CONTENT

PREPARING FOR AN OPEN BOOK EXAM

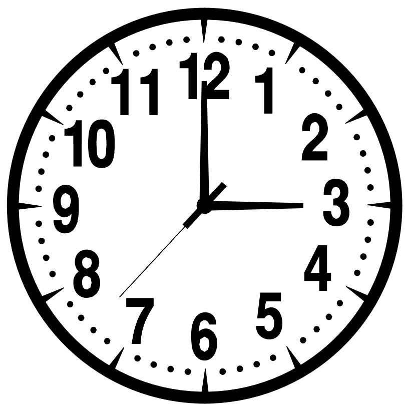
Open Book

Most applicants agree this is the most difficult part of an electrical exam. Time becomes such an important factor. 50 open book questions are to be answered in two hours or 100 questions in four hours on the Journeyman exam.

Open book is a test of your knowledge and use of the National Electrical Code. 86% of the open book Journeyman questions are from the Code book.

Your score on the open book exam depends on how familiar you are with the Code book. Most exam applicants run out of time and are not able to find all the answers to the questions within the limited time.

Journeyman Exam
50 Questions
2 Hour Time Limit



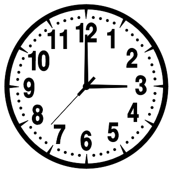
That averages to
2.4 minutes
per question

The key to an open book exam is not to spend too much time on one question. If the question does not contain a key word that you can find in the index, **skip this question**, and continue to the next question. If you spend 3 minutes, 5 minutes, 6 minutes on a question and never find the answer you are eating into the time that should be used for the answers you can find.

In general, there are usually 8 to 10 really difficult questions on an exam. The remaining questions after proper preparation, you will be able to find within the alotted time. Skip these 8 or 10 as you recognize them and move on finding the other answers. If you answer 40 questions correctly out of a total of 50 questions your score would be 80%! That's better than in some cases where the applicant hasn't even answered 20 questions and time has run out. You **can't** spend 5 or 6 minutes on a question. Never leave a question unanswered, unanswered is counted wrong. Always select a multiple choice answer before time runs out.

Proper preparation is so important in passing an open book exam. Don't be guilty of reading a question and feeling, "I know the answer so I won't bother looking in the Code book." The following pages will prove how this can be a big mistake. I teach by being properly prepared with how to find your way around in the Code book. You'll be able to look up all the answers within the time limit.

The difficulty occurs when you say Code book.



Your score on the open book exam depends on how familiar you are with the **Code book**. Most exam applicants **run out of time** and are not able to find all the questions and select a choice of answer within the limited time.

Test question writers hope the question is never copied.

Their score is instantaneous but they **never know what questions were wrong** or where their weaknesses are.

The elusive license, is still unattainable at this point. How would the applicant ever find out what the **correct answer** is? They are not permitted to ever knowing the **correct answer**. How are you to be educated if you **never** know the correct answer?

The only time you will ever know the "**correct answer**" is when you read *Tom Henry Books* where from all the years of studying the intent of the NEC from the TCD, TCR giving the substantiation for each of the new safety rules or deletions from the NEC each three years.

At my age 84, I've been through 21 code cycles and written over 100 electrical books which will give you the **correct answer** in full detail.

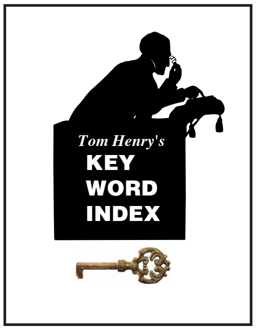
•The Code is Truly a "National" Code. - The men who freely contribute their time and study to the writing of the Code come from all over the United States and thus the final document represents a nationwide cross-section of opinion.

•The Code is an "American Standard." - The fact that the writers of the Code are organized under the procedure of the American Standards Association makes this possible. This simply means that the Code is officially recognized as representing standard American practice. It is a simple standard; there is no need for necessity for anyone to develop another code; the National Electrical Code is sufficient. Proof of this is the fact that cities and other governmental bodies all over the United States have adopted it as the *safety standard for electrical installations*, in spite of the fact that the Code itself, being written by a technical association, has no legal or mandatory status whatsoever.

The National Electrical Code is based on the fact that **to do less would be a hazard**. Many of the sections of the NEC are a result of known fire; incorporating corrections into the NEC each three years is an attempt to prevent similar occurrences.

Every rule in your safety manual is written in somebody's blood. The freedom and safety that you and I enjoy in our communities in large part is due to the sacrifice of others.

THE OPEN BOOK EXAM



The best reference book for locating words in the Code book is "The Key Word Index". This book contains every important word in the Code book with section number and page number. **Now you can find what you're looking for in seconds!** Now you'll be able to show them out on the job where it says that in the Code book. Try it once and you'll never be without it.

The "***ULTIMATE***" Code package includes the ***2023*** NEC, *Tom Henry* 68 TABS (installed), KEY WORD INDEX, REMINDER BOOK, 14 pages of FORMULA INSERTS, plus over 3,600 ***KEY*** Code references **HI-LITED**!

Will Rogers once said, "You can't come back from someplace you've never been." This book will take you there.

•If you focus first on figuring out what the answer is, **before looking at the options given**, it will force you to think back to the text or the lecture where you first heard this information.

This process helps to improve your concentration, and will exercise your memory.

•If you are really stuck on a question, make your best guess and put a question mark next to it. If you finish the test with time to spare, go back and reconsider the ones you marked.

If you do not want to guess, skip the question and put a mark beside it, so you can return to it if you have time at the end of the test.

•Skip answers when you are stuck, but try to get back to them if you can – **it's best to answer every question you can**, within the allotted time frame.

•Forget about always sticking to your first choice. Many people say that your first guess on a test question is usually right, so you should never change your answer. However, recent studies have shown that isn't the case – you're just as likely, or even more likely, to get it right if you change an answer you aren't sure about. So don't stress over whether to change an answer because it wasn't your first choice. **If you change your mind, change your answer**.

•Data collected from takers shows that test-takers who changed some of their answers tended to score higher than those who always stuck with their first choice.

Test takers in the study most often changed answers from wrong to right, which resulted in a higher score.

To pass the exam is very simple, it takes work! Like with anything in life, you get out of it what you put into it. The more time you spend preparing for the exam, the easier it will become. As you work these exams and grade yourself, hi-lite the answers with a marking pen in your Code book, or better yet purchase the "Ultimate Code Book" which has the complete package for taking an electrical exam.

The key to the exam is that the student must first **understand** the question, which requires **careful reading of each word.**

Read this sentence:

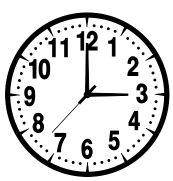
FINISHED FILES ARE THE RE- SULT OF YEARS OF SCIENTIF- IC STUDY COMBINED WITH THE EXPERIENCE OF YEARS.

Now read it once more, and count the **F's** in the sentence. How many did you find?

(a) 3 (b) 4 (c) 5 (d) 6

If you are a careful reader, you will find all **6** F's.

Most applicants taking an exam are not familiar enough with the Code book and it's easy to understand why only 30 out of 100 pass an electrical exam. Many are ***unsuccessful*** because they failed to ***read*** the question correctly.



