ASE xEV (Level 2) - Quiz Questions with Answers

Section C: Establishing an Electrically Safe Work Condition

1.

What does the "AC" stand for in an AC motor?

- **Alternating current**
- Associated current
- Amperage current
- Alive current

Correct answer: Alternating current

AC stands for alternating current. The AC motor is known as a three-phase motor that's powered by 240 volts of alternating current. It can be either an induction motor or synchronous motor.

Induction motors are more cost-effective and require less maintenance. These are used in several high-performance EVs, such as the Tesla Model 3.

2.

Which of the following vehicles shares a lot of the same dashboard warning lights as a non-electrified vehicle?

HEV

BEV

Tesla

Electric truck

Correct answer: HEV

Hybrid Electric Vehicles (HEV) contain many of the same dashboard warning lights as a traditional vehicle. In addition to the warning lights found on an ICE (Internal Combustion Engine) vehicle, the hybrid may add a few others that are found on BEVs (Battery Electric Vehicles). This combination helps to bridge the gap between ICEs and BEVs.

The BEV doesn't have an ICE. Therefore, many of the same warning symbols are no longer needed.

3.

What component manages the temperature of the electric motor?

Thermal cooling system

Onboard charger

DC/DC converter

Power electronics controller

Correct answer: Thermal cooling system

The thermal cooling system is responsible for managing the operating temperature of the electric motor. It also manages the temperature of the power electronics.

The onboard charger is necessary for AC charging, while the DC/DC converter transforms high-voltage power to low-voltage power. xEVs have a power electronics controller to monitor the speed and torque of the motor.

4.

What is the name of the low-voltage battery in an xEV that supplies electricity to start the vehicle?

Auxiliary

Traction

Solid state

Alkaline

Correct answer: Auxiliiary

The auxiliary battery is a low-voltage battery used in xEVs. It supplies electricity to start the vehicle and may power some accessories.

Auxiliary batteries aren't only in xEVs, but also in gas- or diesel-powered vehicles.

5.

What does the Regenerative Braking System Light mean?

System is active

System malfunction

Check regenerative brakes

Recharge is needed

Correct answer: System is active

The RBS (Regenerative Braking System) light indicates that the regenerative braking system is active. It lights up when the EV (Electric Vehicle) is using regenerative braking and is not an indication that something is wrong.

If there was an issue with the braking system, a warning light with an exclamation symbol would appear. This Regenerative Brake Warning means there's a fault in the system.

6.

Which of the following ensures high-quality CPR?

Minimized interruptions in chest compressions

Pushing on the chest as hard as possible

Leaning on the victim between compressions

Extra breaths given beyond what's called for

Correct answer: Minimized interruptions in chest compressions

Anybody can provide high-quality CPR. One of the keys is to minimize interruptions in chest compressions.

Along with that, the compressions must be of adequate rate and depth, and the person should never lean on the victim. Proper hand placement must be performed and excessive ventilation should be avoided.

7.

During what event should CPR be performed?

Cardiac arrest

Heart attack

Stroke

Broken bone

Correct answer: Cardiac arrest

Cardiac arrest is when the heart stops beating unexpectedly. It's caused by an electrical malfunction in the heart.

A heart attack is when there's a blockage to the blood circulation. Typically, when a person experiences a heart attack, they will remain conscious, but cardiac arrest is possible following a heart attack.

8.

What type of vehicle has a special Active Air Suspension indicator?

Tesla

HEVs

BEVs

PHEVs

Correct answer: Tesla

Tesla vehicles are the only type with an Active Air Suspension warning light. This light shows a car with an arrow pointing up and down. It indicates a fault in the system that needs to be checked by a Tesla technician.

Other BEVs (Battery Electric Vehicles) don't contain this warning light. It also won't be found on hybrids or vehicles with internal combustion engines.

9.

As a Level 2 technician, when would you be expected to fight a shop fire?

Only when it's controllable

Any time fire breaks out

If you caused it

When it's caused by a high-voltage battery

Correct answer: Only when it's controllable

If the fire is small and controllable, you can fight the fire in accordance with your employer's Emergency Action Plan (EAP) Standard Operating Procedure (SOP). This controllable fire shouldn't be spreading to any other areas.

To continue fighting the fire, there must be an exit that you can back up to. 911 should also be called.

10.

What type of motor converts electrical energy from stored power into mechanical energy?

Traction

ICE

Diesel

Gas

Correct answer: Traction

The electric traction motor converts electrical energy from a stored power source to mechanical energy. This conversion occurs because of rotational force.

The Internal Combustion Engine (ICE) uses fuel to create energy. Both the diesel and gas engine are types of ICEs.

11.

What is the purpose of CPR?

Maintain blood flow

Promote breathing

Encourage consciousness

Reduce electrical shock damage

Correct answer: Maintain blood flow

CPR (Cardiopulmonary Resuscitation) is needed to keep the blood flow active after cardiac arrest. It may only provide partial blood flow, but that's enough to promote successful resuscitation by medical staff when they arrive.

CPR doesn't promote breathing or encourage consciousness. It also won't stop the damage that's been done if a person has been shocked.

12.

What does the dashboard light with an "EV" mean?

Electric Vehicle (EV) mode

Extra Voltage

Exit Vehicle

Essential Voltage

Correct answer: Electric Vehicle (EV) mode

The dashboard symbol that features a car and the letters "EV" means that the vehicle is in EV mode. Some hybrid vehicles have an EV mode that allows them to run on battery power only. When this dashboard symbol is on, no fuel is being used.

BEVs (Battery Electric Vehicles) don't have this warning light because EV mode is all that can be used. There's no fuel tank in BEVs.

13.

Which of the following items isn't part of the electrified propulsion vehicle (xEV) Service Safety Kit?

