MODULE WRITTEN TEST QUESTIONS

ELECTRICITY
WRITTEN TEST

MODULE I SHOP ORIENTATION

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module I Shop Orientation.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. Five meters is _____.

   a. equal to 5 yards
   b. more than 5 yards
   c. less than 5 yards

2. Ten meters is _____.

   a. equal to 30 feet
   b. more than 30 feet
   c. less than 30 feet

c. Twenty centimeters is _____.

   a. equal to 8 inches
   b. more than 8 inches
   c. less than 8 inches

4. If 2 inches is equal to 50.80 millimeters, how many mm are there in 3 inches?

   a. 101.60
   b. 76.20
   c. 25.40
   d. 16.933

5. If a wire is 10 feet long, and there are 0.3048 meters per foot, how long is the wire in meters?

   a. .03048
   b. 30.48
   c. 3.048
   d. .003048

6. Using the formula, work = force x distance, how much work is done in foot-pounds when lifting a weight of 3000 pounds a vertical distance of 20 feet?

   a. 600 ft. lbs.
   b. 6,000 ft. lbs.
   c. 60,000 ft. lbs.
   d. 600,000 ft. lbs.

7. What would the answer be in question 6 in inch-pounds?

   a. 7,200
   b. 72,000
   c. 7,200,000
   d. 720,000

8. What is the area of a rectangle that is 8 1/2 inches wide and 11 1/3 inches long?

   a. 96 1/3 square inches
   b. 90 square feet
   c. 10 square yards
   d. 4 cubic yards

9. What Fahrenheit temperature is equal to $35^{o}C$?

   a. 35^{o}
   b. 70^{o}
   c. $95^{o}F$
   d. $105^{o}F$

10. What is the Celsius equivalent of 77° F?

a. 50° C
b. 25° C
c. 75° C
d. 30° C

11. What is the C temperature equal to -58° F?

a. -32° C
b. -64° C
c. -50° C
d. -10° C

12. What is the value of 10^{3}?

a. 100
b. 1000
c. 10,000
d. 30

13. What is the value of 10^{-3}?

a. 10
b. .01
c. .001
d. .0001

14. The equation $\sqrt{3 \times 12}$ =?

a. 15
b. 36
c. 6
d. 48

15. The equation $\sqrt[3]{64}$ =?

a. 22
b. 8
c. -64
d. 4

16. The equation $\sqrt{81}$ =?

a. 9
b. 3
c. 80 + 1
d. 80 - 1

17. What is the volume of a cylindrical tank that is 10'6" high and 15'4" in diameter?

a. 150 gal.
b. 1939.7 cu. ft.
c. 600 qt.
d. 2400 pt.

18. A plane surface equivalent to that enclosed by a square which is one foot on each side is _____.

a. cubic foot
b. square foot
c. linear foot
d. running foot

19. An electrical contractor keeps a supply of wire for a total price of $725 before a price increase of 16.5%. What would he have to pay for the wire after the price increase?

a. $890.00
b. $12,687.50
c. $1,268.75
d. $844.63

20. The efficiency of a generator is 82%. If the input is 75,000 watts, what is the output?

a. 61,500
b. 125,000
c. 80,000
d. 31,500

21. Three ways to prevent falling and slipping are to pick up objects from the floor, clean up spills, and _____.

a. wear safety glasses
b. keep walkways clear
c. grind slick surfaces
d. face away from ladders

22. Safety is primarily the responsibility of the _____.

a. government
b. equipment manufacturers
c. employer
d. individual

23. Most accidents are caused by _____.

a. following incorrect procedures
b. equipment failure
c. worker carelessness or error
d. improper marking of work areas

24. Which of the following is not a common cause of eye injuries?

a. Flying objects.
b. Vapors or gases.
c. Glare or intense light.
d. oil or grease.

25. What type of injuries most often result from inproper lifting?

a. Sprained muscles and back injuries.
b. Leg injuries and pulled muscles.
c. Head and back injuries.
d. Head, arm, and leg injuries.

26. How should two people carry a long object such as a ladder?

a. The person in front should hold the front end lower to the ground.
b. The person in back should hold the rear end lower to the ground.
c. Both carriers should be on the same side of the object.
d. Each carrier should hold the object at the end and at an equal height.

27. When mixing acid and water, always pour the _____ into the _____

a. acid, water
b. water, acid
c. acid and water will not mix
d. a solvent has to be added

28. Four general safety provisions should be located when entering the shop. These are the main power disccnnect, fire extinguisher, first aid station and _____.

a. storage areas
b. tool room
c. exits
d. water fountain

29. Which of the following should <u>not</u> be done when lifting a heavy object?

a. Ask for help.
b. Bend knees, kneel or squat when lifting.
c. Bend back when lifting.
d. Use legs to lift.

30. All exits should be marked, free of obstructions and _____.

a. wide enough for two people
b. locked from the inside
c. unlocked
d. equipped with fire extinguisher

31. Which of the following is a safety violation?

a. Wearing safety glasses when they are not needed.
b. Carrying hand tools in pocket.
c. Using tools that have sharp edges.
d. Warning a worker before entering the work area.

32. Safety and first aid equipment are indicated by which color?

a. Yellow
b. Orange
c. Green
d. Blue

33. If another worker's clothing is on fire, what should be done immediately?

a. Throw water on the person.
b. Use the fire extinguisher.
c. Call the shop supervisor.
d. Wrap the person with a blanket or coat.

34. The safety color used to indicate danger and machine parts which can cut, crush, shock or injure is _____.

a. red
b. green
c. blue
d. orange

35. In which type of disaster should rapid evacuation of the shop be the number one priority?

a. Flood
b. Fire
c. Hurricane
d. Tornado

36. The primary tasks of emergency first aid are to stop severe bleeding, begin artificial respiration, and _____.

a. make the patient comfortable
b. prevent or reduce pain
c. prevent or reduce shock
d. move the patient to the hospital

37. What is the most common method of artificial respiration used in first aid?

a. Oxygen, mask resusication.
b. Mouth-to-mouth resusication.
c. Mouth-to-nose resusication.
d. Back pressure/armlift resusication.

38. If a person working in a shop suffers a severe electrical shock and is unconscious, what should be done as soon as the source of electricity is removed?

a. Check for burns.
b. Check for breathing.
c. Check for bleeding.
d. Check for fracture.

39. A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth is a _____.

a. conductor
b. relay
c. ground
d. neutral wire

40. Anything which occupies space and has weight is called _____.

a. atom
b. matter
c. electrode
d. proton

41. $I = \frac{E}{R}$ is a formula for _____.

a. solving heat problems
b. solving cooling problems
c. solving electrical problems
d. none of the above.

42. The property of a material which causes it to oppose an electrical current is called _____.

a. capacitance
b. resistance
c. reactance
d. continuity

43. Materials which offer little resistance to current are called _____.

a. capacitors
b. resistance
c. commutators
d. conductors

44. An instrument used to measure the amount of current in a circuit is called an _____.

a. ammeter
b. voltmeter
c. hydrometer
d. watthour meter

45. The electrical property of an object which contains more protons than electrons has a _____.

a. negative charge
b. positive charge
c. neutral charge
d. none of the above

46. The electrical property of an object which contains more electrons than protons has a _____.

a. negative charge
b. positive charge
c. neutral charge
d. none of the above

47. A circuit which contains a defect that causes electrons to follow a path that presents much less resistance than is normal is a _____.

a. series circuit
b. parallel circuit
c. short circuit
d. printed circuit

48. The movement of electrons through a conductor in one direction only is _____.

a. alternating current
b. induced current
c. direct current
d. static current

49. The electrical force which causes electrons to move through a conductor is _____.

a. electromagnetism
b. electrolysis
c. electrolyte
d. electromotive force

50. A set of guidelines for the installation of electric wiring and apparatus sponsored by the National Fire Protection Association under the auspices of the American National Standards Institute is _____.

a. Electricians Handbook
b. National Electrical Code
c. Foremans Shop Manual
d. State Electrical Code

ELECTRICITY
WRITTEN TEST

MODULE II DC FUNDAMENTALS

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module II DC Fundamentals.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. A series circuit is one in which devices are connected so that there is _____.

   a. two conductors
   b. one path for current
   c. a shorted circuit
   d. a source of 120 volts

2. In drawing a series dc circuit, it is required to have at least _____.

   a. no devices
   b. one device
   c. two or more devices
   d. three or more devices

3. Voltage in a series circuit is _____.

   a. the same across each device
   b. each device voltage same as source
   c. each device voltage is sum of total
   d. equal to applied current

4. The total voltage in a series circuit is distributed across each device which is called _____.

   a. voltage drops
   b. constant voltage
   c. distribution voltage
   d. direct voltage

5. The total resistance in a series circuit is always equal to _____.

   a. the sum of each device
   b. the same in all devices
   c. never the same
   d. the vector sum

6. Current in a series circuit always _____.

   a. remains the same
   b. varies up and down
   c. is always high
   d. sometimes high

7. If one device in a series circuit becomes shorted, the entire circuit would be _____.

   a. open
   b. remain the same
   c. decreased in resistance
   d. dead

8. The total current of a series circuit is determined by the _____.

   a. total resistance of the circuit
   b. total wattage of the circuit
   c. the length of conductor
   d. the number of components

9. In constructing a dc series circuit, what should always be maintained?

a. Polarity
b. Negative and positive
c. Black and white
d. Maybe all of the above

10. When an open occurs in a series circuit, it could indicate _____.

a. a shorted device
b. a broken wire
c. a higher voltage
d. a higher current

11. In a parallel dc circuit what is the voltage across each component?

a. Same across each component.
b. Never the same.
c. Varied across each component.
d. Varies according to the current.

12. To find total resistance in a parallel circuit you could use _____.

a. $R_T = \frac{E_T}{I_T}$
b. $R = E \times I$
c. $\frac{1}{R_T} = R_1 + R_2 + R_3$
d. $R_T = \frac{1}{R_1 + R_2 + R_3}$

13. In constructing a parallel circuit there has to be _____.

a. more than one path of current
b. more than one voltage source
c. voltage source and no resistance
d. only one component in the circuit

14. What remains the same across each component in a strictly parallel circuit?

a. Voltage
b. Current
c. Resistance
d. Ohm's

15. In a dc circuit the electron flow is always from _____.

a. negative to positive
b. left to right
c. top to bottom
d. always different

16. What should be strictly obscured and maintained in a dc circuit?

a. Voltage
b. Current
c. Wire size
d. Polarity

17. When the resistance of a circuit is constant, the current can be changed by changing the _____.

a. voltage
b. current
c. watts
d. power

18. In a parallel circuit the total resistance is always _____ than the smallest component in the circuit.

a. smaller
b. larger
c. higher
d. bigger

19. Unequal resistors connected in parallel will have the same _____ across each component.

a. voltage
b. current
c. watts
d. power

20. The total resistance of a parallel circuit can be found by the formula _____.

a. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

b. $R_T = \frac{R}{N}$

c. $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

d. All of the above

21. Once the total resistance is found in a series-parallel dc circuit, what can then be found if the same voltage is given?

a. Total current.
b. Resistance across each component.
c. Total power.
d. Total watts.

22. What is one of the most common formulas used to find total resistance?

a. Product over the sum.
b. Sum over the product.
c. Add each component.

23. When checking the current of a series circuit, how will the ampere meter be connected in the circuit?

a. Series.
b. Parallel.
c. Series parallel.
d. Negative to positive.

24. When checking voltage across a component, how should the voltmeter be connected?

a. Series
b. Parallel
c. Series-parallel
d. Negative to positive

25. What is the total resistance of a circuit with one 100 ohm resistor in series with two 100 ohm resistors in parallel?

a. 150 ohms
b. 300 ohms
c. 100 ohms
d. 50 ohms

26. A complete circuit that has low resistance has _____.

a. few electrons
b. strong electron bonds
c. weak electron bonds
d. many electrons

27. Before using an ohmmeter to measure resistance in a circuit you should _____.

a. remove circuit power
b. adjust the zero adjust
c. adjust the ohms adjust
d. all of the above

28. An ammeter must be connected _____.

a. only after resistance is checked
b. across the battery
c. in series with the circuit being measured
d. to the individual point being checked but only after the circuit power source is removed

29. To have current in a series-parallel circuit you must have all the following except _____.

a. voltmeter
b. voltage source
c. complete circuit
d. resistance

30. An open condition in one parallel branch will _____.

a. reduce the current flow in the other parallel branches
b. increase the circuit flow in the parallel branches
c. not affect the current flow in the other parallel branches
d. shut off the entire circuit

31. The like poles of a magnet will _____.

a. repel each other
b. have no effect
c. attract each other
d. spin around in a circle

32. The invisible lines of force that surround magnets are called _____.

a. north and south poles
b. little magnets
c. loadstones
d. magnetic fields

33. Residual magnetism is the ability to _____.

a. hold its magnetism
b. repel its magnetism
c. conceal its magnetism
d. have the magnetizing force removed

34. How many poles is needed to construct a magnet?

a. Two
b. Four
c. One
d. None of the above

35. Which of the following is not used in an electromagnet?

a. Wire
b. Coil
c. Magnet
d. Electricity

36. You will find the solenoid and plunger used in _____.

a. a door bell
b. the fuse box
c. an electric loop
d. a radio

37. You will find a relay in _____.

a. a diesel truck
b. a door bell
c. a door chime
d. the fuse box

38. Which part is least likely to be found on an elementary generator?

a. Start switch
b. Pole pieces
c. Slip rings
d. Brushes

39. What effect does many turn coils have on a dc generator?

a. Increases voltage output.
b. Decreases voltage output.
c. Increases current output.
d. None of these.

40. The _____ actually carry the generated voltage to the load in a dc generator.

a. Brushes
b. Pole pieces
c. Start winding
d. Run winding

41. Under a light load which motor has high speed?

a. DC series motor
b. AC series motor
c. AC compound
d. DC shunt

42. Most dc motors that drive machinery have _____.

a. ball bearings
b. painted gray
c. at least 10 hp
d. Ankor bolts

43. Direct current can be supplied to a load, by a loop of wire rotating through a field, with the use of _____.

a. brushes
b. a conductor
c. electro magnets
d. heavy load

44. When a commutator is used on a single loop, the voltage at the brushes has a _____.

a. changing polarity
b. zero value
c. constant value
d. constant polarity

45. To obtain motor action, current is supplied to a loop of wire in a magnetic field by _____.

a. brushes and commutator
b. split rings
c. slip rings
d. brushes

46. The voltage generated in a single-loop generator armature is _____.

a. dc
b. ac
c. pulsating dc
d. none of them

47. Lines of force _____.

a. never cross
b. often cross
c. cross only under certain circumstances
d. are unpredictable

48. The right-hand motor rule is usually used to determine _____.

a. direction of conductor movement
b. conductor speed
c. flux direction
d. induced current

49. A straight current-carrying conductor has _____.

a. no magnetic poles
b. one magnetic pole
c. two magnetic poles
d. a field similar to a bar magnet

50. The properties of a magnet are present in _____.

a. a current-carrying loop of wire
b. a straight wire carrying current
c. a straight wire
d. a loop of wire

ELECTRICITY
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MODULE III AC FUNDAMENTALS

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module III AC Fundamentals.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. The number of cycles of ac current in one second is defined as _____.

   a. amplitude
   b. cycle
   c. frequency
   d. hertz

2. A complete change in the direction of alternating current flow is the _____.

   a. amplitude
   b. cycle
   c. frequency
   d. hertz

3. The amount of voltage, current, or power is the _____.

   a. amplitude
   b. cycle
   c. frequency
   d. hertz

4. Cycles of ac in one second is measured by _____.

   a. amplitude
   b. cycle
   c. frequency
   d. hertz

5. What percent of the peak voltage value is equal to average ac?

   a. 33 1/3
   b. 50
   c. 63
   d. 75

6. Alternating current voltage can be changed with little loss through the use of a _____.

   a. transformer
   b. reactor
   c. inductor
   d. resistor

7. Graphical pictures that show how voltage and currents vary over a period of time are _____.

   a. sineforms
   b. waveforms
   c. full-waveforms
   d. single-pole forms

8. An auto transformer uses _____ coils to do its work.

   a. single
   b. dual
   c. triple
   d. no

9. A transformer that takes a high input voltage at the primary and delivers a low output at the secondary is a _____.

a. step-up transformer
b. step-down transformer
c. single-pole transformer
d. double throw transformer

10. Current flow which is constantly changing in amplitude, and reverses its direction at regular intervals is _____ _____.

a. direct current
b. continuous current
c. alternating current
d. discontinuous current

11. A continuous curve of all the instantaneous values of an ac current or voltage is _____ _____.

a. double wave
b. single wave
c. parallel wave
d. sine wave

12. The unit that changes ac to dc is a _____.

a. rectifier
b. capacitor
c. resistor
d. amplifier

13. Series stacking increaes the _____ _____ of a dry metal rectifier.

a. voltage rating
b. output rating
c. impedance rating
d. maximum rating

14. Parallel connection increases the _____ _____.

a. voltage rating
b. current rating
c. output rating
d. impedance rating

15. Current and voltage are in _____ in resistive circuits.

a. series
b. parallel
c. phase
d. series-parallel

16. Small field-coil current causes a _____ _____.

a. strong field
b. magnetic drop
c. voltage drop
d. weak field

17. Large field-coil current _____ the turning force of the moving coil.

a. increases
b. decreases
c. has no effect
d. none of the above

18. The meter used to measure power directly when connected in a circuit is the _____.

a. ampmeter
b. wattmeter
c. voltmeter
d. VOM

19. The amount of current flow determines strength of the _____.

a. resonance
b. impedance
c. induction
d. magnetic field

20. Magnetic field expands and contracts with varying current causing the effect known as _____.

a. resonance
b. inductance
c. impedance
d. capacitance

21. In electrical circuits, what symbol is used to designate inductance?

a. L
b. mmm
c. a and b
d. neither a nor b

22. Insulating material between the plates of a capacitor is the _____.

a. photo cells
b. armature
c. diode
d. dielectric

23. When electrons flow around a consuming device you have a _____ _____.

a. short circuit
b. open circuit
c. series-parallel circuit
d. fault in the source

24. A fast-operating circuit breaker that is sensitive to very low levels of current leakage to ground is a/an _____ _____.

a. ground-fault interrupter
b. magnetic breaker
c. fixed resistor
d. adjustable inductor

25. In a 120 v. circuit the least desirable current carrying conductor is _____.

a. black
b. red
c. green
d. blue

26. A fuse that will protect the circuit from 0 to 15 amps is identified by _____ _____.

a. round window
b. square window
c. hexagonal window
d. none of the above

27. Alternators that have more than one set of armature coils are called _____ alternators.

a. double phase alternators
b. single phase alternators
c. monophase alternators
d. polyphase alternators

28. The ability of a capacitor to store an electric charge is called _____.

a. capacitance
b. conductance
c. resistance
d. electro magnetism

29. The product of volts and amperes is _____ _____.

a. full power
b. apparent power
c. high power
d. low power

30. If electrons are provided only one possible route to follow from the source through several devices and back to the source, the path is called _____ _____.

a. short circuit
b. open circuit
c. series circuit
d. parallel circuit

31. The two most important kinds of circuits are _____ and _____.

a. parallel and series
b. open and closed
c. contact and open circuits
d. single and double series

32. If a circuit is wired in series, the power load may be stopped by _____.

a. one opening
b. two openings
c. three openings
d. four openings

33. Even though the size and lengths of an aluminum wire and a copper wire are the same, the aluminum wire causes a line drop _____.

a. 3 times that for copper
b. 5 times that for copper
c. 2.6 times that for copper
d. 1.6 times that for copper

34. Even though the size and lengths of iron wire and a copper wire are the same, the iron wire causes a line drop _____.

a. 1.6 times that for copper
b. 5.8 times that for copper
c. 1.05 times that for copper
d. 8 times that for copper

35. Even though the size and lengths of copper wire and a silver wire are the same, the copper wire causes a line drop _____.

a. 1.9 times that for silver
b. 5.8 times that for silver
c. 1.05 times that for silver
d. 6 times that for silver

36. Protection against static charges on operating equipment may be provided by _____.

a. installing larger wire
b. installing better insulated wire
c. installing grounding wire
d. installing a safety switch

37. Circuit breakers are _____.

a. always single element
b. always double element
c. maybe single or double meter
d. has parallel elements

38. A wire that is two mils (0.002") has an area of _____ _____.

a. two c.m.
b. six c.m.
c. four c.m.
d. one c.m.

