligible.
- The speed can be reduced by changing how much time the waveform is turned on and off. A fan at lower speeds consumes lesser energy.

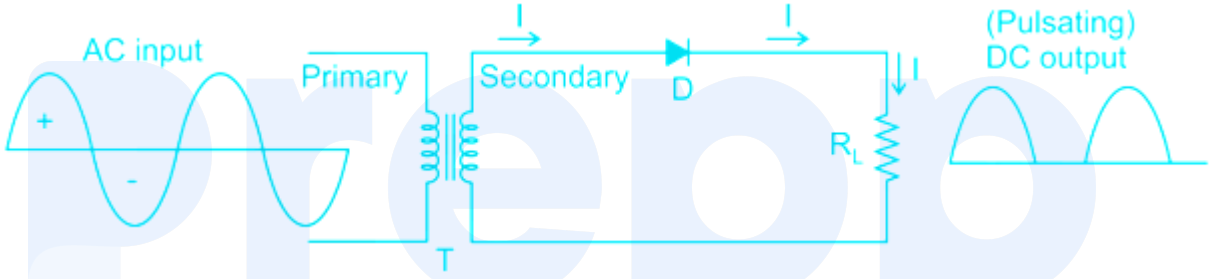
13. **Answer: b**

Explanation:

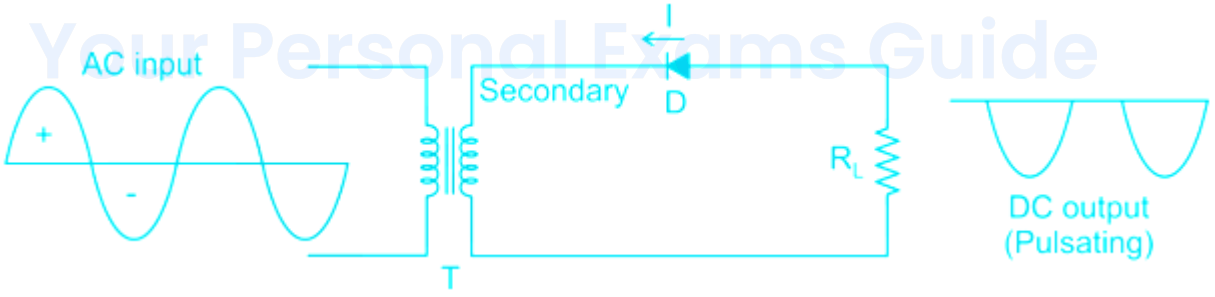
A rectifier is a circuit that converts the AC signal at its input to pulsating DC at its output.

For half-wave rectifier, the output is present is only for one half of the input signal and clipped for the other half.

Positive half wave rectifier clips the negative half of the input signal and only positive part of the input signal is present.



Negative half wave rectifier clips the positive half of the input signal and only negative part of the input signal is present



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14. **Answer: b**

Explanation:

Horizontal strip earthing: This type of earthing is used at places which have rocky earth bed.

Rod earthing: This system of earthing is suitable for areas which are sandy in character. This system of earthing is very cheap as no excavation work is involved.

Plate earthing: It is used for larger stations and transmission lines, where the fault current, likely to be high.

Pipe earthing: It is used for ordinary soil or dry and rocky soil. The size of the pipe depends upon the current to be carried and the type of the soil. Usually, the pipe used for this purpose is of diameter 38 mm and 2.5 meters in length for ordinary soil or of greater length in case of dry and rocky soil.

---

15. Answer: a

Explanation:

- Over-speed causes overvoltage, which may be protected against using overvoltage relays
- Basically, over-speed control is part of the turbine control system
- Due to sudden changes in the load on the generator, the speed of the generator may vary
- Though a governor is provided to control the speed of the generator, the speed might go out of control, damaging the generator
- **Thus, over speed protection of a generator is done by the governor**

---

16. Answer: c

Explanation:

Concept:

Meter constant = (Number of revolution) / (Total energy)

Calculation:

Given that, number of revolutions = 100 in 10 mins

Number of revolutions in 1 hour = 10 × 60

Meter constant = 750 rev/kWh

$750 = \frac{10 \times 6}{E}$

$\Rightarrow E = \frac{100 \times 6}{750} = 0.8\ kWh$

---

17. **Answer: b**

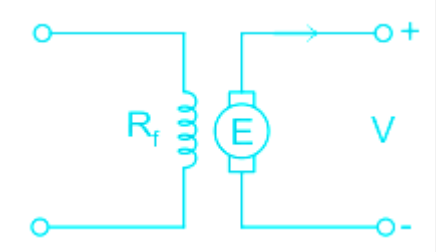
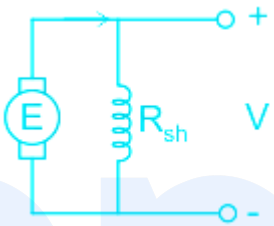
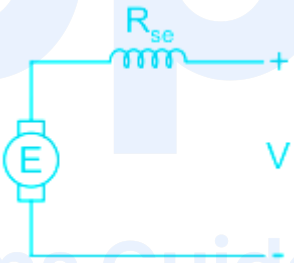
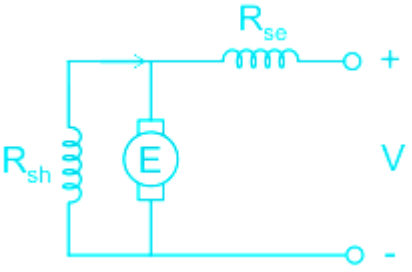
Explanation:

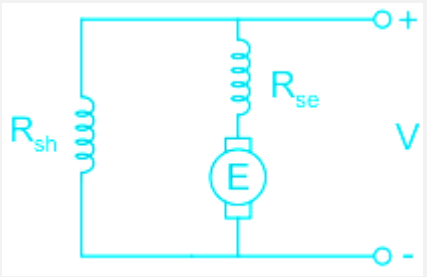
	Type	Voltage (in V)
Primary cell	Carbon zinc	1.5
	Zinc-chloride	1.5
	Manganese alkaline	1.5
	Silver oxide	1.5
	Lithium	2.95
	Mercury	1.35
Secondary cell	Lead-acid	2.2
	Nickel-iron(Edison cell)	1.36
	Nickel-cadmium	1.25
	Silver zinc	1.86
	Silver cadmium	1.1

18. **Answer: b**

Explanation:

Based on the connection of armature and field windings DC generators can be classified as:

Type of DC Machine	Circuit diagram
Separately excited DC generator	
DC shunt generator	
DC series generator	
DC short shunt compound generator	

DC long shunt compound generator	

19. **Answer: b**

Explanation:

- A switch shall be installed at any height of 1.3 m above the floor level. **As from the given option ideal height of a single-pole switch is 1.5 m.**
- Socket-outlets shall be installed either 0.25 or 1.3 m above the floor as desired.
- The clearance between the bottom point of the ceiling fan and the floor shall be not less than 2.4 m.

