

**Registration form**

**Basic Electricity CEU Training Course \$200.00  
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL \$50.00**

Start and Finish Dates: \_\_\_\_\_ *You will have 90 days from this date in order to complete this course*

List number of hours worked on assignment must match State Requirement. \_\_\_\_\_  
California DPH gives 5 hours and other States is 8 or 10 or 12 hours.

Name \_\_\_\_\_ Signature \_\_\_\_\_  
*I have read and understood the disclaimer notice on page 2. Digitally sign XXX*

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Operator ID# \_\_\_\_\_ Exp Date \_\_\_\_\_

**Please circle/check which certification you are applying the course CEU's.**

Water Treatment \_\_\_\_\_ Distribution \_\_\_\_\_ Collection \_\_\_\_\_

Wastewater Treatment \_\_\_\_\_ Other \_\_\_\_\_

**Technical Learning College PO Box 3060, Chino Valley, AZ 86323**

**Primary Fax (928) 272-0747 [info@tlch2o.com](mailto:info@tlch2o.com)**

**Telephone (928) 468-0665 Toll Free (866) 557-1746**

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***We will stop mailing the certificate of completion we need your e-mail address. We will e-mail the certificate to you, if no e-mail address; we will mail it to you.***

## **DISCLAIMER NOTICE**

I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

**State Approval Listing Link**, check to see if your State accepts or has pre-approved this course. Not all States are listed. Not all courses are listed. If the course is not accepted for CEU credit, we will give you the course free if you ask your State to accept it for credit.

**Professional Engineers**; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

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<http://www.tlch2o.com/downloads/PDF/CEU%20State%20Approvals.pdf>

*You can obtain a printed version of the course from TLC for an additional \$169.95 plus shipping charges.*

## **AFFIDAVIT OF EXAM COMPLETION**

I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

## **Grading Information**

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

## CERTIFICATION OF COURSE PROCTOR

Technical Learning College requires that our students who takes a correspondence or home study program course must pass a proctored course reading, quiz and final examination. The proctor must complete and provide to the school a certification form approved by the commission for each examination administered by the proctor.

**Instructions.** When a student completes the course work, fill out the blanks in this section and provide the form to the proctor with the examination.

Name of Course: \_\_\_\_\_

Name of Licensee: \_\_\_\_\_

**Instructions to Proctor.** After an examination is administered, complete and return this certification and examination to the school in a sealed exam packet or in pdf format.

I certify that:

1. I am a disinterested third party in the administration of this examination. I am not related by blood, marriage or any other relationship to the licensee which would influence me from properly administering the examination.
2. The licensee showed me positive photo identification prior to completing the examination.
3. The enclosed examination was administered under my supervision on \_\_\_\_\_. The licensee received no assistance and had no access to books, notes or reference material.
4. I have not permitted the examination to be compromised, copied, or recorded in any way or by any method.
5. Provide an estimate of the amount of time the student took to complete the assignment.

Time to complete the entire course and final exam. \_\_\_\_\_

Notation of any problem or concerns:

Name and Telephone of Proctor (please print):

\_\_\_\_\_

\_\_\_\_\_

Signature of Proctor



# Basic Electricity CEU Course Answer Key

Name \_\_\_\_\_ Telephone # \_\_\_\_\_

Did you check with your State agency to ensure this course is accepted for credit?

You are responsible to ensure this course is accepted for credit. No refunds.  
Method of Course acceptance confirmation. Please fill this section

Website \_\_ Telephone Call\_\_ Email\_\_\_\_ Spoke to\_\_\_\_\_

Did you receive the approval number, if applicable? \_\_\_\_\_

What is the course approval number, if applicable? \_\_\_\_\_

*You can electronically complete this assignment in Adobe Acrobat DC.*

Please Circle, Bold, Underline or X, one answer per question. A **felt tipped pen** works best.

- |          |          |          |          |
|----------|----------|----------|----------|
| 1. AB    | 21. ABCD | 41. AB   | 61. AB   |
| 2. AB    | 22. ABCD | 42. AB   | 62. AB   |
| 3. AB    | 23. ABCD | 43. ABCD | 63. ABCD |
| 4. ABCD  | 24. ABCD | 44. ABCD | 64. ABCD |
| 5. ABCD  | 25. ABCD | 45. ABCD | 65. ABCD |
| 6. ABCD  | 26. ABCD | 46. ABCD | 66. ABCD |
| 7. ABCD  | 27. ABCD | 47. ABCD | 67. ABCD |
| 8. ABCD  | 28. ABCD | 48. ABCD | 68. ABCD |
| 9. AB    | 29. ABCD | 49. ABCD | 69. ABCD |
| 10. AB   | 30. ABCD | 50. AB   | 70. ABCD |
| 11. ABCD | 31. ABCD | 51. AB   | 71. ABCD |
| 12. ABCD | 32. AB   | 52. AB   | 72. ABCD |
| 13. ABCD | 33. ABCD | 53. AB   | 73. ABCD |
| 14. ABCD | 34. ABCD | 54. ABCD | 74. AB   |
| 15. ABCD | 35. ABCD | 55. AB   | 75. AB   |
| 16. ABCD | 36. ABCD | 56. ABCD | 76. AB   |
| 17. AB   | 37. ABCD | 57. ABCD | 77. AB   |
| 18. AB   | 38. ABCD | 58. AB   | 78. AB   |
| 19. ABCD | 39. AB   | 59. AB   | 79. AB   |
| 20. ABCD | 40. AB   | 60. AB   | 80. AB   |

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|--------------|--------------|--------------|--------------|
| 81. A B      | 115. A B C D | 149. A B C D | 183. A B     |
| 82. A B C D  | 116. A B C D | 150. A B C D | 184. A B     |
| 83. A B C D  | 117. A B C D | 151. A B C D | 185. A B     |
| 84. A B C D  | 118. A B C D | 152. A B C D | 186. A B C D |
| 85. A B C D  | 119. A B C D | 153. A B C D | 187. A B C D |
| 86. A B C D  | 120. A B C D | 154. A B C D | 188. A B C D |
| 87. A B C D  | 121. A B C D | 155. A B     | 189. A B     |
| 88. A B C D  | 122. A B C D | 156. A B     | 190. A B     |
| 89. A B C D  | 123. A B C D | 157. A B C D | 191. A B C D |
| 90. A B C D  | 124. A B C D | 158. A B C D | 192. A B C D |
| 91. A B C D  | 125. A B C D | 159. A B C D | 193. A B C D |
| 92. A B C D  | 126. A B C D | 160. A B C D | 194. A B C D |
| 93. A B      | 127. A B C D | 161. A B C D | 195. A B C D |
| 94. A B      | 128. A B C D | 162. A B C D | 196. A B C D |
| 95. A B C D  | 129. A B     | 163. A B C D | 197. A B C D |
| 96. A B      | 130. A B     | 164. A B     | 198. A B C D |
| 97. A B C D  | 131. A B     | 165. A B     | 199. A B C D |
| 98. A B C D  | 132. A B     | 166. A B     | 200. A B C D |
| 99. A B C D  | 133. A B     | 167. A B     | 201. A B C D |
| 100. A B C D | 134. A B C D | 168. A B     | 202. A B C D |
| 101. A B C D | 135. A B C D | 169. A B     | 203. A B C D |
| 102. A B C D | 136. A B C D | 170. A B C D | 204. A B C D |
| 103. A B C D | 137. A B C D | 171. A B C D | 205. A B C D |
| 104. A B C D | 138. A B C D | 172. A B C D | 206. A B     |
| 105. A B C D | 139. A B C D | 173. A B C D | 207. A B     |
| 106. A B C D | 140. A B C D | 174. A B C D | 208. A B C D |
| 107. A B C D | 141. A B C D | 175. A B C D | 209. A B C D |
| 108. A B C D | 142. A B C D | 176. A B C D | 210. A B C D |
| 109. A B C D | 143. A B C D | 177. A B C D | 211. A B C D |
| 110. A B C D | 144. A B C D | 178. A B C D | 212. A B C D |
| 111. A B C D | 145. A B C D | 179. A B C D | 213. A B C D |
| 112. A B C D | 146. A B C D | 180. A B C D | 214. A B C D |
| 113. A B C D | 147. A B C D | 181. A B     | 215. A B     |
| 114. A B C D | 148. A B C D | 182. A B     | 216. A B     |