39. An accidental path of too-low resistance is called _____ _____.

a. open circuit
b. short circuit
c. parallel circuit
d. grounded circuit

40. Solenoids, relays, and transformers are examples of _____.

a. resistors
b. inductors
c. capacitors
d. switches

41. A solenoid opens or closes _____.

a. a valve
b. a set of contacts
c. relays
d. thermostats

42. One of the most common ac circuits used is the _____ _____.

a. distribution circuit
b. three-phase circuit
c. two prong circuit
d. three prong circuit

43. Total resistance of a series circuit is the sum of the _____ _____.

a. volts and amps
b. current and voltage
c. individual resistances
d. current and amps

44. In a simple parallel circuit, all devices operate on the same _____.

a. frequency
b. line voltage
c. potential difference
d. power

45. Force x Distance = _____.

a. power
b. work
c. potential difference
d. inductance

46. The rate of doing work and the rate of energy conversion is _____.

a. potential difference
b. inductance
c. power
d. force

47. The principle of conversion of energy states _____ _____ _____ _____ _____ _____.

a. energy cannot be created or destroyed
b. energy cannot be dissipated
c. energy can be created and destroyed
d. energy can be created but not destroyed

48. In a series resonance circuit the voltage is _____.

a. equal across X_L and X_C.
b. unequal across X_L and X_C.
c. equal across each branch circuit
d. unequal across each branch circuit

49. In a parallel resonance circuit the voltage is _____.

a. equal across each circuit branch
b. unequal across each circuit branch
c. equal across X_L and X_C.
d. unequal across X_L and X_C.

50. A circuit in which $X_L = X_C$ is called a _____ _____.

a. closed circuit
b. resonant circuit
c. open circuit
d. none of the above

ELECTRICITY
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MODULE IV ELECTRONIC COMPONENTS AND CIRCUITS

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module IV Electronics Components and Circuits.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. The giving off of changed particles due to heating is _____ _____.

   a. thermionic emission
   b. heat exchanger
   c. heat retention
   d. heat emission

2. A vacuum tube diode is a _____ _____.

   a. one-electrode tube
   b. two-electrode tube
   c. no-electrode tube
   d. none of the above

3. The diode must block how much reverse voltage?

   a. The same as the forward voltage.
   b. About twice the peak of the forward voltage.
   c. About one half the peak of the forward voltage.
   d. None of the above.

4. When newly loosened free electrons accelerate and jar others loose in a chain reaction, it is called _____.

   a. freeing electrons
   b. loosening electrons
   c. an avalanche of electrons
   d. a storm of electrons

5. What effect does "an avalanche of electrons" have on a vacuum tube diode?

   a. No effect.
   b. Very little if any.
   c. Ruins most diodes.
   d. Changes diode to triode.

6. What type of silicon diode is built to take an avalanche of electrons?

   a. Copper-oxide.
   b. Mercury-vapor.
   c. Silenium.
   d. Zener diodes.

7. A zener diode not only protects a device from an avalanche of electrons but also _____.

   a. prevents the voltage from falling when too much current is drawn
   b. diffuses the electrons
   c. rectifies the electrons
   d. oxidizes the electrons

8. What does the "N" refer to in an N-type semiconductor?

   a. Negative free electrons.
   b. Neutral free electrons.
   c. Natural free electrons.
   d. Normal free electrons.

9. The difference between a P-type semiconductor and a N-type semiconductor is _____.

a. P-type has more free electrons
b. P-type has no free electrons
c. P-type has less free elctrons
d. P-type has same number of electrons

10. The process of obtaining an output voltage, current, or power which is greater than the input is _____.

a. annunciation
b. commutation
c. amplification
d. deionization

11. The ratio of collector current to emitter current is defined as _____.

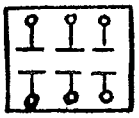
a. Beta (B)
b. Delta (d)
c. Zelta (z)
d. Alpha (a)

12. The ratio of collector current to base current is defined as _____.

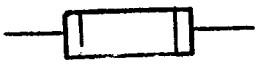
a. Beta (B)
b. Delta (d)
c. Zeta (z)
d. Alpha (a)

13. Beta is sometimes called what in transistor specifications?

a. Radioactive disintergation.
b. Forward current transfer ratio .
c. Photo junction.
d. Maximum power output.

14.  is used in wiring diagrams for _____.

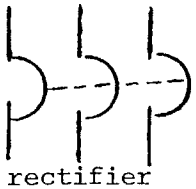
a. fuse
b. thermostat
c. three pole oil circuit breaker
d. thermal overload

15.  is used in wiring diagrams for _____.

a. thermostat
b. thermal overload
c. rectifier
d. fuse

16.  is used in wiring diagrams for _____.

a. thermostat with contact made
b. thermal overload
c. circuit breaker
d. rectifier

17.  is used in wiring diagrams for _____.

a. rectifier
b. fuse
c. three-pole air circuit breaker
d. thermal overload

18.  is used in wiring diagrams for _____

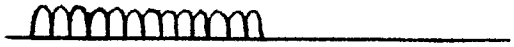
a. rectifier
b. thermal overload
c. fuse
d. circuit breaker

19.  Is used in wiring diagrams for _____.

a. fuse protector
b. fuse
c. thermal overload
d. circuit breaker

20.  This type of voltage is produced by _____.

a. solid-wave rectifier
b. half-wave rectifier
c. split-wave rectifier
d. smooth-wave rectifier

21. 

This type voltage is produced by _____.

a. half-wave rectifier
b. solid-wave rectifier
c. full-wave rectifier
d. split-wave rectifier

22. To study the waveforms produced in a half-wave rectifier circuit, what type apparatus is needed?

a. VOM
b. Split-phase inverter
c. Potentiometer
d. Oscilloscope

23. A positive terminal such as a plate in an electron tube is called an _____.

a. anode
b. triode
c. diode
d. rectifier

24. Collector, base, and emitter are parts of a _____.

a. vacuum tube
b. NPN transistor
c. solid-state diode
d. AF transistor

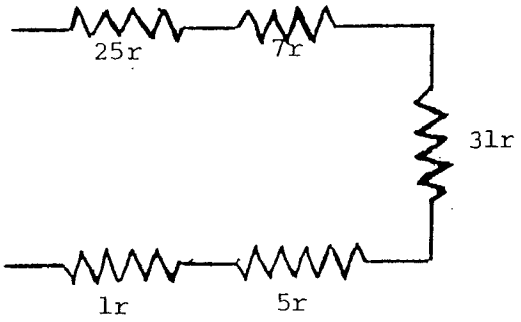
25. According to its name, how many elements should a triode have?

a. One
b. Two
c. Three
d. Four

26. When electrical current is flowing in an aluminum wire _____.

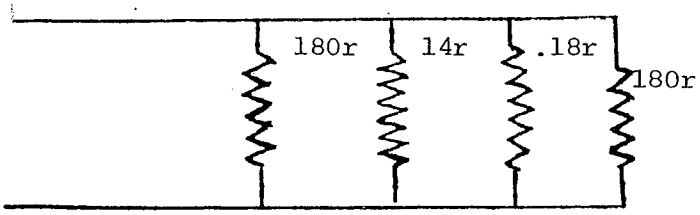
a. protons flow from positive to negative
b. neutrons may be flowing either from plus to minus or minus to plus
c. electrons flow to a less negative potential
d. electrons flow from ground to negative

27. The total resistance of the following circuit is _____.



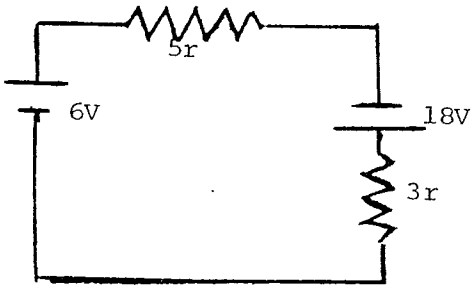
a. 69a
b. 69,000ur
c. .069Kr
d. 6,900mr

28. The resistance of the following circuit is _____.



a. 10.53r
b. 11.35r
c. 10.59r
d. 10.00r

29. The current flowing in the following circuit is _____.

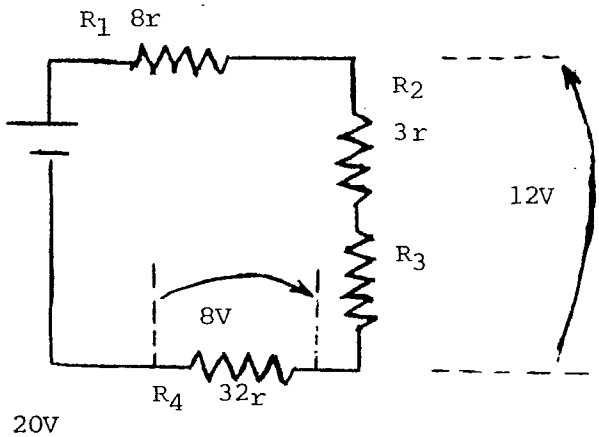


a. 3A
b. 6A
c. 1.5A
d. 12A

30. The power dissipated in the following circuit is _____.

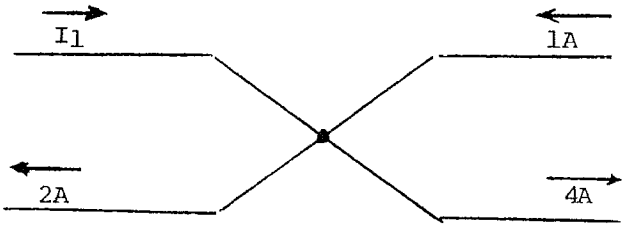
a. 25W
b. 2.5A
c. 2.5W
d. 25V

31. The applied voltage in the following circuit is _____.



a. 20V
b. 22V
c. 4V
d. 18V

32. The current, I_1, in the following circuit is _____.



a. 1A
b. 5A
c. 3A
d. 4A

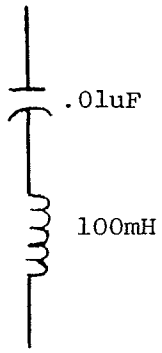
33. The inductive reactance at 2 Khz of a 25 mh inductor is _____.

a. 314r
b. 157r
c. .00318r
d. 50r

34. The capacitive reactance at 5 Khz of a .1 uf capacitor is _____.

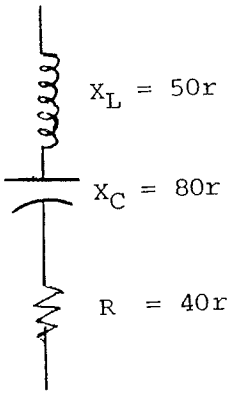
a. 314r
b. .00314r
c. 3180r
d. 318r

35. The resonant frequency of the following circuit is _____.



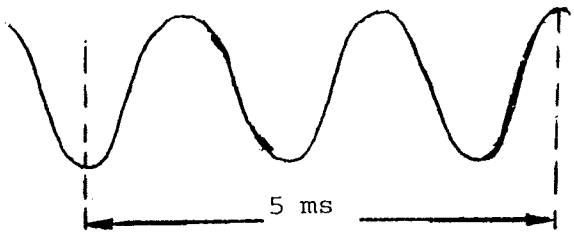
a. 5.03Khz
b. 15.9Khz
c. 50.3Khz
d. 1.59Khz

36. The magnitude of the impedance of the following circuit is _____.



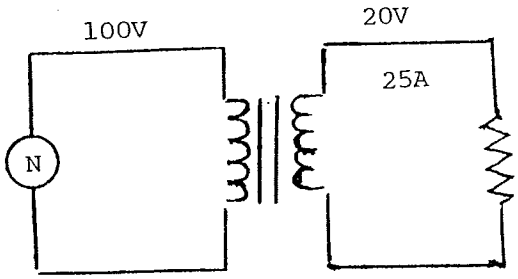
a. 136r
b. 170r
c. 102.5r
d. 50r

37. What is the frequency of the following sine wave?



a. 400hz
b. 500hz
c. 600hz
d. .45hz

38. What is the primary current in the transformer?



a. 5 A
b. 25 A
c. 1 A
d. 100 A

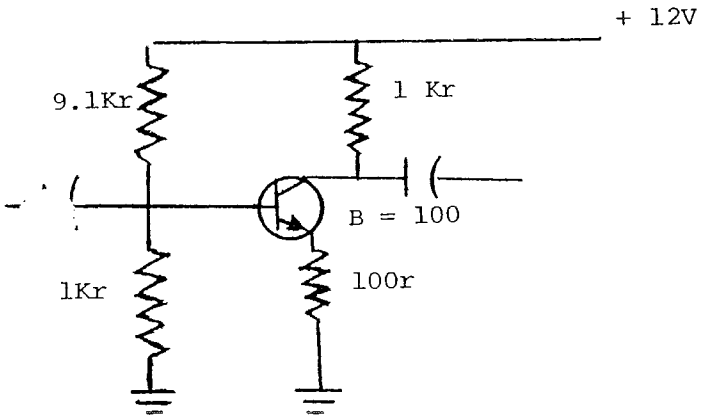
39. In order for an NPN transistor to act as a class A amplifier, which condition must be true?

a. The collector-emitter junction must be forward biased.
b. The base-emitter junction must be reverse biased and the emitter-collector junction must be reverse biased.
c. The base-emitter junction must be revers biased and the base-collector juncton must be forward biased.
d. The base-emitter junction must be forward biased and the base-collector junction must be reverse biased.

40. A common-base amplifier is characterized by _____.

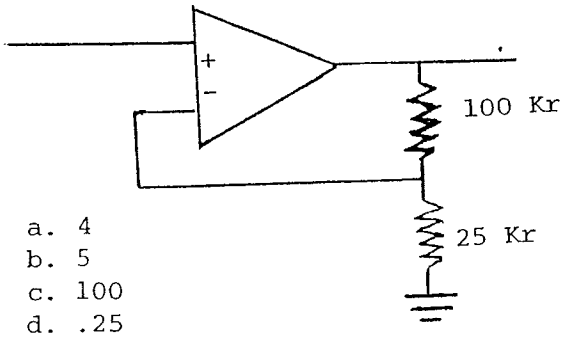
a. low input impedance, high output impedance, and high voltage gain
b. high input impedance, low output impedance, and high current gain
c. low input impedance, low output impedance, and low voltage gain
d. high input impedance, high output impedance, and low current gain

41. The unloaded voltage gain of the following amplifier is approximately _____.



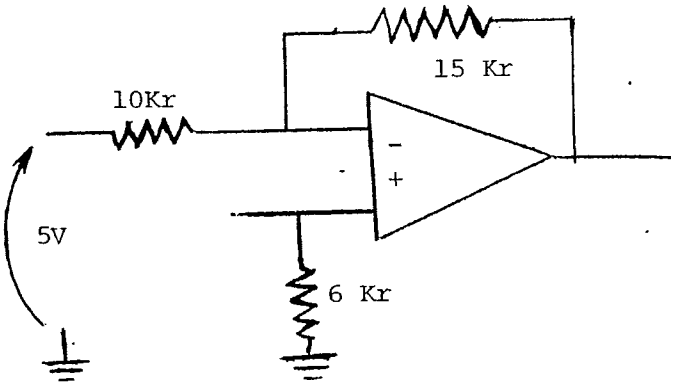
a. 10
b. 5
c. 20
d. 100

42. The voltage gain of the following operational amplifier is _____



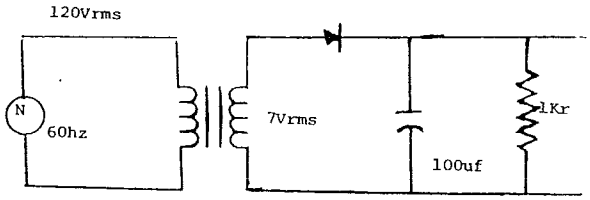
a. 4
b. 5
c. 100
d. .25

43. The voltage on the inverting input of the following operational amplifier is _____.



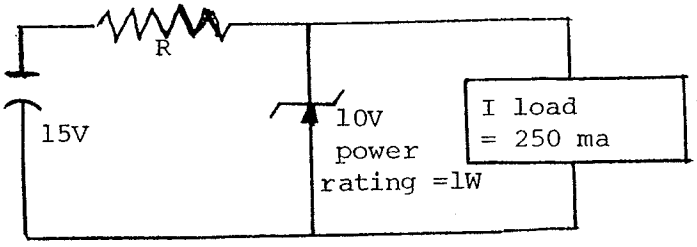
a. 5 V
b. 3 V
c. 0 V
d. 1.88 V

44. The output voltage of the following power supply is _____.



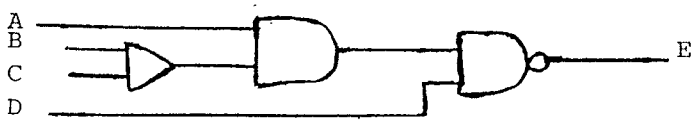
a. 9.9 V
b. 4.95 V
c. 9.2 V
d. 4.25 V

45. What resistance should the resistor have in the following circuit?



a. 60r
b. 18r
c. 40r
d. 4 r

46. The following logic circuit will have a logical 1 output when _____.



a. A = 0
b. B or C = 1
c. D = 1
d. A = 1, B = 1, C = 0, D = 1

47. The Boolean expression for the circuit in problem 46 is _____.

a. $E = A + BC + \overline{D}$
b. $E = \overline{A + D} + BC$
c. $E = AD + \overline{BC}$
d. $E = \overline{AD\ (B + C)}$

48. In amplitude modulation, which of the following is true?

a. The amplitude of the carrier varies with the modulation.
b. The amplitude of the carrier is constant while the amplitude of the sidebands varies with the modulation.
c. The amplitude of the upper sideband plus the amplitude of the lower sideband equals the amplitude of the carrier.
d. The amplitude of the carrier is zero at 100% modulation.