---

20. **Answer: b**

Explanation:

- Electric kettles are powered by the heating element.
- **The heating element is a concealed wire in the metal tube, which resists the flow of electricity .**
- When electricity flows into the heating element, it is turned into heat, which heats the water inside the kettle.
- The heating element is controlled by the thermostat. The thermostat consists of a variable resistor.
- Higher the set temperature, lower the resistance.
- A small current runs through the thermostat, usually controlled by electronic switch known as the transistor.
- The transistor controls the heating element. When the resistance goes up in the thermostat, less current flows through, which causes less current to flow through the heating element.
- This keeps the heating element and the water inside the electric kettle cooler.
- When the resistance is reduced, the current through the thermostat increases, which causes the transistor to increase the current through the heating

element. This raises the temperature of the water.

---

21. **Answer: c**

Explanation:

- In the CTS wiring system, CTS stands for **Cable tyre sheathed.** It is the type of internal wiring.
- Electrical wiring is the electrical power distribution through the wires in a perfect manner for economic use of wiring conductors inside a room or building with better load control.
- Methods of internal wiring usually used are
    1. Cleat wiring system
    2. Wood casing wiring
    3. CTS or TRS or PVC sheathed wiring
    4. Lead sheathed or Metal sheathed wiring
    5. Conduit wiring
- Applications of different wiring systems are given below

Wiring system	Applications
Cleat wiring	Temporary installations, Ex: Events, functions
Wood casing capping wiring	Residential buildings, offices but replaced by CTS and PVC wiring
CTS / TRS wiring	**Residential offices and commercial**
Lead sheathed wiring	Suitable for places exposed to sun and rain and damp places
Conduit wiring (PVC cables)	Industries, workshops, public buildings, residential, commercial and office buildings

---

22. **Answer: a**

Explanation:

When there is a fault in the circuit the earthing wire provides a path for the current to flow to ground. Hence the user will not get shocked when touches the metal parts. So to drive sufficient current it should offer low resistance to drive more current to ground. Ideally, resistance should be zero, practically it should be as low as possible.

---

23. **Answer: c**

Explanation:

- **Before commissioning or installing a water heater, the insulation resistance should not be less than 1.00 MΩ as per ISI.**

According to **I.E. Rule 48:**

- The insulation resistance between the wiring of installation and earth should be of such a value that the leakage current may not exceed 1/50000 the part or 0.02 percent of the full load current.
- The permissible voltage drop in a lighting circuit is 2% of the supply voltage plus one volt.
- The maximum permissible voltage drop in a power industrial circuit should not be more than 5% of the declared supply voltage.
- The insulation resistance of any wiring installation should not be less than 1MΩ.
- The earth resistance should not exceed the value of one Ω.

---

24. Answer: d

Explanation:

- In Power amplifiers, the improved output ac power level is the result of a transfer of energy from the applied dc supplies.
- It is the applied dc power that permits an ac power output to be greater than the input ac power. In other words, there is an "exchange" of dc power to the ac domain that results in higher output ac power.
- Conversion efficiency is defined as:

$\eta = \frac{P_{o(ac)}}{P_i(dc)}$

P o(ac) is the ac power to the load

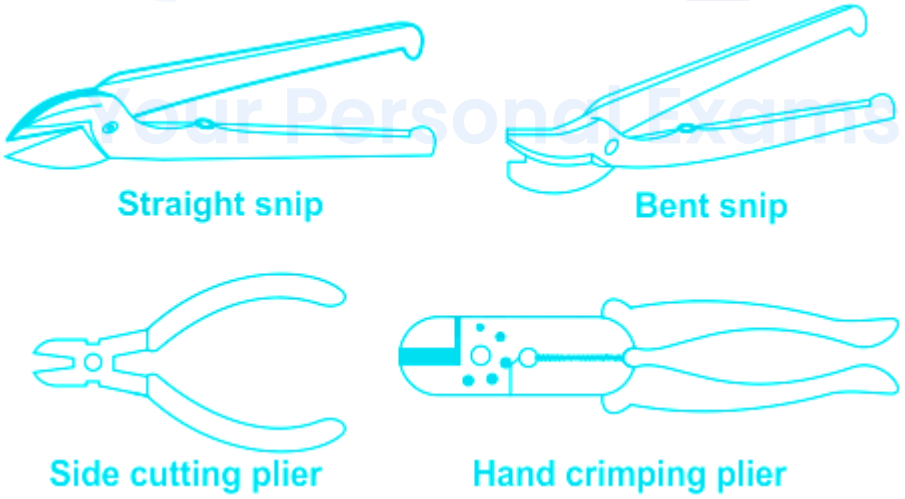
P i(dc) is the dc power supplied.

For a class B power amplifier maximum theoretical maximum efficiency is 78.5 %

Power Amplifier	Conduction Angle	Maximum Efficiency
Class A	360 °	50 %
Class B	180 °	78.5 %
Class AB	180 ° - 360 °	50-78.5 %
Class C	< 180°	≥ 90°

25. Answer: c

Explanation:



26. Answer: c

Explanation:

The forward voltage at which the current through PN junction starts increasing rapidly is known as knee voltage. The Knee voltage of a crystal diode is approximately equal to barrier potential.

Knee voltage of “germanium” diode is 0.3 volts

Knee voltage of “silicon" diode is 0.7 volts

---

27. **Answer: c**

Explanation:

Silicon steels are used for electrical transformer cores the following reasons:

1) Low hysteresis loss

2) High permeability

3) High resistance

4) Virtually eliminated ageing

5) Lower thickness of lamination

---

28. **Answer: d**

Explanation:

- Laminated iron cores are used to reduce the eddy current losses in the transformer, because the laminations are insulated from each other.
- The process of lamination involves dividing the core into thin layers held together by insulating materials such as Varnish, Impregnated paper, etc.
- **Due to lamination effective cross-section area of each layer reduces in the order of 10%** and hence the effective resistance increases.
- As effective resistance increases, the eddy current losses will get decrease.