Your score on the open book exam depends on how familiar you are with the **Code book**. Most exam applicants run out of time and are not able to find all the answers to the questions within the limited time.

Number skills can be tested with math problems or interpreting plans, charts and graphs. You may wonder whether to concentrate on improving your strong areas or on building some background in your fields of ***weakness***. Working more practice exams, broader coverage, would be included for those subjects which are more important in your work. Now weigh your strengths and weaknesses against the job requirements and prepare accordingly.

NEC Code consists of **9 chapters** each dividing into four groupings: General Requirements; Specific Requirements; Communications Systems and Tables

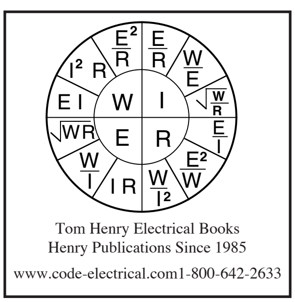
Chapter 1: General
Chapter 2: Wiring and Protection
Chapter 3: Wiring Methods and Materials
Chapter 4: Equipment for General Use
Chapter 5: Special Occupancies
Chapter 6: Special Equipment
Chapter 7: Special Conditions
Chapter 8: Communications Systems
Chapter 9: Tables – Conductor and Raceway Specifications

I agree with questions from theory-Ohm’s law, voltage drop, ampacity, tools, plan reading.

But the difficulty for the applicant comes **from asking questions from all nine chapters** of the National Electrical Code.

The preparation for the exam should educate the dangers of the **behavior of electricity**, the overload, short circuit, the explosion, the fire, the injuries, the deaths.

For some electricians, it has been twenty years or more since they have used math formulas, theory, and calculations. For most, the last time was an apprenticeship class. Now, for the exam, we are required to be an expert in the reading of the Code and in applying all of the tables and demand factors to the calculations.



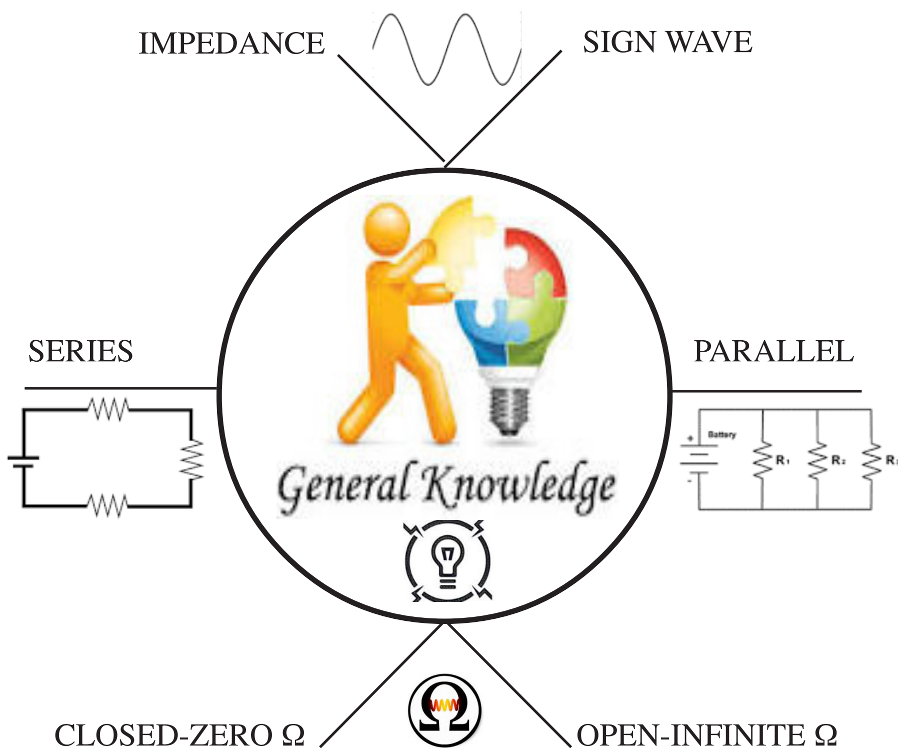
The most difficult task in preparing for the electrical exam is trying to "memorize" the formulas. You increase the strength of your memory by *overlearning the subject* and that’s what our books are about. Our books will show an easier way to study. Study smarter, not harder.

Memorization is the process of committing something to memory. The act of memorization is often a deliberate mental process undertaken in order **to store in memory for later recall.** Memory is the “process of retaining information over time.”

Memorization is a frontage road: It runs parallel to the best parts of learning, never intersecting. It's a detour around all the action, ***a way of knowing without learning***. Only through sustained effort of **rehearsing information are we able to memorize data for longer than a short period of time**.

We tend to remember things that interest us or are made memorable to us.

GENERAL KNOWLEDGE CATEGORIES

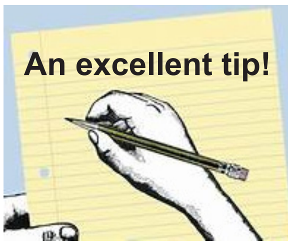


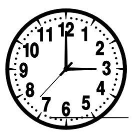
General knowledge is information that has been accumulated over time through various mediums, sources. It excludes specialized learning that can only be obtained with extensive training and information confined to a single medium.

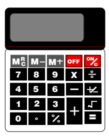
General Knowledge or General Awareness is an important and common section in all competitive and government recruitment examinations.

Hand-writing is a powerful tool for memorization, and it is even more effective if you do it repeatedly. **Get out a pen and paper and start hand-writing what you need to memorize**.

The **General Knowledge** exam questions your knowledge on "Other than Code questions." Some questions may seem difficult for you, but they represent every conceivable type of question encountered on previous electrical exams.







Instead of marking your choice of answer in the book, write it on a separate paper, that way you can retake the exam over until you feel you understand the question and answer.

The exams are ***timed based***, so write down the time you start and finish the practice exam.

25 questions at 2.4 minutes per question = 60 minutes. **Spend an hour a day** working a practice exam and see your scoring increase!

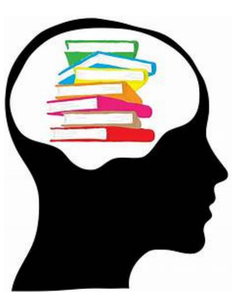
Start now by *reading the question carefully* using your formula sheets and calculator.

To grade your exam:
Count the number of correct answers
and divide by the number of questions 25.
Example: 19 correct answers ÷ 25 questions = 76%

General knowledge categories such as the behavior of electricity, theory, Ohm's Law, ac-dc power, voltage drop, power factor, efficiency, cost, tools, safety, plan reading, specifications, etc.

The **general knowledge** categories test your knowledge of what you have learned from the years spent in the electrical field to **qualify** to take the exam. How much can you remember from your training?

The NEC is updated every 3 years, **general knowledge** categories remain the same over the years in most cases.



There is no NEC section to locate for **general knowledge** questions, you must select the correct answer by **memory**. These are the questions where **formulas** come into play.

Georg Simon Ohm

The German physicist is well known today for his formulation of a law, termed Ohm's law, describing the mathematical relationship between electrical current, resistance and voltage.

Ohm's law. The principle is named after the German scientist Georg Simon Ohm. Ohm demonstrated that there are no "perfect" electrical conductors through a series of experiments in 1825. Every conductor he tested offered some level of resistance. These experiments led to Ohm's law.