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|--------------|--------------|--------------|--------------|
| 217. A B C D | 238. A B C D | 259. A B C D | 280. A B     |
| 218. A B C D | 239. A B C D | 260. A B C D | 281. A B C D |
| 219. A B C D | 240. A B C D | 261. A B C D | 282. A B C D |
| 220. A B C D | 241. A B C D | 262. A B C D | 283. A B C D |
| 221. A B C D | 242. A B C D | 263. A B C D | 284. A B C D |
| 222. A B     | 243. A B C D | 264. A B C D | 285. A B C D |
| 223. A B     | 244. A B C D | 265. A B C D | 286. A B C D |
| 224. A B C D | 245. A B C D | 266. A B C D | 287. A B C D |
| 225. A B C D | 246. A B C D | 267. A B C D | 288. A B C D |
| 226. A B C D | 247. A B C D | 268. A B C D | 289. A B C D |
| 227. A B C D | 248. A B C D | 269. A B C D | 290. A B C D |
| 228. A B C D | 249. A B C D | 270. A B C D | 291. A B     |
| 229. A B C D | 250. A B C D | 271. A B     | 292. A B     |
| 230. A B C D | 251. A B     | 272. A B     | 293. A B     |
| 231. A B     | 252. A B C D | 273. A B     | 294. A B C D |
| 232. A B     | 253. A B C D | 274. A B     | 295. A B C D |
| 233. A B     | 254. A B C D | 275. A B C D | 296. A B C D |
| 234. A B     | 255. A B     | 276. A B C D | 297. A B C D |
| 235. A B C D | 256. A B     | 277. A B C D | 298. A B     |
| 236. A B C D | 257. A B C D | 278. A B C D | 299. A B     |
| 237. A B C D | 258. A B C D | 279. A B C D | 300. A B C D |

## Disclaimer

I understand that this course will cover general laws, regulations, required procedures and work rules relating to electrical principles. It should be noted, however, that the federal and state regulations are an ongoing process and subject to change over time. This course is a continuing education course for employees who are learning general electrical principles but are not allowed to work on electrical projects unless qualified or licensed. It is not designed to meet the full requirements of the Department of Labor-Occupational Safety and Health Administration (OSHA) rules and regulations. Only qualified licensed electricians should be allowed to work on any or all electrical installations or components. This course will not qualify you to work on any type of electrical system or component. I understand that I am 100 percent responsible to ensure that TLC receives the Assignment and Registration Key and that it is accepted for credit by my State or Providence. I understand that TLC has a zero tolerance towards not following their rules, cheating or hostility towards staff or instructors. I need to complete the entire assignment for credit. There is no credit for partial assignment completion. My exam was proctored. I will contact TLC if I do not hear back from them within 2 days of assignment submission. I will forfeit my purchase costs and will not receive credit or a refund if I do not abide with TLC's rules.

**Please Sign that you understand and will abide with TLC's Rules.**

**Signature** \_\_\_\_\_

## **When finished with your assignment.**

Please scan the Registration Page, Answer Key and Driver's License and email it to [info@TLCH2O.com](mailto:info@TLCH2O.com).

If you are unable to scan, take a photo of these documents with your iPhone and send these to TLC, [info@TLCH2O.com](mailto:info@TLCH2O.com).

If you are unable to scan and email, please fax these to TLC,

**(928) 468-0675**

**If you fax, call to confirm that we received your paperwork.**

### **Rush Grading Service**

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of \$50.00. This fee may not cover postage costs. If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line. Thank you...

*Please e-mail or fax this survey along with your final exam*

**BASIC ELECTRICITY CEU TRAINING COURSE  
CUSTOMER SERVICE RESPONSE CARD**

NAME: \_\_\_\_\_

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***PLEASE COMPLETE THIS FORM BY CIRCLING THE NUMBER OF THE APPROPRIATE ANSWER IN THE AREA BELOW.***

Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

Please rate the subject matter on the exam to your actual field or work.

Very Similar 0 1 2 3 4 5 Very Different

How did you hear about this Course? \_\_\_\_\_

What would you do to improve the Course?

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How about the price of the course? Poor \_\_ Fair\_\_ Average\_\_ Good \_\_ Great \_\_

How was your customer service? Poor \_\_ Fair\_\_ Average\_\_ Good \_\_ Great \_\_

Any other concerns or comments.

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## Basic Electricity CEU Course Assignment

***The Basic Electricity CEU Assignment is available in Word on the Internet for your Convenience, please visit [www.ABCTLC.com](http://www.ABCTLC.com) and download the assignment and e mail it back to TLC.***

You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. If you should need any assistance, please email all concerns and the completed manual to [info@tlch2o.com](mailto:info@tlch2o.com).

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your manual and make copy for yourself.

**Multiple Choice, please select only one answer per question. There are no intentional trick questions.**

**Please write down any questions you were not able to find the answers or that have errors.**

### **The Wonder of Electricity**

1. Electrically charged matter is influenced by, and produces, electromagnetic fields.  
A. True      B. False
2. An electric field is an especially basic type of electromagnetic field produced by an electric charge even when it is not moving.  
A. True      B. False
3. Electromagnets: Moving charges make a magnetic field.  
A. True      B. False
4. Electrical charges produce \_\_\_\_\_ which act on other charges.  
A. Hertz                      C. Electromagnetic fields  
B. Electrical current      D. None of the above
5. The \_\_\_\_\_ produces a force on other charges in its vicinity.  
A. Electric field      C. Ampere(s)  
B. Electrical current      D. None of the above
6. Electric potential is the capacity of an electric field to do work on an electric charge, typically measured in?  
A. Electric charge      C. Hertz  
B. Volts                      D. None of the above
7. Which of the following is a movement or flow of electrically charged particles, typically measured in amperes?  
A. Hertz                      C. Ampere(s)  
B. Electrical current      D. None of the above

8. Electrical currents create magnetic fields, and changing magnetic fields generate?  
A. Power                      C. Electrical current(s)  
B. Charged matter      D. None of the above

### How Electricity Is Generated

9. A generator is a mechanism that converts mechanical mass into electrical energy.  
A. True              B. False
10. The small currents of individual sections inside a generator are added together to form one large current.  
A. True              B. False
11. When the electromagnetic shaft rotates, it induces a small \_\_\_\_\_ in each section of the wire coil.  
A. Electric charge      C. Conduction  
B. Electrical current    D. None of the above
12. An electric utility power station uses either a turbine, engine, water wheel, or other similar machine to drive an electric generator — a device that converts mechanical or \_\_\_\_\_ to electricity.  
A. Chemical energy    C. Ampere(s)  
B. Electrical current    D. None of the above

### Joules

13. According to the text, a thousand joules is equal to?  
A. 100 Amps                      C. 100 Hertz  
B. A British thermal unit      D. None of the above
14. Electrons are distributed from atom to atom, creating \_\_\_\_\_ from one end to other.  
A. An electrical current      C. A viable source of electricity  
B. Energy storage              D. None of the above
15. Which of the following measures how well something conducts electricity?  
A. Conductor(s)              C. Kinetic energy  
B. Its resistance              D. None of the above
16. Rubber, plastic, cloth, glass and dry air are good insulators and have?  
A. An electrical current              C. Very high resistance  
B. Good insulators                      D. None of the above

### Electrical Generation and Transmission

17. Generation and transmission of electrical energy, is known as the Tesla effect, can lift light objects and generate sparks, it is extremely inefficient.  
A. True              B. False
18. For large electrical demands electrical energy must be generated and transmitted continuously over conductive transmission lines.  
A. True              B. False

19. It was not until the discovery of the voltaic pile in the eighteenth century that \_\_\_\_\_ became available.

- A. An electrical current
- B. Energy storage
- C. A viable source of electricity
- D. None of the above

20. Which of the following store energy chemically and make it available on demand in the form of electrical energy?

- A. Conductor(s)
- B. The voltaic pile
- C. Kinetic energy battery
- D. None of the above

21. The battery's \_\_\_\_\_ is limited, and once discharged it must be disposed of or recharged.

- A. An electrical current
- B. Energy storage
- C. A viable source of electricity
- D. None of the above

22. The modern steam turbine developed by Sir Charles Parsons generates about 80 percent of the electric power in the world using?