29. **Answer: a**

Explanation:

The rotor or the field coils in a generator produce the magnetic flux that is essential to the production of the electric power. The rotor is a rotating electromagnet that requires a DC electric power source to excite the magnetic field. This power comes from an exciter .

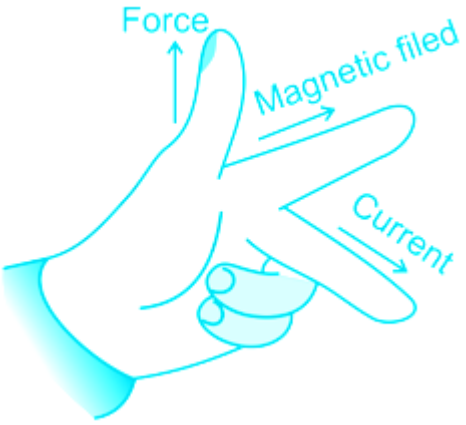
- Shunt generator can be used as exciter.
- DC generator is coupled to the same shaft as the rotor. Therefore, when the rotor rotates this exciter produces the power for the electromagnet.
- Control of the exciter output is done by varying the field current of the exciter.
- This output from the exciter then controls the magnetic field of the rotor to produce a constant voltage output by the generator.

30. **Answer: b**

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 to each other as shown in the figure, and if the forefinger represents the direction of the magnetic field, the middle finger represents the direction of current, then the thumb represents the direction of force.



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31. **Answer: a**

Explanation:

The direct o n line (DOL) starter method of an induction motor is simple and economical. In this method, the starter is connected directly to supply voltage. By this method, small motors up to 5 kW rating are started to avoid the supply voltage fluctuation.

The star-delta starter method of starting three-phase induction motors is very common and widely used among all the methods. In this method, the motor runs at delta connected stator windings. It is also used for small motors up to 5 kW rating.

The Autotransformer is used in both the type of the connections, i.e., either star connected or delta connected. The autotransformer is used to limit the starting current of the induction motor. This method is used for the high rating of squirrel cage induction motors. So, this method is most suitable for a 20 kW squirrel cage induction motor.

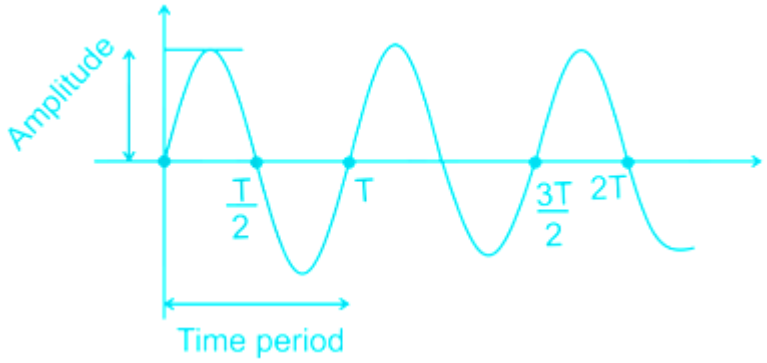
3-point and 4-point starters are used for the starting of DC motors.

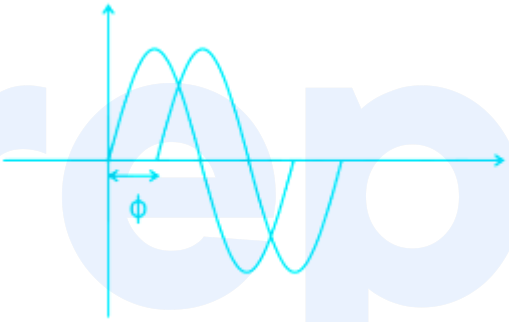
---

32. **Answer: a**

Explanation:

- The angle between zero points of AC quantities is called as phase difference.
- Time period is the time taken to complete one cycle of periodic waveform.
- Frequency is the reciprocal of time period.





In the figure shown,

ϕ = phase difference

A = amplitude

T = time period

f = frequency = 1/T

---

33. Answer: b

Explanation:

- The current transformer uses step-up transformer.

- The current transformer (C.T.), is a type of instrument transformer that is designed to produce an alternating current in its secondary winding which is proportional to the current being measured in its primary.
- Current transformers reduce high voltage currents to a much lower value and provide a convenient way of safely monitoring the actual electrical current flowing in an AC transmission line using a standard ammeter.
- By reducing current in the secondary side, C.T. also steps up the voltage on the secondary side.

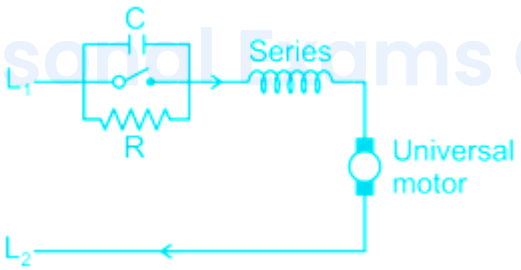
---

34. Answer: a

Explanation:

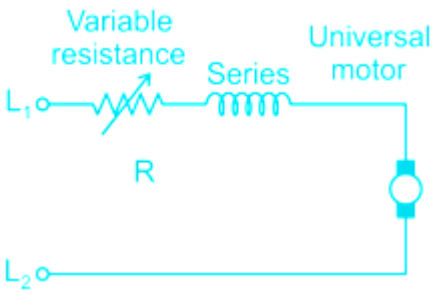
There are various methods to control the speed and to avoid the universal motor running at dangerous speed. One method is to build the universal motor into a device so that the motor would never run at no load. These types of motor are used for small applications that favour connecting the motor directly to the system that it drives. Other ways of controlling speed of a universal motor are

Centrifugal Mechanism for Speed Control:



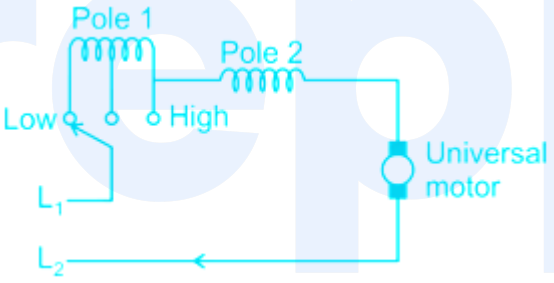
If the motor speed rises above that set by the lever, the centrifugal device or switch opens two contacts and inserts a resistance R in the power circuit to the motor, which causes the motor speed to decrease. If the motor runs too slowly, the centrifugal device will close the two contacts and short circuit the resistance so that the motor speed rises. This process is repeated so rapidly that variations in speed are not noticeable. A resistance is connected across the centrifugal switch or device to perform this function. A capacitor C is used across the contact points in order to reduce sparking produced due to the opening and closing of these points.