In 1827 he discovered some laws relating to the strength of a current in a wire. Ohm found that electricity acts like *water* in a pipe. It is a simple law that states the relationship between voltage, current, and resistance in a mathematical equation.

Ohm discovered that the current in a circuit is directly proportional to the electric pressure and inversely to the resistance of the conductors.

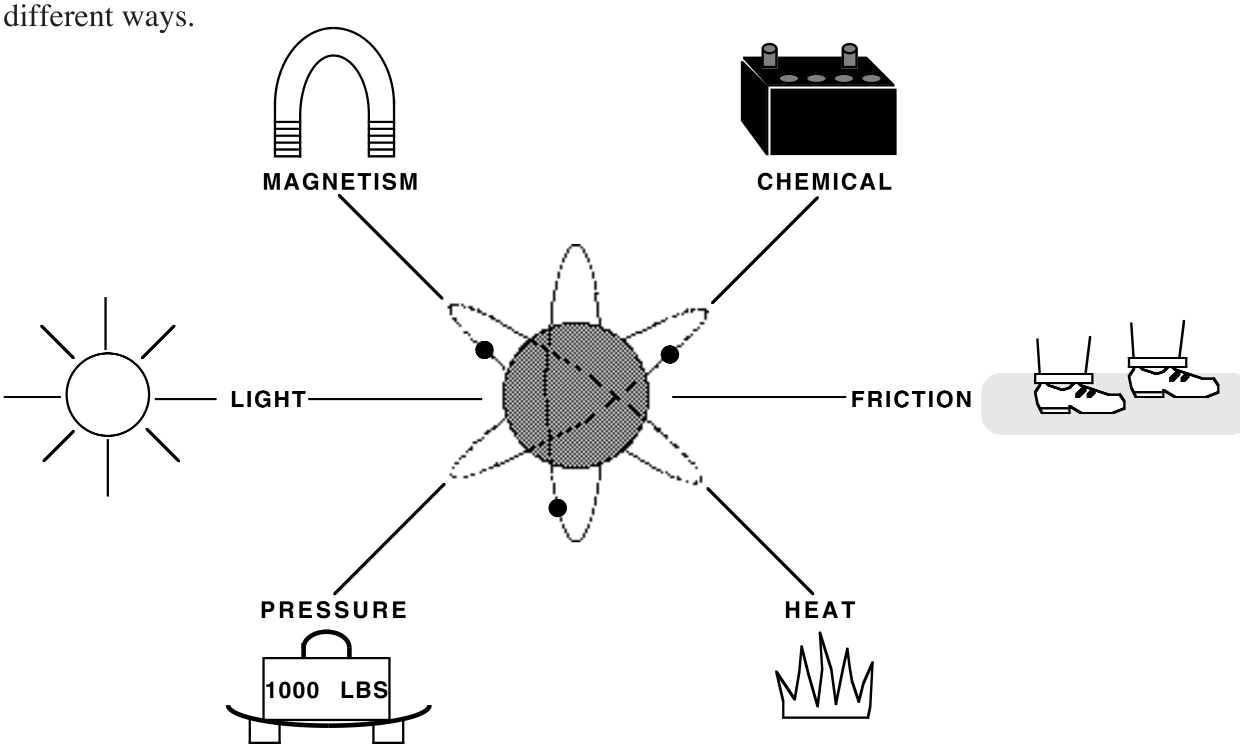
Ohm's Law can be used to verify voltage drop. In a DC circuit, voltage equals current multiplied by resistance. $E = I\,R$.

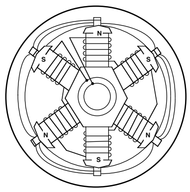
Ohm's Law is one of the most important things that you will use throughout your electrical career. It is a mathematical tool which is of the greatest use in determining an *unknown* factor of voltage, current or resistance in an electrical circuit in which the other two factors are known.

Electricity was **discovered**, not invented. The dictionary defines it as "one of the fundamental entities in nature."

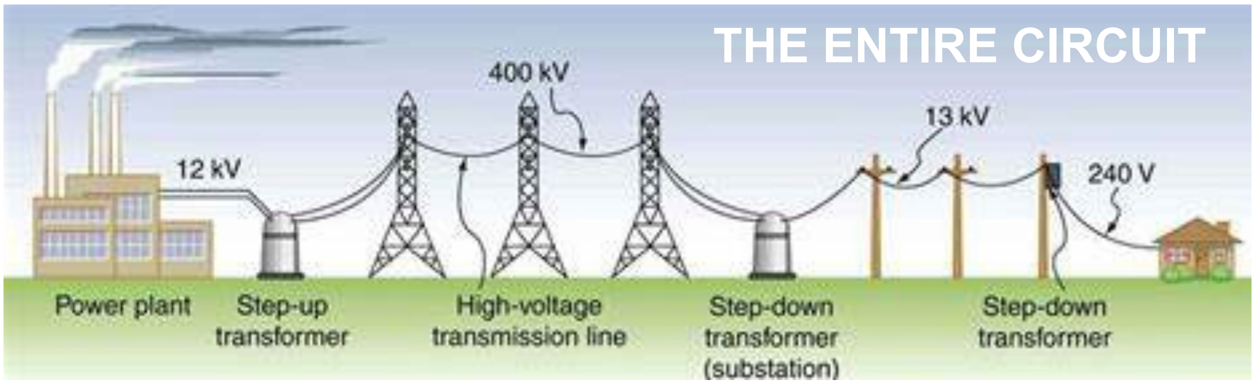
Today it is generally agreed that electric current flow is comprised of moving electrons. This is called the **electron theory**. Electrons are very tiny particles of matter.

Electricity is **produced** when electrons are freed from their atoms. This can be done from six different ways.





The number one producer of electrical energy is the generator which employs the principle of **electromagnetic** induction.

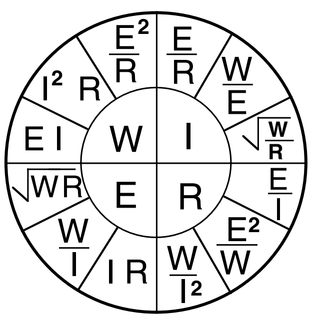


The key to the exam is that the student must first **understand** the question, which requires **careful reading of each word.**

Education is what you have left over when you subtract what you've forgotten from what you've learned.

It is often what we think we know already that often prevents us from learning.

Knowledge has to be improved, challenged, and increased constantly, or it vanishes.



OHM'S LAW

It is a simple law that states the relationship between voltage, current and resistance in a mathematical equation.

In electrical terms, voltage is represented by the letter "E" (electromotive force), current by the letter "I" (intensity), and resistance by the letter "R".

The Ohm's Law formula cannot work properly unless all values are expressed in the **correct units** of measurement:

VOLTAGE is always expressed in VOLTS
CURRENT is always expressed in AMPERES
RESISTANCE is always expressed in OHMS

We must first understand how the electrical system functions and then mathematical analysis can follow.

Since you cannot visually **see** the flow of electrons, current, etc. and you need to **see** the relationship between voltage, current, and resistance, let's do it with some **terms** which you are more familiar with, using **water**.

