



ARKANSAS ELECTRIC VEHICLE RALLY

Sample Questions

1. What are the electrical units for current?
 - a) Amperes
 - b) Watts
 - c) Joules
 - d) Volts
2. An electric vehicle charging system converts _____ into _____ to charge the batteries.
 - a) gas; chemicals
 - b) electrons; protons
 - c) volts; amps
 - d) AC; DC
3. A 96-volt battery pack produces 24 amps of current in a simple circuit. What is the resistance in the circuit?
 - a) 72 ohms
 - b) 4 ohms
 - c) 120 ohms
 - d) 2304 ohms
4. A fuse:
 - a) is a device that trips when there is too much voltage
 - b) usually contains a short piece of metal that melts from the heating effect of too much current
 - c) usually contains a short piece of metal that melts from the heating effect of too much voltage
 - d) is a device that turns on when there is too much current
5. The percentage of a lead-acid battery that can be recycled is closest to:
 - a) 70%
 - b) 45%
 - c) 35%
 - d) 95%
6. Mosfets and IGBTs are solid state devices that _____.
 - a) produce a high voltage
 - b) are commonly found in DC motors
 - c) conduct large amounts of current
 - d) create electricity

7. What does this symbol represent in a wiring diagram?
 - a) a battery
 - b) electricity
 - c) a diode
 - d) a resistor

8. A specific electric motor has a one-hour thermal rating of 150 amps. This means that:
 - a) The motor can safely run for one hour at 150 degrees.
 - b) The motor can safely produce 150 amps at 150 degrees.
 - c) The motor can safely run on 150amps for one hour.
 - d) The motor gets too cold to use after running for one hour at 150 amps.

9. Which tool can be used to accurately check the specific gravity of a lead-acid battery?
 - a) voltmeter
 - b) hydrometer
 - c) thermometer
 - d) test light

10. An electric vehicle uses 5 kilowatt-hours of energy to travel 20 miles. What is the vehicle's average rate of energy consumption per mile?
 - a) .25 kilowatt-hours per mile
 - b) .15 kilowatt-hours per mile
 - c) 5 kilowatt-hours per mile
 - d) 20 kilowatt-hours per mile

11. When direct current is supplied to the field coil of a series-wound DC electric motor, the field coil:
 - a) begins to rotate
 - b) becomes an electromagnet
 - c) spins around the brushes
 - d) conducts current to the battery

12. A 12-volt test light is a handy tool that is normally used to:
 - a) check the voltage of the main battery pack in an electric vehicle
 - b) measure the resistance in a light bulb
 - c) measure the voltage of 12-volt battery
 - d) inspect a 12-volt electrical system

13. What type of battery is most commonly used as a starter battery in automobiles?
 - a) lead-acid
 - b) nickel-metal hydride
 - c) lithium ion
 - d) nickel cadmium

14. When working on the batteries of a full-size electric vehicle, you should make sure that
- the emergency break is off
 - all of the battery posts are exposed
 - the high voltage system is disconnected
 - both a) and b)
15. An electric vehicle travels 15 miles in 30 minutes. What is the average speed of the vehicle?
- 15 miles per hour
 - 60 miles per hour
 - 45 miles per hour
 - 30 miles per hour
16. A potentiometer is a type of _____ resistor.
- potential
 - solid-state
 - variable
 - fixed
17. When a lead-acid battery is discharged _____ reaction is occurring.
- an oxidation-reduction
 - a combustion
 - a synthesis
 - a decomposition
18. Which of the following is generally not considered an alternative vehicle fuel?
- diesel
 - ethanol
 - methanol
 - natural gas
19. Electric potential is measured in:
- watts
 - amperes
 - volts
 - ohms
20. Which of the following is most effectively used to neutralize an acid spill from a lead-acid battery?
- gasoline
 - sulfuric acid
 - baking soda
 - hydrogen gas
21. In a shop class, if you are using a power tool and the circuit breaker trips, you should first:
- reset the circuit breaker
 - unplug your tool and use another circuit
 - use another tool
 - tell your instructor