- A. Natural resources
- B. Energy
- C. A variety of heat sources
- D. None of the above

### **Faraday's Homopolar Disc Generator**

23. Generators rely on Faraday's electromagnetic principle that a conductor linking a changing magnetic field induces a \_\_\_\_\_ across its ends.

- A. Potential difference
- B. Charge
- C. The form of electrical energy
- D. None of the above

24. The transformer intended that electrical power could be transmitted more efficiently at a higher voltage but?

- A. High electrical current
- B. Poor insulators
- C. Lower current
- D. None of the above

### **Common electrical units used in formulas and equations are:**

25. Which of the following is a unit of electrical potential or motive force - potential is required to send one ampere of current through one ohm of resistance?

- A. Volt
- B. Watt
- C. Ohm
- D. None of the above

26. Which of the following is a unit of resistance?

- A. Volt
- B. Watt
- C. Ohm
- D. None of the above

27. Power Factor is a ratio of watts to?

- A. Kilovolt Ampere
- B. Volt amperes
- C. Power Factor
- D. None of the above

28. Which of the following are units of current?

- A. Kilovolt Amperes
- B. Watts
- C. Amperes
- D. None of the above

29. Which of the following is the unit of electrical energy or power?

- A. Ampere
- B. Watt
- C. Static electricity
- D. None of the above

30. Which of the following is a product of volts and amperes as shown by a voltmeter and ammeter - in direct current systems the volt ampere is the same as watts or the energy?

- A. Volt
- B. Kilovolt Ampere
- C. Volt Ampere
- D. None of the above

31. According to the text, a Kilovolt Ampere - one kilovolt ampere – is known as?

- A. 500 Volts
- B. 1,000 Watt
- C. KVA
- D. None of the above

### **Static and Current Electricity**

32. Static electricity is an imbalance of electric charges within or on the surface of a material.

- A. True
- B. False

33. Static electricity charge remains until it is able to move away by means of an electric current or?

- A. Current electricity
- B. Release
- C. Electrical discharge
- D. None of the above

34. Which of the following is named in contrast with current electricity, which flows through wires or other conductors and transmits energy?

- A. Amperes
- B. Wattage
- C. Static electricity
- D. None of the above

### **Contact-induced Charge Separation**

35. Which of the following can be exchanged between materials on contact?

- A. Electron(s)
- B. The triboelectric effect
- C. Piezoelectric charge
- D. None of the above

36. Which of the following is the main cause of static electricity as observed in everyday life?

- A. Electron(s)
- B. The triboelectric effect
- C. Piezoelectric charge
- D. None of the above

37. Which of the following causes your hair to stand up and causes static cling?

- A. Electron(s)
- B. Piezoelectric effect
- C. Contact-induced charge separation
- D. None of the above

### **Electromagnets and Electromagnetism**

#### **Magnetic field circles around a current**

38. Ørsted's slightly obscure words were that " \_\_\_\_\_ acts in a revolving manner."

- A. Electric conflict
- B. A positive current
- C. The electric conflict
- D. None of the above

39. Magnetic fields exist around all sides of a wire carrying an electric current and there is a direct relationship between electricity and magnetism.

- A. True
- B. False

40. In Ørsted's experiments, the force on the compass needle did not direct it to or away from the current-carrying wire, but acted at right angles to it.

- A. True      B. False

41. The force was not dependent on the direction of the current, for if the flow was reversed, then the force remained the same.

- A. True      B. False

### **Electric Current**

42. The movement of electric charge is known as an electric current, the intensity of which is usually measured in amperes.

- A. True      B. False

43. Which of the following can consist of any moving charged particles?

- A. Current                      C. Electrical conduction  
B. Speed of light      D. None of the above

44. Which of the following is defined as having the same direction of flow as any positive charge it contains?

- A. Electric conflict                      C. Electrical spark(s)  
B. A positive current                      D. None of the above

45. The movement of negatively charged electrons around an electric circuit, one of the most familiar forms of current, is thus deemed positive in the opposite direction to that of the?

- A. Electrons                                      C. Positive-to-negative convention  
B. Electromagnetic emissions                      D. None of the above

46. Which of the following can consist of a flow of charged particles in either direction or even in both directions at once, depending on the conditions?

- A. Electrons                                      C. Positive-to-negative convention  
B. Electromagnetic emissions                      D. None of the above

47. Which of the following passes through a material is termed electrical conduction?

- A. Electric current                                      C. Metallic conduction  
B. Electromagnetic current                                      D. None of the above

48. Which of the following is where electrons flow through a conductor such as metal, and electrolysis?

- A. Electric current                                      C. Metallic conduction  
B. Electromagnetic current                                      D. None of the above

49. While the particles themselves can move rather slowly, sometimes with an average drift velocity only fractions of a millimeter per second, the electric field that drives them itself propagates at close to the?

- A. Speed of light                                      C. Electric power  
B. Electromagnetic emissions                                      D. None of the above

### **What is Electric Power?**

50. Electric power is the rate at which electric energy is transported by an electric circuit.

- A. True      B. False

51. The SI unit of power is the watt, one joule per second.  
A. True      B. False

**Water and Electrical Principles are Very Similar**

52. The electronic–hydraulic analogy is the most widely used analogy for "Hydraulic fluid" in a metal conductor.

A. True      B. False

53. Electricity was understood to be a kind of energy, and the names of certain electric quantities are derived from heating equivalents.

A. True      B. False

54. Since electric current is invisible and the processes at play in electronics are often difficult to demonstrate, the various electronic components are represented by?

A. Volts                                      C. Hydraulic equivalents  
B. Hydraulic ohm analogy      D. None of the above

**Basic Ideas**

55. Large tanks of water are held up high, or are filled to differing water levels, and the potential energy of the water head is the pressure source.

A. True      B. False

56. Flow and pressure variables can be calculated in fluid flow network with the use of the?

A. Electron fluids      C. Hydraulic ohm analogy  
B. Pressures              D. None of the above

**Component Equivalents**

57. If water is flowing horizontally, so that the force of gravity can be overlooked, and then electric potential is equivalent to?

A. Nothing to the circuit      C. Pressure  
B. Force of gravity              D. None of the above

58. Electric potential: In general, it is equivalent to kinetic energy.

A. True      B. False

59. Connecting one end of a wire to a circuit is equivalent to forcibly un-capping one end of the pipe and attaching it to another pipe.

A. True      B. False

60. When comparing to a piece of wire, a water pipe should be thought of as having semi-permanent caps on the ends.

A. True      B. False

61. Memristor is a needle valve operated by a flow meter.

A. True      B. False

62. A capacitor cannot "filter out" constant pressure differences.

A. True      B. False

63. A wire with only one end attached to a circuit will do nothing; the pipe remains capped on the free end, and?

- A. Voltage in a capacitor
- B. Force of gravity
- C. Thus adds nothing to the circuit
- D. None of the above

64. Normally measured in amperes, current is equivalent to a \_\_\_\_\_; that is, the volumetric quantity of flowing water over time.

- A. Stretched rubber
- B. Flow meter
- C. Hydraulic volume flow rate
- D. None of the above

65. A transistor is a valve in which a diaphragm, controlled by a low-current signal moves \_\_\_\_\_ which affects the current through another section of pipe.

- A. A plunger
- B. Voltage in a capacitor
- C. A needle valve
- D. None of the above

66. An Inductor is a heavy paddle wheel placed in?

- A. Potential difference
- B. Feedback control
- C. The current
- D. None of the above

67. The inductor and its blades are analogous to inductance, and friction between its axle and the axle bearings corresponds to?

- A. Resistance to current
- B. Water level
- C. The mass and surface area of the wheel
- D. None of the above

68. The perfect voltage source, or ideal battery is a dynamic pump with?

- A. Potential difference
- B. Feedback control
- C. Water flow
- D. None of the above

69. Another analogy is \_\_\_\_\_, if one terminal is kept fixed at ground, sufficiently large that the drawn water does not affect the water level.

