TROUBLESHOOTING

A video of the troubleshooting board can be found at
http://www.youtube.com/watch?v=0Hzee8lVlDY.

A. The troubleshooting event is intended to test students' electric vehicle troubleshooting skills and general electric vehicle knowledge.

B. Overview
1. # of Students: Each school team shall form a troubleshooting team of 2 students.
2. Two Parts of Event
    a. Part 1 – Written Assessment – 7 minutes
    b. Part 2 – Identify Faults on Troubleshooting Board – 7 minutes

C. Part 1 – Written Assessment
1. Students will be given a written assessment that contains 21 questions. The 21 questions will be made up of 20 multiple-choice questions and 1 short answer question. No notes, scratch paper, or other aids will be provided or allowed.
2. The two students will work on the assessment together. They may wish to divide up the questions in an effort to answer all 21 questions in the 7-minute time period.
3. The assessment will test the students' general knowledge of electric vehicle troubleshooting and electric vehicle components.
4. Students may prepare for the assessment by reviewing the EV Technology Pre- and Post-Test and the "Troubleshooting an EV" lessons in the SMARTT Challenge Curriculum.

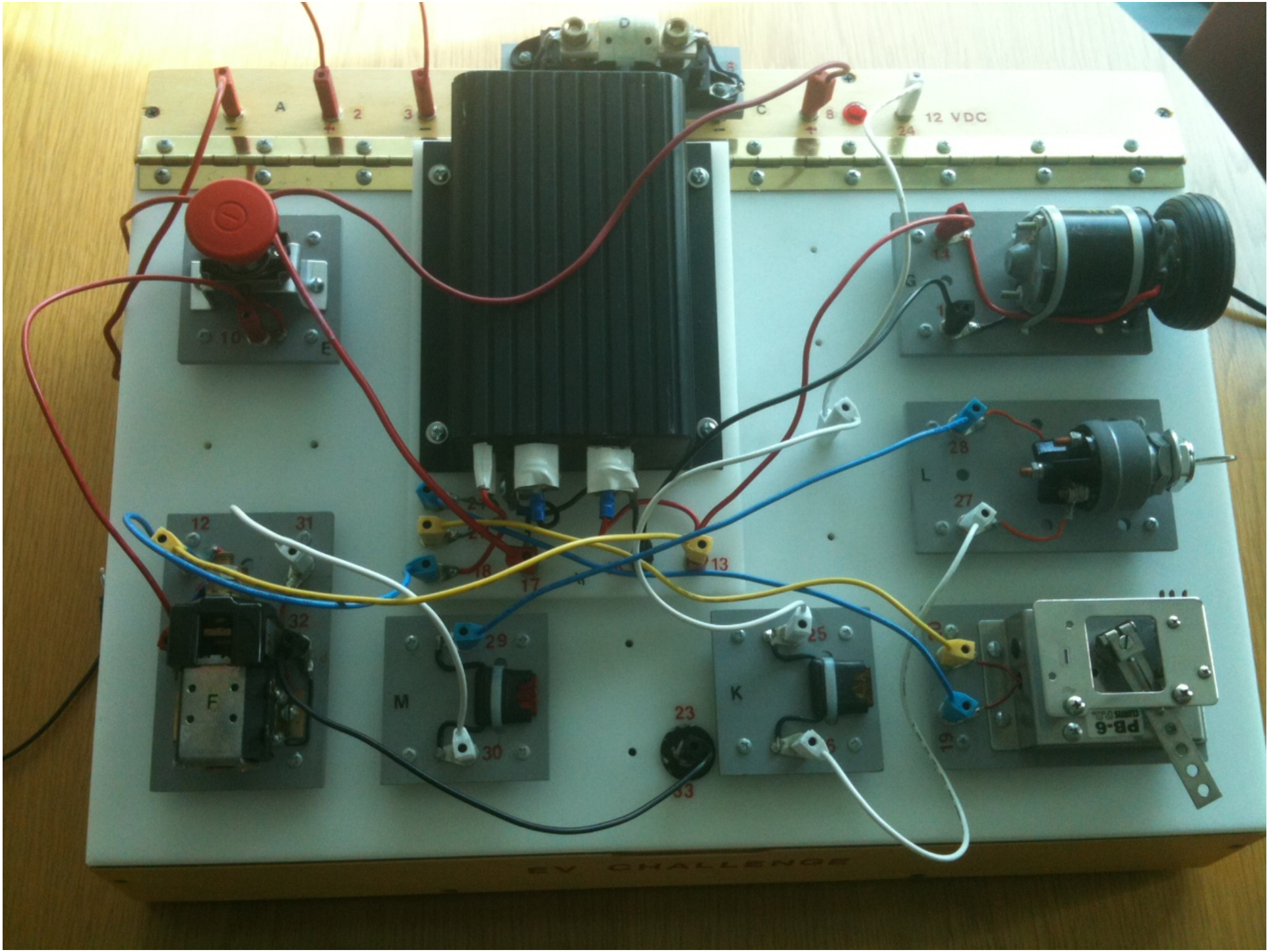
D. Part 2 – Identify and Fix Faults on a Troubleshooting Board
1. Part 2 of the event will utilize a specially designed "Troubleshooting Board."
2. The students' goal is to identify and fix 2 electrical faults placed in the troubleshooting board in the least possible time.
3. Students will be given 7 minutes to identify and fix the 2 faults. If students correct both faults in less than 7 minutes, the time will be recorded and used for tie-breaking purposes only.
4. Students will be able to use a multimeter, the board's wiring diagram, and a pen/pencil/paper (if needed). The wiring diagram is available in the "Forms" section of the SMARTT Challenge web site.
5. Use of a multimeter is the primary way that students will be able to correctly identify the faults.
6. Students will be required to diagnose and "fix" the faults by replacing faulty components or wiring. Appropriate components and wiring will be provided. Tools will not be needed to replace or fix the faults.
7. Although a SMARTT Challenge multimeter will be available, students are strongly encouraged to bring their own multimeter to the event.
8. Safety glasses are required. Although SMARTT Challenge safety glasses will be available, students are strongly encouraged to bring their own safety glasses to the event.