22. When performing work on batteries, be sure to wear:
- a) eye protection
 - b) an apron
 - c) gloves
 - d) all of these
23. Electric power can be calculated by multiplying
- a) watts X volts
 - b) watts X amps
 - c) volts X amps
 - d) amps X ohms
24. Which of the following is not controlled by the 12-volt system of an electric vehicle?
- a) headlights
 - b) windshield wipers
 - c) main contactor
 - d) main motor
25. Using insulated tools is especially important when you are working on or near:
- a) a brake system
 - b) tires
 - c) batteries
 - d) a transmission
26. Which of the following gases is not normally a component of exhaust from a gasoline engine?
- a) carbon dioxide
 - b) chlorine
 - c) water
 - d) carbon monoxide
27. If you want to measure the voltage of a six-volt battery, what scale on a multimeter would provide you with the most precise measurement?
- a) 0-1 volts
 - b) 0-10 volts
 - c) 0-100 volts
 - d) 0-1 amp
28. When you first turn on an electric car, you may hear:
- a) the main motor spin
 - b) the potentiometer move
 - c) the main contacts close
 - d) the battery current

29. In a 12-volt automotive circuit, a red wire frequently indicates _____ and a black wire frequently indicates _____.
- a) positive; ground
 - b) ground; negative
 - c) negative; positive
 - d) neutral; negative
30. The federal Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992 required:
- a) that many fleet operators begin using alternative fueled vehicles in their fleets
 - b) that 25% of the American public must purchase electric vehicles as soon as possible
 - c) that the United States Post Office convert 15% of its delivery trucks to electric by the year 2002
 - d) that cities of over 1 million people must reduce air pollution by 25% by 2010
31. During the last 30 years, the rapid development of _____ has contributed the most to the resurgence of electric vehicles.
- a) solid-state electronics
 - b) lead-acid batteries
 - c) DC motors
 - d) Tire technology
32. The _____ energy stored within an electric vehicle's batteries is first converted to _____ energy before it can be converted to _____ energy by the motor to move the vehicle.
- a) kinetic; potential; electrical
 - b) potential; kinetic; electrical
 - c) chemical; mechanical; electrical
 - d) chemical; electrical; mechanical
33. The earliest electric vehicles were build around:
- a) 1715
 - b) 1835
 - c) 1895
 - d) 1955
34. When operating a power tool you should always:
- a) wear loose clothing
 - b) use water to cool the tool
 - c) remove your jewelry
 - d) both a) and c)
35. A series of cells connected together is called:
- a) an electrode
 - b) a battery
 - c) an electrolyte
 - d) direct current

36. Before using a tool or machine which can cause injury, you should always:
- a) review the appropriate safety manual
 - b) ask your teacher for permission
 - c) ask a friend for help
 - d) both a) and b)
37. A gear ratio indicates:
- a) speed of a gear
 - b) distance between gears
 - c) amount of torque multiplication between gears
 - d) number of teeth on a gear
38. An effective public speaker usually:
- a) practices their presentation
 - b) looks at the ground when speaking
 - c) reads the presentation to the audience
 - d) speaks softly
39. You are driving your electric vehicle at night with the lights on. You notice that your headlights are beginning to dim. Soon your main contactor opens up and your car coasts to a stop. What is the likely cause of this scenario?
- a) the 12-volt system is discharged
 - b) the main motor overheated
 - c) the main contactor malfunctioned
 - d) the potentiometer malfunctioned
40. During the late 1990's, most commercial electric vehicles used either ____ or ____ batteries.
- a) nickel-metal hydride; nickel-cadmium
 - b) lead-acid; nickel-metal hydride
 - c) lead-acid; nickel-cadmium
 - d) sodium-sulfur; nickel-cadmium
41. A "Class A" fire is when _____ is burning.
- a) a battery
 - b) gasoline or oil
 - c) an armature
 - d) wood or paper
42. The main rotating part of a DC motor is called the:
- a) brush
 - b) armature
 - c) rotator
 - d) stator