WATER	**ELECTRICITY**
PUMP	GENERATOR
PIPE	CONDUCTOR
PRESSURE	VOLTAGE
FLOW OF GALLONS	AMPERES
RESTRICTION	RESISTANCE

The **generator** is like a **water pump**, the prime mover.

The **conductor** is like the **water pipe**, the larger the conductor, the less the resistance and the more flow.

The **voltage** is like the **water pressure**, the force pushing.

The **amperes** are like the **flow of water**, an amount of current flowing is like the gallons per minute in water.

The **resistance** is like the **restriction** in the water pipe. A reduction in the water pipe size would cause opposition to the amount of gallons per minute, as would the resistor in an electrical circuit. It limits the flow of current.

Watts (power) is expressing the **rate of work** involved; the power required. With water it requires more work to pump water up to a water tower than it would to pump water at ground level. Wattage is the rate at which the electrical energy is changed into another form of energy, such as light or heat. The faster a lamp changes electrical energy, the brighter it will be.

Horsepower (hp) is the unit of measurement for mechanical power which is equal to 33,000 foot-pounds per minute. One horsepower is developed when the product of the distance and pounds equals 33,000 and this is done in one minute. In electrical terms, one horsepower = **746 watts**. One horsepower is developed if 33,000 pounds are lifted one foot in one minute. This represents the **work** done by the **output** of a motor.

OHM'S LAW DEFINITIONS

(E) VOLT: The practical unit of voltage; the pressure required to force one ampere through a resistance of one ohm. To make electrons flow in a conductor, an electrical pressure must be applied and this is called electromotive force (EMF) or voltage.

(I) AMPERE: The practical unit of electric current flow; the electric current that will flow through one ohm under a pressure of one volt.

(Ω) OHM: The practical unit of electrical resistance; the resistance through which one volt will force one ampere.

(R) RESISTANCE: The opposition which a device or material offers to the flow of current; the opposition which results in the production of heat in the material carrying the current. Resistance is measured in ohms. All resistances have two dimensions: cross-sectional area and length.

(W) POWER: The rate at which electrical energy is delivered and consumed. Power is measured in watts. A motor produces mechanical power measured in horsepower. A heater produces heat (thermal) power. A light bulb produces both heat and light power (usually measured in candlepower).

Electrical power is equal to voltage times the amperage. **W = E x I**

Ohm's Law states: In a DC circuit, the current is directly proportional to the voltage and inversely proportional to the resistance. In other words, the water flowing in a pipe (amperage) will be increased if the water pressure (voltage) is increased. And, if the restriction (resistance) in the pipe is **less**, the water flow (amperage) will be **more**.

SERIES CIRCUIT

An electric circuit is a complete path through which electrons can flow from the negative terminal of the voltage source, through the connecting wires, through the load or loads, and back to the positive terminal of the voltage source. A complete circuit is made up of a voltage source, connecting wires, and the effective load.

If the circuit is arranged so that the electrons have only **one possible path**, the circuit is called a **series circuit**.

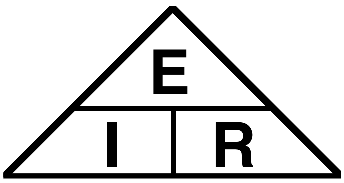
SERIES CIRCUIT

•*Actual exam question.* Other factors remaining the same, the effect on the current flow in the circuit would cause the current to ____if the applied voltage was doubled.

(a) double (b) divide by 2 (c) remain the same (d) increase 4 times

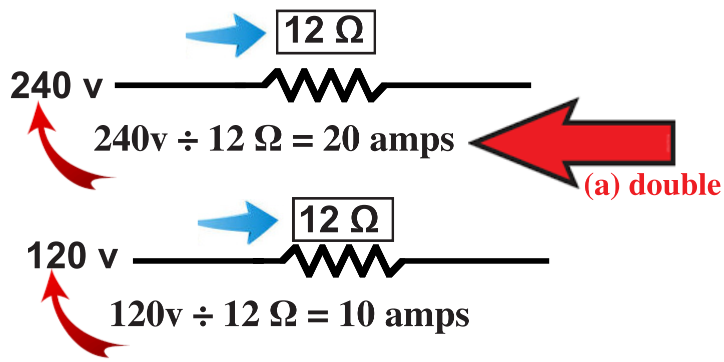
•Answer: To solve an unknown, you will need to know two knowns.

The Ohm's Law Triangle



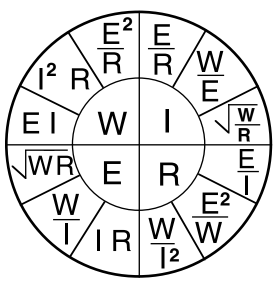
E = voltage
I = intensity of current (amps)
R = ohms of resistance

I = E ÷ R



Actual exam question. A 3Ω, 6Ω, 9Ω and a 12Ω resistor are connected in series @ 120 volts. The resistor that will consume the most power is the ____ .

(a) 3Ω (b) 6Ω (c) 9Ω (d) 12Ω



Answer:

Resistance adds in series 3 Ω + 6 Ω + 9 Ω + 12 Ω = **30 ohms**
Find I = E ÷ R
I = 120v ÷ 30 Ω = **4 amps flows through the entire circuit**

W = I²R

4a x 4a x 3 Ω = 48 watts
4a x 4a x 6 Ω = 96 watts
4a x 4a x 9 Ω = 144 watts
4a x 4a x **12 Ω = 192 watts**
Total 480 watts

Actual exam question. In the series circuit below, which resistor will consume the most power? Use 2 amps flow.

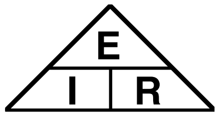
(a) 2Ω (b) 4Ω (c) 6Ω (d) 8Ω

Answer: **W = I² x R**

2a x 2a x 2Ω = 8 watts 2a x 2a x 4Ω = 16 watts
2a x 2a x 6Ω = 24 watts 2a x 2a x **8Ω = 32 watts**

Actual exam question. A 6 volt lead-acid battery has an internal resistance of 0.01Ω. How much current will flow if the battery has a short circuit?

(a) zero (b) infinity (c) 6 amps (d) 600 amps



Answer: I = E ÷ R   6 volt ÷ .01Ω = 600 amps

Actual series exam questions.

• When two resistances are connected in series, ____.

(a) voltage across them must be the same (b) current in each resistor will be the same
(c) there will be no current in the circuit (d) they will become inductive

• When one resistance in a series circuit is open ____.

(a) the voltage is zero across the open resistance
(b) the current is zero in all the resistances
(c) the current is maximum in the normal resistances
(d) the current increases in the voltage source

• To increase voltage output, battery cells are connected in ____.

(a) series (b) parallel (c) series-parallel (d) parallel-series

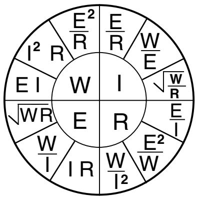
• In a series circuit with unequal resistances the ____.