Retrieval hook

Magnetic car topper

Class-0 electrical safety gloves

Glove leak tester

Correct answer: Retrieval hook

All Service Safety Kits should include a magnetic car topper, along with caution barricades and cones to create a safety zone around the vehicle. It should also include caution tape and a fire extinguisher.

In conjunction with those parts, this safety kit should include Class-0 electrical safety gloves and leather over-gloves. It also needs a glove leak tester and protective shield head gear. The retrieval hook is a safety item that should be located somewhere in the shop for emergency use.

14.

How long should a technician wait to touch high-voltage terminals or connectors after disabling the system with the Manual Service Disconnect (MSD) or other manufacturer method?

Prescribed time by Original Equipment Manufacturer (OEM)

One minute

Five minutes

Ten minutes

Correct answer: Prescribed time by Original Equipment Manufacturer (OEM)

Once a technician has disabled the system with the Manual Service Disconnect (MSD) or other methods outlined by the automaker, it's important to wait the prescribed time by the OEM before touching any high-voltage terminals or connectors.

Every manufacturer has different guidelines, so there's no blanket rule giving a time. Refer to the OEM instructions and guidelines set at the workplace.

15.

At what point is it safe to touch a person in contact with an electrical current?

Never

When you have a conductive stick to push them with

When standing on a rubber mat

Anytime

Correct answer: Never

It's never safe to touch a person being shocked by an electrical current. By touching them, you could become part of the current.

Instead, you want to turn off the power at the source, whenever possible. You also want to call 911. Once the patient isn't being shocked, you can follow other first aid protocols, such as treating burns, performing CPR, and keeping the person from becoming too cold.

16.

Prior to the start of CPR, what should be done?

Call 911

Verify electric source is active

Head count taken of employees

EV should be moved out of bay

Correct answer: Call 911

If an emergency event has occurred, 911 should be called first. CPR can be started after 911 is called, and performed at the direction of the operator.

By starting CPR, you give the victim a better chance of survival when the emergency responders arrive.

17.

What does a BEV eliminate the need for?

Fuel

Transmission

Exterior lighting

Suspension

Correct answer: Fuel

The Battery Electric Vehicle (BEV) doesn't need any fuel to run. Instead, it uses a battery pack and electric motor(s). A Plug-In Hybrid Electric Vehicle (PHEV) can also run on electric-only power, but it still contains a fuel tank as a backup source.

The BEV still has a transmission, although it may only be a single-speed. These vehicles also have exterior lighting and suspension.

18.

What is the term used to describe compression-only CPR?

Hands-only CPR

Fast CPR

Traditional CPR

Medical CPR

Correct answer: Hands-only CPR

Hands-only CPR is done without mouth-to-mouth breathing. It may not be as effective, but is an alternative when helping someone in public or at work.

The chest compressions continue the same way as conventional CPR, but without the mouth-to-mouth breathing aspect occurring.

19.

For adult victims, what is the chest compression to mouth-to-mouth breathing ratio during CPR?

30:2

22:2

20:1

10:1

Correct answer: 30:2

During CPR, use 30:2 compressions to breaths. The chest compressions should occur at a rate between 100 and 120 per minute.

These chest compressions should reach a depth of two inches. Yet, the depth should never increase beyond 2.4 inches.

20.

What does the warning light with a turtle mean?

Limited power

Slow mode

Reduce speed

Proceed with caution

Correct answer: Limited power

A turtle dashboard warning light means that the EV has limited power. The warning light may be either red or amber-colored.

It could indicate a fault that prevents the vehicle from being responsive. This warning may signal a serious fault, so it needs to be looked at immediately.

21.

What must a Level 2 technician set up around the electrified work area?

Safety zone

Chairs

Nothing

Conductive barriers

Correct answer: Safety zone

The Level 2 technician is responsible for setting up a safe zone around the electrified work area. Whenever high-voltage system repairs are left unattended, warning signs must alert others of the danger.

Additionally, removed parts must follow all of the guidelines for the Lockout/Tagout (LOTO) procedure.

22.

What is the difference between a HEV and BEV?

- **Powertrain**
- Number of wheels
- Shape/size
- Durability

Correct answer: Powertrain

The Hybrid Electric Vehicle (HEV) has an internal combustion engine, battery pack, and electric motor(s). The Battery Electric Vehicle (BEV) doesn't have an internal combustion engine, but only contains a battery pack and electric motor(s).

The amount of wheels, shape/size, and durability aren't affected by whether the vehicle is an HEV or BEV.

23.

What should you do if the high-voltage battery causes a fire?

Evacuate the area immediately

Try to put it out

Call others over to help

Move other vehicles to safety

Correct answer: Evacuate the area immediately

Even if the fire looks controlled, if it was caused by a high-voltage battery, you should evacuate the area immediately. Because of the stranded energy in the battery, an explosion could occur.

Once everyone is safe, it's important to call 911. First responders have the equipment to put out battery fires.

24.

What does the Ready to Drive dashboard symbol look like?

Car with double arrow underneath

Letters "RG"

Thumbs up

Sign that says "GO"

Correct answer: Car with double arrow underneath

The Ready to Drive light shows a car and a double arrow below it. This light is green and is one that doesn't alert to any danger.

When the hybrid or EV is ready to drive, this light comes on. It helps to determine if the vehicle is running, since it can be nearly silent.

25.

Which of following components is the Level 2 technician allowed to touch while the Level 1 technician is not?

Manual Service Disconnect (MSD)

Gas engine

Stereo system wiring

High-voltage battery

Correct answer: Manual Service Disconnect (MSD)

The Level 2 technician is permitted to touch the Manual Service Disconnect (MSD) and other high-voltage components, while the Level 1 technician isn't trained for these jobs.