- A. Quantity of water
- B. Water level
- C. A large body of water at a high elevation
- D. None of the above

70. All pipes have \_\_\_\_\_, just as all wires have some resistance to current.

- A. Quantity of water
- B. Water level
- C. Some resistance to flow
- D. None of the above

71. Voltage is also called voltage drop or?

- A. Valve assembly
- B. Potential difference
- C. A positive displacement pump
- D. None of the above

72. According to the text, electric charge is equivalent to?

- A. Resistance to current
- B. Quantity of water
- C. The mass and surface area of the wheel
- D. None of the above

73. As with a diode, a small pressure difference is needed before the valve opens. In addition, like a diode, too much reverse bias can damage or destroy the?

- A. Valve assembly
- B. Feedback control
- C. A positive displacement pump
- D. None of the above

74. A resistor is considered a constriction in the bore of the pipe that requires less pressure to pass the same amount of water.

- A. True
- B. False

75. Voltage is the difference in pressure between two points, usually measured in volts.

- A. True
- B. False

76. A diode is equivalent to a two-way check valve with a tight valve seal.

- A. True
- B. False

### Understanding Voltage

77. Voltage, electrical potential difference, electric tension or electric pressure and measured in units of electric potential.

- A. True
- B. False

78. Volts, or joules per coulomb is the electric potential difference between two points, or the difference in electric potential energy of a unit charge transported between two points.

- A. True
- B. False

79. Voltage is electric potential energy per unit charge, measured in amps per coulomb.

- A. True
- B. False

80. Electric potential is mathematically expressed as the line integral of the electric field and the time rate of change of voltage.

- A. True
- B. False

81. The electric potential of a material is not even a well-defined quantity, since it varies on the subatomic scale.

- A. True
- B. False

82. A voltmeter can be used to measure the \_\_\_\_\_ between two points in a system?

- A. Energy
- B. Electric potential
- C. Voltage
- D. None of the above

83. Voltage can be caused by \_\_\_\_\_ or, by electric current through a magnetic field, by time-varying magnetic fields, or some combination of these three.

- A. Static electric fields
- B. Electromotive force
- C. Electric potential difference
- D. None of the above

84. Which of the following is defined so that negatively charged objects are pulled towards higher voltages?

- A. Voltage
- B. Electromotive force
- C. Electric potential difference
- D. None of the above

85. Which of the following must be distinguished from electric potential energy by noting that the "potential" is a "per-unit-charge" quantity?

- A. Pressure
- B. Electric potential
- C. Charge
- D. None of the above

86. Which of the following is equal to the work done per unit charge against a static electric field to move the charge between two points?

- A. Energy
- B. Electric potential
- C. Voltage
- D. None of the above

87. Which of the following along with the dynamic electromagnetic field must be included in determining the voltage between two points?

- A. Electric current
- B. Electromotive force
- C. A static (unchanging) electric field
- D. None of the above

88. Which of the following is now obsolete but tension is still used?

- A. Pressure
- B. Electric potential
- C. Charge
- D. None of the above

89. Which of the following may represent either a source of energy or lost, used, or stored energy?

- A. Voltage
- B. Electromotive force
- C. Electric potential difference
- D. None of the above

90. Which of the following can flow from lower voltage to higher voltage, but only when a source of energy is present to "push" it?

- A. Pressure
- B. Current
- C. Charge
- D. None of the above

91. Which of the following is not the only issue determining charge flow?

- A. Electric field
- B. Electromotive force
- C. Resistance
- D. None of the above

### **Faraday's Law**

92. Any change in the magnetic environment of a coil of wire will cause a \_\_\_\_\_ to be "induced" in the coil.

- A. Voltage
- B. Magnetic field strength
- C. Magnetic flux in the loop constant
- D. None of the above

### **Lenz's Law**

93. When an EMF is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced EMF is such that it produces a current whose magnetic field opposes the change that produces it.

- A. True
- B. False

94. The induced magnetic field inside any loop of wire always acts to keep the induced electromotive force in the loop constant.

- A. True
- B. False

**The most widespread version of Faraday's law states:**

95. Which of the following terms in any closed circuit is equal to the negative of the time rate of change of the magnetic flux through the circuit?

- A. An electromagnet
- B. Magnetic flux
- C. The induced electromotive force
- D. None of the above

**Electrical Generator**

96. If a wire is connected through magnetic flux in the loop constant, current will flow, and thus electrical energy is generated, converting the mechanical energy of motion to electrical energy.

- A. True
- B. False

97. Which of the following generated by Faraday's law of induction due to relative movement of a circuit and a magnetic field?

- A. EMF
- B. Electrical energy
- C. Magnetic flux in the loop constant
- D. None of the above

98. An electromotive force is created when a permanent magnet is moved relative to?

- A. An electromotive force
- B. Magnetic flux
- C. A conductor
- D. None of the above

99. With Faraday's disc example, the disc is rotated in a uniform magnetic field perpendicular to the disc, causing a current to flow in the radial arm due to the?

- A. An electromotive force
- B. Magnetic flux
- C. Lorentz force
- D. None of the above

**Understanding Resistance**

100. Except in particular superconductor materials, \_\_\_\_\_ generally do not freely flow.

- A. Electron(s)
- B. Potential difference
- C. Resistance
- D. None of the above

101. No electrons move at all until the voltage or \_\_\_\_\_ is very high, typically thousands of volts.

- A. EMF
- B. Size of the charge
- C. Amperes
- D. None of the above

102. In those materials with high \_\_\_\_\_ few electrons will move.

- A. Amps
- B. Current
- C. Resistance
- D. None of the above

103. Resistance is measured in \_\_\_\_\_ and is designated by the symbol  $\Omega$  (omega).

- A. Ohms
- B. Size of charge
- C. Potential difference
- D. None of the above

**Measuring Resistance**

104. The symbol "V" is used to represent something called the?

- A. Current difference
- B. Potential difference
- C. Ampere difference
- D. None of the above

105. Which of the following is the amount of work done in moving a charge between two points, divided by the size of the charge?

- A. Current difference
- B. Potential difference
- C. Ampere difference
- D. None of the above

106. The potential difference is measured in volts, and potential is commonly referred to as voltage. "I" is the symbol for current and "R" is the symbol for the? of the system.

- A. Ohms
- B. Potential difference
- C. Resistance
- D. None of the above

107. Current is measured in amperes and resistance is measured in?

- A. Ohms
- B. Potential difference
- C. Resistance
- D. None of the above

**Ohm's Law tells us that:**

108. Which of the following increases, current decreases; if resistance decreases, current increases?

- A. Voltage
- B. Size of the charge
- C. Resistance
- D. None of the above

109. Current is directly proportional to?

- A. Voltage
- B. Size of the charge
- C. Resistance
- D. None of the above

**What is Electrical Resistance?**

110. The electrical resistance of an electrical conductor is the opposition to the passage of an electric current through that conductor; the inverse quantity is?

- A. Classical mechanics
- B. Its resistivity
- C. Electrical conductance
- D. None of the above

111. Which of the following terms shares some conceptual parallels with the mechanical notion of friction?

- A. Electrical resistance
- B. Electric field vector
- C. Current
- D. None of the above

112. All materials show some resistance, except for superconductors, which have a?

- A. Resistance of zero
- B. Its resistivity
- C. The charge is negative
- D. None of the above

113. In other cases of a diode or battery, V and I are not directly proportional, or in other words the I-V curve is not a straight line through the origin, and Ohm's law does not hold, in this case, resistance and \_\_\_\_\_ are less useful concepts, and more difficult to define.

- A. Conductance
- B. Electric field vector
- C. Infinity
- D. None of the above

**Kirchoff's Contribution**

114. If the charged object has a \_\_\_\_\_, the force will be in the direction of the electric field vector at that point.

- A. Positive charge
- B. Its resistivity
- C. Charge is negative
- D. None of the above

115. Which of the following is given by the quantity of the charge multiplied by the magnitude of the electric field vector?

- A. Conductance
- B. Electric field vector
- C. The magnitude of the force
- D. None of the above

116. A net force acting on an object will cause it to accelerate, as explained by \_\_\_\_\_ that explores concepts such as force, energy, potential etc.