Resistance Method for Speed Control:



In this method, the speed of the electric motor is controlled or set by connecting a variable resistance R in series with the motor. Due to having the resistance before the motor, the current to the motor is reduced, which in turns reduces the speed of the motor according to the setting of that variable resistance.

Field Tapping Method for Speed Control:



In this method, the field poles are tapped at various points so that the speed of the motor can be varied by varying the field strength. If there are more tapings from the field, then we can have various speeds for the motor. For this purpose of speed setting, the field poles are wound in various sections with different series of wire and taps are brought out from each section.

---

35. Answer: c

Explanation:

In pure inductive circuit, current lags the voltage by 90°.

In pure capacitive circuit, current leads the voltage by 90°.

In R - L circuits, current lags the voltage but it is not exactly 90°.

In R - C circuits, current leads the voltage but it is not exactly 90°.

---

36. Answer: b

Explanation:

The satisfactory operation of a cable depends to a great extent upon the characteristics of insulation used. In general, the insulating materials used in cables should have the following properties.

- High insulation resistance to avoid leakage current
- **High dielectric strength** to avoid electrical breakdown of the cable
- High mechanical strength to withstand the mechanical handling of cables
- Non-hygroscopic i.e., it should not absorb moisture from air or soil; The moisture tends to decrease the insulation resistance and hastens the breakdown of the cable. In case the insulating material is hygroscopic, it must be enclosed in a waterproof covering like a lead sheath
- Non-Inflammable
- Low cost so as to make the underground system a viable proposition
- Unaffected by acids and alkalies to avoid any chemical action

---

37. Answer: c

Explanation:

- **The Potential transformer is an instrument transformer used to step down the higher voltage to a lower safe voltage for the measurement of voltage & Power .**
- The PT is made from a high quality core with very low core loss & operated at low flux density to keep the magnetizing current at a small magnitude.

- The leakage reactance also reduced to a minimum value. The turn ratio is also kept precise.

---

38. Answer: a

Explanation:

The form factor is defined as the ratio of the RMS value to the average value of an alternating quantity.

F.F. (Form factor) = $\frac{R.M.S\ Value}{Average\ Value}$

Crest Factor 'or' Peak Factor is defined as the ratio of the maximum value to the R.M.S value of an alternating quantity.

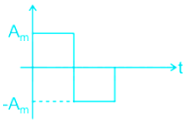
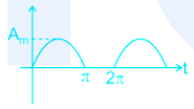
C.F. 'or' P.F. = $\frac{Maximum\ Value}{R.M.S\ Value}$

For a sinusoidal waveform:

Form Factor = 1.11

Crest Factor = 1.414

IMPORTANT EVALUATIONS:

WAVEFORM	SHAPE	MAX. VALUE	AVERAGE VALUE	RMS VALUE	FORM FACTOR	CREST FACTOR
SINUSOIDAL WAVE		A_m	$\frac{2A_m}{\pi}$	$\frac{A_m}{\sqrt{2}}$	$\frac{\frac{A_m}{\sqrt{2}}}{\frac{2A_m}{\pi}} = 1.11$	$\frac{A_m}{\frac{A_m}{\sqrt{2}}} = \sqrt{2}$
SQUARE WAVE		A_m	A_m	A_m	$\frac{A_m}{A_m} = 1$	$\frac{A_m}{A_m} = 1$
TRIANGULAR WAVE		A_m	$\frac{A_m}{2}$	$\frac{A_m}{\sqrt{3}}$	$\frac{\frac{A_m}{\sqrt{3}}}{\frac{A_m}{2}} = \frac{2}{\sqrt{3}}$	$\frac{A_m}{\frac{A_m}{\sqrt{3}}} = \sqrt{3}$
HALF-WAVE RECTIFIED WAVE		A_m	$\frac{A_m}{\pi}$	$\frac{A_m}{2}$	$\frac{\frac{A_m}{2}}{\frac{A_m}{\pi}} = \frac{\pi}{2}$	2

39. **Answer: c**

Explanation:

The back emf of a dc motor is directly proportional to speed.

E b ∝ Nϕ

If the speed of a DC motor increases, there will be increase in back emf also.

Current drawn in the DC motor is given by

$I_a = \frac{V - E_b}{R_a}$

When the speed of a DC motor increases, emf will get increases and hence the current drawn will get decreases.

---

40. Answer: d

Explanation:

In Transistors biasing is done to keep stable DC operating conditions needed for its functioning as an amplifier. A properly biased transistor must have its Q-point (DC operating parameters like IC and V CE) at the centre of saturation mode and cut-off mode i.e. active mode.

In the active mode of transistor operation, the base-emitter junction is forward biased and the base-collector junction is reverse biased.

Important Point:

Different modes of BJT operations

Mode	Emitter -base Junction	Collector-Base Junction
Cut off	Reverse	Reverse
Active	Forward	Reverse
Reverse Active	Reverse	Forward
Saturation	Forward	Forward

---

41. **Answer: d**

Explanation:

Complex power:

Complex power is a complex quantity that contains both the average power P and the reactive power Q.

$S = P + jQ$

The complex power delivered to an element is given by

$S = V \times I^*$

S = complex power

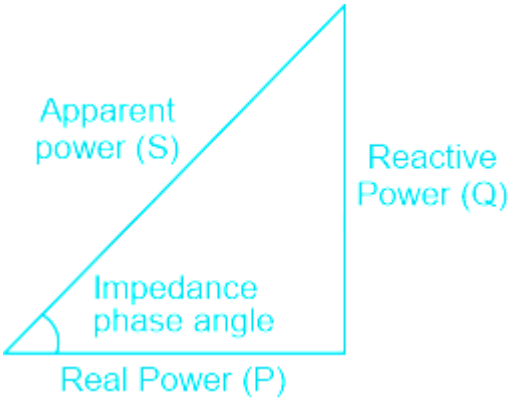
V = Voltage across the element

I* = Conjugate of current through the element

Reactive power is a means of measuring the energy flow rate to and from reactive loads.