Both technicians are permitted to work on non-electrified components. Neither technician is qualified to work on the high-voltage battery.

Section D: Safety-Related Work Practices

26.

Lithium-ion batteries are dry-cells containing what type of substance?

Electrolyte

Acid

Water

Sand

Correct answer: Electrolyte

The lithium-ion battery is known as a dry-cell battery. It contains electrolytes, most commonly a lithium salt solution, known as Lithium Hexafluorophosphate (LiPF6).

These electrolytes are corrosive, flammable, and toxic. Contact with the electrolytes should never be made.

27.

What instructions do technicians need to follow when removing or installing an electric vehicle battery pack?

Original Equipment Manufacturer (OEM)

OSHA

Employer

Internet influencer

Correct answer: Original Equipment Manufacturer (OEM)

There are manual handling risks associated with replacing or disposing of heavy battery packs. For this reason, technicians should always follow the Original Equipment Manufacturer (OEM) instructions to reduce danger.

It's also important to follow all recommendations by OSHA, as well as the employer. These guidelines should be taught to technicians as part of the training.

28.

Which of the following won't be required when conducting high-voltage battery service?

Retrieval hook

Lifting equipment

Special equipment for make/model

Original Equipment Manufacturer (OEM) instructions

Correct answer: Retrieval hook

The retrieval hook is a handy safety tool provided by some employers. It's to be used when electric shock occurs and the power source can't be disconnected.

Required items may include lifting equipment that facilitates the battery pack removal. Technicians also need any special equipment designed for that particular make and model. This information is all supplied by the Original Equipment Manufacturer (OEM).

29.

What type of energy releases high voltage ranging from 100 V DC to 800 V DC?

Stranded

Trapped

Contained

Dispersed

Correct answer: Stranded

Stranded energy can release high-voltage energy from 100 V DC to 800 V DC, depending on the battery condition. This stored energy in the battery or capacitors can be released after damage or an accident.

When the stranded energy is released, you may hear popping, sizzling, or see sparks. 911 should always be called if stranded energy is a possibility.

30.

What is responsible for monitoring the battery's temperature?

Battery Management System (BMS)

Electric traction motor

DC/DC converter

Thermal cooling system

Correct answer: Battery Management System (BMS)

The Battery Management System (BMS) monitors the temperature. It's also responsible for checking overall state-of-health and cell voltages. The information received by the BMS is processed and sent to the various sensors and computers, allowing systems to make adjustments as needed.

The electric traction motor is responsible for changing power to mechanical energy, while the DC/DC converter changes the high-voltage DC current to lower voltage for accessories. The thermal cooling system is responsible for the temperature of the motor and power electronics.

31.

What is used in xEVs to detect the defects in insulation?

Integrated electrical leakage detectors

Battery Management System (BMS)

Onboard charger

Power electronics controller

Correct answer: Integrated electrical leakage detectors

Integrated electrical leak detectors are used in xEVs. These detectors monitor for a loss of isolation within the high-voltage components and inverter. The detectors detect defects in the insulation or other physical damage to prevent injury.

The Battery Management System (BMS) monitors the condition of the battery, but isn't looking for loss of isolation. The onboard charger and power electronics controller only have to do with the charging of the EV.

32.

Which of the following situations won't cause a lithium-ion battery to release toxic gases or explode?

Full charge

Incorrectly charged

Damaged

After an accident

Correct answer: Full charge

Lithium-ion batteries contain toxic substances and flammable electrolytes. The batteries are made from nickel, manganese, lithium, cobalt, and other hazardous substances.

When the battery is incorrectly charged or damaged, it can release toxic substances. It can also lead to an explosion or a fire.

33.

How should labeled components be opened?

By Original Equipment Manufacturer (OEM) instructions

By Level 1 technicians

While standing on a rubber mat

They don't need to be opened

Correct answer: By Original Equipment Manufacturer (OEM) instructions

Any high-voltage component with a label attached should be opened according to the Original Equipment Manufacturer (OEM) instructions. Directions can differ based on the make and model of the vehicle.

These components are only to be opened by Level 2 or 3 technicians. The insulated rubber mat is a great tool that can prevent electric shock, but it's not required.

34.

Technician A believes that an insulation inspection must be performed visually before reconnecting a high-voltage battery. Technician B says that an insulation testing tool must be used. Which technician is correct?

Technician B

Technician A

Neither technicians

Both technicians

Correct answer: Technician B

It's critical to inspect the insulation before reconnecting a high-voltage battery. To do this, all testing practices and procedures must be performed with an insulation testing tool, making Technician B correct.

Visual inspection may not reveal defects in the insulation, thereby putting Technician A in danger.

35.

At what point can a Level 2 technician replace high-voltage cables or connectors?

After the high-voltage battery has been disconnected

Never, only a Level 3 technician can perform these tasks

Whenever they need to be replaced

Never, these parts aren't meant to be replaced

Correct answer: After the high-voltage battery has been disconnected

Once the high-voltage battery is disconnected and the components are confirmed to be de-energized, the cables and connectors can be replaced. All parts must be secured with the appropriate Lockout/Tagout procedures.

It's important to follow all Original Equipment Manufacturer (OEM) guidelines when working with high-voltage systems. Level 3 technicians are also qualified to do this work.

36.

Which of these is not a complication of cutting into high-voltage wire while testing?

Faster charging times

Dangerous shorting condition

System disabled

Cable damage

Correct answer: Faster charging times

Cutting into high-voltage wire during testing is not going to create faster charging times. Technicians are never permitted to cut or pierce high-voltage wiring for testing.

Doing so creates the possibility for a dangerous shorting condition. It can also disable the system and leave permanent cable damage.

37.