43. When electrical current is flowing through a wire, a _____ can be found around the wire.
- a) vacuum
 - b) battery
 - c) magnetic field
 - d) higher pressure
44. Which of the following is most true: One of the main differences between an electric motor and an internal combustion engine is:
- a) an electric motor is complex and has many moving parts
 - b) an electric motor has very little torque when it first starts to rotate
 - c) an internal combustion engine is more efficient than an electric motor
 - d) an internal combustion engine has many moving parts
45. An electric vehicle is driven at 40 miles per hour for 30 minutes. The driver then increases the vehicle's speed to 60 miles per hour for another 15 minutes. What is the approximate distance that the vehicle has traveled?
- a) 25 miles
 - b) 35 miles
 - c) 40 miles
 - d) 45 miles
46. In general, when is a cutting tool safest to use?
- a) when the cutting edge is dull
 - b) when the cutting edge is sharp
 - c) when the cutting edge is hot
 - d) when the cutting edge is loose
47. Which wire has the largest diameter?
- a) # 1/0
 - b) #22
 - c) #10
 - d) # 2/0
48. A hacksaw:
- a) is best used to cut wood
 - b) cuts on the forward stroke
 - c) is better than a reciprocating saw
 - d) cannot be used to cut plastic
49. What statement best describes electricity?
- a) the movement of charged particles
 - b) the ability to produce work
 - c) a measure of current
 - d) all of the above
50. In a DC motor, the brushes:
- a) keep the stator clean
 - b) rotate around the field coil
 - c) make contact with the commutator
 - d) never need replacing

51. When an electric vehicle is in regenerative braking mode, which of the following is normally occurring?
- a) the vehicle is downshifting
 - b) the vehicle is speeding up
 - c) current is going to the motor
 - d) current is going to the batteries
52. What is one of the main benefits of a fuel cell?
- a) it is simple to manufacture
 - b) water is a product of a fuel cell's operation
 - c) it is inexpensive
 - d) all of these
53. A pulse-width modulation controller in an electric vehicle:
- a) sends wide pulses to the batteries
 - b) sends pulses of current to the motor
 - c) controls the modules
 - d) pulses the modules with a wide controller
54. A "Class B" fire is best put out by _____ the flames.
- a) cooling
 - b) fanning
 - c) blowing on
 - d) smothering
55. What EV component has been most improved by solid-state electronics?
- a) contactor
 - b) motor
 - c) main fuse
 - d) controller
56. One of the main advantages of most full-size electric vehicles is their:
- a) fifteen-minute recharge time
 - b) efficient use of energy
 - c) lightweight battery pack
 - d) availability to the general public
57. What is specific gravity?
- a) how specific an object's gravity is
 - b) the specific weight of an object
 - c) the height of acid in a battery
 - d) the density of a substance compared to water
58. When a lead-acid battery is recharged, sulfate crystals are:
- a) deposited onto the lead plates
 - b) created once again
 - c) removed from the lead plates
 - d) both a) and b)

59. An emergency manual disconnect switch in an EV usually allows the operator to:
- a) shut off the 12-volt system
 - b) disable the high voltage system
 - c) rapidly discharge the batteries
 - d) disconnect the accelerator cable from the potentiometer
60. A capacitor stores:
- a) electrical charge
 - b) momentum
 - c) rotational energy
 - d) light capacity
61. Safety glasses must be worn:
- a) when working on batteries
 - b) whenever one is in the lab or shop
 - c) when working with power tools
 - d) both a) and C
62. When one gallon of gasoline is completely burned, approximately ____ of carbon dioxide gas are produced.
- a) 10 gallons
 - b) 50 gallons
 - c) 100 gallons
 - d) 1000 gallons
63. In 1900, what were the two main types of automobiles?
- a) electrical and internal combustion
 - b) steam and electric
 - c) internal combustion and steam
 - d) there weren't any automobiles in 1900
64. What is the electrical unit for power?
- a) watt
 - b) volt
 - c) ampere
 - d) ohm
65. What is one way that a deep-cycle lead-acid battery is usually different from a lead-acid starting battery?
- a) the deep-cycle battery has thicker lead plates
 - b) the deep-cycle battery has thinner lead plates
 - c) the deep-cycle battery produces more cold-cranking amps
 - d) both a) and c)
66. A flywheel-powered vehicle relies on what physical phenomenon?
- a) angular momentum
 - b) rotational inertia
 - c) conservation of momentum
 - d) all of the above