E. Scoring
1. Part 1 – Written Assessment – 50%; 10 points for short answer, 40 points for multiple choice. 50 points total.

2. Part 2 – Troubleshooting Board – 50%; 25 points for correctly fixing each fault, 50 points total.
3. 100 points total for entire event.
4. The winner of the event will be the team with the highest combined score from Parts 1 & 2.
5. Ties will be broken using the following:
    a. The shortest time used to fix both faults on the Troubleshooting board.
    b. The highest score on the written assessment.
    c. The highest score on the short answer section of the written assessment.

F. Troubleshooting Board Description

1. The SMARTT Challenge Troubleshooting Board has been specially designed for the Troubleshooting event. The board fits on a tabletop and simulates the operation of the electrical system in a typical SMARTT Challenge vehicle. The board utilizes a 36-volt high voltage system and a 12-volt low voltage system.
2. The board is equipped with the following components:
    a. 36-volt Curtis controller
    b. Curtis 0 – 5000 ohm pot box (potentiometer)
    c. 3 12-volt sealed batteries that make up a 36-volt battery pack.
    d. A sealed 12-volt auxiliary battery
    e. DC permanent magnet motor
    f. Albright main contactor
    g. On/off key switch
    h. High voltage main disconnect
    i. High voltage main fuse
    j. 2 12-volt fuses
    k. "Test-points" that correspond to the numbers on the wiring diagram
    l. Jumper wires and spare components will also be provided
3. The board operates as follows:
    a. Step 1: Make sure that the main disconnect is closed
    b. Step 2: Turn key switch on
    c. Step 3: Move lever on potentiometer. Motor should rotate.
4. How the Troubleshooting board will be used:
    a. Step 1: Well prior to the event, students should watch the troubleshooting board found online at http://www.youtube.com/watch?v=0Hzee8lVlDY.
    b. Step 2: At the event, students will be given a wiring diagram of the troubleshooting board and given one minute to review the diagram and the board.
    c. Step 3: Students will be given 7 minutes to find and fix the faults. **Students are limited to no more than four guesses.**
    d. Step 4: The faults may be fixed by using jumper wires or by replacing a faulty component(s). The jumper wires and components will be provided. No tools will be necessary. The troubleshooting judge may assist the students with the placement of the jumper wires.