What is the optimum temperature range for a high-voltage battery?

77°F to 95°F

82°F to 105°F

67°F to 85°F

55°F to 75°F

Correct answer: 77°F to 95°F

The optimum temperature range for high-voltage batteries is 77°F to 95°F. Most electric-propulsion vehicles contain integrated air- or liquid-cooling systems to keep the battery between these temperatures.

Overcharging the batteries or damage, especially from an accident, can lead to overheating of the batteries and they could ignite.

38.

What must the high-voltage battery pack be constructed with?

Ingress Protection (IP)-rated casings

Teflon

Rubber

Conductive materials

Correct answer: Ingress Protection (IP)-rated casings

All high-voltage battery packs and components must be cased with materials that have an Ingress Protection (IP) rating between IP65 and IP68. This level of protection ensures that water and dust don't get inside.

Additionally, the battery and high-voltage components must be inspected to ensure there aren't cracks or damaged seals. This type of damage can lead to dust or water infiltration.

39.

What secures the high-voltage system from switching on unexpectedly?

Approved Lockout/Tagout (LOTO) process

Rubber gloves

Retrieval hook

Putting key fob in pocket

Correct answer: Approved Lockout/Tagout (LOTO) process

By using the approved Lockout/Tagout (LOTO) process, you prevent the high-voltage system from turning on during service. After parts have been de-energized and removed, they must be secured through this process.

Both rubber gloves and a retrieval hook are important safety features, but they won't prevent the system from turning back on. You also don't want to put the key fob anywhere within range of the vehicle.

40.

Why are warning labels placed on electric vehicles?

To indicate danger of electrical current

To help you understand the make or model

To explain trim level features

To explain servicing procedures

Correct answer: To indicate danger of electrical current

Warning labels are placed on electric vehicles to indicate the potential danger of electrical current. They are placed by the Original Equipment Manufacturer (OEM).

The warning labels don't indicate the make or model of the vehicle. They also won't help you understand the trim level features or explain servicing procedures.

Section A: Purpose and Definitions

41.

Which of the following skills does the Level 2 technician not need?

- **Repairing high-voltage battery packs**
- Identifying potential hazards
- Repairing high-voltage systems
- Creating a safe work environment

Correct answer: Repairing high-voltage battery packs

The Level 2 technician has not been trained to repair high-voltage battery packs. Only a Level 3 technician is qualified for this work.

The Level 2 technician has received training to operate and repair high-voltage systems. They also maintain a safe working environment, use Personal Protective Equipment (PPE), and can identify potential hazards to reduce the risk.

42.

What is the lowest level technician that's qualified to isolate voltage from the EV's high-voltage system?

Level 2

Level 1

Level 3

None

Correct answer: Level 2

Level 1 technicians are not qualified to work on the high-voltage systems of the EV. To isolate voltage from the EV systems, you must be a Level 2 technician.

The Level 3 technician can also perform this work. This technician is qualified to work on EV batteries as well.

43.

Why must the Level 2 technician know how to secure the high-voltage system?

So it doesn't become activated

So nothing gets stolen

To keep it from getting lost

To add an extra cost to the bill

Correct answer: So it doesn't become activated

Power must be isolated from the high-voltage system while it's being worked on. If the current were to start flowing, it could cause electrical shock and injury.

Therefore, a Level 2 technician must understand how to secure the high-voltage system and keep it from activating. They must also know how to isolate voltage from the systems.

44.

What must a technician do before getting the Level 3 certification?

Attain Level 2 qualifications

Work 40 hours as a service technician

Own Personal Protective Equipment (PPE)

Drive an EV

Correct answer: Attain Level 2 qualifications

The Level 3 technician will also have achieved the Level 2 certification. They must also have training for high-voltage battery packs.

Level 3 technicians are qualified to perform "live" work, so they must understand the risks and learn how to reduce hazards.

45.

Which EV technician is qualified to drive EVs?

All three levels

Level 1

Level 2

Level 3

Correct answer: All three levels

All three level technicians are qualified to operate EVs. The Level 1 technician is known as an electrically aware person, who has learned the risks of working around and with high-voltage systems. This technician can maintain and repair non-high-voltage components.

The Level 2 person is known as a high-voltage vehicle technician. This technician can isolate high-voltage systems and repair de-energized components. The Level 3 person is known as a high-voltage vehicle and battery technician.

46.

Which of the following tasks cannot be performed by a Level 2 technician?

Diagnose issues with the high-voltage battery

Isolate voltage from the system

Secure the high-voltage system so it can't be activated

Perform general work on de-energized high-voltage components

Correct answer: Diagnose issues with the high-voltage battery

Only a Level 3 technician is qualified to diagnose or repair issues with the high-voltage battery. The Level 2 technician is qualified to evaluate the condition of the high-voltage electrical system and isolate the voltage.

Level 2 technicians can also secure the high-voltage system to ensure it doesn't get activated, and restart the system. These technicians perform general work on de-energized components and understand the risks of working with a high-voltage system.

47.

What level technician is permitted to separate individual battery modules?

Level 3

Level 2

Level 1

None

Correct answer: Level 3

The Level 3 technician can separate individual battery modules. They can also perform diagnostic and repair work.

Level 3 technicians can also perform all of the same tasks as the Level 2 and Level 1 technicians.

48.

What is the title given to a Level 3 technician?

High-voltage vehicle and battery technician

High-voltage vehicle technician

Electrically aware person

EV technician

Correct answer: High-voltage vehicle and battery technician

The Level 3 person is considered a high-voltage vehicle and battery technician. They can diagnose and repair high-voltage batteries, plus separate individual battery modules.

The Level 2 technician is known as a high-voltage vehicle technician. Level 1 technicians are electrically aware people.