Apparent power is the maximum possible average power.

The power triangle is shown below.



P = Active power (or) Real power in W = V rms Irms cos ϕ

Q = Reactive power in VAR = V rms Irms sin ϕ

S = Apparent power in VA = V rms Irms

S = P + jQ

$S = \sqrt{P^2 + Q^2}$

ϕ is the phase difference between the voltage and current

Power factor $\cos\phi = \frac{P}{S}$

Power factor can be defined as the ratio of real power to apparent power.

⭐ Important Points

Unit of reactive power is Var.

Unit of apparent power is VA.

Unit of total power is Watt.

---

42. Answer: b

Explanation:

- **The distribution panel is used to segregate the power line according to their characteristics.**
- A distribution board (also known as panelboard, breaker panel, or electric panel) is a component of an electricity supply system that divides an electrical power feed into subsidiary circuits.
- While providing a protective fuse or circuit breaker for each circuit in a common enclosure.

---

43. Answer: d

Explanation:

In purely resistive circuits, the current and applied voltage are in phase with each other.

In purely inductive circuits, the current lags the applied voltage by 90°

In purely capacitive circuits, the current leads the applied voltage by 90°

---

44. Answer: d

Explanation:

- At the beginning of the High tension transmission line, there is a very high voltage at the secondary side. This is achieved by using a step-up transformer.
- At the beginning of the High tension transmission line, the primary side is low voltage side & the secondary is the high voltage side.
- **For this purpose delta & star connections are suitable at primary and secondary sides respectively** .
- Because in star connection phase voltage is $\frac{1}{\sqrt{3}}$ times of line voltage.
- Hence the cost of insulation is saved. Also, the cost of insulation throughout the transmission line is reduced.

Different connections and respective transformers are given below

Connection	Uses
Delta primary, Star secondary	**Step-up transformer**
Star primary, Delta secondary	Step down transformer
Star primary, Star secondary	Small high voltage transformers
Delta primary, Delta secondary	Low power primary distribution

⭐ Mistake Points

Delta – star connection is most economical for step-up applications(transmission side) and **also the secondary side (Y) connection provides a stable neutral point for 1-ϕ loads in the secondary distribution network (3-ϕ, 4 wire).**

∴ Δ - Y connection is popular for both the step-up (transmission side, high voltage) and step-down(distribution side, low voltage) applications.

- Delta-star connected distribution transformers are widely used in low power distribution for 3 phase 4 wire supply .
- The primary winding connected in delta providing a three-wire balanced load to the utility company
- While the secondary winding connected in the star connection, to provide the required 4th-wire neutral or earth connection.

---

45. **Answer: b**

Explanation:

Synchronization of alternator means connecting an alternator into the grid in parallel with many other alternators, that is in a live system of constant voltage and constant frequency.

Before connecting an alternator into the grid, the following conditions must be satisfied:

Equal voltage: The terminal voltage of incoming alternator must be equal to the bus-bar voltage.

Same frequency: The frequency of generated voltage must be equal to the frequency of the bus-bar voltage.

Phase sequence: The phase sequence of the three phases of alternator must be similar to that of the grid or busbars.

Phase angle: The phase angle between the generated voltage and the voltage of the grid must be zero.

The first condition of voltage equality can be satisfied by a voltmeter. To satisfy the conditions of equal frequency and identical phases, one of the following two methods can be used:

- Three Dark Lamps Method
- Two Bright, One Dark Method
- Synchroscope Method

---

46. Answer: b

Explanation:

- In the star-delta starting method of 3 - ϕ induction motor, the stator winding is connected in a star at the instant of starting and when the motor picks up the speed about 80 percent of rated speed, then it is connected in delta connection.

- So that the starting line current of the motor is reduced to one-third as compared to the starting current with the windings connected in delta.
- When the induction motor starts the windings of the stator are star-connected, each stator phase gets a voltage $V_L/\sqrt{3}$. Here V_L is the line voltage.
- Since the developed torque is proportional to the square of the voltage applied to an induction motor. Star - delta starter reduces the starting torque to one-third that is obtained by direct delta starting.
- **So that 3 - ϕ induction motor at running condition connected in delta to provide High torque (3 times of star connection).**

---

47. Answer: b

Explanation:

- **The abnormal rubbing sound of induction motors can be prevented by proper and regular lubrication.**
- The main sources of noise in electrical machines are time change of the electromagnetic fields, the noise of bearings and other mechanical sources.
- Also, the unwanted noise is creating too due to coolant flow or parts that come into contact with coolant in electric machines.
- The main mechanical sources of the noise

1. Alignment
2. Inaccurate machining of parts
3. Running speed
4. Number of rolling elements carrying the load
5. The mechanical resonance frequency of the outer ring
6. Lubrication conditions (rubbing sound)
7. Temperature

---

48. Answer: d

Explanation:

- DOL starter consists of MCCB, contractor coil, and overload relay. It acts as a switch under normal working conditions by providing the means to switch ON and switch OFF the motor.
- **It holds the switch ON condition when the motor is running by the use of a latch mechanism and interrupts the flow of current to the motor once the stop button is pressed.**
- It also incorporates the overload tripping mechanism that can be operated by either thermal or magnetic overload trips. These tripping mechanisms are activated when there is a sustained increase of current flow through the starter.

---

49. **Answer: b**

Explanation:

- The constant current charging is more efficient than the consonant voltage charging as in case of constant voltage charging the charging current may be excessive which causes heating of the battery during charging.
- **The voltage charging is more rapid than the constant current charging. The time of charge in a constant voltage system as compared to the constant current system is almost reduced to half.**
- The practical charging method uses two types of sources. The constant current charging at the starting where the battery is relatively empty.
- Once the battery reaches a certain voltage near the maximum voltage the battery then constant voltage charging is accomplished.

