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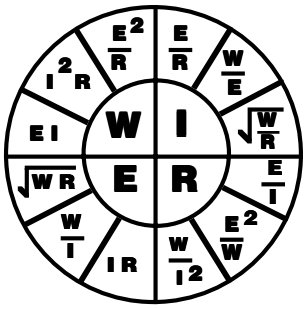
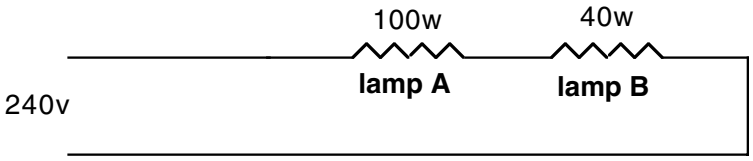
Examples:



1. The total circuit resistance would be ____ ohms.



Solution: $R = E^2 \div W$ 240v x 240v ÷ 100w = 576Ω
240v x 240v ÷ 40w = 1440Ω
Resistance adds in series 576Ω + 1440Ω = **2016 R total.**

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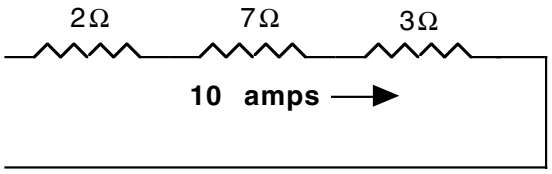
2. The applied voltage in the circuit below would be ____.



Solution: E = I x R The loads are connected in series so the resistance would add together 2Ω + 7Ω + 3Ω = 12Ω total. 10 amps x 12 ohms = **120 volts applied.**

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3. The voltage drop across the 15Ω resistor is ____volts.

Solution: VD = I x R The total resistance is 15Ω + 25Ω + 60Ω = 100Ω.
Next find the current flow in the circuit.
I = E ÷ R = 240v ÷ 100Ω = 2.4 amps flowing through the series circuit. 2.4a x 15Ω = **36 volts** is dropping at the 15Ω.

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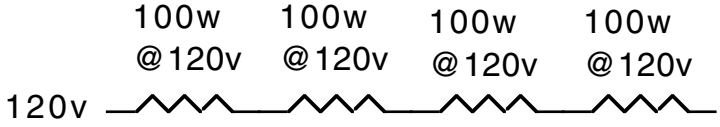
4. What is the total power of these four light bulbs?



Solution: First find the fixed resistance. $R = E^2/W$. Then find $W = E^2/R$
120v x 120v ÷ 100w = 144Ω. Resistance adds in series for a total of 576 ohms.
120v x 120v ÷ 576Ω = **25 watts.**

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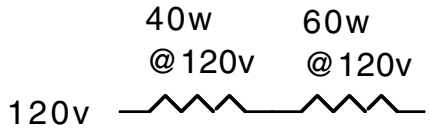
5. What is the total wattage of these two light bulbs?



Solution: First find the fixed resistance. $R=E^2/W$ 120v x 120v ÷ 40w = 360Ω. 120v x 120v ÷ 60w = 240Ω.Resistance adds in series for a total of 600 ohms. Then solve $W = E^2/R$ 120v x 120v/600Ω = **24 watts.**

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6. The current flow through a 10Ω resistor is 5 amps. The power consumed by this load would be ____ watts.

(a) 50 (b) 2 (c) 500 [(d) 250]

Solution: $W = I^2 \times R$ 5a x 5a = 25 amps x 10Ω = **250 watts.**

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7. A wire with a resistance of 0.491Ω per k/ft would have a resistance of ____ Ω for nine feet of wire.

[(a) .004419] (b) 4.419 (c) .4419 (d) .04419

Solution: 0.491 Ω x .009 feet = **.004419 Ω**

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8. A load 6Ω and a 3Ω are connected in parallel. The total resistance would be ___ Ω.

(a) 9 [(b) 2] (c) 18 (d) 1

Solution: R = R1 x R2 ÷ R1 + R2 = 6Ω x 3Ω = 18Ω ÷ (R1 + R2) 9Ω = **2 Ω**

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9. When a number of resistances are connected in parallel, the total resistance will always be ____.

(a) greater than the smallest resistance
(b) greater than the largest resistance
[(c) less than the smallest resistance]
(d) none of these

Safety

In the mid-1970s, OSHA determined that the NEC did not adequately address electrical safety as it related to people (the NEC is used only to cover installation), so OSHA asked the NFPA for help. In response, the first edition of NFPA 70E was published in 1979.

The document the NFPA produced is called NFPA 70E.

NFPA 70E is a standard that focuses on **protecting people** and identifies requirements that are considered necessary to provide a workplace that is generally free from electrical hazards. NFPA 70E is intended to address conditions that exist, and abnormal conditions where **people** can become involved.

NFPA 70E, titled Standard for Electrical Safety in the Workplace, is a standard of the National Fire Protection Association. The document covers electrical safety requirements for employees.

NFPA 70E identifies the requirements for enhanced **personal safety.** It is growing in recognition as an extremely important national consensus standard that defines the requirements for an overall electrical safety program. It is being adopted widely by organizations across the U.S. National consensus standards, like NFPA 70E, may be entered into evidence in a court of law.

As a national consensus safety standard, NFPA 70E is not a law and it has not been incorporated into the Code of Federal Regulations. Therefore, compliance is not deemed mandatory. Even so, OSHA has cited NFPA 70E in cases where lack of compliance has resulted in a workplace accident.

NFPA 70E applies to **employees** who work on or near exposed energized electrical conductors or circuit parts. This includes electrical maintenance personnel, operators, troubleshooters, electricians, linemen, engineers, supervisors, site safety personnel or anyone exposed to energized equipment of **50 volts or more**.

The National Electrical Code® is generally considered an electrical installation document and protects employees under normal circumstances. NFPA 70E is intended to provide guidance with respect to electrical safe work practices.

Locks and tags both are required if they can be installed on circuits with an operating voltage of **50 volts or greater**. Lockout is only one step in establishing a safe work condition.

If the liveparts operating at **50 volts or more** are not placed in an electrically safe work condition, other safety-related work practices shall be used to protect employees who might be exposed to the electrical hazards involved.

Electrical equipment can produce either a shock or an arc.

A shock hazard analysis shall determine the voltage to which personnel will be exposed, boundary requirements, and the PPE necessary in order to minimize the possibility of electrical shock to personnel. The degree of risk increases as the voltage increases.

Safety Exam Questions

1. An outstanding cause of accidents is the improper use of tools. The most helpful conclusion you can draw from this statement is that ____.

(a) most tools are defective
(b) most workers are poorly trained
(c) many accidents involving the use of tools are unavoidable
(d) many accidents involving the use of tools occur because of poor working habits

2. Which of the listed conditions can be considered as the single greatest cause of accidents?

(a) Speed (b) Excessive knowledge or skill (c) Human error (d) Excitement

3. The principal objection to using water from a hose to put out a fire involving electrical equipment is that ____.

(a) it may spread the fire
(b) metal parts may rust
(c) serious shock may result
(d) fuses may blow