49. In frequency modulation, which of the follwing is true?

a. FM has no sidebands.
b. The percent modulation is equal to the carrier frequency divided by the frequency swing.
c. The amplitude of the carrier can never be zero for any degree of modulation.
d. The amplitude of the carrier and the number and amplitude of the significant sidebands vary with the modulation.

50. The term swr is _____.

a. the ratio of the power lost to power transmitted in a transmission line.
b. the ratio of the number of waves that stand still to the number of waves transmitted
c. the ratio of the maximum to minimum voltage on a transmission line
d. the ratio of the power dissipated in the output stage of a transmitter to the power delivered

ELECTRICITY
WRITTEN TEST

MODULE V BASIC LOGIC CIRCUITS

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module V Basic Logic Circuits.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. Binary numbers are built on a base of _____.

   a. 1
   b. 2
   c. 3
   d. 4

2. Decimal numbers are built on a base of _____.

   a. 5
   b. 10
   c. 15
   d. 20

3. When a digit is moved one place to the left and a zero added, increasing the value by 10, it is known as _____ _____.

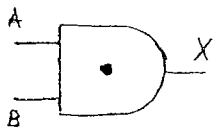
   a. base 2
   b. base 4
   c. base 8
   d. base 10

4. With a base 2, every time a digit is moved one place to the left, its value is _____ as much.

   a. twice
   b. three times
   c. ten times
   d. same value

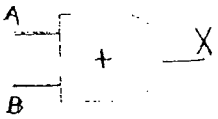
5. Each digit, a one or a zero, in a binary number is called a _____.

   a. digit
   b. bit
   c. number
   d. decimal

6. 

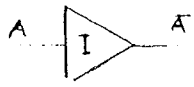
This is a symbol for _____ gate.

   a. NAND
   b. NOR
   c. OR
   d. AND

7. 

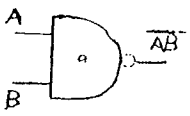
This is a symbol for _____ gate.

   a. NAND
   b. NOR
   c. OR
   d. AND

8. 

This is a symbol for _____ circuit.

   a. NOT
   b. NOR
   c. OR
   d. NAND

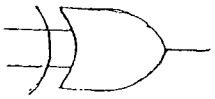
9. 

This is a symbol for _____ gate.

a. NOT
b. NOR
c. OR
d. NAND

10. 
This is a symbol for _____ gate.

a. NOT
b. NOR
c. OR
d. NAND

11. 
This is a symbol for _____ gate.

a. Exclusive NOR
b. Exclusive OR
c. Exclusive AND
d. Exclusive NAND

12. The general name of digital gates such as NOR, OR, AND, etc. is _____.

a. diodes
b. cycles
c. counters
d. logic

13. The little circles or logic symbols denote _____ _____.

a. logic transfer
b. logic switch
c. logic inversion
d. open circuit

14. The different possible input-output relationships of a logic circuit can be recorded in a table called a _____ _____.

a. logic table
b. truth table
c. scale table
d. input-output table

15. In a binary system the number 1 is used to designate _____.

a. on
b. off
c. neutral
d. closed

16. The computer unit that receives and reads information is the _____ unit.

a. output
b. input
c. memory
d. arithmetic
e. control

17. The computer unit that stores information and instructions is the _____ unit.

a. output
b. input
c. memory
d. arithmetic
e. control

18. The computer unit that converts the results of the whole operation into a usable form is the _____ unit.

a. output
b. input
c. memory
d. arithmetic
e. control

19. The computer unit that does the calculating is the _____ unit.

a. output
b. input
c. memory
d. arithmetic
e. control

20. The computer unit that controls the functions of the other units is the _____ unit.

a. output
b. input
c. memory
d. arithmetic
e. control

21. A switching circuit which provides a predictable output for a given set of inputs is a _____.

a. digit
b. gate
c. base
d. annalog

Input 1	Input 2	Output
0	0	____
1	0	____
0	1	____
1	1	____

NOR Gate Truth Table

22. Line 1 output is _____.

a. 0
b. 1
c. 2
d. 3

23. Two NAND gates can be combined to for one _____ gate.

a. OR
b. NOR
c. AND
d. NOT

24. The NOT circuit is also called an _____.

a. analog
b. inverter
c. amplifier
d. occilator

25. A two-stage circuit with the output of each stage coupled back to the input of the other is a _____.

a. astable multibibrator
b. monostable multivibrator
c. bistable multivibrator
d. all of the above

26. Another definition of an astable multivibrator is a _____ _____ multivibrator.

a. one-shot
b. free running
c. flip-flop
d. off-on

27. The monostable multivibrator is also called a _____ _____.

a. one-shot
b. free running
c. flip-flop
d. none of the above

28. A bistable multivibrator is also referred to as a _____ _____.

a. one-shot
b. free running
c. flip-flop
d. none of the above

29. Which type multivibrator is extensively used in digital computers?

a. astable
b. monostable
c. bistable
d. tristable

30. A device made of germanium or silicon used to rectify an alternating current is called a _____ _____.

a. crystal cartridge
b. crystal diode
c. crystal transistor
d. crystal anode

31. The unit of measure for capacitance is the _____.

a. volt
b. henry
c. hertz
d. farad

32. A semiconductor device used to amplify electrical signals is a _____.

a. transistor
b. triode
c. resistor
d. insulator

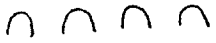
33. What type diodes are used in high-voltage low current rectifiers.

a. gas
b. vacuum
c. zener
d. full-wave

34. What form of voltage do half-wave rectifiers produce?

a. 

b. 

c. 

d. 

35. A semiconductor device used to amplify electrical signals is a _____.

a. vacuum
b. transistor
c. diode
d. transformer

36. A relay is a switch that is operated by means of _____.

a. modulation
b. inductance
c. polarization
d. electromagnetism

37. A resistor is used to insert _____ resistance into a circuit.

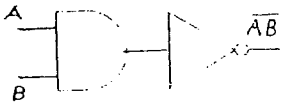
a. magnetic
b. electrical
c. wave
d. dielectric

38. Boolean Algebra operates on the principle that a mathematics statement is either true or false. This is used in Truth Tables and is called the _____ _____.

a. decimal system
b. binary system
c. octal system
d. none of the above

39. A computer must be able to make decisions which depend on the inputs it receives. The circuits used for these inputs are called _____ _____.

a. parallel circuits
b. series circuits
c. logic circuits
d. closed circuits

40. 

equals _____ _____.

a. AND gate
b. NOR gate
c. NAND gate
d. OR gate

41. An electronic gate is enabled when it is _____.

a. closed
b. opened
c. cracked
d. none of the above

42. When an enabled gate produces an output voltage that is less negative it is considered _____ _____.

a. positive logic
b. negative logic
c. neutral logic
d. no logic

43. When in an enabled condition, a gate is represented by _____.

a. 0
b. 1
c. 2
d. 3

44. When unenabled, the output of the gate is represented by _____.

a. 0
b. 1
c. 2
d. 3

45. A complex circuit involving AND, OR, and inverter gates is an _____ _____ gate.

a. Exclusive - AND
b. Exclusive - NOR
c. Exclusive - OR
d. Exclusive - Inverter

46. The output of a logic circuit is one of two conditions. These conditions are _____ _____.

a. plus-minus
b. full-empty
c. on-off
d. none of the above

47. 2^4 = _____.

a. 6
b. 8
c. 24
d. 16

48. 10^0 = _____.

a. 0
b. 10
c. 100
d. 1

49. $10^0 \times 2^0$ = _____.

a. 0
b. 20
c. 12
d. 1

50. $10^2 + 10^0 + 2^2 + 2^0 \times 10^0$ = _____.

a. 240
b. 24.0
c. 2.40
d. 106

ELECTRICITY
WRITTEN TEST

MODULE VI RESIDENTIAL WIRING

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module VI Residential Wiring.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. The service rating for a single-family residence shall be not less than 100 amps, according to the Code, when the initial load amounts to _____.

   a. 7.5kW
   b. 10kW
   c. 12.5kW
   d. 15kw

2. In general, the minimum ampacity of the ungrounded service-entrance conductors of a service is _____.

   a. 50 amps
   b. 60 amps
   c. 80 amps
   d. 90 amps

3. With respect to the service disconnecting means the grounding electrode conductor shall be connected to the grounded service conductor on _____.

   a. the supply side
   b. the load side
   c. either supply or load side
   d. both supply and load sides

4. For the kitchen small appliance load in dwelling occupancies, the Code requires not less than _____.

   a. two 20-amp circuits
   b. one 15-amp circuit
   c. two 15-amp circuits
   d. one 20-amp circuit

5. The maximum rating of the overcurrent device on a 17-amp noncontinuous, single nonmotor appliance circuit is _____.

   a. 14 amps
   b. 15 amps
   c. 20 amps
   d. 25 amps

6. The rating of a cord-and-plug appliance used on a 20-amp branch circuit having two or more outlets shall not exceed _____.

   a. 16 amps
   b. 15 amps
   c. 18 amps
   d. 12 amps

7. The demand load for a 16 kW electric range should be assessed at _____.

   a. 8200 watts
   b. 9600 watts
   c. 12600 watts
   d. 14400 watts

8. The internal depth of outlet boxes intended to enclose flush devices shall be at least _____.

   a. 1/2 inch
   b. 7/8 inch
   c. 15/16 inch
   d. 1 1/2 inches

9. The maximum number of No. 14 conductors permitted in a 1 1/2 x 4 inch octagonal outlet box is _____.

a. 5
b. 9
c. 8
d. 7

10. The silver terminals connected to the lamp holders are the _____ terminals.

a. feeder
b. hot
c. traveler
d. neutral

11. White wire is used for _____ conductors.

a. hot
b. neutral
c. phase
d. ungrounded

12. On a lamp holder, the _____ conductor goes on the screw shell.

a. neutral
b. hot
c. phase
d. ungrounded

13. The green terminals are only used to connect _____ wires.

a. grounding
b. neutral
c. phase
d. hot

14. _____ dimensions are used in figuring floor plans for a residence.

a. Inside
b. Outside
c. All area covered by roof
d. All area including garage

15. According to the NEC the watts per square foot are _____.

a. 3
b. 5
c. 120
d. 240

16. The maximum height for a distribution panel in a residence is _____.

a. eye level
b. 8 feet
c. 6 1/2 feet
d. waist high and above

17. One quarter scale on a set of plans means _____.

a. one quarter inch equals one foot
b. one quarter inch for every foot
c. one foot of floor lines measures 1/4 inch
d. all of these

18. In a residence the maximum distance between plugs is _____.

a. 3 feet
b. 6 feet
c. 4 feet
d. 12 feet

19. How is a four-way identified?

a. Four screws
b. Three screws
c. Off and on
d. The size

20. What are the hazards of fusing a circuit at too high on amperage rating?

a. Get electrical shock
b. Overheat conduction
c. Make light burn brighter
d. Damage the fuse

21. What is the surrounding temperature that affects the ampere rating of fuses and thermal circuit breakers called?

a. F^{o}
b. Ambient temperature
c. C^{o}
d. None of these

22. How many 15 ampere general lighting circuits will it take to install the wiring for a floor area of 600 sq. ft. 120 Volts?

a. Four
b. Two
c. Three
d. One

23. How many small appliance circuits are required in a residence?

a. Two or more.
b. One to six.
c. Two to six.
d. Installed as needed.

24. What must be done to split a duplex receptacle for switching one outlet while the other is continuously live?

a. Install two plugs.
b. Break the jumper from the silver screws.
c. Add a jumper on both sides.
d. Break the jumper from the gold screws.

25. What does a dotted line indicate on a house plan?

a. Switch leg.
b. Power leg.
c. Home run.
d. Last outlet on circuit.

26. How can a three way switch be identified?

a. The color.
b. With off and on.
c. On off and on.
d. The size.

27. To control two lights from one location, what type switch should be used?

a. One single pole.
b. Two single poles.
c. One two-way.
d. One three-way

28. What type switches are used to control one light from two locations?

a. Two of each.
b. One three and one four way.
c. Two four-way.
d. Two three-way.

29. When working up an electrical estimate, after completing a general survey of the building plans, the second step is to _____.

a. read the contract specifications thoroughly
b. count and tabulate the number of branch circuit outlets
c. measure the length of the cable runs
d. all of the above

30. The procedure known as "Take-off" means to _____.

a. separate the electrical drawings from the plans
b. count and tabulate the number of branch circuit outlets
c. deduct the cost of the plans from the estimate
d. multiply total labor man-hours by present wage scale

31. A commonly used scale that is used on architectural drawings for houses is _____.

a. 1/8" = 1'0".
b. 1/4" = 1'0".
c. 1/2" = 1'0".
d. 2/3" = 1'0".

WHAT IS A SHORT CIRCUIT

ANSWER

A LITTLE BITTY CIRCUIT ABOUT THIS LONG

32. The appliance circuit in the laundry area is _____.

a. the same circuit used in the kitchen
b. a 15 ampere general purpose circuit
c. a separate 20 ampere circuit
d. a separate 10 ampere circuit

33. How much power do switches consume?

a. None
b. 100 watts
c. 150 watts
d. 50 watts

34. When selecting the size of the box to be used at an outlet location, what are two important considerations?

a. The shape and color of the box.
b. The height of the installation and type of construction.
c. The number and size of the conductors entering the box.
d. The color of the conductors entering the box.

35. After the proper selection of boxes, how can the possibility of installing the wrong size box be prevented?

a. Do the job yourself.
b. Note the size of each box on the floor plan,
c. Check the Code book when installing the box.
d. Double check the box size.

36. What type of cable has an inner layer of type RHW insulation and is made especially for underground service installation?

a. RHW
b. UF
c. USE
d. AFC

37. The two "hot" conductors of the underground cable connected to the meter pan are_____.

a. the two top terminals
b. the two bottom terminals
c. one top and one bottom terminal
d. none of these

38. When connecting the grounding-electrode conductor to a water pipe, it must be connected on the _____.

a. street side of the water meter and valve
b. house side of the water meter
c. pipe before it comes into the house
d. after pipe comes into the house

39. If non-metallic water piping is used, the grounding electrode may consist of two driven rods of steel or iron at least _____.

a. 1/2" in dia. and 6' in length
b. 5/8" in dia. and 8' in length
c. 3/4" in dia. and 10' in length
d. 2/3" in dia. and 7' in length

40. When the building is considered rain tight, the interior electrical wiring is started. This stage of construction is known as _____.

a. cable-pulling
b. dry-walling
c. boxing-in
d. roughing-in

41. If a device box is to have internal cable clamps and wired with a receptacle, how many conductors must be deducted from the total allowed?

a. One
b. Two
c. Three
d. Four

42. As a safety measure when using an electric drill, never change drill bits when _____.

a. on a ladder
b. a hole is only half drilled
c. the power cord is connected
d. on the roof

43. A recessed fixture may be connected to a junction box provided the conductors have insulation that is suitable for the temperature encountered. The type of wire usually used is _____.

a. AF
b. RH
c. TW
d. RW

44. The fixture conductors must be enclosed in a suitable metal raceway, such as 3/8 inch greenfield _____.

a. not more than two feet long
b. between four and six feet in length
c. over six feet in length
d. not less than two feet

45. Which type of fixture cannot be installed in clothes closets?

a. Fluorescent
b. Flush
c. Pendant
d. Recessed

46. The minimum conductor size required for a dryer circuit is _____.

a. 8 AWG
b. 10 AWG
c. 12 AWG
d. 15 AWG

47. In kitchen and dining areas a receptacle outlet shall be installed at each counter space wider than _____.

a. 12 inches
b. 18 inches
c. 24 inches
d. 30 inches

48. In multi-wire circuits, when the neutral wires must be spliced _____.

a. the screw terminals of the receptacles should be used
b. the screw terminals of the receptacle must not be used
c. place both wires under one screw terminal of the receptacle
d. none of these

49. For any lighting fixture weighing more than 50 pounds, they must be supported by _____.

a. the outlet box
b. special hangers independent of the outlet box
c. #10 AWG conductors
d. #10 AGA conductors

50. Bell wires with low-voltage insulation and light and power wires _____.

a. cannot be installed in the same box or raceway
b. must be insualted from each other
c. must enter a box through separate knock-outs
d. must enter a box through same knock-outs