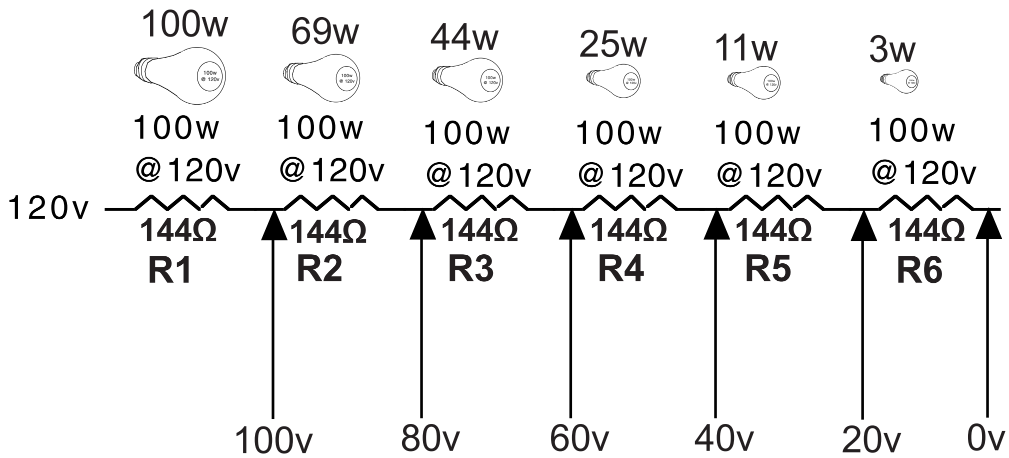
(a) highest resistance has the highest current
(b) lowest resistance has the highest current
(c) lowest resistance has the highest voltage
(d) highest resistance has the highest voltage

SUMMARY SERIES CIRCUIT

•The same current flows through each part of a series circuit.
•The total resistance is equal to the sum of individual resistances.
•The total voltage across a series circuit is equal to the sum of individual voltage drops.
•The voltage drop across a resistor is proportional to the size of the resistor.
•The total power dissipated is equal to the sum of the individual power dissipations.

Voltage Drop in a Series Circuit

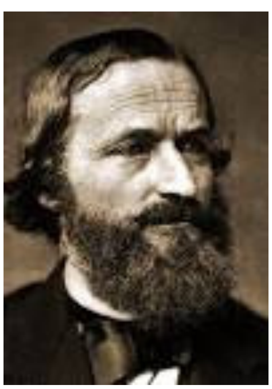




Resistance adds in series. **144 ohm** x 6 = **864** ohms total resistance series circuit.
The current flowing is I = E ÷ R 120v ÷ 864 Ω = **.1388 amp**.
VD = I x R .13888888888 amp x 864 ohm = 120 volts dropped.

Voltage **Drop** at:
R1 = .1388 x 144Ω = 19.99 or 20v
R2 = .1388 x 288Ω = 39.97 or 40v
R3 = .1388 x 432Ω = 59.96 or 60v
R4 = .1388 x 576Ω = 79.94 or 80v
R5 = .1388 x 720Ω = 99.93 or 100v
R6 = .1388 x 863Ω = 119.92 or 120v

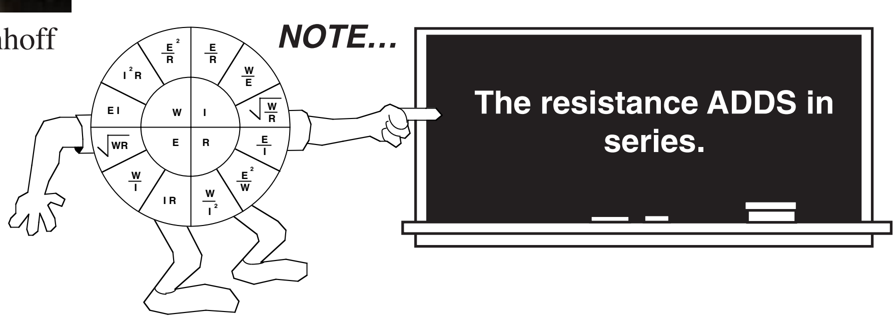
The Voltage at:
R1 = 120v
R2 = 100v
R3 = 80v
R4 = 60v
R5 = 40v
R6 = 20v



Gustav Kirchhoff

Kirchhoff's Voltage Law: "The sum of the voltage drop is equal to the source voltage."

Kirchhoff's circuit laws state that in any DC circuit, the sum of the voltage drops across each component of the circuit is equal to the supply voltage.



Actual Ohm's Law exam questions.

• The difference of electrical potential between two conductors of a circuit is the____.

(a) resistance (b) amperage (c) voltage (d) wattage

• The load in an electrical circuit is used to ____.

(a) generate electrical energy (b) transmit electrical energy
(c) utilize the electrical energy (d) cause a voltage drop

• Of the six ways of producing emf, which method is used the least?

(a) pressure (b) solar (c) chemical action (d) friction

• The continuity of a coil of winding may be determined by measuring the resistance of the coil. If the resistance measured is infinite, the coil winding is ____.

(a) partially shorted (b) totally shorted (c) open (d) in good condition

• Which of the following will **not** affect the resistance of a circuit?

(a) Length of the Conductor (b) Diameter of the Conductor
(c) Insulation of the Conductor (d) Temperature

• If you double the voltage in a circuit and cut the resistance in half, the current will become ____.

(a) the same as before (b) twice as great (c) half as great (d) four times as great

• A wire has a resistance of 5 ohms. What will be the resistance of another wire of the same material three times as long and half the cross sectional area?

(a) 7.5Ω (b) 15Ω (c) 30Ω (d) 50Ω

• The sum of series voltage drops ____.

(a) equals the average value of all voltage drops (b) equals the applied voltage
(c) is usually more than the applied voltage (d) is less than the smallest voltage drop

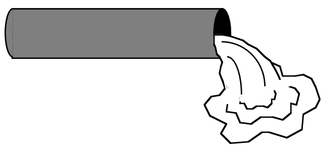
• A length of wire has a resistance of 10 ohms. What is the resistance of a wire of the same material three times as long and twice the cross-sectional area?

(a) 5 Ω (b) 15 Ω (c) 20 Ω (d) 30 Ω

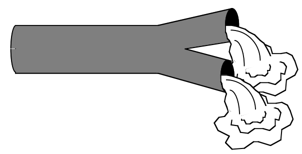
PARALLEL CIRCUIT

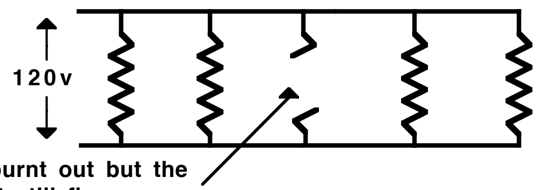
A parallel circuit is a circuit having **more than one path** for current to flow from a common voltage source.