67. A standard lead-acid battery has a twenty-hour capacity of 100 amp-hours. However, this same battery only has a one-hour capacity of 65 amp-hours. Why does this battery have a lower one-hour capacity rating?
- a) batteries generally have less capacity when discharged at a faster rate
 - b) when discharged for twenty hours, the battery increases its voltage
 - c) this battery is probably defective
 - d) when discharged for one hour, the electrolyte in the battery became colder.
68. In many gasoline-powered vehicles, the brakes are assisted by the _____ that is produced by the engine.
- a) Exhaust
 - b) Vacuum
 - c) Spark
 - d) Torque
69. When lifting a heavy object such as a battery, it is best to:
- a) drag it across the floor to where you want it
 - b) lift it primarily with your back and not your legs
 - c) lift it primarily with your legs and not your back
 - d) lift it primarily with your arms
70. When designing an electric vehicle, it is important to consider the:
- a) battery weight
 - b) driver location
 - c) vehicle's center of gravity
 - d) all of these
71. What does this symbol represent in a wiring diagram?
- a) a switch
 - b) a ground
 - c) a diode
 - d) a capacitor
72. When a converted electric vehicle's 12-volt start switch is turned on by the vehicle's driver, which of the following usually happens?
- a) the potentiometer sends current to the controller
 - b) the motor brushes are pre-heated
 - c) the controller sends current to the motor
 - d) a contactor closes
73. A vehicle has 10 kilowatt-hours of energy within its battery pack (at a one-hour discharge rate). In order to travel 50 miles in one hour, what is the approximate discharge rate that the vehicle must be driven at?
- a) .2 kilowatt-hours per mile
 - b) .5 kilowatt-hours per mile
 - c) 1 kilowatt-hours per mile
 - d) 5 kilowatt-hours per mile

74. The potbox in an electric vehicle sends a signal to the:
- a) controller
 - b) DC/AC converter
 - c) Motor
 - d) Potentiometer
75. When working on the high voltage system of an electric vehicle, you should:
- a) wear loose fitting clothing
 - b) wear rubber gloves
 - c) use uninsulated tools
 - d) expose all of the high voltage connections
76. A diode is primarily designed to:
- a) conduct current in two directions
 - b) store current better than capacitors
 - c) conduct current in one direction
 - d) vary resistance
77. In 1912, Charles Kettering installed the first _____ on a gasoline car.
- a) headlights
 - b) crank
 - c) muffler
 - d) starter motor
78. When working on the 12-volt system of a vehicle, it is important to:
- a) remove the ground cable from the 12-volt power source
 - b) connect the positive and negative cables of the battery
 - c) remove the appropriate fuse from the fuse box
 - d) make sure the battery is discharged
79. You are steadily driving an electric vehicle at 55 mph up a steep incline for two miles. Suddenly, a malfunction occurs and the vehicle coasts to as top. What is the likely cause of this malfunction?
- a) the potentiometer became disconnected from the accelerator cable
 - b) the main contactor opened up
 - c) the 12-volt system became discharged
 - d) a high voltage fuse blew
80. In 1990, the California Air Resources Board adopted a ZEV mandate that required:
- a) major auto manufacturers to sell certain percentages of zero emission vehicles in California
 - b) major California cities to sell zero emission vehicles
 - c) that only zero emission vehicles could be sold in California
 - d) zero emission vehicles begin to phase out internal combustion vehicles in California