A
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8
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12 VDC
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G
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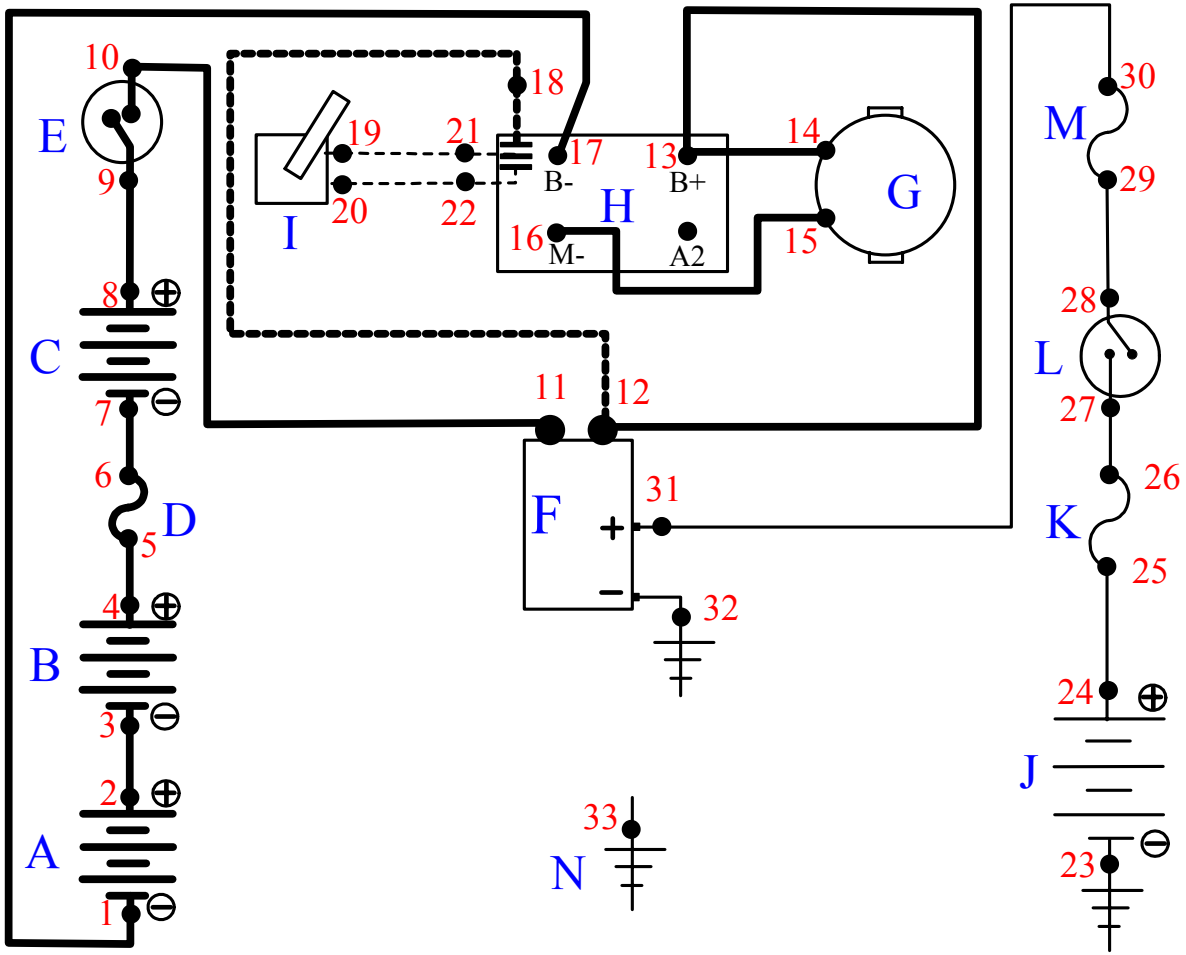
PB-6
EV CHALLENGE

Troubleshooting Board Wiring Diagram



- High Voltage
- High Voltage - Low Current
- Potentiometer Leads
- Low Voltage
- # Test Point

A, B, C -- 12V Traction Batteries
D - High Voltage Fuse
E - Main Disconnect
F - Main Contactor
G - Motor
H - Controller
I - Potentiometer
J - 12V Auxiliary Battery
K - 12V Main Fuse
L - Key Switch
M - 12V Contactor Fuse
N - Chassis Ground