SERIES CIRCUIT HAS ONLY ONE PATH



PARALLEL CIRCUIT HAS MORE THAN ONE PATH

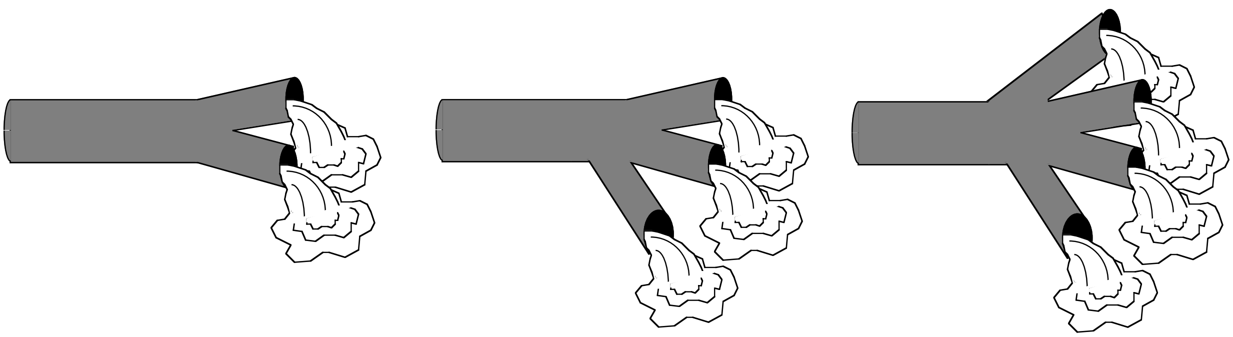




Bulb burnt out but the current still flows through the other bulbs.

In parallel the lights are connected **side-by-side** instead of end-to-end so that there exists more than one path through which current can flow.

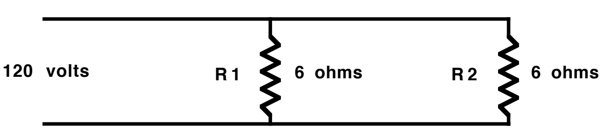
In a parallel circuit the **total** resistance is **less** than the size of the smallest load. And, everytime you **add** another load to the circuit the **total** resistance will be **less**.



Each time a pipe (load) is **added** the total restriction (resistance) is **less**. By adding another pipe you create another path for the flow. With the addition of a another pipe you have more flow (amperage), the only way you can have more flow (amperage) is to have less restriction (resistance).

EQUAL PARALLEL RESISTANCES

The simplest calculation for total resistance in a parallel circuit is when all of the loads are **equal** in resistance.



• Checkpoint: Apply the formula for total resistance in parallel for **equal** resistors.

$$\frac{\text{Resistance of one}}{\text{Number of resistors}} = 6\ \Omega \div 2 \text{ resistors} = \mathbf{3\ \Omega\ total\ resistance\ in\ parallel}.$$

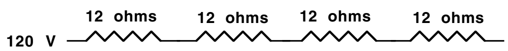
Actual exam question. Four heater coils with a given voltage will consume the most power when connected ____.

(a) all in series (b) two in parallel (c) all in parallel (d) two parallel pair in series

Answer: In series the resistance adds to 48 ohms. In parallel equal resistors are the resistance of ONE ÷ the number of resistors = 12 ÷ 4 = 3 ohms TOTAL resistance.

W = E² ÷ R

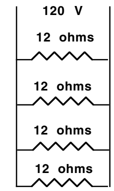
SERIES



120v x 120v = 14400 ÷ 48 Ω = **300 watts**

PARALLEL

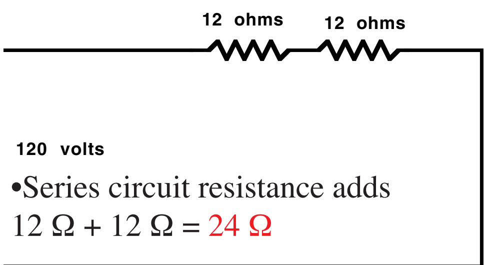
120v x 120v = 14400 ÷ 3 Ω = 4800 watts



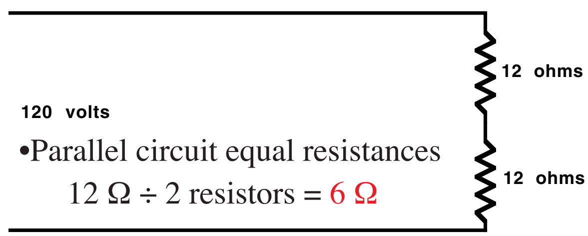
Actual exam question: If two equal resistances connected in series across a circuit are now connected in parallel across the same supply, the power produced will be ____ that of the series connection.

(a) one-fourth (b) one-half (c) two times (d) four times

Answer:



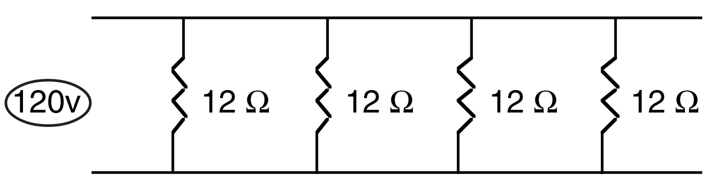
W = E² ÷ R

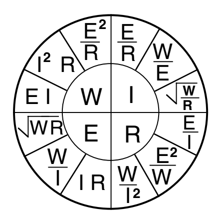


Series: 120v x 120v = 14400 ÷ 24 Ω = **600** watts power

Parallel: 120v x 120v = 14400 ÷ 6Ω = **2400** watts power

Actual exam question. What is the total wattage of the four parallel - 12Ω loads @ 120 volts?





(a) 300 watts (b) 2400 watts (c) 4800 watts (d) none of these

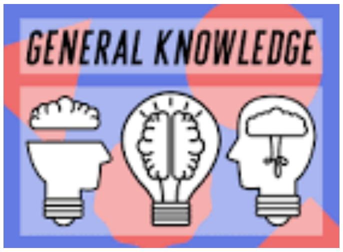
W = E² ÷ R *Answer*: 120v x 120v = 14400 ÷ 3 Ω = 4800 watts

Actual exam question. What is the power of the four parallel - 12Ω loads @ 240 volts?

(a) 4800 watts (b) 9600 watts (c) 19,200 watts (d) none of these

Answer: 240v x 240v = 57600 ÷ 3 Ω = 19,200 watts

Note. By doubling the voltage from 120v to 240v the power was increased four times.



GENERAL KNOWLEDGE EXAM #1
25 Questions
30 Minute Time Limit

1. When a switch is closed, it has a total resistance of ____.

(a) infinity (b) unstable value (c) un-readable (d) zero

2. What is the function of the zero adjust control in a multimeter?

(a) With this control, the sensitivity of the instrument can be changed
(b) The zero point is corrected with the help of this control
(c) It serves to conduct the current
(d) The moving parts can be tightened

3. The wattmeter ____.

(a) has three connections, two of which are used at a time
(b) can measure DC power but not 60 Hz AC power
(c) has voltage and current coils to measure real power
(d) measures apparent reactive power and resistance

4. Which of the following will not cause a major error in an ohmmeter reading?

(a) A small change in the resistance to be measured
(b) A slight error in the range switch selection
(c) A small voltage between points under test
(d) A slight change in switchable internal resistance

5. An open coil can be detected by a ____ reading.

(a) high resistance (b) potentiometer (c) dynamometer (d) high voltage

6. In making a resistance test, remember that the resistance of a short circuit is ____.

(a) approximately zero
(b) midway between high and low
(c) infinite
(d) slightly above the midrange

7. An open resistor when checked with an ohmmeter reads ____.

(a) infinite (b) zero (c) low but not zero (d) high but within the tolerance

8. The continuity of a coil of winding may be determined by measuring the resistance of the coil. If the resistance measured is infinite, the coil winding is ____.