Section B: General Requirements for Electrical Safety-Related Work Practices

49.

Who needs to be treated by a professional after an electrical shock?

- **Everybody**
- Those with burns
- Anyone feeling dizzy
- If they've hit their head

Correct answer: Everybody

Even a low-voltage shock can cause damage. Depending on the person's health, they could experience cardiac arrhythmias, kidney damage, and internal burns.

Even if a burn isn't present, the patient should receive medical care. Call 911 whenever an electrical shock has occurred.

50.

What systems must be de-energized when high-voltage components or cables are disconnected or removed?

High-voltage

Low-voltage

Zero voltage

Medium voltage

Correct answer: High-voltage

The high-voltage systems must be de-energized before any high-voltage cables and components are disconnected or removed. During non-high-voltage maintenance or repairs, the high-voltage systems may not need to be disabled or de-energized.

In addition to de-energizing the system, the parts must be verified safe before working on them.

51.

How safe is "live work"?

Not safe at all

Safe under the right conditions

Completely safe

Should never be done

Correct answer: Not safe at all

Level 3 technicians perform "live work". This work is not considered electrically safe.

For this reason, it's even more important to follow all the recommended guidelines, especially when working around high-voltage systems.

52.

What causes the heart to stop during an electric shock?

Muscle contractions

Burns

Respiratory distress

Pain

Correct answer: Muscle contractions

The electric shock creates muscle contractions within the body. The heart is a muscle and it can contract to the point that it stops beating.

If this occurs, cardiac arrest occurs. CPR (Cardiopulmonary Resuscitation) can help to keep the blood flowing in the shocked patient until medical help arrives.

53.

When should face shields be cleaned?

After each use

Before each use

Never

Once a week

Correct answer: After each use

Face shields should be cleaned immediately after each use. They must also be stored properly to prevent damage and contamination.

Face shields are worn to protect the technician's eyes from flash over or arc flash while working on energized components.

54.

What is the electrically safe work condition?

State

Procedure

Process

Chain of command

Correct answer: State

The electrically safe work condition is a state where the high-voltage electrical circuit parts and conductors are disconnected or isolated from energized high-voltage parts. It's not a procedure that gets done, but the state that occurs when the procedures are performed.

In an electrically safe work condition, the parts have no voltage. This condition allows the technician to work without the use of Personal Protective Equipment (PPE).

55.

What is the name of the foam-filled fiberglass pole that safeguards technicians assisting people that are victims of electrical shock?

Retrieval hook

Push stick

Wonder wand

Assist pole

Correct answer: Retrieval hook

An insulated retrieval hook is also known as a rescue hook or a hot stick. It's a foam-filled fiberglass pole that can be used to assist victims of electrical shock.

The retrieval hook helps to remove injured people from hazardous areas. Technicians should be trained to separate a person from an active circuit if power can't be shut off.

56.

What does the face shield protect the eyes from?

Arc flash

Corrosive materials

Debris to the eyes

Fire

Correct answer: Arc flash

Face shields are used to protect the eyes from flash over or arc flash. This condition can occur if electrical arcing is produced when working on energized parts or the electrified xEV batteries.

Face shields must have a full 180 degree field of vision and be rated for arc thermal protection.

57.

Technician A states that a vehicle may not run after the Diagnostic Trouble Code (DTC) is set due to a loss-of-isolation circuit. Technician B says that the DTC may not affect driveability.

Which technician is correct?

Both

Technician A

Technician B

Neither

Correct answer: Both

The loss-of-isolation causes a Diagnostic Trouble Code (DTC) after two consecutive trips for the same failure. As a safety precaution, the vehicle may not turn on after the power is shut down.

On the other hand, the vehicle may be completely driveable during this time. Therefore, both technicians are correct.

58.

At what level of electric shock are severe burns and internal organ damage probable?

Over 2,000 mA

Between 6–16 mA

Between 17–99 mA

Between 100–2,000 mA

Correct answer: Over 2,000 mA

Once the electrical current reaches over 2,000 mA, there's a high chance of severe burns and internal organ damage. Cardiac arrest is also a high probability.

Even a shock lower than this can lead to death, nerve damage, muscular contractions, and ventricular fibrillation.

59.

When should approved leather over-gloves be inspected?

Before and after each day's use

Before each day's use

After each day's use

Once a week

Correct answer: Before and after each day's use

Over-gloves must be inspected before and after each day's use. Technicians must inspect the gloves for damage or contamination.

Metal shavings and grease are conductive materials. These contaminants could result in fire or electrical hazard when touching high-voltage materials. Over-gloves should never be used if they are contaminated.

60.

When an arc flash occurs, what can accompany it?

Explosive release of thermal energy

Flashing lights

Screeching noise

Leaking contaminants

Correct answer: Explosive release of thermal energy

When the insulation or air separation between two high-voltage conductors is compromised, an arc flash can occur. This plasma arc forms between the two conductors.

An arc flash releases a potentially explosive release of thermal energy. This release may trigger a blast, similar to a bomb, known as an arc blast.

61.

Barricades must be used with signs and tags to prevent access to work areas with live activated components operating at what minimum degree?

30 V AC rms or 60 V DC

20 V AC rms or 50 V DC

40 V AC rms or 70 V DC

50 V AC rms or 80 V DC

Correct answer: 30 V AC rms or 60 V DC

Any time that live activated components are operating at 30 V AC rms or 60 V DC or more, barricades must be used to prevent access. Barricades are used in conjunction with signs and tags.

Attendants must be used if barricades don't provide enough protection from electrical hazards.

62.

What is the term used to describe the high power discharges of electricity occurring between two or more conductors?