ELECTRICITY
WRITTEN TEST

MODULE VII COMMERCIAL WIRING

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module VII Commercial Wiring.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. One of the approved methods of identifying the high leg of a four-wire delta connected secondary system is by _____.

   a. use of a white wire
   b. use of a red wire
   c. use of a green wire
   d. tagging the wire

2. Underground service conductors carried up a pole must be protected from mechanical injury to a height of at least _____.

   a. 12 feet
   b. 8 feet
   c. 15 feet
   d. 9 feet

3. The largest standard cartridge fuse rating is _____.

   a. 6,000 amps
   b. 2,000 amps
   c. 1,000 amps
   d. 600 amps

4. A 25-foot tap taken from a 100-amp feeder shall have an ampacity of not less than _____.

   a. 15 amps
   b. 20 amps
   c. 25 amps
   d. 33 1/3 amps

5. Metal enclosures for grounding electrode conductors shall be _____.

   a. rigid conduit only
   b. not less than 3/4 inch in diameter
   c. bonded
   d. electrically continuous

6. The largest size of electrical metallic tubing is _____.

   a. 3 inches
   b. 4 inches
   d. 2 inches
   e. 1 1/4 inches

7. The maximum number of overcurrent devices in one cabinet of a lighting and appliance panel board shall be _____.

   a. 30
   b. 36
   c. 42
   d. 48

8. A transformer which is hooked up to provide single-phase voltage, which of the voltages is the most common?

   a. 120/240
   b. 480/277
   c. 120/277
   d. 480/120

9. A delta connected transformer can provide _____.

a. 120/240 volts
b. 480/277 volts
c. 120/208 volts
d. 480/212 volts

10. A circuit conductor which is intentionally grounded is called the _____.

a. grounding conductor
b. grounded conductor
c. grounding electrode conductor
d. underground conductor

11. The size of a grounding electrode conductor is based on the _____.

a. wire size of the service entrance conductors
b. current-carrying capacity of the service entrance conductors
c. kVA rating of the transformer bank
d. none of the above

12. A remote control on/off switch without a pilot light will be used. How many conductors are connected to the switch?

a. Three
b. Four
c. Five
d. Six

13. The relay used in the low-voltage, remote-control system has a _____.

a. low impedance
b. solid core
c. split coil design
d. high impedance

14. When voltage on a Branch Circuit is 120 volts, the maximum voltage drop permitted at the point of utilization is _____.

a. 2.4 volts
b. 3.6 volts
c. 6 volts
d. 4 volts

15. The allowable ampacity of a No. 8 AWG type THW copper conductor installed in conduit is_____.

a. 40 amperes
b. 45 amperes
c. 50 amperes
d. 35 amperes

16. An ac general-use snap switch rated for 20 amperes may be used to control a motor load of _____.

a. 20 amperes
b. 16 amperes
c. 10 amperes
d. 15 amperes

17. A light can be controlled from three locations using _____.

a. two single-pole switches and a three-way switch
b. three three-way switches
c. two three-way switches and one four-way switch
d. none of the above

18. A single-pole switch is installed in a circuit so it opens _____.

a. the grounding conductor
b. the grounded conductor
c. the ungrounded conductor
d. the underground conductor

19. According to the National Electrical Code EMT may not be used _____.

a. in cinder concrete
b. for concealed work
c. for exposed work
d. for outside work

20. To determine the maximum number of conductors permitted in a junction box, a conductor origination outside the box and terminating inside the box _____.

a. is not counted
b. is counted as one conductor
c. is counted as two conductors
d. is counted as three conductors

21. EMT must be supported within _____.

a. 18 inches of each outlet box
b. three feet of each outlet box
c. two feet of each outlet box
d. four and one-half feet of each outlet box

22. When installing a plug fuse in a new installation, it is required that _____.

a. an Edison-base fuse be used
b. a type S fuse be used
c. a plug-type fuse be used
d. a type H fuse be used

23. Two motors with full load ratings of 6 amperes and 12 amperes are to be installed on a single branch circuit. The circuit conductors must have a minimum ampacity of _____.

a. 18 amperes
b. 19.5 amperes
c. 21 amperes
d. 17 amperes

24. In a closed refrigeration system, the refrigerant changes to a liquid in the _____.

a. compressor
b. condenser
c. evaporator
d. all of the above

25. The preheat type of fluorescent lamp has a _____.

a. starter in the cathode circuit
b. continuously heated cathode
c. cold cathode
d. on/off heated cathode

26. Branch-circuit conductors installed within three inches of a ballast must have a temperature rating of not less than _____.

a. 75^{o} C
b. 90^{o} C
c. 80^{o} C
d. 110^{o} C

27. When connecting a recessed fixture to a lighting outlet located above the ceiling, it is permissible to use _____.

a. 4 to 6 feet of flexible metal
b. 5 feet of plastic raceway
c. 3 feet of metal raceway
d. 2 feet of plastic raceway

28. When purchasing an emergency generator, the size selected must be at least equal to _____.

a. the maximum kW load
b. the maximum kW load plus the starting kVA of the largest motor
c. the maximum kW load plus the total starting kVA of all motors that can be started simultaneously
d. the maximum kW load plus the starting kVA of the smallest motor

29. A 300-ampere feeder has a tap connection which is 20 feet long. The tap conductor must have an ampacity of at least _____.

a. 300 amperes
b. 100 amperes
c. 50 amperes
d. 40 amperes

30. Dual-element fuses protecting a motor are usually selected at not over _____ % of the motor's full-load ampere rating.

a. 100
b. 125
c. 150
d. 175

31. When selecting fuses and circuit breaker what four factors must always be considered. Choose one factor not considered.

a. Voltage
b. Current
c. Short circuit rating
d. Color

32. Most molded case circuit breakers have a thermal trip unit which senses current and a magnetic trip which senses _____.

a. short circuits
b. resistance
c. voltage
d. impedance

33. For a 75 feet run of 1/2 inch EMT, how many supports must be installed? Both ends of each raceway are terminated in outlet boxes.

a. 15
b. 10
c. 7
d. 3

34. A book of rules governing all the material to be used and the work to be performed on a commercial construction project is _____.

a. specifications
b. bidders sheet
c. general conditions
d. schedule of drawings

35. The NFPA publishes a 10-volume series covering the National fire codes. What book if part of volume 5?

a. NEW
b. NEMA
c. NAPA
d. NFPA

36. Many transformers are immersed in a liquid which may be _____.

a. oil
b. gas
c. water
d. transformer fluid

37. A three-phase four wire system cannot have voltage of _____

a. 277/48 volts
b. 120/240 volts
c. 208/240 volts
d. 220/440 volts

38. A service-drop is conductors from utility pole to building and ran _____.

a. overhead
b. in conduit
c. underground
d. at least 8 feet from ground

39. Service conductors entering a building underground are called _____.

a. service lateral
b. service feeder
c. ungrounded
d. primary conductors

40. In addition to grounding the service equipment to the underground water pipe, what is required?

a. Water meter
b. At least #4 copper
c. At least 1 ground rod pipe
d. None of these

41. The grounding electrode conductor is the conductor from the serve equipment to the _____.

a. meter socket
b. water line
c. hot water heater
d. neutral bar

42. The grounding electrode conductor may be solid or stranded, uninsulated, covered or bare and must not be _____.

a. orange
b. spliced
c. broken
d. parallel

43. What is the KVA-capacity of three 150-KVA transformers wye connected?

a. 150 KVA
b. 300 KVA
c. 450 KVA
d. 225 KVA

44. Flexible metal conduit shall not be less than 1/2 inch except when supplying _____.

a. service equipment
b. portable equipment
c. lighting fixtures
d. control circuits

45. The markings on a receptacle terminal indicate AL/CU. This means it is approved for _____.

a. aluminum and copper
b. all purpose
c. aluminum/conductor
d. copper only

46. A Edison Base incandescent lamp holder is the same as a _____.

a. medium base
b. mogul base
c. screw shell base
d. candelabra

47. The light producing element in the incandescent lamps is a tungsten wire called the _____.

a. filament
b. element
c. circuit
d. none of these

48. The surface metal raceway of a recessed lighting fixture must be the maximum length of _____.

a. 3 feet
b. 2 1/2 feet
c. 6 feet
d. 1 foot

49. Three-way, four-way and twig switches to be used for controlling emergency lighting are permitted.

a. Yes
b. No
c. Under local code.
d. Up to contractor.

50. Which of these fuses would offer the greatest protection for a motor?

a. Dual-element, time delay current limiting fuses.
b. Current limiting.
c. Type S.
d. Low peak, dual element, current limiting fuse.

51. Over current protection for motors can be found under article #_____.

a. 422
b. 240
c. 430
d. 517

52. The B phase conductor of a 4-wire Delta must be tagged what color?

a. Green
b. Red
c. Orange
d. Pink

ELECTRICITY
WRITTEN TEST

MODULE VIII INDUSTRIAL WIRING

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the task in Module VIII Industrial Wiring.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. Convert 11.5 feet to feet and inches.

   a. 12 feet
   b. 11 feet 8 inches
   c. 11 feet 6 inches
   d. 11 feet 5 inches

2. What is the minimum burial depth for direct burial cable (without supplementary protection).

   a. 2 feet
   b. 12 inches
   c. 1 foot
   d. 16 inches

3. What is the main purpose of a pothead?

   a. Support wire
   b. Reduce cost
   c. Maintain correct phase
   d. Terminate cable

4. Which factors are used to determine the electrical energy rate charged by the power company?

   a. Amperes used, delta or safe connection fuse used.
   b. Watts used, ownership of transformer, power factor.
   c. Volts used, type of transformer, circuit breaker.
   d. Watthours, power factor, watt demand.

5. The high-voltage fuse interrupting rating should be at least as high as the _____.

   a. load times 125%
   b. feeder times 125%
   c. available short-circuit current at supply terminals
   d. ampere load

6. A busway is commonly called a _____.

   a. conductor
   b. bus duct
   c. wireway
   d. trolley

7. A panel board for which more than ten percent of its overcurrent devicers are rated at 30 amperes or less, with a neutral connection is called a _____.

   a. distribution disconnect
   b. main panel board
   c. GFIC panel board
   b. main panel board
   d. lighting and appliance panel board

8. What is the maximum number of poles permitted in the panel board?

   a. 42 overcurrent devices
   b. 7 overcurrent devices
   c. 42 single pole breakers
   d. 7 double pole breakers

9. A panelboard with a rating of 225 amperes may be installed on any feeder with a capacity of _____.

a. 225 amperes or more
b. 225 amperes or less
c. 225 amperes times 125%
d. 225 amperes divided by 125%

10. A rubber cord serving a three-phase load must provide a minimum of of how many conductors?

a. Four
b. Two
c. A minimum of three conductors.
d. Stranded copper with nine metallic covering.

11. When rubber cord drops are used to connect machines to an overhead busway, _____ should be provided to support the cords.

a. brackets
b. strain relief grips
c. conduit
d. glue

12. Programmed clock systems are often equipped with two motors. One motor is used for normal time-keeping, the other provides _____.

a. a spare
b. an accelerated resetting feature
c. emergency time
d. it opens a safe

13. Small motors will usually have _____ power factors and _____ effeciencies than larger motors.

a. higher, higher
b. higher, lower
c. lower, lower
d. lower, higher

14. The slip in speed of an induction motor is the difference between the _____ speed of the motor and its _____ speed.

a. stator, rotar
b. synchronous, actual
c. startwinding, runwinding
d. stator, motor

15. An induction motor consists of two electrical circuits, _____ and the _____, linked by a common magnetic circuit.

a. stator, rotor
b. startwinding, runwinding
c. rotor, dynamic brake
d. capacitor, winding

16. The synchronous speed of a two-pole, 60-hertz motor is _____.

a. 1200 rpm
b. 30 rpm
c. 1800 rpm
d. 3600 rpm

17. If the rms voltage is 208, the peak voltage (in volts) will be _____.

a. 147
b. 220
c. 294
d. 120

18. Precipitation unit performs what function?

a. cooling
b. compressing
c. filtering
d. lubrication

19. Impedance is the total opposition to current in a/an _____ system.

a. dc
b. ac
c. resistive
d. inductive

20. The amount of opposition to current flow due to inductance depends upon the amount of _____ present, and the _____ of the ac system.

a. inductive resistance, power factor
b. capacitive resistance, power factor
c. inductance, frequency
d. capacitive reactance, resistance

21. What is the true power measured in?

a. Watts
b. Volts
c. Amperes
d. Impedance

22. What is reactive power measured in?

a. Impedance
b. Amperes
c. Volt-amperes reactive
d. Capacitance

23. What is apparent power measured in?

a. Impedance
b. Capacitance
c. Volts
d. Volt-amperes

24. The rotating part of an ac motor is called the _____.

a. stator
b. rotor
c. running winding
d. starting winding

25. How can the direction of rotation of a split-phase motor be reversed?

a. By using a reversing starter.
b. By reversing the connections to both windings.
c. By reversing the connections to the starting windings.
d. Reversing the power leads.

26. The maximum total voltage drop for feeders and branch circuits should not exceed _____ percent overall.

a. Two
b. Three
c. Five
d. Seven

27. The unit of inductance is _____.

a. ahm
b. imperdance
c. hertz
d. henry

28. Reactance is symbolized by the letter(s) _____.

a. Z
b. VAR
c. X
d. KW

29. The minimum burial depth for rigid nonmetallic conduit is _____ inches.

a. 12
b. 18
c. 24
d. 36

30. The minimum burial depth for rigid metallic conduit is _____ inches.

a. 12
b. 18
c. 6
d. 24

31. Conductors leading from the terminals to a 100-amp dc generator shall have a minimum ampacity of _____.

a. 100 amps
b. 125 amps
c. 115 amps
d. 150 amps

32. Fuses and circuit breakers are connected in series with the load at _____.

a. circuit
b. current
c. phase current
d. neutral

33. What is the voltage drop when 50 amperes feed a motor using No. 6 AWG wires? The motor is located 200 feet from the source of supply.

a. 79.
b. 7.9
c. .79
d. .079

34. Which one of these type motors are usually not used in the industrial plant?

a. Capacity start
b. Induction
c. DC Shunt
d. Three phase

35. Feeder busway sections are available in standard lengths of _____.

a. 10'
b. 20'
c. 5'& 10'
d. 10'& 20'

36. Which type of circuit breaker from the ones listed below should be used to protect a circuit from direct shorts or heavy overloads?

a. Magnetic
b. Thermal
c. Eutectic alloy
d. Thermal-magnetic

37. Which of the following statements about relays and contactors is true?

a. Relays are used in low power circuits and contactors in high power circuits.
b. Contactors are used in low power circuits and relays in high power circuits.
c. Relays and contactors must be used in low power circuits, neither is suitable for high power operation.
d. Relays and contactors are interchangeable in any given electrical application.

38. The largest single advantage of a three-wire control system over a two-wire control system in industrial applications is _____.

a. safety
b. reliability
c. economy
d. flexibility

39. A low-voltage control system is used in some motor control systems in place of full-voltage control when _____.

a. the system to be controlled is less than 24 Vac
b. the system to be controlled used a dc motor or controller
c. safety or cost factors must be considered in the installation
d. the system to be controlled is less than 24 Vdc

40. Interlocking is used in motor control systems to prevent _____.

a. two motors from operating at the same time
b. overloads in either motor
c. two motors from operating in the wrong sequence
d. either motor from running in the wrong direction

41. Dynamic breaking is normally accomplished in a single phase induction motor by _____.

a. changing the frequency of the applied voltage
b. applying a dc voltage to the field winding after the ac power is removed.
c. reversing the connections to the motor
d. applying a dc voltage to the motor while the field winding is energized

42. Which of the following circuit breakers should be used to protect a motor from overloads in a circuit?

a. Thermal
b. Magnetic
c. Thermal-magnetic
d. Eutetic-magnetic

43. The direction of rotation of a universal motor can be reversed by _____.

a. reversing the connections to either the field or armature winding
b. applying ac to the field winding and dc to the armature winding
c. Applying dc to the field winding and ac to the armature winding
d. reversing the connections (power lines) which feed the motor

44. Dynamic breaking is normally accomplished in a shaded-pole induction motor by _____.

a. applying dc voltage to the field winding after the ac power is removed
b. changing the frequency of the applied voltage
c. reversing the connections to the motor
d. applying a dc voltage to the motor while the field winding is energized

45. A thermostat is a _____.

a. level control device
b. heat control device
c. sound control device
d. level control device

46. The primary of a transformer is fed with either _____.

a. ac or pulsating dc
b. ac or dc
c. dc or pulsating ac
d. dc or pulsating dc

47. A given transformer has a primary voltage of 120 V. If the turns ratio of the transformer is 1.10 and the load connected across the secondary is 12 ohms, the secondary current would be _____.

a. 0.25 amp
b. 0.5 amp
c. 2.0 amp
d. 1.0 amp

48. Inductive loads usually shorten relay contact life since they produce _____.

a. tinting
b. rust
c. tarnish
d. arcing

49. Motors that operate from either ac or dc are called _____.

a. universal motors
b. three phase motors
c. shaded pole motors
d. capacitor start motors

50. Meters are most accurate at _____

a. full scale
b. mid scale
c. lower one quarter scale
d. three quarters of full scale

ELECTRICITY
WRITTEN TEST

MODULE IX TRANSFORMER INSTALLATION

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module IX Transformer Installation.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

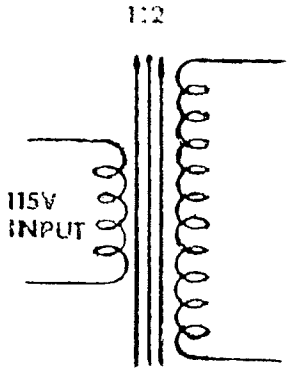
1. Due to the methods of construction and materials used, maintenance of ordinary transformers is required _____.

   a. weekly
   b. monthly
   c. infrequently
   d. often

2. An air-core transformer, is best at _____.

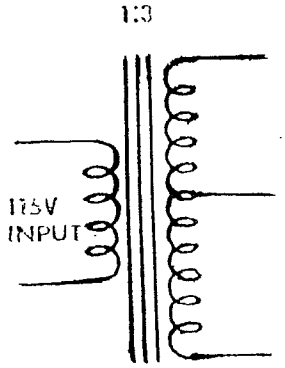
   a. high frequencies
   b. low frequencies
   c. high current
   d. high voltage