- A. Classical mechanics
- B. Its resistivity
- C. The charge is negative
- D. None of the above

117. Which of the following terms at infinity is assumed to be zero?

- A. Conductance
- B. Electric field vector
- C. The electric potential
- D. None of the above

### Potential Difference

118. The voltage difference between any two points in a circuit is known as the Potential Difference or?

- A. Voltage Drop
- B. Its resistivity
- C. The charge is negative
- D. None of the above

119. Which of the following flows around a circuit in the form of electrical charge, potential difference does not move it is applied?

- A. Conductance
- B. Current
- C. Infinity
- D. None of the above

120. Ohm's Law states that for a linear circuit the current flowing through it \_\_\_\_\_ across it.

- A. Electrical resistance
- B. Its resistivity
- C. Is proportional to the potential difference
- D. None of the above

121. Which of the following terms is usually taken to be at zero volts (0V) and everything is referenced to that common point in a circuit?

- A. Conductance
- B. Electric field vector
- C. Ground potential
- D. None of the above

122. To complete the analysis, we work backwards to the original circuit, applying Kirchoff's laws: Kirchoff's Current Law: The sum of currents entering a junction must equal the sum of currents leaving that?

- A. Voltage difference
- B. Junction
- C. Potential difference
- D. None of the above

### Direct Current (DC) or Alternating Current (AC)

123. Which of the following as produced by example from a battery and required by most electronic devices, is a unidirectional flow from the positive part of a circuit to the negative?

- A. Alternating current
- B. Direct current
- C. An electric field
- D. None of the above

124. Which of the following is any current that reverses direction repeatedly; almost always this takes the form of a sine wave?

- A. Alternating current
- B. Direct current
- C. An electric field
- D. None of the above

125. Alternating current thus pulses back and forth within \_\_\_\_\_ without the charge moving any net distance over time.

- A. Capacitance
- B. Negative
- C. A conductor
- D. None of the above

126. It delivers energy in first one direction, and then the reverse, making the time-averaged value of \_\_\_\_\_ is zero.

- A. Lines of force
- B. Electric field
- C. An alternating current
- D. None of the above

127. Which of the following is affected by electrical properties that are not observed under steady state direct current?

- A. Alternating current
- B. Negative
- C. An electric field
- D. None of the above

128. These properties are important when circuitry is subjected to \_\_\_\_\_, such as when first energized.

- A. Lines of force
- B. Energy in first one direction
- C. Transients
- D. None of the above

129. In engineering or household applications, current is often described as being either direct current (DC) or alternating current (AC).

- A. True
- B. False

### Electric Field

130. The study of electric fields created by stationary charges is called electrostatics. The field may be visualized by a set of imaginary lines whose direction at any point is the same as that of the field.

- A. True
- B. False

131. A hollow conducting body carries all its charge on its outer surface. The field is therefore zero at all places inside the body.

- A. True
- B. False

132. There is a finite limit to the electric field strength that may be withstood by any medium.

- A. True
- B. False

133. The voltage of a large lightning cloud may be as high as 100 MV and have discharge energies as great as 250 kWh.

- A. True
- B. False

134. Which of the following is created by a charged body in the space that surrounds it, and results in a force exerted on any other charges placed within the field?

- A. Alternating current field
- B. Negative field
- C. An electric field
- D. None of the above

135. The electric field acts between two charges in a similar manner to the way that the \_\_\_\_\_ between two masses.

- A. Lines of force
- B. Electric field
- C. Gravitational field acts
- D. None of the above

136. Which of the following always acts in attraction, drawing two masses together, while the electric field can result in either attraction or repulsion?

- A. Capacitance
- B. Negative
- C. Gravity
- D. None of the above

137. Which of the following at a distance is usually zero?

- A. Lines of force
- B. Electric field
- C. Transients
- D. None of the above

138. Which of the following varies in space, and its strength at any one point is defined as the force that would be felt by a stationary, negligible charge if placed at that point?

- A. Alternating current
- B. Capacitance
- C. An electric field
- D. None of the above

139. Which of the following must be vanishingly small to prevent its own electric field disturbing the main field?

- A. Test charge
- B. Electric field
- C. Energy in first one direction
- D. None of the above

140. As the electric field is defined in terms of force, and force is a vector, so it follows that an electric field is also a vector, having both magnitude and direction, it is called?

- A. Capacitance
- B. Negative
- C. A vector field
- D. None of the above

141. Which of the following emanating from stationary charges have several key properties: first, that they originate at positive charges and terminate at negative charges?

- A. Lines of force
- B. Electric field
- C. Field lines
- D. None of the above

142. This operating principal of the Faraday cage is a conducting metal shell that isolates its interior from?

- A. Outside electrical effects
- B. Electrical breakdown
- C. This principle
- D. None of the above

143. Which of the following are important when designing items of high-voltage equipment?

- A. Electric field strength
- B. Electrical breakdown
- C. The principles of electrostatics
- D. None of the above

144. Air tends to arc across small gaps at \_\_\_\_\_ which exceed 30 kV per centimeter.

- A. Electric field strengths
- B. 100 amps
- C. 10,000 volts
- D. None of the above

145. Which of the following is greatly affected by nearby conducting objects, and it is particularly intense when it is forced to curve around sharply pointed objects?

- A. The field strength
- B. Electrical breakdown
- C. Potential of the surface
- D. None of the above

### **Electric Potential**

146. Which of the following was formally defined as the force exerted per unit charge?

- A. The electric field
- B. Potential
- C. Potential of the surface
- D. None of the above

147. Where the equipotentials lie closest together and usually expressed in volts per meter, the \_\_\_\_\_ is the line of greatest slope of potential.

- A. Vector direction of the field
- B. Electric potential difference
- C. Electrically uncharged—and unchargeable
- D. None of the above

148. This definition of potential, while formal, has little practical application, and a more useful concept is that of electric potential difference, and is the energy required to move a unit charge between?

- A. Electrically uncharged—and unchargeable
- B. Electric potential difference
- C. Two specified points
- D. None of the above

149. Which of the following has the special property that it is conservative, which means that the path taken by the test charge is irrelevant?

- A. Potential of the surface
- B. Potential
- C. An electric field
- D. None of the above

150. Which of the following is closely linked to that of the electric field?

- A. Two specified points
- B. The concept of electric potential
- C. Electrically uncharged—and unchargeable
- D. None of the above

151. The electric potential at any point is defined as the energy required to bring a unit test charge from \_\_\_\_\_ slowly to that point?

- A. An electric field
- B. An infinite distance
- C. Potential of the surface
- D. None of the above

152. Which of the following is so strongly identified as the unit of choice for measurement and description of electric potential difference?

- A. Volt
- B. Electric potential difference
- C. Potential of the surface
- D. None of the above

153. It is useful to define a common reference point to which potentials may be expressed and compared. While this could be at infinity, a much more useful reference is the?

- A. An electric field
- B. Earth itself
- C. Potential of the surface
- D. None of the above

154. Earth is therefore electrically uncharged—and unchargeable and assumed to be an infinite source of equal amounts of?

- A. Potential
- B. Electric potential difference
- C. Positive and negative charge
- D. None of the above

155. Electric potential is a scalar quantity, that is, it has only magnitude and not direction.

- A. True
- B. False

156. A small charge placed within an electric field experiences a pressure, and to have brought that charge to that point against the pressure requires a charge.

- A. True
- B. False

### Understanding Single-Phase Power

157. Which of the following refers to the distribution of alternating current electric power using a system in which all the voltages of the supply vary in unison?

- A. High power systems
- B. Double phase
- C. Single-phase electric power
- D. None of the above

158. Which of the following is used when loads are mostly lighting and heating, with few large electric motors?

- A. Single-phase distribution
- B. Poly-phase distribution
- C. Double-phase power distribution
- D. None of the above

159. Which of the following connected to an alternating current electric motor does not produce a revolving magnetic field?

- A. High power systems
- B. A single-phase supply
- C. Voltages of the supply vary in unison
- D. None of the above

160. Which of the following represents the currents in each conductor reach their peak instantaneous values sequentially?

- A. Three phase(s)
- B. Moly-phase distribution
- C. Single-phase distribution
- D. None of the above

161. Which of the following represents the three supply conductors are offset from one another in time by one-third of their period?