Arc faults

Electric jump

Flash bang

Shorted connector

Correct answer: Arc faults

Electrical arc faults are high power discharges of electricity that occur between two or more conductors. This malfunction is one of the most common causes of fire.

The heat coming from the discharge causes the wire insulation to breakdown and deteriorate, leading to the arc or spark that creates a fire.

63.

What is the name for the line connected to the chassis ground and electrified components that proactively detect varying voltages and initiates pre-emptive isolation?

Equipotential bonding line

Isolating line

De-energized line

Safety line

Correct answer: Equipotential bonding line

The equipotential bonding line is designed to connect to the electrified components and chassis ground. It's designed to detect the varying voltages and initiate pre-emptive isolation.

With the equipotential bonding line in place, potential failures are prevented when a fault occurs.

64.

Aside from high-voltage systems, what other application can insulated hand tools be used on?

No other application

Any general repair

Non-high-voltage repairs

Household repairs

Correct answer: No other application

Insulated tools are only designed to be used on high-voltage systems. They aren't intended to be used in any other repair application.

Technicians should have insulated hand tools for work with high-voltage systems and other tools for non-high-voltage repairs.

65.

What must be placed when a technician leaves a high-voltage system repair unattended?

Warning signs

Conductive barricade

Cone

Magnetic car topper

Correct answer: Warning signs

Technicians are responsible for placing warning signs when leaving a high-voltage system repair unattended. They must also maintain a defined safety zone around the work area, as per the vehicle manufacturer.

Conductive barricades should never be used. Cones and magnetic car toppers should always mark off the xEV work area, even when the technician is present.

66.

xEVs have a floating ground operating in what capacity with the vehicle chassis ground?

Not connected

Connected

Running in series

Running in parallel

Correct answer: Not connected

The xEV has a floating (isolated) ground. This ground is not connected to the vehicle chassis ground.

This setup creates a built-in safety mechanism. A Diagnostic Trouble Code (DTC) is stored after two consecutive trips with the same failure.

67.

What is the term used to describe the state when a high-voltage electrical conductor or circuit part is disconnected and isolated from energized high-voltage parts?

Electrically safe work condition

No power state

Electric neutral

Powered down

Correct answer: Electrically safe work condition

The electrically safe work condition is a state where high-voltage circuit parts and electrical conductors are disconnected and isolated from energized high-voltage parts. This state doesn't apply to high-voltage battery packs.

These parts must be locked or tagged in accordance with OSHA regulations. These parts must also be tested for the absence of voltage, so the technician isn't required to wear Personal Protective Equipment (PPE) around them.

68.

When can insulating sleeves be used?

If parts will be touched with gloves alone

Never

With every job

At the technician's discretion

Correct answer: If parts will be touched with gloves alone

Insulating sleeves may be used if the work practices can't prevent touching energizing parts using gloves alone. These insulating sleeves must meet ASTM D1051 regulations for use.

The insulating sleeves should be inspected before and after each day's use and not worn if any contamination or damage is discovered.

69.

Which of the following isn't required for electrical insulating gloves?

Soft inner material for comfort

Stamped for MAX USE VOLT 1000V AC

Red-colored label with voltage range

Expiration date with laboratory test information

Correct answer: Soft inner material for comfort

The lineman's gloves do not need to have a certain type of inner material to create more comfort. They must be stamped for MAX USE VOLT 1000V AC.

The electrical insulating gloves must also have a red-colored label with the voltage range specified, and have an expiration with the laboratory testing information on them.

70.

How can power be cut off at the source of electric shock if it's coming from an electrified vehicle?

Manual Service Disconnect (MSD)

Fuse

Relay

Charging cord

Correct answer: Manual Service Disconnect (MSD)

The Manual Service Disconnect (MSD) lever is a low-voltage component that removes power from the contractor control circuits. By removing the MSD, the system becomes de-energized.

If the source of the power is coming from the high-voltage battery, there may not be a disconnect available.

71.

What is the equation to determine how much current will pass through the body based on the power source?

I = V/R

C = R/V

I = V+R

I = V-R

Correct answer: I = V/R

To calculate the amount of current that would pass through a person's body, you want to use I = V/R. Take the voltage and divide it by the resistance.

As an example, if the source has 400 V and the resistance is 600 ohms, the total current would be 660 mA (400/600). That equates to more than eight times the 75 mA lethal limit.

72.

What arc faults are xEV systems subject to?

Both series and parallel

Series

Parallel

None

Correct answer: Both series and parallel

EV systems are subject to series arc faults caused by disruption in continuity of the conductor. They are also prone to parallel arc faults from the unintended current between the two conductors. These parallel arc faults are usually caused by a ground fault.

Arc flash is a known hazard of EV batteries, especially after they have been damaged or are deemed defective.

73.

What is the term to describe the uneven and uncoordinated pumping of the heart after an electrical shock?

Ventricular fibrillation

Muscle contraction

Nerve damage

Shock

Correct answer: Ventricular fibrillation

Ventricular fibrillation occurs when the heart pumps unevenly and uncoordinated after an electrical shock. This condition is a threat with electrical shock between 17–99 mA.

At this same time, muscular contraction and nerve damage are likely. Death is also probable.

74.

At what voltage can electrocution be fatal?

30 volts

25 volts

20 volts

40 volts

Correct answer: 30 volts

Electrocution becomes deadly at as little as 30 volts. Any voltage greater than 30 volts AC rms and 60 volts DC is considered dangerous.

Electric vehicles produce this level of voltage, and are considered dangerous to work around or on without proper precautions.

75.

When should xEV technicians wear eye protection?

When exposed to electrical arc or electrical hazards

Never

Always

Only if objects could fly into the eyes

Correct answer: When exposed to electrical arc or electrical hazards

All technicians working around xEV should wear eye protection when exposed to electrical arc or electrical hazards. Side protection should also be used if there's a risk of flying objects.