(a) partially shorted (b) totally shorted (c) open (d) in good condition

9. A/an ____ is a device actuated by the operation of some devices with which it is directly associated, to govern succeeding operations of some or allied devices.

(a) interlock (b) relay (c) starter (b) coil

10. Parallel battery cells have the same voltage as one cell but have ____.

(a) less current capacity (b) more current capacity
(c) unstable resistance (d) none of these

11. In relation to a transformer, the ratio 20:1 indicates that ____.

(a) there are 20 turns in the primary and 1 turn in the secondary
(b) secondary voltage is 1/20 of the primary voltage
(c) for every 20 turns on the primary, there is one turn on the secondary
(d) all of these

12. In a DC generator, a ____ is used to convert AC output of the armature coils into DC.

(a) rotor (b) slip ring (c) commutator (d) magnetic field

13. A test lamp using a light bulb is used to test a/an ____.

(a) polarity check (b) AC or DC check (c) overload test (d) ground check

14. An exposed wiring method using cleats, knobs, tubes and flexible tubing for the protection and support of single insulated conductor run in or on a building and not concealed by the building structure is ____.

(a) armored cable wiring (b) metal clad cable wiring
(c) open wiring on insulators (d) concealed knob and tube wiring

15. Electrons on the outer shell are called _____ electrons.

(a) conductor (b) inside shell (c) valence (d) outside shell

16. When the battery cells are in series, voltages add; while current capacity is ____.

(a) zero (b) the same as one cell (c) infinite (d) the sum of each cell

17. A 6 volt lead-acid battery has an internal resistance of 0.01Ω. How much current will flow if the battery has a short circuit?

(a) zero (b) infinity (c) 6 amps (d) 600 amps

18. An ion ____.

(a) is electrically neutral
(b) has a positive charge
(c) has a negative charge
(d) might have either a positive or negative charge

19. In a parallel circuit, the voltage across each branch is ____ the source voltage.

(a) equal to (b) greater than (c) less than (d) none of these

20. When a 60 watt bulb is connected in series with a 500 watt room heater and the bulb is replaced with a 25 watt bulb on a 120 volt circuit the ____.

(a) heater output will decrease
(b) heater output will increase
(c) bulb will not glow
(d) heater output will remain unchanged

21. The valence electron of a conductor is also called a ____.

(a) proton (b) free electron (c) bound electron (d) positron

22. In a center-tapped circuit, ____transformer secondary voltage is utilized.

(a) one fourth (b) one third (c) one half (d) full

23. If the secondary voltage of a transformer is step-down, the primary will have ____.

(a) half as many turns as the secondary (b) fewer turns than the secondary
(c) more turns than the secondary (d) as many turns as the secondary

24. Capacitors are used in electric circuits to ____.

(a) store energy
(b) introduce a voltage drop
(c) produce a low opposition path to high frequencies
(d) all of these

25. In a parallel circuit with an unequal resistance on each branch ____.

(a) the power drawn on each branch is equal
(b) the current on each branch is equal
(c) the voltage across each branch is equal
(d) none of these

JOURNEYMAN OPEN BOOK EXAM #1 25 Questions One Hour Time Limit

1. Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ____.

(a) ungrounded (b) neutral (c) equipment grounding (d) grounded

2. The connection between the grounded circuit conductor and the equipment grounding conductor, or the supply-side bonding jumper, or both at the service is recognized as the ____.

(a) neutral conductor (b) equipment bonding jumper
(c) main bonding jumper (d) grounding electrode conductor

3. When calculating floor area for branch circuit load calculations, the floor area is measured from the ____ dimensions of the building, dwelling unit, or area involved.

(a) drawing (b) scale (c) outside (d) inside

4. NM cable shall be permitted to be laid in notches of wooden studs where the NM cable at those points is protected by a steel plate at least ____ thick to cover the area of the wiring.

(a) 1/16" (b) 3/32" (c) 1/8" (d) 3/16"

5. A motor control center in an equipment room requires GFCI protected 125-volt, single-phase, 15 or 20 amp rated receptacle outlet within ____ feet.

(a) 25 (b) 30 (c) 45 (d) 50

6. Alternating current snap switches shall be permitted for control of inductive loads not exceeding ____ of the ampere rating of the switch at the applied voltage.

(a) 70% (b) 60% (c) 50% (d) 33%

7. Other than the required interconnections and control wiring, only those conductors that are intended for termination in a/an ____ section of a switchboard or switchgear shall be located in that section.

(a) isolated (b) horizontal (c) vertical (d) dual

8. Plate electrodes shall be installed not less than ____ below the surface of earth.

(a) 2 feet (b) 2 1/2 feet (c) 3 feet (d) 4 feet

9. Each grounded conductor shall terminate within the panelboard in a/an ____ terminal that is not also used for another conductor.

(a) single (b) multiwire (c) dual (d) individual

10. In dwelling units, GFCI protection is required for all 15 and 20 ampere, 125 volt receptacles are installed within ____ feet of the outside edge of a bathtub or shower stall.

(a) 4 (b) 6 (c) 8 (d) 12

11. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably ____.

(a) isolated (b) locked (c) guarded (d) insulated

12. All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground in kitchens or areas with a/an ____ and permanent provisions for either food preparation or cooking shall have GFCI protection for personnel.

(a) sink (b) oven (c) range (d) fryer

13. As it relates to load calculations, calculations shall be permitted to be rounded to the nearest whole ampere, with decimal fractions smaller than ____ dropped.

(a) 0.5 (b) 0.05 (c) 0.6 (d) 0.8

14. GFCI protection shall be provided for lighting outlets not exceeding ____ volts installed in crawl spaces.

(a) 115 (b) 120 (c) 150 (d) 300

15. Each section of equipment that requires rear or side access to make field connections shall be so marked by the manufacturer on the ____.

(a) front (b) right side (c) left side (d) rear

16. In other than one and two family dwellings, a receptacle outlet for indoor service equipment shall be located within ____ of the service equipment.

(a) 25 feet (b) 50 feet (c) 75 feet (d) the same room or area

17. Insulated conductors used inside switchgear or switchboards are required to be ____.

(a) suitable (b) labeled (c) acceptable (d) listed

18. GFCI protection shall be provided for ____ receptacles.

(a) equipment requiring servicing **(b) permanently installed fire alarm**
(c) permanently installed burglar alarm **(d) industrial laboratories**

19. All lamps for general illumination in temporary wiring installations shall be protected from accidental contact or breakage by a suitable ____ or lampholder with a guard.

(a) screen (b) luminaire (c) barrier (d) guard

20. In addition to the number of 120 volt, single-phase branch circuits required in other areas of a dwelling, at least one additional ___ ampere branch circuit shall be provided to supply the laundry receptacle outlet in the laundry room. The circuit shall have no other outlets.

(a) 15 (b) 20 (c) 25 (d) 30

21. Disregarding demand factors, the calculated lighting load for a 5,000 sq.ft. office building is ____ volt-amperes.

(a) 16,500 (b) 15,400 (c) 8,000 (d) 6,500

22. Appliance receptacle outlets installed in a dwelling unit for specific appliances, such as laundry equipment, shall be installed within ____ of the intended location of the appliance.