---

50. **Answer: a**

Explanation:

BIS Symbol	Equipment
	Distribution fuse board without switches
	Distribution fuse board with switches
	Main fuse board without switches
	Main fuse board with switches

51. **Answer: a**

Explanation:

Symbol:

Truth Table:

Input A	Input B	Output Y = A.B
0	0	0
0	1	0
1	0	0
1	1	1

Output Equation: Y = A.B

---

52. **Answer: a**

Explanation:

Wire size		Ampere rating at 60° C (140 F) In Ampere (A)		Ampere rating at 75° C (167 F) in Ampere (A)	
AWG	mm^2	Copper	Aluminium	Copper	Aluminium
14	2.1	15	--	15	--
12	3.3	20	15	20	15
10	5.3	30	25	30	25
8	8.4	40	30	50	40
7	**11.8**	**50**	**35**	**55**	**45**
6	13.3	55	40	65	50
4	21.2	70	55	85	65
2	33.6	95	75	115	90

53. **Answer: d**

Explanation:

Earthing is used to protect from an electric shock. It helps by providing a path for a fault current to flow to earth.

The size of the earth wire depends on

a) Maximum fault current carrying through the ground wire

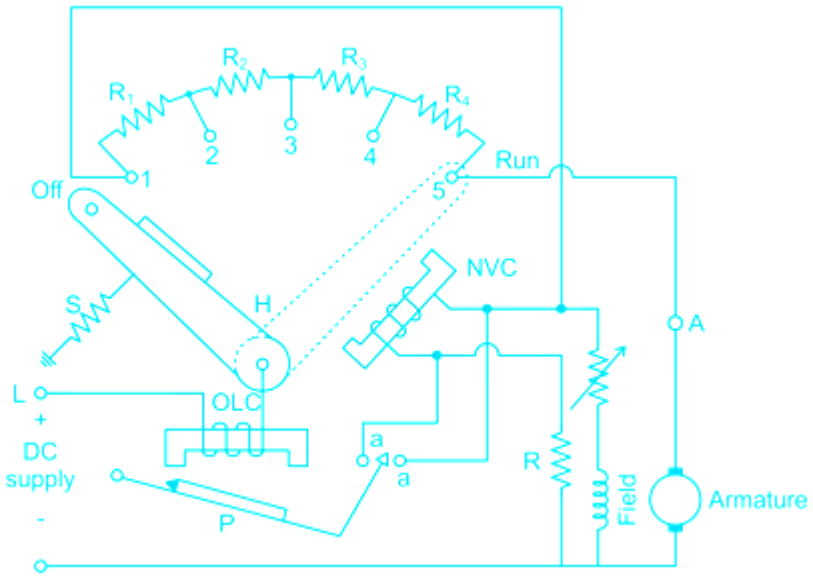
b) Resistance and moisture content of soil

---

54. Answer: d

Explanation:

- **NVR coil stands for the No-Volt Release coil also represent by NVC. It is used in dc motor starter.**
- No volt coil retains the starter knob in the last step, as far as the supply voltage is available. When supply voltage fails, the knob returns to off position.
- No Volt Coil ensures that whenever supply resumes after switching off or supply failure, the motor does not start automatically to lowest armature resistance, but starts only through current limiting resistors.
- The starter introduces large resistance initially and as the speed picks up, the starter knob is turned forward in a few steps. In the last step, the resistance is bypassed.



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55. **Answer: a**

Explanation:

Concept:

Energy = Power × time

Energy = voltage × current × time

Calculation:

Energy = 6 × 6 = 36 W-h

Power = 10 × 0.25 = 2.5 W

Time (t) = Energy/Power

$t = \frac{36}{2.5} = 14.4\ h \approx 14\ hours$

---

56. **Answer: d**

Explanation:

- Visible light is the small part within the electromagnetic spectrum that human eyes are sensitive to and can detect.
- **The color of visible light depends on its wavelength and frequency.**
- Visible light waves consist of different wavelengths. These wavelengths range from 700 nm at the red end of the spectrum to 400 nm at the violet end.
- Low-frequency radiation is invisible. With an adequately bright source of nearly 400 THz (1 THz = 10^{12} Hz) most humans begin to recognize a dull red color.
- As the frequency is increased, the recognized color gradually changes from red to orange to yellow to green to blue to violet. The eye doesn't recognize a violet color easily.
- It always seems to look dark compared to other sources at equal intensity. Somewhere between 700 THz and 800 THz the world goes dark again.

---

57. Answer: d

Explanation:

- Ceramics are hard and brittle and are in the form of amorphous or glassy solids. The bond in these materials is mixed ionic and covalent.
- The electrons are not free to move, hence they are thermal and electrical insulators. At low temperatures, ceramics behave elastically. They do not possess any malleability.
- **Due to the above reasons, rings or discs made from ceramic are used as insulators at support poles in the transmission & distribution system.**
- A ceramic is a solid material comprising an inorganic compound of metal, non-metal, or metalloid atoms primarily held in ionic and covalent bonds. Common examples are earthenware, porcelain, and brick.

Ceramics have certain properties like

- High melting points so they are highly heat resistant.
- Great hardness and strength.

- Very durable.
- Very low electrical conductivity that's why they are used as insulators in the transmission system.
- Very low thermal conductivity.
- Very much inert to chemical activities so they are unreactive to other chemicals resulting in a longer lifespan.

---

58. Answer: b

Explanation:

- **Wind energy is harnessed by using a wind turbine generator.**
- Wind turbines convert the energy in wind to electricity by rotating propeller-like blades around a rotor. The rotor turns the drive shaft, which turns an electric generator.
- Three key factors affect the amount of energy a turbine can harness from the wind are wind speed, air density, and swept area.
- At Hydropower plant salient pole type alternator is used to convert hydro energy into electrical energy.
- Steam turbine-driven generators (Turbo generators) are commonly used in solar thermal electric power plants, coal, geothermal, nuclear, waste incineration plants, and natural gas power plants.

---

59. Answer: b

Explanation:

- **The number 1100101 is a binary number** .
- Binary is the most basic computer language. A binary number is a number expressed in the binary or base-2 numeral system which represents numeric values using two different symbols: typically 0 (zero) and 1 (one).
- 1 represents an ON state while a 0 represents an OFF state.