All eye protection must meet OSHA requirements.

76.

What is the minimum current traveling across the heart that is lethal?

- **75 mA**
- 16 mA
- 25 mA
- 100 mA

Correct answer: 75 mA

A current as low as 75 mA can be lethal when traveling across the heart. Not all electrocution travels across the body, especially if only one hand is being used. In this case, the current may pass down one side of the body instead of hand-to-hand.

This current level also produces extreme pain, possible respiratory distress, and severe muscular contractions. The victim won't be able to let go of the source.

77.

Which of the following conditions is not a reason to contact a healthcare professional prior to working on electric vehicles?

Orthotic shoes

Hearing aids

Cardiac pacemaker

Insulin pump

Correct answer: Orthotic shoes

Some medical devices should be cleared by a professional before working around xEVs. Orthotic shoes are not one of the devices that need to be cleared.

Technicians should always consult with a medical professional if they have an implanted debibrillator or cardiac pacemaker. It's also important to gain medical advice if using an internal analgesic medication pump, an insulin pump, hearing aids, or other medical devices.

78.

Which of these is not a factor when determining the severity of shock a person receives?

Which direction the person was facing while shocked

Intensity, type, and frequency of the current

Path the current took through the body

Length of time the person was subject to the shock

Correct answer: Which direction the person was facing while shocked

There are three primary factors that determine the severity of the shock. The first factor is the intensity, type, and frequency of the current.

Secondly, the path the current takes through the body must also be considered. Finally, the length of time that the person was shocked can change the outcome.

79.

What is another name for the let-go range?

Freezing current

Release current

Stop current

Frozen current

Correct answer: Freezing current

The let-go range or freezing current is the point at which the person being shocked may no longer be able to let go of the source due to muscle contractions. Typically, this let-go range can start as low as 6 mA.

At 5 mA, the person may receive a strong shock that is disturbing, but not too painful. Yet, at this point, the involuntary reactions can still lead to injuries.

80.

What reduces the chance of the current passing through the heart during an electric shock?

Using only one hand

Standing on one foot

Working with eyes closed

Wearing safety glasses

Correct answer: Using only one hand

By using only one hand, there's less of a chance that the current will pass through the heart. In this case, the path is typically down one side of the body.

If the current passes through hand-to-hand, that's when fibrillation can occur.

81.

What is the most likely hazard when working around Electrified Propulsion Vehicles (xEVs)?

Electrical shock

Fire

Arc flashes

Arc blasts

Correct answer: Electrical shock

Electrical shock is the most likely hazard when working on or around Electrified Propulsion Vehicles (xEVs). Electrocution at levels as low as 30 volts can lead to death.

Fire is also a risk, as well as arc flashes and arc blasts. High-voltage batteries are dangerous to work around without proper training.

82.

What Class is recommended for a rubber insulating mat when working around xEVs?

Class 0

Class 1

Class 2

Class 3

Correct answer: Class 0

The Class 0 mats are recommended for technicians working around xEVs to prevent deadly shocks. These mats are flame retardant, oil and acid resistant, and tested to 5 kV for up to 1,000 V maximum working voltage.

These rubber insulating mats also have high dielectric strength.

83.

The severity of shock increases with what factor?

Higher current flow

Lower current flow

Higher ambient temperatures

Lower voltage

Correct answer: Higher current flow

The higher the flow of current is, the more severe the damage becomes. It's also important to consider what type of current it was (AC or DC).

Intensity is another concern, because it isn't the voltage that causes the shock, but the current.

84.

What is the name of the electrical current that causes the muscles to lock up, making the person unable to release grip from the source?

Let-go

Shocker

Stuck-on

Stuck current

Correct answer: Let-go

The let-go threshold defines the current that is strong enough to force severe muscle contractions. With these contractions, the person being shocked won't be able to release their grip on the electrical source, causing them to remain part of the current.

The let-go threshold can occur at as little as 6 milliamps (mA). Ideally, power would be cut to the source to stop the person from being shocked.

85.

What technician(s) is responsible for safety and security when an xEV enters a work area?

Level 2 and Level 3

Level 1

Level 2

Level 3

Correct answer: Level 2 and Level 3

It's the responsibility of the Level 2 and Level 3 technicians to maintain safety and security any time that an xEV is in the work area. Level 1 technicians can assist, but are not responsible.

Technicians must ensure there's limited traffic and the appropriate physical barriers, signage, and boundary guarding practices are followed.

86.

What provides forehead protection while working on xEVs?

Face shields

Safety glasses

Welding helmet

Baseball cap

Correct answer: Face shields

Face shields offer forehead protection while working on xEVs. They must provide a 180-degree field of vision and be rated for arc thermal protection values.

Arc Class 2 face shields are recommended. These are flame-resistant and are used for thermal isolation.

87.

Protective footwear must be able to insulate wear from what type of current?

18 kV at 60 Hz AC for 1 minute/ continuous 750 volts

15 kV at 50 Hz AC for 1 minute/ continuous 550 volts

20 kV at 70 Hz AC for 1 minute/ continuous 950 volts

25 kV at 80 Hz AC for 1 minute/ continuous 1250 volts

Correct answer: 18 kV at 60 Hz AC for 1 minute/ continuous 750 volts

Technicians may wear boots or shoes for electrical protection when working near an energized xEV. These shoes must be able to protect the wearer from 18 kV at 60 Hz AC for 1 minute/ continuous 750 volts of current.

To do so, the shoes must be kept dry. They must also be clean and free of contaminants, such as oil or metal shavings.

88.

When should insulated hand tools be inspected?

Before every use

After every use

Once a week

Never

Correct answer: Before every use

Insulated hand tools should be inspected before each use. During the inspection, technicians must make sure there's no damage.