- A. Three-phase service
- B. Single phase
- C. The waveforms
- D. None of the above

162. Which of the following are connected to windings around the interior of a motor stator, they produce a revolving magnetic field; such motors are self-starting?

- A. Three phase(s)
- B. Poly-phase distribution
- C. Squirrel cage
- D. None of the above

### Standard Frequencies of Single-Phase Power

163. High power systems, say, hundreds of kVA or larger, are nearly always?

- A. Three-phase
- B. High power systems
- C. The waveforms of the three supply conductors
- D. None of the above

164. In North America, individual residences and small commercial buildings with services up to about 417 amperes at 240 volts will usually have three-wire single-phase distribution, often with only one customer per distribution transformer.

- A. True
- B. False

165. In densely populated areas of cities, network power distribution is used with many customers and many supply transformers connected to provide hundreds or thousands of kVA, a load concentrated over a few hundred square meters.

- A. True
- B. False

166. Standard frequencies of single-phase power systems are either 50 or 60 Ohms.

- A. True
- B. False

167. The lowest supply normally available as single phase varies according to the standards of the electrical utility.

- A. True      B. False

### Understanding Three-Phase Power

168. The three-phase system was introduced and patented by George Westinghouse.

- A. True      B. False

169. A hot wire allows the three-phase system to use a higher voltage while still supporting lower-voltage single-phase appliances.

- A. True      B. False

170. Which of the following represents electric power is a common method of alternating-current electric power generation, transmission, and distribution?

- A. Three phase(s)      C. Balanced load  
B. Di-phase distribution      D. None of the above

171. Which of the following are more inexpensive than others because it uses less conductor material to transmit electric power than equivalent single-phase or two-phase systems at the same voltage?

- A. Three-phase system      C. Supply conductor  
B. Single phase      D. None of the above

172. Which of the following terms has the effect of giving constant power transfer over each cycle of the current and makes it possible to produce a rotating magnetic field in an electric motor?

- A. This delay between phases      C. Linear balanced load  
B. The lowest phase order      D. None of the above

173. Three-phase systems may have a?

- A. Neutral wire      C. Non-linear balanced load  
B. One phase system      D. None of the above

174. In a three-phase system, \_\_\_\_\_ carry three alternating currents (which reach their instantaneous peak values at different times).

- A. A balanced load      C. Instantaneous peak values  
B. Three circuit conductors      D. None of the above

175. Taking one conductor as the reference, the other two currents are delayed in time by one-third and two-thirds of one cycle of the?

- A. Electric current      C. Lowest phase order  
B. Phase system      D. None of the above

176. Which of the following is common not to have a neutral wire as the loads can simply be connected between phases?

- A. High-voltage distribution situations      C. Linear balanced load  
B. Two-phase system      D. None of the above

**Three-phase has properties that make it very desirable in electric power systems:**

177. Power transfer into a \_\_\_\_\_ is constant, which helps to reduce generator and motor vibrations.

- A. High-voltage distribution situations
- B. Two-phase system
- C. Linear balanced load
- D. None of the above

178. Which of the following can produce a magnetic field that rotates in a specified direction, which simplifies the design of electric motors?

- A. A balanced load
- B. Three-phase systems
- C. Instantaneous peak values
- D. None of the above

179. Three is \_\_\_\_\_ order to exhibit all of these properties.

- A. The highest phase order
- B. Number
- C. The lowest phase order
- D. None of the above

180. Most household loads are?

- A. Single-phase
- B. Three-phase systems
- C. Dual phases
- D. None of the above

181. The phase currents tend to assist out one another, summing to zero in the case of a linear balanced load.

- A. True
- B. False

**3 Or 4 Wire**

182. The '3-wire' and '4-wire' designations count the ground wire used on many transmission lines.

- A. True
- B. False

183. A three-phase induction motor has a simple design, inherently low starting torque.

- A. True
- B. False

184. A three-phase motor is more compact and less costly than a single-phase motor of the same voltage class and rating and single-phase DC motor.

- A. True
- B. False

185. Large types of loads do not require the revolving magnetic field characteristic of three-phase motors but take advantage of the higher voltage and power level usually associated with three-phase distribution.

- A. True
- B. False

186. Which of the following occur in two varieties: three-wire and four-wire?

- A. Three-phase circuits
- B. Two-phase system
- C. Instantaneous phase order
- D. None of the above

187. The three-wire system is used when the loads on the 3 live wires will be balanced, for example in motors or heating elements with?

- A. A balanced load
- B. 3 identical coils
- C. Instantaneous peak values
- D. None of the above

188. The neutral wire is used when there is a chance that the?

- A. Loads are not balanced
- B. Lowest phase order
- C. Linear balanced load
- D. None of the above

189. Three-phase motors also vibrate less and hence last longer than single-phase motors of the different phases used under the same conditions.

- A. True
- B. False

190. Legacy single-phase fluorescent lighting systems benefit from reduced flicker in a room if adjacent fixtures are powered from large rectifier systems.

- A. True
- B. False

191. Which of the following may have three-phase inputs; the resulting DC is easier to filter than the output of a single-phase rectifier?

- A. Three-phase circuits
- B. A static phase converter
- C. Large rectifier systems
- D. None of the above

192. Which of the following may be used for battery charging, electrolysis processes such as aluminum production or for operation of DC motors?

- A. Rectifiers
- B. Either DC or single-phase AC
- C. Subphase
- D. None of the above

### Phase Converters

193. Occasionally the advantages of three-phase motors make it worthwhile to convert single-phase power to?

- A. A static phase converter
- B. Three-phase
- C. A third "subphase"
- D. None of the above

194. Which of the following goes to zero at each moment that the voltage crosses zero but three-phase delivers power continuously?

- A. Many three-phase devices
- B. A static phase converter
- C. Single-phase power
- D. None of the above

195. A rotary phase converter essentially a three-phase motor with special starting arrangements and power factor correction that produces?

- A. Rectifier-type loads
- B. Balanced three-phase voltages
- C. Either DC or single-phase AC
- D. None of the above

196. The usage of the main transformer method separated it from another common method, the static converter, as both methods have no moving parts, which separates them from the?

- A. Rectifier-type load
- B. Subphase
- C. Rotary converters
- D. None of the above

197. Another method often attempted is with a device referred to as?

- A. Many three-phase devices
- B. A static phase converter
- C. A third "subphase"
- D. None of the above

198. A static phase converter method does not work when sensitive circuitry is involved such as CNC devices or in induction and?

- A. A single-phase supply
- B. Rectifier-type loads
- C. The static converter
- D. None of the above

199. A three-phase generator can be driven by a?
- A. Three-phase generator                      C. Single-phase motor  
B. Static phase converter                      D. None of the above
200. Which of the following can also form an uninterruptable power supply when used in conjunction with a large flywheel and a standby generator set?
- A. Rectifier-type loads                      C. The motor-generator method  
B. Subphase                      D. None of the above
201. Some devices are made which create an imitation three-phase from?
- A. Three-wire single-phase                      C. A third "subphase"  
B. Many three-phase devices                      D. None of the above
202. Which of the following terms can run on this imitation three-phase configuration but at lower efficiency?
- A. Three-wire single-phase                      C. A third "subphase"  
B. Many three-phase devices                      D. None of the above
203. Variable-frequency drives are used to provide precise speed and torque control of three-phase motors, and some models can be powered by?
- A. A single-phase supply                      C. The static converter  
B. Either DC or single-phase AC                      D. None of the above
204. Which of the following work by converting the supply voltage to DC and then converting the DC to a suitable three-phase source for the motor?
- A. Many three-phase devices                      C. A third "subphase"  
B. VFDs                      D. None of the above
205. Which of the following terms are designed for fixed-frequency operation from a single-phase source?
- A. A single-phase supply                      C. The static converter  
B. Digital phase converters                      D. None of the above
206. One method for using three-phase equipment on a single-phase supply is with a rotary phase converter.
- A. True                      B. False

**Alternatives to Three-Phase**

207. High-phase-order transmission lines may allow transfer of more power through a given transmission line right-of-way without the expense of a high-voltage direct current converter at each end of the line.
- A. True                      B. False
208. Which of the following is used when three-phase power is not available and allows double the normal utilization voltage to be supplied for high-power loads?
- A. Split-phase electric power                      C. Electromagnetic induction  
B. In-direct current                      D. None of the above

209. Loads that connect each phase to neutral, assuming the load is the same power draw, the two-wire system has a neutral current that is greater than neutral current in?