3. The schematic symbol below is for a/an _____ transformer.



   a. step-down, iron-core
   b. step-up, paper-core
   c. step-down, air core
   d. step-up, iron core

4. The schematic symbol below is for a/an _____ transformer.



   a. step-down, iron-core, tapped secondary
   b. step-up, air-core, tapped primary
   c. step-down, air-core tapped secondary
   d. step-up, iron-core, tapped secondary

5. Which type of transformer loss is reduced by using silicon steel as the core material?

   a. copper loss
   b. flux leakage
   c. eddy currents
   d. hysteresis loss

6. The undesirable currents in a transformer core are _____ currents.

a. ratio
b. eddy
c. primary
d. secondary

7. Transformer cores are laminated in order to _____.

a. increase displacement currents
b. reduce mutual inductance
c. provide an easy path for current
d. reduce eddy currents

8. The current handling capacity of a transformer is determined by the _____.

a. applied voltage
b. thickness of insulation
c. shape of the core
d. physical size of the wire used

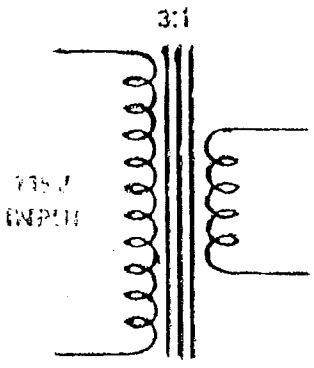
9. Copper losses may be minimized by using _____.

a. larger diameter wire
b. high-resistance wire
c. laminated cores
d. coaxial cable

10. The power dissipated by winding resistance in a transformer is called I^2R loss, or _____ loss.

a. eddy current
b. copper
c. hysteresis
d. core

11. The schematic symbol below is for a/an _____ transformer.



a. step-down, iron core
b. step-up, air-core
c. step-down, air-core
d. step-up, iron core

12. A transformer is a device that transfers electrical energy from one circuit to another electrically-isolated circuit by _____.

a. magnetizing current
b. electromagnetic induction
c. exciting current
d. eddy current

13. An iron core is used in a power transforme in order to _____.

a. concentrate the field about the windings
b. release the high-frequency currents
c. disperse the field about the windings
d. increase the eddy currents

14. The part of a transformer connected to the source is called the _____.

a. primary winding
b. secondary winding
c. iron core
d. laminations

15. The material used to separate the core laminations of a power transformer is usually _____.

a. paper
b. carbon
c. lead
d. varnish

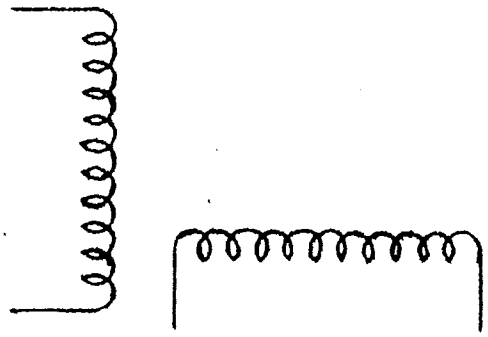
16. A transformer designed for low-frequency operation requires a core of _____.

a. low permeability
b. low reluctance
c. high retentivity
d. high copper loss

17. Iron-core transformers are normally used at _____.

a. low frequencies
b. low voltages
c. high currents
d. high frequencies

18. The coefficient of coupling for the two coils would be _____.

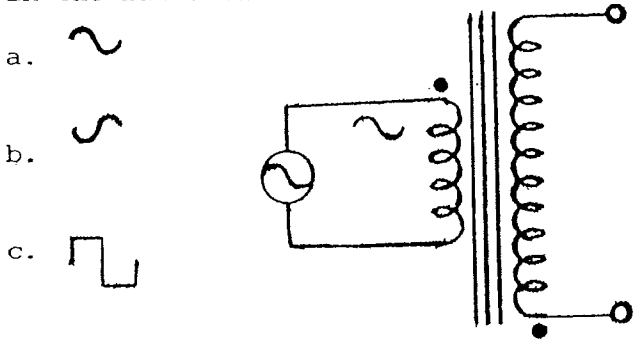


a. maximum
b. minimum
c. average
d. effective

19. The phase of the secondary winding of a simple transformer depends on the polarity of the primary winding and the _____.

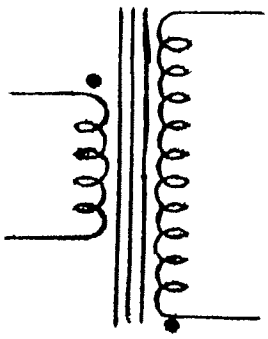
a. wire gauge
b. number of windings
c. transformer losses
d. direction of the windings

20. Which waveform would be correct for the output of the secondary in the illustration below?



a.
b.
c.
d.

21. On the schematic, the dots indicate the _____.



a. areas where the insulation has broken down
b. top lead of the primary and secondary have the same polarity
c. primary and secondary have the same number of windings
d. polarity of the secondary is opposite to the primary

22. A step-down transformer receives energy at one voltage and delivers it at a/an _____.

a. equal voltage
b. lower frequency
c. lower voltage
d. higher voltage

23. The small current that flows in the primary winding of a transformer with no load connected to the secondary is called the _____ current.

a. secondary
b. exciting
c. eddy
d. leakage

24. The extent of coupling between two inductors is expressed by _____.

a. varying current
b. counter EMF
c. self-inductance
d. coefficient of coupling

25. If the primary of a power transformer has 2,000 turns with 120 volts AC applied, how many turns are needed in the secondary to have an output of 6 volts AC?

a. 60 turns
b. 100 turns
c. 166 turns
d. 600 turns

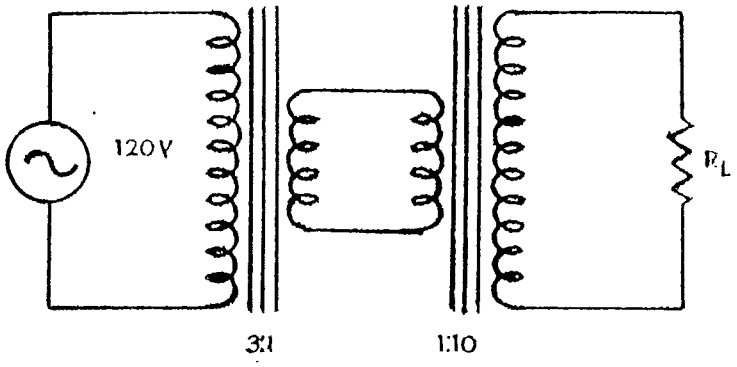
26. A step-up transformer has low _____.

a. voltage input, high-voltage output
b. current input, high-current output
c. power input, high-power output
d. frequency input, high-frequency output

27. If a 5:1 ratio step-down transformer has 250v on the primary, what is the secondary voltage?

a. 25v
b. 50v
c. 250v
d. 1250v

28. Compute the output voltage (E_{RL}) in the illustration below.



a. 40v
b. 30v
c. 400v
d. 600v

29. What is the efficiency of a transformer with an input of 120 volt amperes and an output of 108 watts?

a. 100%
b. 90%
c. 50%
d. 0%

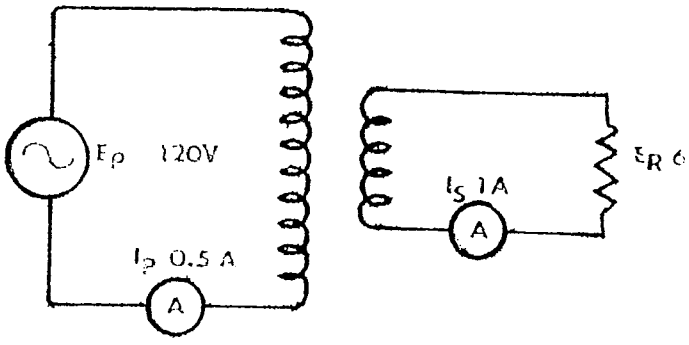
30. If the input power of a transformer is 600 va and the output power is 594 w, what is the efficiency?

a. 90%
b. 95%
c. 99%
d. 100%

31. The energy used to realign the magnetic structure of a transformer core twice each cycle is dissipated as heat. This loss is called _____.

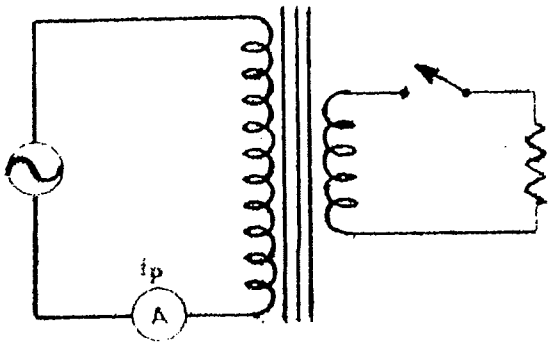
a. copper loss
b. flux leakage
c. hysteresis loss
d. eddy current loss

32. What is the efficiency of the illustrated transformer?



a. 98%
b. 60%
c. 100%
d. 10%

33. In the circuit below, if the switch is closed, the current flow in the primary will _____.

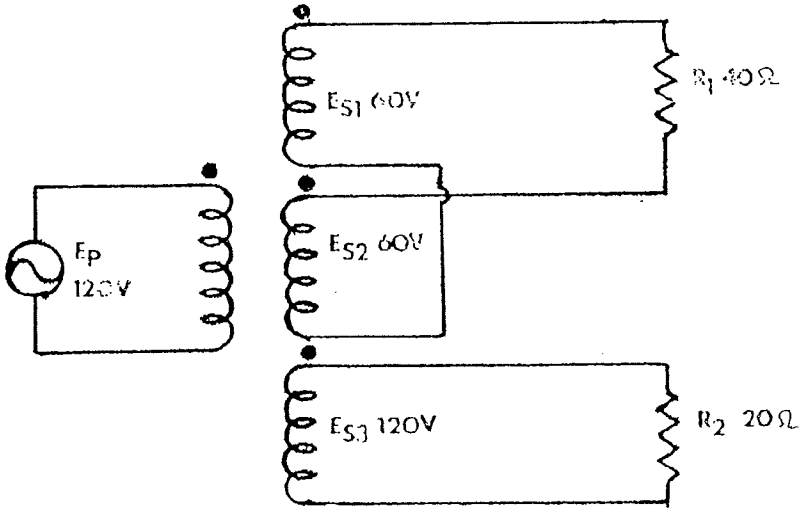


a. increase
b. decrease
c. not change
d. stop

34. In a step-up transformer the primary current is _____.

a. more than the secondary current
b. less than the secondary current
c. equal to the secondary current
d. equal to the coefficient of coupling

35. Compute the primary current flow for the transformer shown below.

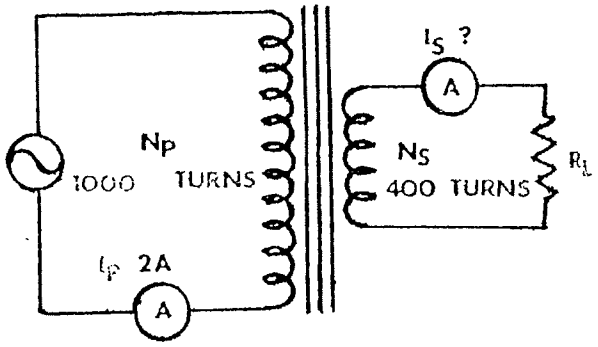


a. 2 amps
b. 3 amps
c. 6 amps
d. 9 amps

36. If a 3:1 ratio step-down transformer has 3 amps of current in the primary what is the current in the secondary?

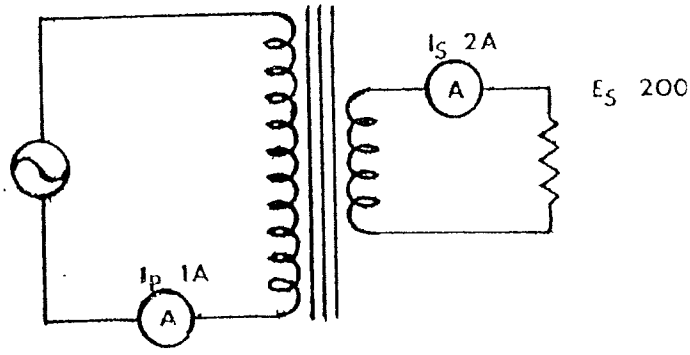
a. 1a
b. 3a
c. 9a
d. 6a

37. How much current is flowing through the resistive load in the circuit below.



a. 3 amps
b. 4 amps
c. 5 amps
d. 6 amps

38. In the illustration below, the applied voltage is _____.



a. 400 v
b. 20 v
c. 40 v
d. 200 v

39. In a step-down transformer the current through the secondary will be _____.

a. less than the current in the primary
b. greater than the current in the primary
c. the same as the primary
d. directly proportional to frequency

40. A step-down transformer receives energy at one voltage and delivers it at a/an _____.

a. equal voltage
b. lower frequency
c. lower voltage
d. higher voltage

41. A transformer which has a lower secondary voltage than primary voltage is a/an _____.

a. step-up transformer
b. air-core transformer
c. step-down transformer
d. iron-core transformer

42. If the primary of a power transformer has 400 turns with 120v AC applied, what is the voltage output from a 50 turn secondary?

a. 12 v
b. 15 v
c. 20 v
d. 25 v

43. In coils of a transformer, the motion of the flux is caused by the _____.

a. moving secondary
b. alternating current
c. direct current
d. rotating primary

44. Double wound transformers contain a minimum of _____.

a. one main winding
b. one main winding with two coils
c. a primary and a secondary winding
d. a primary and a double-wound secondary

45. A delta-WYE, four wire secondary gives _____.

a. a 120-volt single-phase and 208 volt, three-phase output
b. 208 volt, single phase and 120 volt, three-phase output
c. 208 volt three-phase output
d. 120 volt, three phase output

46. Transformer capacities may be increased by _____.

a. connecting them in series
b. pumping the oil
c. cooling the oil with fans
d. reducing the load

47. In a WYE connection _____.

a. the line voltage and coil voltage are the same
b. the line voltage is equal to 1.73 times the coil voltage
c. the line voltage is equal to 1.73 times the coil current
d. none of the above

48. A transformer used to reduce current values to a size where small meters can register them is a/an _____

a. potential transformer
b. auto transformer
c. current transformer
d. auto transformer

49. The secondary for a potential transformer is usually wound for _____.

a. 10 volts
b. 115 volts
c. 230 volts
d. 500 volts

50. The primary winding of a transformer is the _____.

a. high-voltage side
b. low voltage side
c. input winding
d. output winding

ELECTRICITY
WRITTEN TEST

MODULE X AC AND DC ROTATING EQUIPMENT

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module IX Motor Control.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. A motor starter can be used for which of the following functions?

   a. Starting, stopping, and motor overload protection.
   b. Reversing, changing speed, and jogging.
   c. Sequence control, pilot operation, low-voltage protection.
   d. All of the above.

2. A magnetic controller provides which of the following functions NOT provided by a manual starter?

   a. Motor overload protection.
   b. Automatic reset.
   c. Both start and stop capabilities.
   d. Automatic and remote operation.

3. What is the movable part of an electro-magnet assembly called?

   a. Rotor
   b. Coil
   c. Armature
   d. Contact

4. The most commonly used NEMA starter size, covering the range of 2 to 10 horsepower, is NEMA size _____.

   a. 00
   b. 1
   c. 5
   d. 10

5. The holding circuit interlock on a standard magnetic starter is designed to _____.

   a. stay closed when the start button is released
   b. open when the start button is pressed
   c. close when the start button is pressed
   d. stay open when the start button is released

6. Electrical interlocks are used to maintain correct _____.

   a. speed control
   b. rotation reversal
   c. operation sequence
   d. load application

7. Padlocking attachments are added to push-buttons stations to lock the _____.

   a. start button in its normal position
   b. start button in its depressed position
   c. stop button in its normal position
   d. stop button in its depressed position

8. Push-button stations for hazardous locations have what surface characteristics provided between the cover and the base?

   a. Watertight seal.
   b. Sheet metal overlap.
   c. Flat rubber gasket.
   d. Machined surface.

9. How must the pushbuttons be wired when a motor must be stopped from more than one location?

   a. Stop buttons in series.
   b. Stop buttons in parallel.
   c. Start buttons in series.
   d. Both b and c above.

10. The spring mechanism in a precision snap-switch stores and releases the energy required to _____.

   a. decrease overtravel
   b. actuate the plunger
   c. maintain the overcurrent trip
   d. open or close contacts rapidly

11. What type of actuator is used in about 90 percent of all limit switches?

   a. Plunger.
   b. Rotating cam.
   c. Lever arm.
   d. Cable-operated.

12. You would be most apt to find a rotating-gear limit switch in which of the following applications?

   a. Conveyor control.
   b. Punch press equipment.
   c. Timing applications.
   d. Hoist or door travel control

13. Mercury switch failure is most frequently caused by which of the following?

   a. Glass tube breakage.
   b. Mercury deterioration.
   c. The stranded lead wire breaking.
   d. Electrode arcing.

14. Which of the following functions will plugging switch perform?

   a. Stop a motor running either forward or reverse.
   b. Operate a motion detector alarm.
   c. Interlock or sequence several motors.
   d. All of the above.

15. During each plugging operation, the motor draws current at the rate of _____.

   a. one-half full-load
   b. one and one-half times full-load
   c. three to four times full-load
   d. six to eight times full-load

16. A thermocouple element is activated by heat, which produces a/an _____.

   a. low voltage
   b. increased pressure
   c. increased spring tension
   d. change in contact position

17. If a control is required to regulate liquid level in a tank or vessel, it will likely have a/an _____.

   a. inverse level regulator
   b. pressure switch
   c. float switch
   d. two-element differential switch

18. Because of their operating characteristics electron-tube and solid-state relays are called _____.

   a. therminonic relays
   b. electromagnetic relays
   c. electromechanical relays
   d. amplifying relays

19. Phase sequence-sensing relays are used where positive control is required of which of the following power equipment applications?

a. Three phase, four wire distribution.
b. Open-delta control system.
c. Automatic sequence motor control.
d. Automatic motor reversing control.