If there's damage, the tool may not be able to fulfill its intended function, leaving a risk of an incident.

89.

At what mA range does the threat of respiratory arrest start to become a concern?

- **17–99 mA**
- 6–16 mA
- 100–2,000 mA
- Over 2,000 mA

Correct answer: 17–99 mA

Between 17–99 mA, the concerns include respiratory distress. The individual will experience extreme pain from this shock and suffer from severe muscle contractions.

They also won't be able to let go of the source, keeping them in the circuit. Death is possible at this point.

90.

As a person is electrocuted and the skin is burned, what happens to the body's resistance?

It decreases

It increases

Nothing happens

It varies depending on the situation

Correct answer: It decreases

The average internal resistance of the human body is between 300 and 1,000 ohms. Resistance of dry skin is typically measured between 1,000 and 100,000 ohms.

As the person gets burnt, blistered, or wet, the resistance drops dramatically. That's what makes it even more dangerous as the victim gets burnt during electrocution.

91.

When should lineman's gloves be worn by technicians?

When working near all xEV high-voltage components

When working on all xEV high-voltage components

When working on xEV high-voltage batteries

Never

Correct answer: When working near all xEV high-voltage components

Lineman's gloves are known as electrical insulating gloves. These should be worn by a technician whenever they work near any xEV high-voltage component.

The recommended safety gloves are rated Class 0 electrical.

92.

When treating a victim of high-voltage shock, what is the first step?

Call 911

Touch the victim

Start CPR

Evacuate the building

Correct answer: Call 911

Before doing anything else, it's vital that 911 is called. If there are multiple people, you can have someone else call 911 while you start treating the victim.

You must also make sure that the high-voltage power is disconnected at the source. If you are unable to disconnect the power source, you can separate the victim from the source with an insulated retrieval hook.

93.

To create an electrically safe work condition, which of the following needs to be done?

Parts must be tested to ensure the absence of voltage

Personal Protective Equipment (PPE) is worn

Conductive barriers are used in energized areas

LEVEL ONE technicians are working on high-voltage components

Correct answer: Parts must be tested to ensure the absence of voltage

If the work condition is electrically safe, all of the parts removed have been tested to ensure the absence of voltage. The technician can work without Personal Protective Equipment (PPE) on these parts because they aren't charged.

An electrically safe work condition also has the removed, de-energized parts either locked up or tagged in accordance with OSHA regulations.

94.

At what milliamp (mA) electrical shock will the person feel a slight tinging sensation?

1 mA

5 mA

10 mA

25 mA

Correct answer: 1 mA

At 1mA, the person could feel a slight tingling sensation. While this situation may not be considered fatal, it can still be dangerous in certain conditions, such as if the person has health issues.

At 5 mA, a slight shock can be felt, but it usually doesn't create too much pain. At this level, the person should still be able to let go of the source.

95.

What is the internal resistance of the human body?

- **300 to 1,000 ohms**
- 100 to 500 ohms
- 200 to 750 ohms
- 500 to 2,000 ohms

Correct answer: 300 to 1,000 ohms

On average, the internal resistance of the human body is between 300 and 1,000 ohms. The majority of this resistance is in the skin, which is a poor conductor.

Dry skin can increase the resistance, which is why it's more dangerous as the victim gets burnt from electrocution.

96.

What is the term used to describe the bomb-like blast that occurs from the thermal energy release during an arc flash?

Arc blast

Arc light

Arc bomb

Arc explosion

Correct answer: Arc blast

Arc blast is the term that describes the bomb-like blast occurring from the thermal energy release from an arc flash. During an arc blast, the heat at either end of the arc can hit temperatures of 35,000°F.

The metal from the vapored conductors can be expelled at speeds greater than 740 mph. At the same time, intense heat is emitted and other hazards include shrapnel, toxic smoke, blinding light, and molten metal.

97.

What is another danger associated with electrical shock during the let-go range (6–16 mA)?

- **Falls**
- Respiratory distress
- Nerve damage
- Cardiac arrest

Correct answer: Falls

When a person is shocked at 6 mA or higher, it's considered part of the let-go range. The person may not be able to let go of the source due to severe muscle contractions.

At the same time, they are at risk of falling because of the lack of control. When they are broken free from the source, the individual could fall, leading to even more injuries.

Section E: De-Energizing

98.

Where should the keyless fob be located during maintenance or repair of xEVs?

Secured outside of detection range

In the vehicle

In the technician's pocket

On a workstation near the vehicle

Correct answer: Secured outside of detection range

The keyless fob must be secured outside of the detection range while working on xEVs. The key fob should be in a secured container, along with any high-voltage battery disconnects.

You don't want the key fob in the vehicle or a technician's pocket. It also shouldn't be located near the vehicle, where it could accidentally power the system.

99.

What do the Level 2 and Level 3 technicians need to do before working on a high-voltage vehicle?

Notify someone else that's trained

Remove all fuses and relays

Sweep up the area

Take a break

Correct answer: Notify someone else that's trained

It's important for the technician to notify someone else that's trained on high-voltage safety procedures before starting a job. This applies to both the Level 2 and Level 3 technicians.

Technicians are never to work alone on a high-voltage vehicle.

100.

What does Lockout/Tagout (LOTO) prevent?

Re-energizing the work environment

Theft

Getting parts confused

It's not meant for protection

Correct answer: Re-energizing the work environment

When Lockout/Tagout (LOTO) is used correctly, it prevents the work environment from being accidentally re-energized. Someone could re-install a part not knowing that the system is being worked on, thereby putting the technician and others at risk for electric shock.

Lockout is used when the environment is uncontrolled, while tagout can be used in controlled environments.