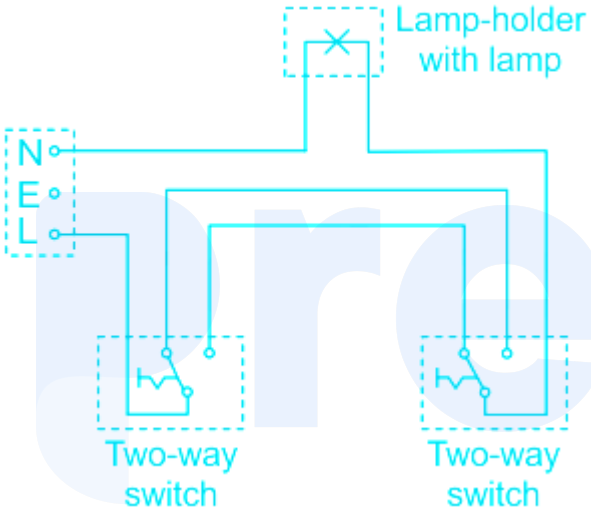
- The base-2 system is a positional notation with a radix of 2. Each digit is referred to as a bit.

---

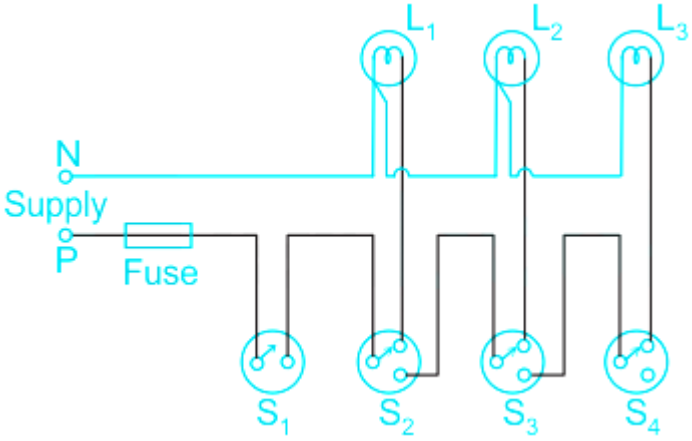
60. **Answer: a**

Explanation:

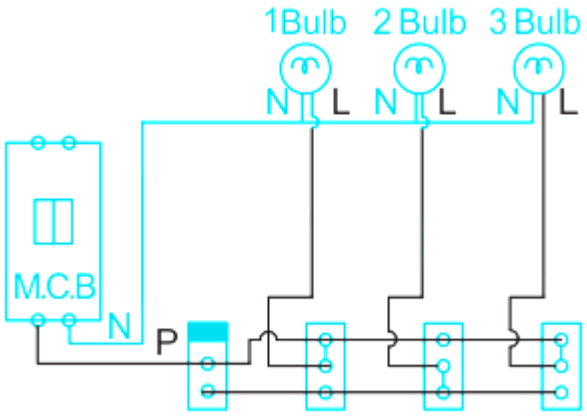
Staircase wiring:



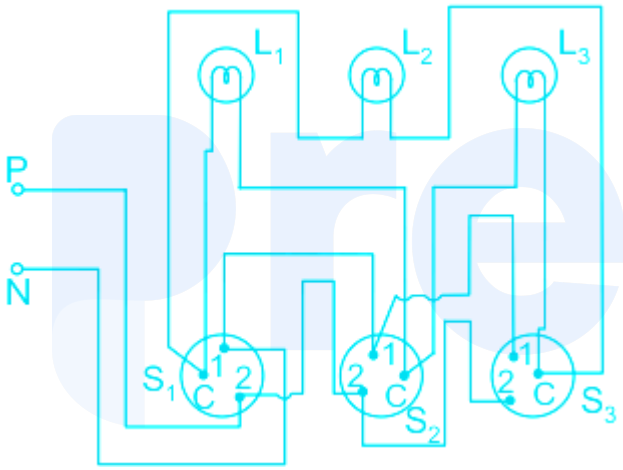
Go-down wiring:



Hostel wiring:



Tunnel wiring:



61. **Answer: d**

Explanation:

Applications of different DC motors are given below.

Series wound motor: It has a very high starting torque. Hence it is used for heavy-duty applications such as electric railways, mine hoists, continuous conveyors cranes, rolling mills, metallurgical works etc.

Shunt-wound motor: This is almost constant speed motor and its torque varies nearly as the current. Hence, it is used for driving constant speed line shafts, lathes, constant speed head centrifugal pumps, fans, woodworking machines, reciprocating pumps,

laundry washing machines, milling machines, grinders, small printing presses, paper making machines, metal cutting machines etc.

Cumulative compound motor: It has high starting torque and has varying speed within limits i.e. it has self-adjustable speed with changing the load. Hence, it is used for driving compressors, pressure blowers, door lifts, circular saws, passenger elevators, freight elevators etc.

Differentially compound motor: It has low starting torque and has a constant speed, but the dangerously high speed at no load under the circumstances it is seldom used.

---

62. **Answer: d**

Explanation:

Concept:

Input power of 3 phase motor = $3 V_P I_P \cos \phi$

Where,

V_P = phase voltage

I_P = phase current

cos ϕ = power factor

For different phase rating,

Input power of 3 phase motor = $V_{p1} I_{p1} \cos \phi + V_{p2} I_{p2} \cos \phi + V_{p3} I_{p3} \cos \phi$

Calculation:

Input power of 3 phase motor = (230 X 5 X 1) + (230 X 4.5 X 1) + (230 X 5.5 X 1)

Input power of 3 phase motor = **3,450 Watt**

---

63. **Answer: c**

Explanation:

Analog instruments:

- In these instruments, the signals vary in a continuous fashion and can take on an infinite number of values in a given range.
- Fuel gauge, ammeter, and voltmeters, wristwatch, speedometer fall in this category.

Digital instruments :

- Signals that vary in discrete steps and that take a finite number of different values in a given range are digital signals and the corresponding instruments are of digital type.
- Digital instruments have some advantages over analog meters, in that they have high accuracy and high speed of operation. A digital multi-meter is an example of a digital instrument.
- **These are used as standard instruments for calibrating deflection instruments.**

---

64. **Answer: d**

Explanation:

Electrical wire is made of materials like copper, aluminium and silver. As silver is expensive, mostly copper and aluminium are used in wiring.

Copper:

- It is a good conductor of electricity.
- It is used in wiring materials in cables.
- Is has low resistance and is used for conduction of electricity at high, medium and low voltage.

Aluminium:

- It is light weight and cheaper in comparison to copper. Therefore, this type of conducting material is mostly used in electrical wiring
- It is silvery–white in colour and it has a soft texture. It is often used in wiring and making cable.