20. When voltage is applied to an industrial relay coil, what effect will the resulting magnetic field have?

a. Cause the contacts to attract each other.
b. Collapses at the center of the armature.
c. Pulls the armature toward the core.
d. All of the above.

21. Electrical conduit systems in hazardous areas must have seals to prevent which of the following?

a. An explosion from traveling in the conduit.
b. Gases or vapors from traveling in the conduit.
c. Pressure piling or buildup.
d. All of the above.

22. When armored cable is used, grounding is provided by using which of the following?

a. A separate conductor.
b. The armor itself.
c. The enclosure seal or clamp.
d. All of the above.

23. A synchronous motor controller will start the motor as an induction motor and then _____.

a. bring it into synchronism using dc excitation
b. run it as a synchronized dc motor
c. synchronize the stator with the line frequency
d. synchronize the power factor and frequency

24. A motor control center is a group or combination of _____.

a. pushbutton stations
b. starters in a single enclosure
c. feeder buses
d. circuit breakers

25. Grouping all control devices at a central location simplifies trouble-shooting and general maintenance because _____.

a. starters can be replaced quickly
b. dead front construction eliminates hazards
c. smaller circuit breakers can be used
d. conduit runs can be short

26. What organization is responsible for classifying enclosures for control panels and electrical devices?

a. UL
b. NEMA
c. ASA
d. IEEE

27. When control panel wires are the same color, they can best be identified by _____.

a. painting the conductor ends a different color
b. numbered markers at the conductor ends
c. using colored wire tracers
d. using the control blueprints

28. The most common wire terminals used in control panel wiring are _____.

a. solder terminals
b. bolt pressure terminals
c. solderless crimp terminals
d. screw on terminals

29. Wire connections are properly made with spring-type screw-on connectors only on connections having _____.

a. aluminum-to-aluminum wire
b. copper-to-copper wire
c. aluminum-to-copper wire
d. copper-to-steel wire

30. Name the more common connectors used for splicing branch conductors to the main feeder conductors.

a. Split bolt, clamp and parallel cable-tap.
b. Screw-on and crimp.
c. Solder and solderless.
d. Stranded and solid.

31. The rotating part of an ac motor is called the _____.

a. stator
b. rotor
c. running winding
d. starting winding

32. A rotating magnetic field is produced by the current in the two windings displaced by 90 electrical degrees. This is the principle of _____.

a. phase timing
b. phase splitting
c. phase sequence
d. phase relationship

33. The starting winding of a single-phase induction motor is disconnected from the circuit by _____.

a. magnetic induction
b. inductive reaction
c. a centrifugal switch
d. field excitation

34. Most fractional horsepower motors have what type of bearings?

a. Plain or sleeve bearings.
b. Ball or roller bearings.
c. Hard and annealed bearings.
d. Soft and porous bearings.

35. A single-phase motor is made self starting by the addition of a/an _____.

a. running winding
b. starting winding
c. electric starter
d. autotransformer

36. If the starting winding is left in the circuit, it will cause the motor to _____.

a. run faster
b. run slower
c. draw excessive current and overheat
d. stall on light load

37. How can the direction of rotation of a split-phase motor be reversed?

a. By using a reversing starter.
b. By reversing the connections to both windings
c. By reversing the connections to the starting windings
d. By changing the brush position

38. A megohmeter reading of zero or low ohms is indicated between the stator winding and motor frame. The winding is _____.

a. open
b. series connected
c. grounded
d. cross connected

39. The capacitors used for ac motor starting have no _____.

a. polarity markings
b. voltage rating
c. definite capacitance value
d. dielectric rating

40. The capacitor in a capacitor-start motor is connected in series with the _____.

a. running winding
b. starting winding and centrifugal switch
c. compensating winding
d. split-phase winding

41. A capacitor motor has difficulty starting. What is the probable cause?

a. Reversed magnetic field.
b. Shorted commutator segments.
c. Shorted windings.
d. All of the above.

42. A dc series motor does NOT operate satisfactorily on ac for which of the following reasons?

a. Poor efficiency on ac.
b. Poor power factor on ac.
c. Excessive sparking on ac.
d. All of the above.

43. An outstanding feature of a universal motor is its _____.

a. highest horsepower-per-pound ratio
b. slow speed
c. poor performance on dc
d. best performance on 60 Hz power

44. The most common mechanical method of providing speed reduction for universal motors is to use _____.

a. gearing
b. brakes
c. chains
d. belts

45. Which of the following is a common cause of brush sparking in a universal motor?

a. Shorted armature winding.
b. Open armature winding.
c. High commutator mica.
d. All of the above.

46. Early breakdown of winding insulation can be caused by _____.

a. low brush pressure
b. dust, oil, or other contaminants
c. high commutator mica
d. All of the above

47. The NEC permits which of the following statements to be applicable for single-phase fractional horsepower motors.

a. One switch can be a disconnecting means and a controller.
b. Short-circuit protection and overload protection can be combined.
c. A single device can serve more than one function.
d. All of the above.

48. The NEC requires a motor to be within sight of the controller, or no farther than _____.

a. 20 feet from the controller
b. 50 feet from the controller
c. 75 feet from the controller
d. 100 feet from the controller

49. The motor circuit switch, or CB must disconnect the motor and its controller from _____.

a. all grounded conductors
b. all ungrounded conductors
c. the overload relays
d. the branch circuit

50. Running overload protection in a manual starting switch is provided by a _____.

a. dual element fuse
b. toggle switch
c. thermal activated device
d. snap action mechanism

51. Armature short circuits can be detected and identified by which of the following tests?

a. Bar-to-bar.
b. Voltage drop.
c. Growler.
d. All of the above.

ELECTRICITY
WRITTEN TEST

MODULE XI ELECTRICAL CONTROLS AND DEVICES

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module XI Electrical Controls and Devices.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. When more than one electrical load is connected in a line diagram, the loads are connected in _____.

   a. series
   b. parallel
   c. parallel series
   d. series parallel

2. A _____ condition refers to any input into the circuit by a person.

   a. manual
   b. automatic
   c. standard
   d. mechanical

3. A _____ condition is one that will respond to changes in a system.

   a. manual
   b. automatic
   c. standard
   d. mechanical

4. Control relays, solenoids, and pilot lights are examples of loads connected directly to line _____.

   a. one
   b. two
   c. neutral
   d. three

5. In electrical circuits, the basic means of communicating the language of control is the _____ diagram.

   a. schematic
   b. line
   c. elementary
   d. sketch

6. An electrical device which consists of a frame, plunger, and coil, and is used to create a push or pull type action, is the _____.

   a. contactor
   b. magnetic motor starter
   c. relay
   d. solenoid

7. An electrical device which consists of a frame, plunger, and coil, and is used to open and close a set of contacts in addition to providing overload protection, is called a _____.

   a. contactor
   b. magnetic motor starter
   c. relay
   d. solenoid

8. In manual contactors, external electrical connections are made indirectly to the fixed contacts through _____.

   a. the knife blades
   b. the movable contacts
   c. saddle clamps
   d. the springs

9. When two contactors are connected in such a way that both sets of contacts cannot be closed at the same time, the contactors are _____ interlocked.

a. electrically
b. power
c. automatically
d. mechanically

10. The primary difference between a contactor and a starter is the addition of _____ protection to the starter.

a. overload
b. fuse
c. starting
d. resistance

11. When a motor is loaded so heavily that the motor shaft cannot turn, a condition called _____ exists.

a. locked armature
b. locked rotor
c. frozen shaft
d. binding

12. A time delay device called the _____ is used to protect a motor while it is running.

a. fuse
b. breaker
c. timing relay
d. Overload

13. A three-phase power source has _____ hot wire(s).

a. five
b. four
c. three
d. two

14. A three-phase power source has _____ neutral wire(s).

a. three
b. two
c. four
d. one

15. Relays are primarily used to switch currents in the _____.

a. control circuit
b. power circuit
c. power distribution circuit
d. load circuit

16. Relays with sets of contacts which are closed by some type of magnetic effect are called _____.

a. electro mechanical relays
b. solid state relays
c. hybrid relays
d. magnetic relays

17. When using a contactor to control a DC load, you are required to break _____.

a. two power lines
b. four power lines
c. one power line
d. six power lines

18. When using a contactor to control a three-phase load, you are required to break _____.

a. three power lines
b. one power line
c. six power lines
d. two power lines

19. A way to help confine, divide, and extinguish the arc for each set of contacts is to use _____.

a. arc chutes
b. over loads
c. a current transformer
d. a transient suppresion module

20. As the NEMA number of a contactor or starter increases (sizes 1, 2, etc.) the power rating of the contactor or starter _____.

a. decreases
b. increases
c. remains the same
d. depends upon amperes

21. Excessively noisy solenoids may be a result of _____.

a. broken shading coil
b. voltage too low
c. dirt, rust, or fillings on the magnetic face
d. all of the above

22. _____ magnets are magnets which can retain their magnetism after a magnetizing force has been removed.

a. Temporary
b. Permanent
c. Statorary
d. Bimetalic

23. When it is necessary to add extra start-stop pushbutton stations, the stop pushbuttons are corrected in _____.

a. parallel
b. series
c. series parallel
d. parallel series

24. When it is necessary to add extra start-stop pushbutton stations, the start pushbuttons are connected in _____.

a. series
b. series parallel
c. parallel series
d. parallel

25. A drum type switch is used with a _____.

a. wound-rotor motor
b. synchronous motor
c. DC motor
d. squirrel-cage motor

26. In a forwarding and reversing starter circuit the foward push-button has _____ contacts.

a. two normally closed
b. two normally open
c. one normally open, one normally closed
d. either of the above

27. In a forwarding and reversing starter each starter has two sets of auxillary contacts, each starter has a set of _____ contacts.

a. two normally closed
b. two normally open
c. one normally open, one normally closed
d. either of the above

28. In a hand-off automatic control station the selector switch has _____ positions.

a. one
b. two
c. three
d. four

29. How many main line contactor assemblies are used in an across-the-line reversing motor control.

a. One
b. Two
c. Three
d. Four

30. How many wires are connected from a FWD-REV-STOP pushbutton station to the control circuit.

a. Two
b. Three
c. Four
d. Five

31. All motor currents flowing through either the FWD or REV contactors must also flow through the _____.

a. overload contacts
b. overload heaters
c. control circuit
d. contactor coil contacts

32. Prolonged operation of a motor in a high slip condition can cause which of the following effects?

a. Overload tripping.
b. Auto transformer burnout.
c. Motor burnout.
d. Both a and c.

33. What can result if the TR relay in an auto transformer motor starter times out before the motor accelerates sufficiently?

a. Excessive starting current.
b. Transformer burnout.
c. Damaged relay contacts.
d. All of the above.

34. What is a common and economical method used for multispeed operation of three-phase motors?

a. Consequent-pole reconnection.
b. Reconnecting from wye to delta.
c. Separate winding for each speed.
d. Interconnecting the phases C-B-A.

35. In a time-sequence start circuit how are the coils connected to the motor starter coil?

a. Parallel.
b. Series.
c. Series parallel.
d. Parallel series.

36. A pushbutton is a control device used to switch an electrical circuit _____.

a. manually
b. mechanically
c. automatically
d. all of the above

37. A pressure switch is a control device used to switch an electrical circuit _____.

a. manually
b. mechanically
c. automatically
d. all of the above

38. Reduced voltage starting is used as a means of _____.

a. reducing the starting current
b. speed control
c. full voltage starting
d. starting difficult loads

39. The part of a DC motor that is used to reverse the direction of current flow in the armature coils is the _____.

a. brush set
b. armature
c. commutator
d. field poles

40. The DC motor, unlike the AC motor, may need reduced voltage starting in order to _____.

a. reduce the current
b. reduce the torque
c. protect the electrical environment
d. protect the motor

41. An across the line magnetic motor switch may be used to provide jogging control if the proper type of pushbutton station is used in the control circuit. This type is _____.

a. jog
b. jog-stop
c. start-jog-stop
d. stop-jog-stop

42. Which of the following functions will a jogging switch perform?

a. Stop a motor running either forward or reverse.
b. Inching.
c. Change direction of motor.
d. All of the above.

43. Which of the following functions will a plugging switch perform?

a. Stop a motor running either forward or reverse.
b. Operate a motor detector alarm.
c. Interlock or sequence several motors.
d. All of the above.

44. During each plugging operation, the motor draws current at the rate of _____.

a. one-half full-load
b. one and one-half times full-load
c. three to four times full-load
d. six to eight times full-load

45. If a control is required to regulate liquid level in a tank or vessel, it will likely have a/an _____.

a. inverse level regulator
b. pressure switch
c. float switch
d. two-element differential switch

46. In electric braking the amount of braking force is varied by changing the _____.

a. spring pressure
b. time the motor is connected in reverse
c. surface area of brake
d. applied voltage

47. Dynamic braking is usually applied to DC motors because _____.

a. DC motors reverse faster than AC motors
b. there must be access to the rotor
c. AC motors do not have stationary fields
d. AC power cannot develop a retarding torque

48. Friction brakes are sometimes used with dynamic braking because _____.

a. dynamic braking cannot hold a stopped load
b. friction brakes are less expensive
c. dynamic braking uses too much power
d. AC brakes cannot be used with DC

49. The advantage of using friction brakes is _____.

a. Low maintenance
b. simplified maintenance
c. their ability to control loads that are stopped often
d. their ability to be connected to any voltage

50. To change the speed of an AC induction motor, the _____ or _____ must be changed.

a. voltage, resistance
b. number of poles, frequency
c. inductance, capacitance
d. all of the above

ELECTRICITY
WRITTEN TEST

MODULE XII ELECTRONIC CONTROLS AND DEVICES

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precautions and procedures regarding the tasks in Module XII Electronic Controls and Devices.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. Voltage doubler circuits are useful in producing _____ voltages for circuits requiring low currents.

   a. low
   b. high
   c. decreasing
   d. constant

2. The principal type or types of photo-sensitive material(s) used in light control circuits is _____.

   a. photoemissive
   b. photoconductive
   c. photovoltaic
   d. all of the above

3. By connecting diodes in series, the voltage rating may be _____ over the value of a single rectifier.

   a. increased
   b. decreased
   c. remain the same
   d. doubled

4. During operation of the power supply, peak voltages are stored in the _____ of the filter sections.

   a. resistors
   b. coils
   c. capacitors
   d. resistors and coils

5. The load resistor acts as a preload on the power supply and causes a _____ _____.

   a. voltage drop
   b. current drop
   c. power decrease
   d. none of the above

6. The output voltage will usually _____ when a load is applied.

   a. increase
   b. decrease
   c. remain same
   d. decrease considerably

7. Variable voltage for electronic DC motor speed control is usually supplied by a _____ _____ rectifier.

   a. bridge control
   b. silicon controlled
   c. two diode
   d. selenium controlled

8. A reason for using DC motors in equipment is their good _____ torque.

   a. running
   b. operating
   c. starting
   d. stopping

9. The speed of a DC motor can be controlled only _____.

   a. from zero to normal speed
   b. over a narrow range
   c. at low speeds
   d. when loaded

10. The outer layers of a transistor are called the _____.

a. emitter and base
b. emitter and barrier
c. collector and base
d. emitter and collector

11. In the Zener regulator circuit, the Zener must be capable of passing _____ of the current I_R.

a. a little
b. none
c. all
d. much

12. The differential amplifier is widely used in integrated circuitry because it has _____ bias stability.

a. fair
b. good
c. excellent
d. superb

13. Input bias current is the _____ current going to the input transistors.

a. base
b. collector
c. grid
d. base-grid

14. A DC motor using a transistor speed control circuit can be made to operate at _____.

a. base speed
b. above base speed
c. below base speed
d. either of the above

15. In a half-wave recrifier, the diode is _____ biased during the positive half cycle of the input waveform.

a. reverse
b. forward
c. non
d. either a or b

16. The Triac circuit symbol is composed of two inverse connected _____ symbols.

a. SCR
b. diode
c. triode
d. bridge

17. The thermistor and photoconductive cell act on the principle of _____ changes.

a. inductance
b. resistance
c. insulation
d. capacitance

18. In testing a diode with an ohmmeter, the ratio of the reverse resistance to the forward resistance will be greater than _____.

a. 5:1
b. 100:1
c. 10:1
d. 20:1

19. Logic functions are a means of expressing predetermined operations by the use of _____.

a. mechanical relays
b. direct transmittal
c. electrical signals
d. servomechanisms

20. To indicate that the time delay of a logic control element may be varied continuously over its range, a/an _____ is placed through the symbol.

a. arrow
b. slash
c. dot
d. a or b

21. In an SCR, the current needed to trigger the gate is the _____ current.

a. triggering
b. turn-off
c. stabilization
d. turn-on

22. An SCR can be used to control current flow in _____.

a. AC circuits only
b. DC circuits only
c. AC and DC circuits
d. motor circuits only

23. The pulsating DC output of a rectifier circuit is made smooth by _____.

a. filter network
b. a transformer
c. thermionic emission
d. a diode connected in series with the output

24. All semiconductors have which of the following?

a. Heat sinks.
b. Limited thermal capacity.
c. Good heat dissipating abilities.
d. High thermal conductance.