Electric Vehicle Technology #7409

Pre- and Post-test

The pre-test consists of 40 of these questions selected at random. The post-test consists of all 100 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 150 amps 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
A. the emergency brake is off.
B. all of the battery posts are exposed.
C. the high voltage system is disconnected.
D. both A and B

15. An electric vehicle travels 15 miles in 30 minutes. What is the average speed of the vehicle?
A. 15 miles per hour
B. 60 miles per hour
C. 45 miles per hour
D. 30 miles per hour

16. A potentiometer is a type of _____ resistor.
A. potential
B. solid-state
C. variable
D. fixed

17. When a lead-acid battery is discharged, _____ reaction is occurring.
A. an oxidation-reduction
B. a combustion
C. a synthesis
D. a decomposition

18. Which of the following is generally not considered an alternative vehicle fuel?
A. Diesel
B. Ethanol
C. Methanol
D. Natural gas

19. Electric potential is measured in:
A. watts.
B. amperes.
C. volts.
D. ohms.

20. Which of the following is most effectively used to neutralize an acid spill from a lead-acid battery?
A. Gasoline
B. Sulfuric acid
C. Baking soda
D. Hydrogen gas

21. If you are using a power tool and the circuit breaker trips, you should first:
A. reset the circuit breaker.
B. unplug your tool and use another circuit.
C. use another tool.
D. 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 amps

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 2000.
D. that cities of over 1 million people must reduce air pollution by 25% by 2010.

31. During the last thirty 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 vehicle was built 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 the _____.
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 become 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 that _____.
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 and drives for another 15 minutes. What is the approximate distance that the vehicle 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 the 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 modulated 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. only when working on batteries.
B. whenever one is in the lab or shop.
C. only 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. Electric 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

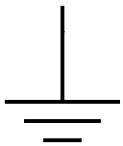
67. A standard lead-acid battery has a twenty-hour capacity of 100 amp-hours. However, this same battery only has a one-hour capacity of 65 amp-hours. Why does this battery have a lower one-hour capacity rating?
A. Batteries generally have less capacity when discharged at a faster rate.
B. When discharged for twenty hours, the battery increased 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/DC 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 cable 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 a stop. 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 six 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 horsepower 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 motor shaft has a diameter of 2 inches and has 20 teeth. This gear drives another gear with a diameter of 4 inches and a 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/s^2?
A. 1025 newtons
B. 995 newtons
C. 5000 newtons
D. 200 newtons

95. An electric vehicle is driven at 30 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. cannot 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 an axle and charge the batteries as you drive 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 axle.
C. Alternators are too complex.
D. There aren't any alternators large enough to charge a large battery pack.

Equations Needed for Electric Vehicle Technology Course #7409 Exam

Ohm's Law: $R = V / I$ where R = resistance, V = voltage and I = current

Average speed = total distance / total time

Total distance = average speed X total time

Kinetic Energy = $\frac{1}{2}(mv^2)$, where m = mass and v = velocity

Newton's Second Law: $F = ma$, where F = force, m = mass, and a = acceleration

EV Pre-Post Test Answer Sheet

1	A	35	B	69	C
2	D	36	D	70	D
3	B	37	C	71	B
4	B	38	A	72	D
5	D	39	A	73	A
6	C	40	B	74	A
7	D	41	D	75	B
8	C	42	B	76	C
9	B	43	C	77	D
10	A	44	D	78	A
11	B	45	B	79	D
12	D	46	B	80	A
13	A	47	D	81	C
14	C	48	B	82	B
15	C	49	A	83	A
16	C	50	C	84	B
17	A	51	D	85	D
18	A	52	B	86	D
19	C	53	B	87	B
20	C	54	D	88	A
21	D	55	D	89	B
22	D	56	B	90	A
23	C	57	D	91	D
24	D	58	C	92	A
25	C	59	B	93	B
26	B	60	A	94	C
27	B	61	B	95	B
28	C	62	D	96	D
29	A	63	B	97	D
30	A	64	A	98	A
31	A	65	A	99	B
32	D	66	D	100	A
33	B	67	A		
34	C	68	B		