81. A hybrid electric vehicle:
- a) usually has less range than a pure electric vehicle
 - b) gets all of its energy from a battery pack
 - c) has two or more power sources
 - d) always has a small internal combustion engine
82. Vehicles A and B are identical except that their battery packs have different voltages. Although both battery packs contain 1000 pounds of deep-cycle lead-acid batteries, vehicle A's pack is 144 volts and vehicle B's pack is 96 volts. With fully charged packs under the same driving conditions, why does vehicle A have a slightly greater range than vehicle B?
- a) vehicle A has better batteries
 - b) Because the batteries in vehicle A will not need to produce as much current as the batteries in vehicle B, the batteries in A will discharge at a slower rate.
 - c) The batteries in vehicle A are twelve volt batteries and the batteries in vehicle B are size volt batteries
 - d) A higher voltage battery pack has more electricity
83. Which of the following is an example of a good conductor?
- a) copper
 - b) rubber
 - c) sulfur
 - d) water
84. What does the symbol below represent in a wiring diagram?
- a) a fuse
 - b) a battery
 - c) a light
 - d) a coil
85. Electric energy is purchased from your utility in what unit?
- a) kilowatts
 - b) amp-hours
 - c) volts
 - d) kilowatt-hours
86. A battery has a 20-hour rating of 100 amp-hours. This rating means that this battery can _____ before being discharged.
- a) produce 100 amps for 20 hours
 - b) produce 100 amps for one hour
 - c) produce 20 amps for five hours
 - d) produce 5 amps for 20 hours
87. A parallel circuit:
- a) is better than a series circuit
 - b) has more than one path for current flow
 - c) has parallel wires in the circuit
 - d) is better for electric cars

88. The torque of a series DC electric motor is normally the greatest:
- a) when the motor has high current flowing through it
 - b) when the motor has high RPMs
 - c) when the motor has low current flowing through it
 - d) both b) and c)
89. Torque is:
- a) a measure of rotational speed
 - b) often measured in foot-pounds
 - c) a measure of the horse power of an electric motor
 - d) both a) and b)
90. An automobile's suspension is designed to support the vehicle's:
- a) Gross vehicle weight
 - b) Body weight
 - c) Passenger load
 - d) Cargo load
91. A gear on the end of a motor shaft has a diameter of 2 inches and has 20 teeth. This gear drives another gear with a diameter of 4 inches and 40 teeth. What is the gear ratio of this gear system?
- a) 1:2
 - b) 2:4
 - c) 20:1
 - d) 2:1
92. What is the kinetic energy of a toy electric vehicle of mass 3 kg and velocity of 2 meters/second?
- a) 6 joules
 - b) 1 joule
 - c) 5 joules
 - d) 12 joules
93. The controller in an electric vehicle performs a function that is similar to the ____ in a gasoline vehicle.
- a) catalytic converter
 - b) fuel injector
 - c) engine
 - d) gas tank
94. What force is needed to accelerate a 1000 kg electric vehicle at 5 m/s²?
- a) 1025 newtons
 - b) 995 newtons
 - c) 5000 newtons
 - d) 200 newtons

95. An electric vehicle is driven an 20 miles per hour for 30 minutes. The driver then increases the vehicle's speed to 60 miles per hour and drives for another 30 minutes. What is the vehicle's average speed during the entire time?
- a) 35 miles per hour
 - b) 45 miles per hour
 - c) 50 miles per hour
 - d) 55 miles per hour
96. Most general purpose wire crimpers can be used to:
- a) cut wire
 - b) crimp terminals on wires
 - c) strip insulation off wires
 - d) all of the above
97. If a typical gasoline powered vehicle is driven 15000 miles, approximately how many pounds of carbon dioxide does it release into the air?
- a) 1000 pounds
 - b) 5000 pounds
 - c) 10000 pounds
 - d) 15000 pounds
98. The strength of an electromagnetic coil:
- a) can be increased by placing an iron bar within the coil
 - b) can not be easily changed
 - c) can be increased by reducing the current in the wire
 - d) can be reduced by increasing the number of wires within the coil
99. Battery box ventilation is important to prevent the accumulation of:
- a) battery acid
 - b) hydrogen gas
 - c) sulfur dioxide gas
 - d) carbon monoxide gas
100. Many people wonder whether you could extend the range of an electric vehicle by attaching an alternator to the axle and charging the batteries as you drove down the road at a steady speed. Why will this not increase your range?
- a) the energy needed to drive the alternator would be more than the energy created
 - b) an alternator could not be connected to an axel
 - c) alternators are too complex
 - d) there aren't any alternators large enough to charge a large battery pack