25. Each diode in a rectifier circuit acts as a _____-_____ valve for current flow.

a. one way
b. two way
c. three way
d. none of the above

26. Electron flow in a diode is always _____.

a. cathode to base
b. base to cathode
c. base to anode
d. cathode to anode

27. The reason for connecting the collector to the metal case in a power transistor is to help _____.

a. raise voltage
b. stabilize current
c. dissipate heat
d. ground collector

28. For an NPN transistor, an ohmmeter connected from collector to base, positive at the collector, will have a _____ reading.

a. high
b. low
c. negligible
d. infinity

29. Full control of AC is obtained by use of a triac and a triggering device, the _____.

a. tetrode
b. switch
c. diac
d. base

30. A _____ is generally used to fire the diac, which then triggers the triac.

a. resistor
b. capacitor
c. coil
d. gate

31. When the triac conducts, it provides a much lower impedance path for the _____ than the primary of the transformer.

a. resistor
b. current
c. voltage
d. capacitance

32. The triac replaces the _____ ordinarily found in low-voltage remote control circuits.

a. coil
b. relay
c. resistor
d. filter

33. Because of its high current capability the SCR can also be used to control heavy-duty _____ motors.

a. AC
b. DC
c. AC and DC
d None of the above

34. An SCR in series with the load in an AC circuit limits the maximum _____ attainable across the load.

a. voltage
b. current
c. voltage drop
d. power

35. The circuit combination of a transistor switch and a _____ can function as a speed control; a function a single relay cannot do.

a. diode
b. triac
c. diac
d. gate

36. Solid-state components may be used to replace _____ and _____ for interlocking motor control.

a. switches, relays
b. switches, coils
c. coils, capacitors
d. coils, resistors

37. A tachometer generator is a small generator attached to a rotating shaft for the purpose of generating a _____ proportional to shaft speed.

a. current
b. voltage
c. resistance
d. counter emf

38. A voltage regulator is an electronic circuit that maintains a nearby constant output _____, for a given load current range.

a. current
b. resistance
c. voltage
d. neither of the above

39. Full-wave power control can be accomplished by an SCR, if it is operated from a source of _____ _____.

a. constant AC
b. pulsating DC
c. Any DC
d. AC power

40. As load current through an SCR increases, motor voltage and _____ will both increase.

a. reverse emf
b. control
c. resistance
d. speed

41. Current flow through the transistor is a function of _____ bias voltage.

a. forward
b. reverse
c. constant
d. either a or b

42. When thyristors are used as power switches, the _____ value of line voltage will appear across either thryristor until it conducts.

a. minimum
b. half
c. full
d. smallest

43. The dynamic braking circuit utilizes _____ _____ to brake the motor.

a. pulsating DC
b. constant AC
c. any DC
d. either b or c

44. The rapid rate of the fall of current in a coil causes _____ induced voltages.

a. low
b. high
c. constant
d. neither a or b

45. The high voltage induced in a DC relay coil when it is shut off can be minimized by using a _____ across the coil.

a. diac
b. diode
c. triode
d. capacitor

46. In DC operating coils, the current through the coil is limited only by its _____, which does not change with the position of the armature.

a. resistance
b. impedance
c. capacitance
d. counter emf

47. Negative feedback is a feedback signal in a direction to _____ the variable that the feedback represents.

a. increase
b. reverse
c. reduce
d. stabilize

48. The _____ _____ point is the point on the load line which represents the currents in a transistor and the voltages across it when no signal is applied.

a. cut off
b. cut on
c. DC bias
d. neither of above

49. Which of the following is not a basic transistor circuit configuration?

a. common emitter
b. common collector
c. common base
d. common grid

50. An emitter-base junction is a _____-junction between emitter and base.

a. pn
b. np
c. pnp
d. NPN

ELECTRICITY
WRITTEN TEST

MODULE XIII MOTOR REPAIR

DIRECTIONS: This 50 item test is designed to measure your ability to identify technical terms, tools, and equipment; to plan and organize work assignments, to solve technical problems and make job-related decisions; and to identify safety precatuions and procedures regarding the tasks in Module XIII Motor Repair.

Each of the test questions or incomplete statements is followed by a set of suggested answers or completions. Select the one best answer for each test item.

1. Applying AC to a DC shunt motor field causes a high impedance because of the windings _____.

   a. high resistance
   b. inductive reactance
   c. high induced voltage
   d. capacitive reactance

2. A DC series motor does not operate satisfactorily on AC for which of the following reasons?

   a. Poor efficiency on AC.
   b. Poor power factor on AC.
   c. Excessive sparking on AC.
   d. All of the above.

3. An outstanding feature of a universal motor is its _____.

   a. highest horsepower per pound ratio
   b. slow speed
   c. poor performance on DC
   d. best performance on 60 H_z.

4. Under no load conditions, a universal motor tends to run away; its speed is limited only by _____.

   a. the supply frequency
   b. the number of field poles
   c. windage and friction
   d. commutation

5. The most common mechanical method of providing speed reduction for universal motors is to use _____.

   a. gearing
   b. brakes
   c. chains
   d. belts

6. Which of the following is a common cause of brush sparking in a universal motor?

   a. Shorted armature winding.
   b. Open armature winding.
   c. High commutator mica.
   d. All of the above.

7. Early breakdown of winding insulation can be caused by _____.

   a. low brush pressure
   b. dust, oil, and other contaminants
   c. high commutator mica
   d. all of the above

8. The capacitors used for AC motor starting have no _____.

   a. polarity markings
   b. voltage ratings
   c. definite capacitance value
   d. dielectric rating

9. The capacitor in a capacitor-start motor is connected in series with the _____.

   a. running windings
   b. starting winding and centrifugal switch
   c. compensating winding
   d. split-phase winding

10. Which formula is used to find the equivalent capacitance for two capacitors in series?

a. $C_T = \frac{C_1 \quad C_2}{C_1 + C_2}$

b. $C_T = C_1 + C_2$

c. $C_T + \frac{C_1 + C_2}{C_1 \quad C_2}$

d. $C_T = C_1 - C_2$

11. A capacitor motor has difficulty starting. What is the probable cause?

a. Reversed magnetic field.
b. Shorted commutator segments.
c. Shorted windings.
d. All of the above.

12. A single-phase motor is made self starting by the addition of a/an _____.

a. running winding
b. starting winding
c. electric starter
d. auto transformer

13. A split-phase motor is started by connecting both the running winding and starting winding across the line in _____.

a. parallel
b. series
c. series-parallel
d. an inductive coupling

14. If the starting winding is left in the circuit, it will cause the motor to _____.

a. run faster
b. run slower
c. draw excessive current and overheat
d. stall on light load

15. How can the direction of rotation of a split-phase be reversed?

a. By using a reversing starter.
b. By reversing the connections to both windings.
c. By reversing the connections to starting windings.
d. By changing the brush position

16. The stator winding makes electrical contact with the motor frame. The winding is said to be _____.

a. open
b. grounded
c. lap wound
d. skein wound

17. A megohmeter reading of zero or low ohms is indicated between the stator winding and frame. The winding is _____.

a. open
b. series connected
c. grounded
d. cross connected

18. An open in the centrifugal switch circuit indicates a/an _____.

a. shorted winding
b. shorted switch
c. grounded winding
d. open winding

19. A motor runs slower than normal. The defect may be _____.

a. worn bearings
b. improper-size fuse
c. open running winding
d. wrong size brushes

20. A repulsion start-induction-run motor runs as an induction motor when the _____.

a. commutator segments are short circuited
b. brushes are shifted to a neutral plane
c. shorting devices are disconnected
d. stator connections are reversed

21. The brushes in a repulsion motor are connected _____.

a. to external supply
b. to stator winding
c. together by a jumper wire
d. for induction running only

22. The short-circuiting device in a repulsion start induction-run motor operates by _____.

a. circulating currents
b. magnetic attractions
c. centripetal force
d. centrifugal force

23. Which of the following motors has a squirrel-cage winding embedded in the armature under the regular winding?

a. Compound
b. Repulsion-start, induction-run.
c. Repulsion.
d. Repulsion-induction.

24. Changing the electrical connections to reverse the direction of rotation of a motor running at full speed is called _____.

a. plugging
b. braking
c. slugging
d. brush shifting

25. A rotating magnetic field in a shaded-pole motor is produced by using _____.

a. salient poles
b. shaded coils
c. capacitors
d. a high inductance winging

26. The direction of rotation in a conventional shaded-pole motor can be reversed by _____.

a. reversing theline direction
b. using a capacitor
c. reversing the rotor
d. reversing the stator poles 180°

27. The direction of rotation of a shaded-pole motor is always toward the _____.

a. main poles
b. shaded poles
c. salient poles
d. consequent poles

28. The speed of an induction motor depends on line frequency and the _____.

a. stator poles
b. number of rotor teeth
c. rotor slip
d. shaded pole position

29. A synchro transmitter sends an electrical signal to the _____.

a. synchro receiver
b. motor field
c. motor starter
d. synchro generator

30. The stator windings of synchro transmitters and receivers are excited by _____.

a. the differential field flux
b. the AC magnetic field of rotor
c. a DC source
d. compensating winding

31. Synchro receivers are electrically identical to _____.

a. split-phase motor
b. three phase motors
c. synchro transmitters of the same size
d. synchro control transformers of the same size

32. When both the synchro transmitter and receiver rotors are displaced from zero by the same angle, they are in _____.

a. correspondence
b. phase
c. error
d. unbalanced field synchronism

33. How are the stator and rotor windings connected in a differential synchro transmitter?

a. Series
b. Wye
c. Parallel
d. Delta

34. The NEC requires a motor to be within sight of the controller, or no further than _____.

a. 20 feet from the controller
b. 50 feet from the controller
c. 75 feet from the controller
d. 100 feet from the controller

35. Motor and controller frames must be grounded to _____.

a. prevent a potential above-ground
b. have a common return path
c. eleminate a grounding conductor
d. isolate the motor from over currents

36. Running overload protection in a manual starting switch is provided by a _____.

a. dual element fuse
b. toggle switch
c. thermal activated device
d. snap action mechanism

37. When selecting a motor, which of the following must be considered?

a. Voltage and horsepower.
b. Speed and frame enclosure size.
c. Bearings and motor protectors.
d. All of the above.

38. The insulating materials used for motor windings are classified according to the _____.

a. motor horsepower rating
b. levels of temperature rise
c. overcurrent protecting available
d. controller size

39. The principle of motor action causes any current-carrying conductor in a magnetic field to _____.

a. move with the field
b. move at right angles to field
c. set up an opposing field
d. develops a stronger field

40. The point at which armature conductors are moving parallel to the field flux is called the _____.

a. point of maximum cemf
b. greatest torque point
c. neutral plane
d. commutation

41. How should DC motor brushes be shifted to overcome the voltage of self-induction?

a. Opposite the direction of rotation.
b. In the direction of rotation.
c. Toward the strongest field pole.
d. Opposite the strongest field pole.

42. The DC motor that uses both a series and shunt winding and combines the characteristics of both, is called a _____.

a. compound motor
b. universal motor
c. repulsion motor
d. differential motor

43. By pushing and pulling the rotor shaft, a motor can be checked for _____.

a. end play
b. side play
c. firm mounting
d. free shaft movement

44. Insulation resistance of motor should be checked with a megohmeter, and the reading recorded when the motor _____.

a. fails to start
b. is first installed
c. breaks down
d. operates with an overload

45. A loss in the capacitance of a capacitor-start motor results in reduced _____.

a. speed
b. voltage
c. armature reaction
d. starting torque

46. Troubles in the armatures of repulsion and universal motors is usually caused by a/an _____.

a. shorted winding
b. shorted commutator
c. open winding
d. open commutator

47. The general area where electrical faults occur most often is in the motor _____.

a. control equipment
b. brushes
c. rotor
d. all of above

48. Electrical noise cannot be heard with _____.

a. power off
b. power on
c. rotor locked
d. defective bearing

49. The belt tension between the motor and driven machine should be _____.

a. tight
b. adjusted for 1/4 inch midpoint deflection
c. adjusted for 1/2 inch to 3/4 inches midpoint deflection
d. slack

50. Which of the following is required for evaluating and determining causes of trouble in motor circuitry?

a. A magneto.
b. Test equipment.
c. A current limiting switch.
d. A DC supply.

Important

on Test

Safety Part

TABLE V. SAFETY COLOR CODE FOR SHOP MACHINES AND EQUIPMENT

Color	Purpose	Examples
Safety Red.	Danger and emergency.	—Signs, white letters on red background. —Acetylene pipes.
	Stop controls.	—Emergency stop bars on hazardous machines. Stop buttons and switches for stopping machinery. —Locate fire emergency equipment.
Safety Orange.	Warning. Machine parts which may cut, crush, shock, or injure, and to emphasize such hazards when enclosure doors are open or when gears, belt or other guards around moving equipment are open or removed exposing unguarded hazards.	—Guards on machinery. —Locate hazardous parts of machine. —Inside covers of shields and switch boxes.
Safety Yellow.	Caution.	—Adjusting wheels, levers and knobs which the operator uses and controls that should be checked before turning on power.
Safety Yellow or with Yellow Band around middle at least ¼ its height with contents identified thereon.	Flammable liquids with flash point of 27°C (80°F) or below or combustible materials.	—Safety cans or other containers of flammable liquids or combustible materials.
Safety Yellow or with Yellow Band around middle at least ¼ its height with contents identified thereon.	Flammable waste materials.	—Safety cans for flammable combustible materials. Waste container for flammable materials.
Safety Yellow with conspicuous, high-visability lettering — Flammable—Keep Fire Away.	Caution.	—Storage cabinets of flammable materials labeled "Flammable—Keep Fire Away."
Safety Yellow with black stripes or safety yellow and black checkers.	Caution for striking against, stumbling, falling, tripping.	—Obstacles such as low beams and extensions that protrude.
Safety Yellow stripes.	Outline work areas.	—Work areas around stationary machines. —Outline traffic lanes.
Safety Blue.	Information and caution against machines or equipment out-of-order or under repair.	—Signs on machines, "Out-of-Order."
Safety Blue.	Information and caution.	—Outside of large switch box or control covers.
Safety Green.	Safety and location of first aid and safety equipment.	—Location of medical equipment.
Safety Black Symbol on Safety Yellow or Magenta on Safety Yellow.	Radiation hazard.	—Radiation from X-ray radiation types, such as alpha, beta, gamma, neutron, proton, deuteron and meson.
Safety Black, Safety White and Safety Yellow or combination of Safety Black with Safety White or Safety Yellow.	Traffic Control Areas or markings for information purposes.	—Barricades.
Vista* Green or Machinery Gray.	To reduce eye strain.	—Body of machines, tables and workbenches.
Ivory.	To improve visibility.	—Tooling action areas of a machine and edges of tables and workbenches.
Aluminum with Black Band around the Middle at least ¼ the height of container with contents identified thereon.	Waste container other than for flammable materials.	—Waste containers.
Yellow Bands.	Pipe identification.	—Natural gas and steam.
Blue Bands.	Pipe identification.	—Compressed air.
Black Bands.	Pipe identification.	—Vent lines.
ey Bands.	Pipe identification.	—Water.
Green Bands.	Pipe identification.	—Oxygen.

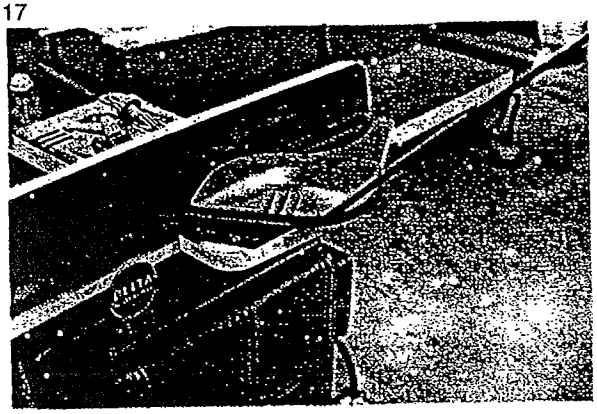
*Vista green is a trade name for a Pittsburgh Paint machinery enamel.

Safety orange, the second of the safety colors—and one of the most important—always represents a **warning.** It is used to designate machine hazards. Here are a few examples of how safety orange is applied in the shop.

16

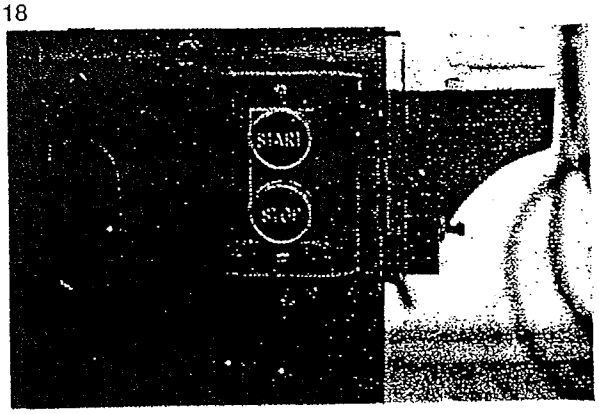
Guards that cover a specific hazard and must be in place before operation can begin are designated by safety orange.

17



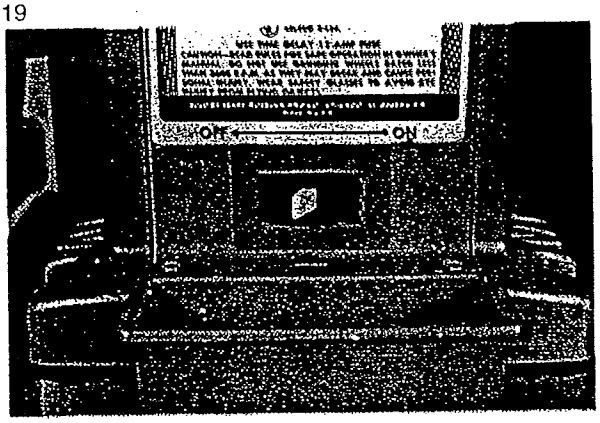
It is used to identify the location of electrical boxes that contain stop/start buttons. . .

18

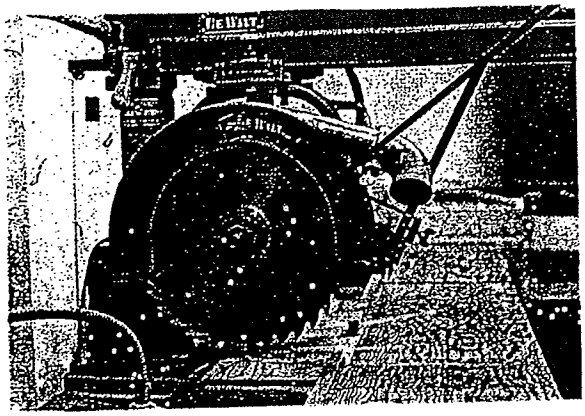


. . .and switch levers or toggles. Note that these areas have been outlined with orange rather than having been painted entirely. This is because research has shown that bright safety colors are more effective if they are used sparingly.