---

65. Answer: a

Explanation:

Four-point starter:

The four-point starter works as a current controlling device in the deficiency of back EMF while it starts running off the DC motor. A four-point starter also works as a protecting device. **The main difference between a 4-point starter compared to a 3-point starter is, the holding coil is detached from the shunt-field circuit.**

The 4-point starter uses four terminals for speeding up the motor. These four terminals namely, armature terminal (A), field terminal (F), and the line terminal (L).

- NVC (No Volt Coil): The connection of a four-point starter can be done in parallel with the field coil
- The line terminal (L) is connected to a positive supply
- The armature terminal (A) is connected to the winding of an armature
- The field terminal (F) is connected to the field winding
- It is provided as not to affect the current flowing through 'Hold on' coil even when the field current changes

---

66. Answer: a

Explanation:

Y - Δ starting:

The delta connected I.M. is started as Y – connected, when motor pick –up the speed, the connections are changed to Δ i.e. run as Δ – connected if started as Y-connection.

$I_{sY} = \frac{I_{s\Delta}}{3}$

$T_{sY} = \frac{T_{s\Delta}}{3}$

Both starting current and starting torque are reduced by $\frac{1}{3}$

---

67. Answer: d

Explanation:

LC oscillator consists of an amplifier and tuned LC circuit as feedback network. For the LC oscillator circuit, amplifier stage can be built by using active devices like op-amp, bipolar junction transistor, or FET.

---

68. Answer: d

Explanation:

- **When reading wire sizes, the second number indicates the number of conductors in the wire.**
- The labels on the outer sheathing of a cable indicate the size, or gauge, of the individual conducting wires, the wire material, the number of wires contained inside the cable, the maximum voltage rating, and whether there is a ground wire present or not.
- The wire size and number of wires are indicated with numbers. A ground wire is indicated by "G," "w/G," or "with Ground." The wire material is indicated by "CU" for copper and "AL" for aluminum.
- Some examples are given below:

1. **14-2G:** Cable contains two insulated wires plus a ground wire; the wires are 14-gauge.
2. **14-3G** : Cable contains three insulated wires plus a ground wire; the wires are 14-gauge.
3. **12-2 w/G** : Cable contains two insulated wires plus a ground wire; the wires are 12-gauge.
4. **12-3 w/G** : Cable contains three insulated wires plus a ground wire; the wires are 12-gauge.
5. **600 V** : Cable is rated for a maximum of 600 volts; this is standard for residential NM cable.
6. **TYPE NM-B** : Non-metallic type-B cable; this is the current standard for residential installations. "NM-B" cable is more heat-resistant than older "NM" cable.

---

69. **Answer: d**

Explanation:

- **Generally high-pressure mercury- vapor lamp emits greenish-blue light. But from the options most probable answer is bluish-white color light.**
- The mercury vapor lamp is a high-intensity discharge lamp. It uses an arc through vaporized mercury in a high-pressure tube to create very bright light directly from its own arc.
- Mercury vapor lamp is deficient in red light.
- It emits a characteristic greenish-blue light.
- It produces color distortion.
- It has an efficiency of about 40 lumens per watt.

Important:

Advantages:

- Good efficiency
- Color 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 color film/photography
- The warm-up time required to start the lamp

Applications:

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

---

70. Answer: b

Explanation:

- **When the stop button is pressed on a motor controller, it releases the contactor coil.**
- Due to which flow of current to the motor is interrupted & motor operation stopped.
- The contractor coil holds the switch ON condition when the motor is in running condition and interrupts the flow of current to the motor once the stop button is pressed.
- It also incorporates the overload tripping mechanism that can be operated by either thermal or magnetic overload trips. These tripping mechanisms are activated when there is a sustained increase of current flow through the starter.

---

71. Answer: d

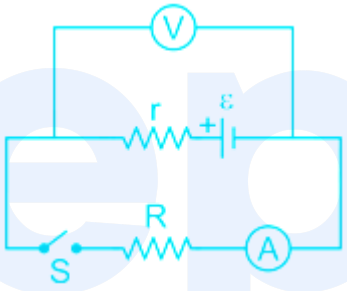
Explanation:

Earthing is used to protect from an electric shock. It helps by providing a path for a fault current to flow to earth. Earth wire is made of galvanized steel because of good mechanical properties.

72. **Answer: b**

Explanation:

- The electromotive force (e) or e.m.f. is the energy provided by a cell or battery per coulomb of charge passing through it, it is measured in volts (V).
- It is equal to the potential difference across the terminals of the cell when no current is flowing.
- If a cell of emf E and internal resistance r, connected to an external resistance R, then the circuit has the total resistance (R + r). The current I in the circuit is given by,



$$I = \frac{E}{R+r} \Rightarrow E = IR + Ir$$
$$V = IR = E - Ir \Rightarrow Ir = E - V$$

$$\Rightarrow r = \frac{(E-V)}{I} = \frac{(E-V)}{V}R$$

73. **Answer: a**

Explanation:

- Rotor resistance starter is used in a high rating slip ring induction motor
- It uses an external resistance/phase in the rotor circuit so that the rotor will develop a high value of torque.
- High torque is produced at low speeds when the external resistance is at its higher value.
- At the start, supply power is connected to stator through a three-pole contactor and, at the same time, an external rotor resistance is added

- The high resistance limits staring current and allow the motor to start safely against a high load.
- Hence if resistance is inserted in the rotor circuit of a **slip ring induction motor,** then compared to direct line starting the starting current reduces but starting torque increases.

---

74. Answer: c

Explanation:

Faraday's Law of Electrolysis is applicable in the working of the lead-acid cell.

Faraday's First Law of Electrolysis states that the chemical deposition due to the flow of current through an electrolyte is directly proportional to the quantity of electricity (coulombs) passed through it.

Faraday's Second Law of Electrolysis states that, when the same quantity of electricity is passed through several electrolytes, the mass of the substances deposited are proportional to their respective chemical equivalent or equivalent weight.

---

75. Answer: b

Explanation:

- In the case of alternators, a field rheostat may be used to change the excitation or its field current.
- If alternators are running in parallel, a change in the field current will not change the active power shared significantly but will **change the operating power factor** .
- With the change in the excitation, the armature current will change which will change the active power by a small amount.
- If the excitation decreased, its power factor becomes more lagging.