- A. A three-phase system
- B. Its polarity does not change
- C. Two-phase
- D. None of the above

210. Some motors are not linear, motors running on three-phase tend to run smoother than those on?

- A. A three-phase system
- B. Its polarity does not change
- C. Two-phase
- D. None of the above

### **Direct Current versus Alternation Current**

211. Direct current flows on an oscilloscope screen it always appears on one side of the zero axis, because of?

- A. Polarity
- B. Sine current
- C. Electromagnetic waves
- D. None of the above

212. According to the text, batteries produce steady?

- A. DC
- B. Voltage
- C. Electromagnet induction
- D. None of the above

213. Which of the following does change in magnitude, but always appears on the same side of the zero axis on an oscilloscope?

- A. Pulsating DC
- B. The polarity of the voltage
- C. Three-phase power
- D. None of the above

214. On an oscilloscope the voltage and current appear on both sides of the zero axis, as \_\_\_\_\_ alternates and the current changes direction.

- A. Pulsating DC
- B. The polarity of the voltage
- C. Three-phase power
- D. None of the above

215. Direct current flows in one direction only.

- A. True
- B. False

### **Electromagnet Induction**

216. Electromagnetic Induction is the ability of a magnetic field to generate a voltage or current in a conductor with physical contact.

- A. True
- B. False

217. Alternating current is generated through an electrical effect called?

- A. Polarity induction
- B. Direct current induction
- C. Electromagnetic induction
- D. None of the above

218. Which of the following flows in the circuit, when the conductor becomes part of a circuit?

- A. Current
- B. Voltage
- C. Electromagnet Induction
- D. None of the above

219. As the coils are turned through a rotational magnetic, voltage is generated, this converts rotational motion into?

- A. Current flow
- B. Direct current
- C. Electromagnetic induction
- D. None of the above

220. The conductor and the \_\_\_\_\_ are not physically connected, yet a voltage is induced in the conductor when the conductor moves through the magnetic field, or when the magnetic field moves through the conductor.

- A. Magnetic field
- B. Electromagnetic induction
- C. Three-phase power
- D. None of the above

221. AC motors also depend upon electromagnetic induction converting \_\_\_\_\_ into rotational motion.

- A. Current flow
- B. Direct current
- C. Electromagnetic induction
- D. None of the above

### **Sine Wave for AC**

222. Alternating voltage and current generated by rotary motion take the form of a sine wave.

- A. True
- B. False

### **Sine waves are measured and compared by certain features.**

223. In each cycle, there are one reversal and three maximums.

- A. True
- B. False

224. The amplitude of the sine wave tells you the maximum value of current or?

- A. Sine wave
- B. Magnetic field
- C. Voltage
- D. None of the above

225. A cycle is one complete repetition of the wave form; it is produced by one complete revolution- $360^{\circ}$  -of the conductor through the?

- A. Sine wave
- B. Magnetic field
- C. Voltage
- D. None of the above

226. Which of the following terms peaks in the positive direction at  $90^{\circ}$ , crosses the zero axis at  $180^{\circ}$ , peaks in the negative direction at  $270^{\circ}$ , then reaches zero again at  $360^{\circ}$ ?

- A. Sine wave
- B. Magnetic field
- C. Voltage
- D. None of the above

227. Which of the following is generated at 60 cycles or 50 cycles per second?

- A. Each cycle
- B. Most AC
- C. Voltage or current
- D. None of the above

228. Two waves can have the same amplitude and frequency, the same amplitude but different frequency, and different amplitude and different?

- A. Amplitude
- B. Horizontal line
- C. Frequency
- D. None of the above

229. The Peak to Peak voltage is the voltage calculated between the maximum positive and maximum negative points on the sine wave, it is twice the?

- A. Amplitude
- B. A horizontal line
- C. AC
- D. None of the above

230. RMS voltage or current is a standard means of measuring?

- A. Magnetic field
- B. Alternating current
- C. Positive current and voltage
- D. None of the above

231. Negative current and voltage do the same amount of work as positive voltage and current.

- A. True      B. False

**Transformers**

232. Makes AC power transmission and distribution possible and transform values of voltage and current.

- A. True      B. False

233. Transformers work because electric current generates a magnetic field around an electrical conductor to the earth.

- A. True      B. False

234. If each turn in the Secondary coil has 8 volts across it, each turn in the primary will also have 4 volts across it.

- A. True      B. False

235. Transformers operate on the principle of?

- A. Tesla's principles      C. Electromagnetic induction  
B. One voltage from another      D. None of the above

236. Transformers usually transfer \_\_\_\_\_ from one circuit to another.

- A. AC voltages      C. Expanding magnetic field  
B. Energy      D. None of the above

237. Which of the following are designed either to step voltage up or to step it down?

- A. Most transformers      C. Frequencies  
B. Step down convertor      D. None of the above

238. The magnetic field is constant, if the current flow is steady, as with?

- A. AC voltages      C. Expanding magnetic field frequencies  
B. DC      D. None of the above

239. Which of the following consist of a primary winding or coil connected to the source circuit and a secondary winding connected to the load circuit?

- A. Transformers      C. Electromagnetic induction  
B. Primary windings      D. None of the above

240. Which of the following flows through the primary, the collapsing and expanding magnetic field induces a voltage and current in the secondary as the lines of force keep cutting through the secondary coil windings?

- A. AC      C. Expanding magnetic fields  
B. DC      D. None of the above

241. With each turn of wire in the, primary coil has an equal share at the primary voltage across it and the same \_\_\_\_\_ is induced in each turn of the secondary coil.

- A. Voltage      C. Frequency  
B. Primary winding      D. None of the above

### Step-Down Transformers

242. If there are fewer turns in the secondary, the \_\_\_\_\_ will be lower than the primary.

- A. Transformer
- B. Primary winding
- C. Secondary voltage
- D. None of the above

### Step-Up Transformers

243. If there are more turns in the secondary coil than in the \_\_\_\_\_, voltage will be higher on the secondary circuit.

- A. Secondary coil
- B. Primary
- C. Ground
- D. None of the above

### Autotransformers

244. In Autotransformers, the primary and secondary share?

- A. A common winding
- B. Primary winding
- C. Primary coil
- D. None of the above

245. The part of the winding connected to the source is the?

- A. A common winding
- B. Primary winding
- C. Primary coil
- D. None of the above

246. The part of the winding connected to the load is the?

- A. Secondary winding
- B. Primary winding
- C. Secondary voltage
- D. None of the above

247. Which of the following can be tapped at any point to form either the primary or the secondary portion of the winding?

- A. Transformer
- B. Primary winding
- C. Winding
- D. None of the above

248. The location of the tap determines the number of turns in the?

- A. Transformer
- B. Primary winding
- C. Primary or secondary windings
- D. None of the above

### Line Loss

249. Whenever power is sent over transmission lines, the resistance of the lines results in power lost in?

- A. The form of heat
- B. Second load
- C. A 120/240-volt system
- D. None of the above

250. Step-down transformers reverse the process at substations and service drops, lowering the \_\_\_\_\_ back to usable levels.

- A. Voltage
- B. Current
- C. Three-phase electricity
- D. None of the above

251. At the generating station step-up transformers are used to raise voltage to extremely high levels, sometimes more than 100,000 volts

- A. True
- B. False

### 3-Phase Power

252. Which of the following is distributed in the form of 3-phase AC?

- A. Most power
- B. Current
- C. Ohms
- D. None of the above

253. As the coils turn through the magnetic field, power is sent out on?

- A. Three lines
- B. Current
- C. The third wire
- D. None of the above

254. Which of the following is needed, it is available between any two phases, or, in some systems, between one of the phases and ground?