(a) 24” (b) 36” (c) 48” (d) 72”

23. Decorative lighting and similar accessories used for holiday lighting and similar purposes shall be listed and ____.

(a) marked (b) approved (c) labeled (d) stamped

24. Outlets supplying all pool motors on branch circuits rated 150 volts or less to ground and ____ amperes or less, single or 3 phase, shall be provided with Class A GFCI protection.

(a) 60 (b) 50 (c) 40 (d) 30

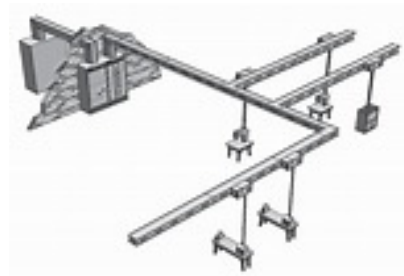
25. Disconnecting means shall be located within sight from, and ____ from air-conditioning or refrigerating equipment.

(a) serviceable (b) isolated (c) accessible (d) readily accessible

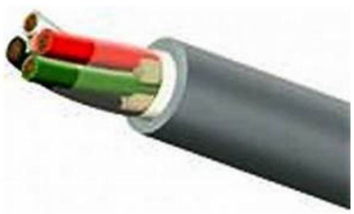
EXAM #1 - Fill in the blank with the correct letter shown below.

#1 ____.

#2 ____.



#3____.



#4 ____.

#5. ____.

#6. ____.

#7. ____.

#8. ____.

#9. ____.

A - ARTICLE 376 Metal Wireways

I -ARTICLE 390 Underfloor Raceways

F -ARTICLE 392 Cable Trays

H -ARTICLE 340 Underground Feeder and Branch Circuit Cable Type UF

B -ARTICLE 368 Busways

D -ARTICLE 326 Integrated Gas Spacer Cable Type IGS

G -ARTICLE 342 Intermediate Metal Conduit Type IMC

C- ARTICLE 320 Armored Cable Type AC

E -ARTICLE 336 Power and Control Tray Cable Type TC

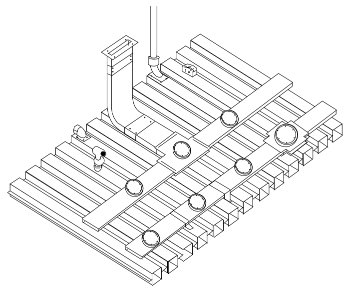
EXAM #2 - Fill in the blank with the correct letter shown below.

#1 ____.

#2 ____.

#3 ____.

#4 ____.



#5 ____.

#6 ____.

#7 ____.

#8 ____.

#9 ____.

A -ARTICLE 352 Rigid Polyvinyl Chloride Conduit Type PVC

B -ARTICLE 386 Surface Metal Raceways

C -ARTICLE 374 Cellular Metal Floor Raceways

D -ARTICLE 350 Liquidtight Flexible Metal Conduit Type LFMC

E -ARTICLE 344 Rigid Metal Conduit Type RMC

F -ARTICLE 366 Auxiliary Gutters

G -ARTICLE 334 Nonmetallic-Sheathed Cable: Types NM, NMC

H -ARTICLE 332 Mineral-Insulated, Metal-Sheathed Cable Type MI

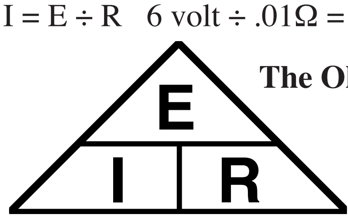
I -ARTICLE 348 Flexible Metal Conduit Type FMC

GENERAL KNOWLEDGE ANSWERS EXAM #1

1. **(d) zero**
2. **(b) The zero point is corrected with the help of this control**
3. **(c) has voltage and current coils to measure real power**
4. **(a) A small change in the resistance to be measured**
5. **(a) high resistance**
6. **(a) approximately zero**
7. **(a) infinite**
8. **(c) open**
9. **(a) interlock**
10. **(b) more current capacity**
11. **(d) all of these**
12. **(c) commutator**
13. **(d) ground check**
14. **(c) open wiring on insulators**
15. **(c) valence**
16. **(b) the same as one cell**
17. **•(d) 600 amps (answer in detail below)**
18. **(d) might have either a positive or negative charge**
19. **(a) equal to**
20. **•(a) heater output will decrease (answer in detail below)**
21. **(b) free electron**
22. **(c) one half**
23. **(c) more turns than the secondary**
24. **(d) all of these**
25. **(c) the voltage across each branch is equal**

•17. To solve an unknown, you will need to know two knowns.

I = E ÷ R   6 volt ÷ .01Ω = 600 amps

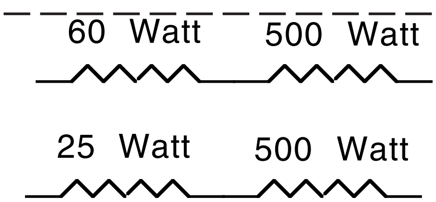


The Ohm's Law Triangle

E = voltage

I = intensity of current (amps)

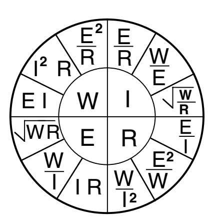
R = ohms of resistance



Solve resistance: $E^2 \div W$

120v x 120v = 14,400 ÷ 60w = 240Ω

120v x 120v = 14,400 ÷ 25Ω = 576Ω



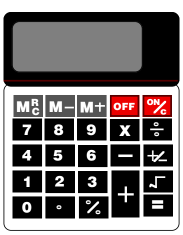
The 25 watt bulb increases resistance which will decrease the output wattage.

ANSWERS

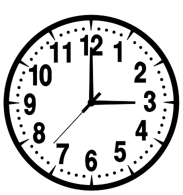
2023 JOURNEYMAN OPEN BOOK EXAM #1 - ANSWERS

1. (a) ungrounded	210.4(B)
2. (c) main bonding jumper	DEF 100
3. (c) outside	220.5(C)
4. (a) 1/16”	300.4(A)(1)
5. (a) 25 feet	210.63
6. (c) 50%	404.14(B)(2)
7. (c) vertical	408.3(A)(2)
8. (b) 2 1/2 feet	250.53(A)(5)
9. (d) individual	408.41
10. (b) 6 feet	210.8(A)(10)
11. (c) guarded	110.26(B)
12. (a) sink	210.8(B)(3)
13. (a) 0.5 dropped	220.5(B)
14. (b) 120 volts	210.8(C)
15. (a) front	408.18(C)
16. (d) same room or area	210.63(B)(1)
17. (d) listed	408.19
18. (a) equipment requiring service	210.8(E)
19. (b) luminaire	590.4(F)
20. (b) 20 amp	210.11(C)(2)
21. (d) 6500va	T. 220.42 (A) 5000sq.ft. x 1.3va = 6500va
22. (d) 72”	210.50(C)
23.(c) labeled	590.5
24. (a) 60 amp	680.22(A)(4)
25. (d) readily accessible	440.14

Hi Lite each answer in your Code Book



After completing the exam, grade yourself by counting the correct number of questions and divide by the number of questions answered.
Example: 19 correct answers ÷ 25 questions = 76%.



Time limit 60 minutes ÷ 25 questions = 2.4 minutes per question!