19

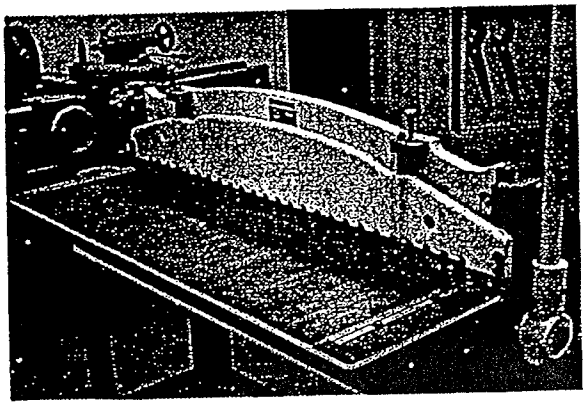


20



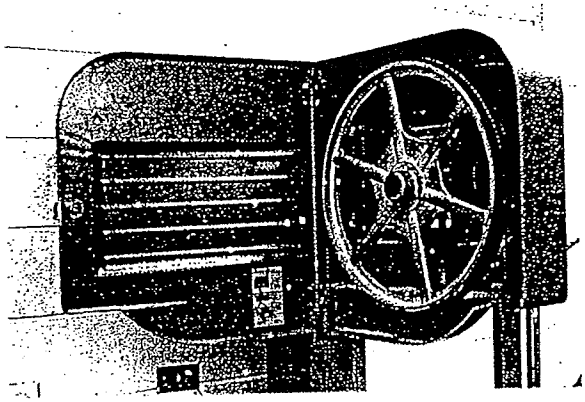
Safety orange is used to accent parts of a machine which might cut. . .

21



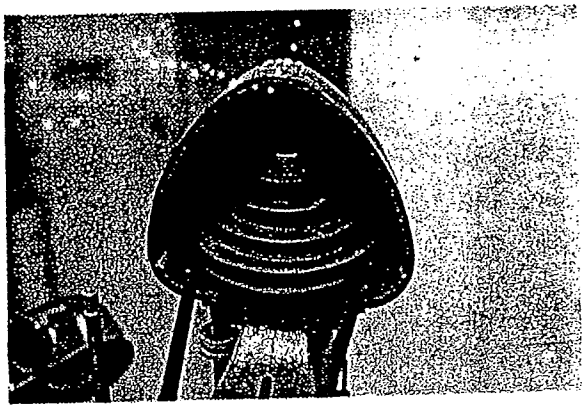
. . .crush or in some way cause injury to a shop worker.

22



It is used to identify access or inspection doors which may have been left open.

23



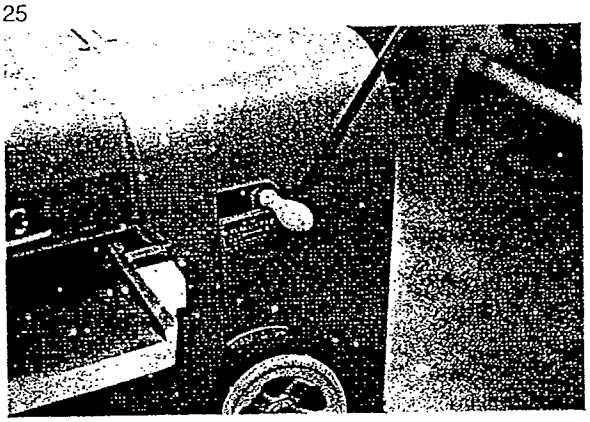
And it is used to focus attention on exposed hazards such as pulleys, belts or gears.

Safety yellow is the specified color for **caution.** Like the amber light of the traffic signal, its message is "go slow and be cautious."

24

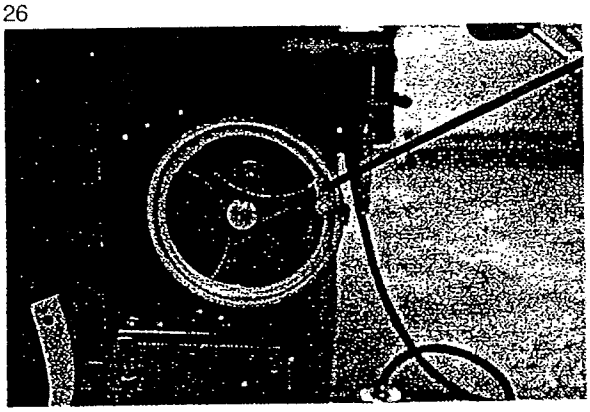
It is also used to identify critical parts of a machine such as wheels and levers. . .

25



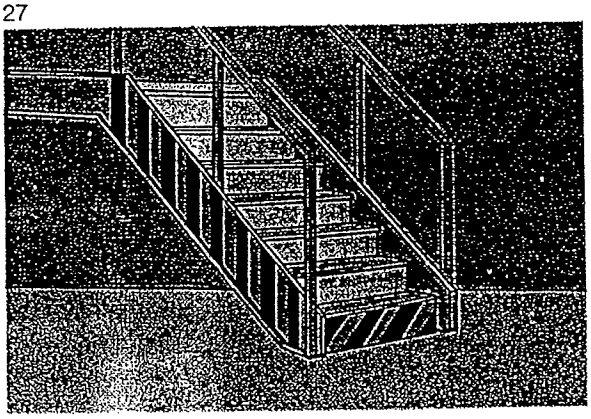
. .and controls, such as handles or knobs which are used the adjustment of machines and equipment when the power is off. An exception to this rule is the speed control lever on some power equipment. It may be adjusted while the unit is running.

26

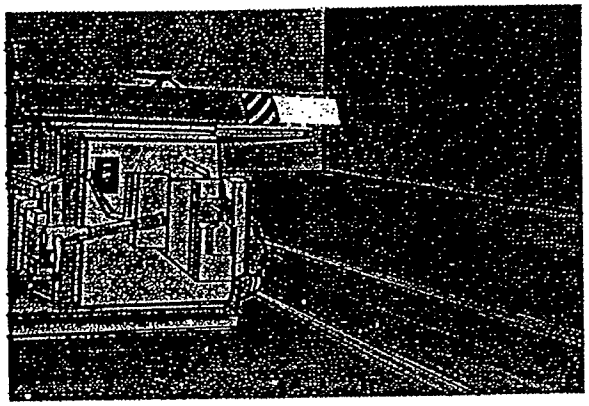


When used in combination with safety black—which will be discussed later—safety yellow may be used in a series of diagonal black and yellow stripes to identify non-moving hazards that may cause stumbling or falling, such as steps or open stairways. . .

27

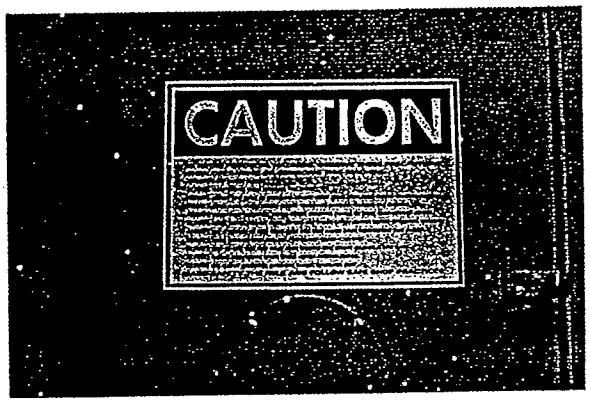


28



. . .or parts of machines that might project into traffic lanes.

29

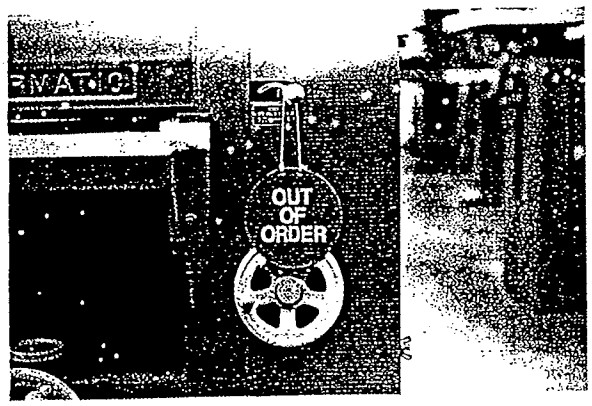


Safety yellow is also used in combination with safety black for caution signs that may be located around the shop.

30

Safety blue is used to represent **information.** It is used for signs if warning or caution is implied. They are usually shown with white letters on a safety blue background.

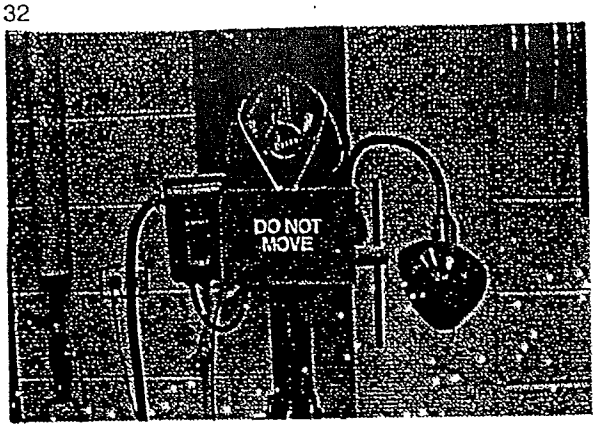
31



It is used to indicate caution against using defective machines or machines under repair. Signs that say "out of order". . .

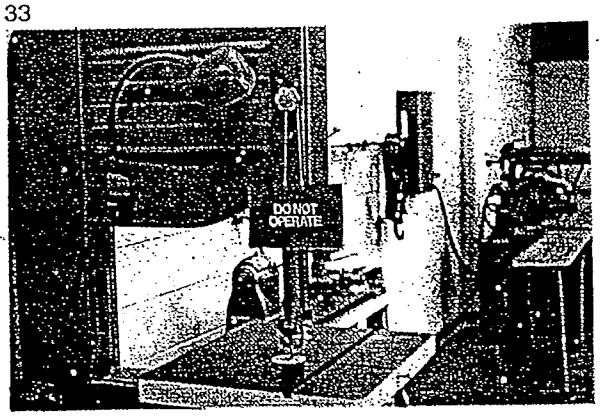
. . ."Do not move". . .

32



. . .or "Do not operate" should always be hung on a machine in a conspicuous place to warn of any unsafe conditions that might exist.

33

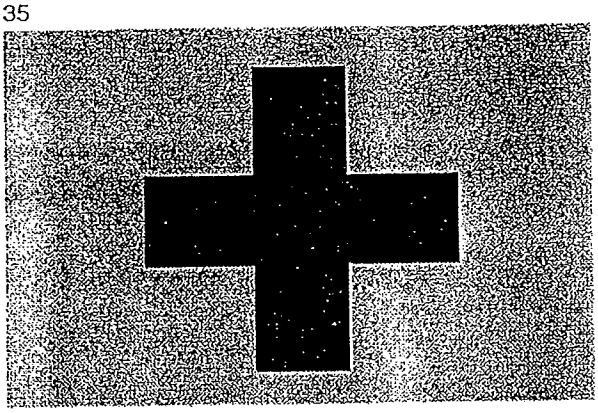


Safety green should always be associated with **safety** and **medical practice.** It is used to identify safety equipment and their locations.

34

When used in identifying first aid equipment, it may be shown as a green cross on a white background. . .

35



MODULE I - SHOP ORIENTATION

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24.	
25.	
26.	
27.	A
28.	C
29.	C
30.	C
31.	B
32.	
33.	D
34.	A
35.	B
36.	C
37.	B
38.	B
39.	C
40.	B
41.	C
42.	B
43.	D
44.	A
45.	B
46.	A
47.	C
48.	C
49.	D
50.	B

MODULE II D. C. FUNDAMENTALS

1. b
2. c
3. c
4. a
5. a
6. a
7. c
8. a
9. d
10. b
11. a
12. a
13. a
14. a
15. a
16. d
17. a
18. a
19. a
20. d
21. a
22. a
23. a
24. b
25. a
26. c
27. d
28. c
29. a
30. a c
31. a
32. d
33. a
34. a
35. c
36. a
37. a
38. a
39. a
40. a
41. a
42. a
43. a
44. a b
45. a
46. a d
47. a
48. a
49. a
50. a

MODULE III A. C. FUNDAMENTALS

1. c
2. b
3. a
4. d
5. c
6. a
7. b
8. a
9. b
10. c
11. d
12. a
13. a
14. b
15. c
16. d
17. a
18. b
19. d
20. b
21. c
22. d
23. a
24. a
25. c
26. c
27. d
28. a
29. b
30. c
31. a
32. a
33. d
34. b
35. c
36. c
37. a
38. c
39. b
40. b
41. a or b
42. b
43. c
44. b
45. b
46. c
47. a
48. a
49. a
50. b

MODULE IV ELECTRONIC COMPONENTS AND CIRCUITS

1. a
2. b
3. b
4. c
5. c
6. d
7. a
8. a
9. b
10. c
11. d
12. a
13. b
14. c
15. d
16. a
17. c
18. b
19. a
20. b
21. c
22. d
23. a
24. b
25. c
26. c
27. c
28. b
29. a
30. c
31. b
32. b
33. a
34. d
35. a
36. d
37. b
38. a
39. d
40. a
41. a
42. b
43. c
44. c
45. b
46. a
47. d
48. b
49. d
50. c

MODULE V BASIC LOGIC CIRCUITS

1. b
2. b
3. d
4. a
5. b
6. d
7. c
8. a
9. d
10. b
11. b
12. d
13. c
14. b
15. a
16. b
17. c
18. a
19. d
20. e
21. b
22. b
23. c
24. b
25. d
26. b
27. a
28. c
29. c
30. b
31. d
32. a
33. b
34. c
35. b
36. d
37. b
38. b
39. c
40. c
41. b
42. a
43. b
44. a
45. c
46. c
47. d
48. d
49. d
50. d

MODULE VI RESIDENTIAL WIRING

1. b
2. b
3. a
4. a
5. d
6. a
7. b
8. c
9. d
10. d
11. b
12. a
13. ~~d~~ A
14. b
15. a
16. c
17. d
18. d
19. a
20. b
21. b
22. d
23. a
24. d
25. a
26. c
27. a
28. d
29. a
30. b
31. ~~a~~ b
32. c
33. a
34. c
35. c
36. b
37. a
38. a
39. b
40. d
41. ~~b~~ c
42. c
43. a
44. b
45. c
46. b
47. a
48. b
49. b
50. a

MODULE VII COMMERCIAL WIRING

1. d
2. ~~a~~ b
3. ~~b~~ A
4. d
5. d
6. b
7. c
8. a
9. a
10. ~~c~~ b
11. a
12. a
13. c
14. b
15. c
16. c
17. c
18. c
19. a
20. a
21. b
22. b
23. c
24. b
25. a
26. b
27. a
28. b
29. b
30. d
31. d
32. a
33. c
34. a
35. a
36. a
37. a
38. a
39. a
40. c
41. ~~c~~ b
42. b
43. c
44. c
45. a
46. a
47. a
48. c
49. b
50. d
51. c
52. c

MODULE VIII INDUSTRIAL WIRING

1. c
2. a
3. d
4. d
5. c
6. b
7. d
8. c
9. b
10. a
11. b
12. b
13. c
14. b
15. a
16. d
17. c
18. c
19. b
20. c
21. a
22. c
23. d
24. b
25. c
26. c
27. d
28. c
29. b
30. c
31. d
32. a
33. b
34. c
35. a and b
36. a
37. a
38. a
39. c
40. c
41. b
42. a
43. a
44. a
45. b
46. b
47. a
48. a
49. c
50. c
51. c

MODULE IX TRANSFORMER INSTALLATION

1. c
2. a
3. d
4. d
5. d
6. b
7. d
8. d
9. a
10. b
11. a
12. b
13. a
14. a
15. d
16. b
17. a
18. b
19. d
20. b
21. d
22. c
23. b
24. d
25. b
26. a
27. b
28. c
29. b
30. c
31. c
32. c
33. a
34. a
35. c
36. c
37. c
38. a
39. b
40. c
41. c
42. b
43. b
44. c
45. a
46. a
47. b
48. c
49. b
50. ~~a~~ c

MODULE X AC AND DC ROTATING EQUIPMENT

1. d
2. d
3. d – c
4. c
5. c – A
6. c
7. ~~c~~ b
8. c
9. a
10. d
11. a
12. d
13. b
14. d
15. c
16. d
17. c
18. b
19. d
20. a
21. d
22. d
23. b
24. b
25. a
26. b
27. b
28. c
29. b
30. a
31. b
32. d
33. c
34. b
35. b
36. c
37. b
38. c
39. a
40. b
41. d
42. d
43. d
44. a
45. c
46. d
47. d
48. b
49. b
50. c
51. c 52. d

MODULE XI ELECTRICAL CONTROLS AND DEVICES

1. b
2. a
3. b
4. b
5. b
6. d
7. b
8. c
9. d
10. a
11. b
12. d
13. c
14. d
15. a
16. a
17. c
18. a
19. a
20. b
21. c
22. b
23. b
24. d
25. a
26. c
27. c
28. c
29. b
30. d
31. b
32. d
33. a
34. a
35. a
36. a
37. c
38. a
39. c
40. d
41. c
42. b
43. d
44. d
45. c
46. d
47. b
48. a
49. b
50. b

MODULE XII ELECTRONIC CONTROLS AND DEVICES

1. b
2. d
3. a
4. c
5. a
6. b
7. b
8. c
9. a
10. d
11. c
12. b
13. a
14. d
15. b
16. a
17. b
18. c
19. c
20. a
21. d
22. c
23. a
24. b
25. a
26. d
27. c
28. a
29. c
30. b
31. b
32. b
33. c
34. a
35. b
36. a
37. b
38. c
39. b
40. d
41. a
42. c
43. a
44. b
45. b
46. a
47. c
48. c
49. d
50. a

MODULE XIII MOTOR REPAIR

1. b
2. d
3. a
4. c
5. a
6. d
7. b
8. a
9. b
10. a
11. b
12. b
13. a
14. c
15. c
16. b
17. c
18. d
19. a
20. a
21. c
22. d
23. d
24. a
25. b
26. d
27. b
28. b
29. a
30. b
31. c
32. a
33. b
34. b
35. a
36. c
37. d
38. b
39. b
40. c
41. a
42. a
43. a
44. b
45. d
46. c
47. a
48. a
49. c
50. b