- A. Single-phase electricity
- B. Current
- C. The form of 3-phase AC
- D. None of the above

### The Edison System

255. The 3-wire Edison System has one hot conductor, and two grounded neutral conductors.

- A. True
- B. False

256. The lower the voltage to ground in any electrical system, the less likely are shorts, fires, and shocks.

- A. True
- B. False

257. In a 120/240-volt system, the \_\_\_\_\_ between each hot wire and neutral is 120 volts.

- A. Voltage
- B. Current
- C. Neutral
- D. None of the above

258. Which of the following terms between the two hot wires is 240 volts?

- A. Voltage
- B. Current
- C. Amps
- D. None of the above

### Balanced and Unbalanced Loads on the Edison System

259. The same current flows in each hot wire when loads are balanced, that is, when they have the same?

- A. Resistance
- B. Current
- C. Voltage
- D. None of the above

260. When loads are not balanced-the \_\_\_\_\_ of one is greater than the other-current flows in the neutral.

- A. Hot wires
- B. Current
- C. Resistance
- D. None of the above

### System Grounding

261. Most electrical supply systems, \_\_\_\_\_, are grounded at some point as a safety measure.

- A. Both AC and DC
- B. Load current
- C. An electrical conductor to the earth
- D. None of the above

262. All conductors or metal parts-conduit, ground busses -which are connected to ground at some point have \_\_\_\_\_ on them with respect to ground.

- A. Grounded conductors
- B. Zero voltage
- C. Ground connection
- D. None of the above

263. According to the text, in grounded systems, insulation faults or shorts to ground on \_\_\_\_\_ will carry high current and blow fuses or trip breakers.

- A. Hot conductors
- B. Load current
- C. No resistance
- D. None of the above

264. Which of the following or short to ground on a hot conductor may not open a fuse or breaker, or affect system operation at all?

- A. An insulation fault
- B. Grounding Wire
- C. Zero voltage
- D. None of the above

265. It is essential to recognize the difference between a \_\_\_\_\_ and a Grounding Wire.

- A. Grounded conductor
- B. Grounding Wire fault
- C. Zero voltage jumper
- D. None of the above

266. Which of the following is any conductor that is grounded at the source and carries load current?

- A. Grounded conductor
- B. 3-wire Edison system ground
- C. Ground connection
- D. None of the above

267. The neutral in a 3-wire Edison system is a?

- A. Grounded conductor
- B. Grounding Wire fault
- C. Ground connection
- D. None of the above

268. Which of the following developed in its connections, anything connected to ground by it would have voltage on it?

- A. Hot conductors
- B. No resistance
- C. Resistance
- D. None of the above

269. The connection to ground must be secure and?

- A. Hot conductors
- B. Permanent
- C. An electrical conductor to the earth
- D. None of the above

270. Which of the following terms are usually insulated, since there is the possibility of voltage on them in case of a bad connection?

- A. Grounded conductors
- B. Grounding Wire fault
- C. Ground connection
- D. None of the above

271. A Grounding Wire connects current-carrying metal parts of equipment to ground.

- A. True
- B. False

272. A Grounding Wire will not have current when a fault occurs, and then only briefly until a fuse blows or breaker resets.

- A. True
- B. False

273. Some installations include a grounding rod driven in to the earth. Neither a grounding wire nor a grounded conductor must ever be fused, switched, or broken in any way.

- A. True      B. False

274. The short to ground on the hot conductors has grounded the system there, and reversed the hot and the supposedly grounded parts of it.

- A. True      B. False

### **Powering Single-Phase Loads from 3-Phase Systems**

275. Any 3-phase system has single-phase voltage between the powerlines that can be used to power single-phase loads at line-to-line voltage, or at some other voltage if a?

- A. 3-wire Edison system      C. Single-phase transformer  
B. Grounding Wire      D. None of the above

### **Four-Wire Wye**

276. Which of the following can be connected between any powerline and the grounded neutral?

- A. Three-phase transformer      C. Single-phase loads  
B. Single-phase transformer      D. None of the above

### **Four-Wire Delta**

277. A four-wire delta system has a grounded neutral conductor connected to a center tap on one?

- A. Terminal or lead      C. Single-phase load  
B. Secondary winding      D. None of the above

278. Which of the following equal to half of the line-to-line voltage is available between the powerline on either end of that winding and the grounded neutral?

- A. Grounded neutral      C. Single-phase voltage  
B. Secondary winding      D. None of the above

279. Which of the following terms between the other phase conductor and the grounded neutral will be considerably higher than half line-to-line voltage?

- A. Phase      C. Voltage  
B. Polarity      D. None of the above

280. If there is no neutral conductor, do not attempt to connect a single-phase load between one of the phase conductors and ground!

- A. True      B. False

281. Which of the following should be balanced between the lines as much as possible if single-phase loads are to be powered correctly?

- A. Single-phase power      C. Three-phase system  
B. Polarity      D. None of the above

282. A grounded neutral is perfectly balanced and the current in the neutral will be zero if \_\_\_\_\_ connected between the phase lines?

- A. Single-phase voltage      C. Single-phase loads  
B. Polarity      D. None of the above

### Connecting Loads

283. There are usually just two supply terminals or leads to most lights and these lights require?

- A. Single-phase power
- B. Polarity
- C. Three-phase system
- D. None of the above

284. Small, single speed, single-phase motors can operate on either 115 or 230 volts by connecting different terminals, or by adding or removing a?

- A. Phase
- B. Terminal or lead
- C. Jumper
- D. None of the above

285. According to the text, if there is a choice of which voltage to use, connect the motor for 230 volts; it will draw only half as much current at the?

- A. Higher voltage
- B. Single-phase power
- C. Single-phase voltage
- D. None of the above

286. Which of the following usually makes no difference; the motor will run equally well and in the same direction with the leads reversed?

- A. Phase
- B. Polarity
- C. Jumper
- D. None of the above

287. If connected for 115 volts, one conductor will be grounded, \_\_\_\_\_ may be designated for the grounded conductor because of the way the motor is insulated.

- A. Phase-to-ground voltage(s)
- B. One conductor will be grounded
- C. One of the leads or terminals
- D. None of the above

288. Which of the following represents motors that have six or more terminals or leads?

- A. Singular-phase voltage
- B. Multiple speed single-phase
- C. Triple-phase loads
- D. None of the above

289. Which of the following are motors that have three properly sequenced voltages of the correct polarity?

- A. Single-phase power
- B. Multiple speed single-phase
- C. Three-phase
- D. None of the above

290. Which of the following induction motors have dual voltage units?

- A. Single-phase power
- B. Multiple speed single-phase
- C. Three-phase
- D. None of the above

291. Single-phase power is one black wire, designated for the hot conductor and the other, white or grey or green for grounded neutral.

- A. True
- B. False

292. Industrial heaters, ovens, and dryers, may require single or three-phase power.

- A. True
- B. False

### Series Circuit

293. In a series circuit, the components are connected end-to-end, so that all the electrons that leave the source in a current pass through all the components, one after the other, before returning to the source.

- A. True
- B. False

294. In a series circuit current, in \_\_\_\_\_, flows through all the loads.

- A. Ohm's Law
- B. Resistance(s)
- C. Ampere(s)
- D. None of the above

295. When a switch is opened, or when one of the loads burns out; all the loads will stop working, since there is no way for the \_\_\_\_\_ to complete the circuit back to the source.

- A. Volts
- B. Current
- C. Resistance(s)
- D. None of the above

296. The resistance of a series circuit is the sum of the \_\_\_\_\_ of all the loads.

- A. Ohms
- B. Resistance
- C. Ampere(s)
- D. None of the above

### **Parallel Circuits**

**Loads are normally arranged in parallel with each other:**

297. Which of the following can operate and be controlled individually, if one load burns out the others are not affected?

- A. Loads
- B. The current
- C. Resistance(s)
- D. None of the above

298. The voltage across each load is source voltage, so each load receives the voltage it requires. The current in each branch is determined by the resistance of the load in that particular branch.

- A. True
- B. False

### **Equivalent Circuits**

299. You will need to convert the equivalent conductance back into a resistance before adding it to the resistance of another component in series.

- A. True
- B. False

300. Complex circuits include components in both series and parallel, to properly figure fuse or conductor size, it is often necessary to find the total?

- A. Ohms
- B. Current
- C. Volts
- D. None of the above

## **When finished with your assignment.**

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