ASE xEV (Level 1) - Quiz Questions with Answers

Section C: Establishing an Electrically Safe Work Condition

1.

What does HEV stand for?

- **Hybrid Electric Vehicle**
- Hybrid Energy Vehicle
- Has Electric Volts
- Hybrid Electrical Vehicle

Correct answer: Hybrid Electric Vehicle

The HEV is a Hybrid Electric Vehicle. It has a gas engine paired with an electric motor for efficiency.

HEVs are different from the plug-in hybrid vehicle that is recharged with a plug. The HEV also varies from the Electric Vehicle (EV) because it has a gas engine.

2.

What is the warning symbol with a car and an exclamation mark?

General electric issue

Overheating batteries

Eco mode enabled

Low battery level

Correct answer: General electric issue

The warning symbol with a car and an exclamation mark means there's trouble with the electrical system. It's a broad warning symbol, indicating trouble with the motors, battery, or wiring. This warning light can be of various colors, with red indicating that the problem is more serious than if it's amber-colored.

3.

What battery in the electric car is considered to be high-voltage?

- **Traction battery**
- Auxiliary battery
- AGM battery
- Lead-acid battery

Correct answer: Traction battery

The traction battery is where the electricity is stored to be used by the electric motor. The amount of voltage held by the traction battery depends on the make and model of the vehicle.

Electric cars also have auxiliary batteries, but these are low voltage. They are the same that can be found in a gas-powered vehicle, available in different types, such as AGM, lithium-ion, or lead-acid, depending on the manufacturer.

4.

The bodily damage done from electrical shock depends on several factors. Which one of these options doesn't affect the outcome?

Height of the victim

How high the voltage is

How the current travels through the body

Amount of time it takes to get help

Correct answer: Height of the victim

The outcome of an electrical shock depends on what type of current and how high the voltage was. It also depends on how the current travels around the body, and the person's health. There's also a difference based on how quickly the person is treated.

What doesn't matter is who the person is, as far as height, nationality, or gender. Electrical shock can be fatal to people of any size.

5.

What is the BEV lacking that a hybrid vehicle contains?

Fuel tank

Auxiliary battery

Brakes

Fuses

Correct answer: Fuel tank

The Battery Electric vehicle (BEV) doesn't run on fuel. Instead, it has a battery and electric motor that it uses for propulsion.

While the hybrid vehicles contain an electric motor and battery, they also work with fuel. Both types of vehicles contain an auxiliary battery, brakes, and fuses.

6.

What does the dashboard warning light with a battery and a lightning symbol mean?

Low battery

Batteries are too hot

The battery is being charged

There's a mechanical defect with the battery

Correct answer: Low battery

This symbol is the Battery Charge Level Warning. It indicates that the battery charge has become low and the driver should recharge.

This warning symbol has nothing to do with battery temperature or mechanical failure. The battery temperature warning shows a battery with the temperature symbol, while mechanical failure is often indicated by a wrench. It also doesn't tell you that the vehicle is charging, as most EVs don't indicate when it is plugged in by a dashboard light.

7.

What is the condition called when the heart stops beating?

Cardiac arrest

Heart attack

Insomnia

Arrhythmia

Correct answer: Cardiac arrest

Cardiac arrest is the term used to describe the sudden failure of the heart to beat. It's considered an electrical problem because the heart is no longer receiving the signal to beat.

A heart attack is when the blood flow to the heart is blocked. In many cases, the victim of a heart attack remains conscious during the event, but could enter into cardiac arrest as a result of the blockage. An arrhythmia is when the heart beat is irregular.

8.

How is a PHEV different from an HEV?

PHEV gets plugged in to recharge

HEV has a longer wheelbase

PHEV has more interior electrical features

HEV contains a bigger fuel tank

Correct answer: PHEV gets plugged in to recharge

The PHEV and HEV are both hybrid electric vehicles. The PHEV stands for Plug-in Hybrid Vehicle, while HEV stands for Hybrid Electric Vehicle.

The difference between the two is that the PHEV has a charging port to be plugged in. The hybrid electric vehicle does not get plugged in, but both have a gas engine that works in conjunction with an electric motor.

9.

How should the high-voltage battery and heavy EV components be lifted?

With the help of lifting equipment

By bending at the knees

Using two technicians

They don't need to be lifted

Correct answer: With the help of lifting equipment

Whenever the high-voltage battery of heavy EV components needs to be lifted, special equipment should be used. With an average weight of around 1,000 pounds, the EV battery isn't meant to be lifted without equipment.

Special care is also needed when lifting the EV. A dual-post lift with a battery fixture jack should always be used.

10.

What voltage can DC motors run on?

96 to 192 volts

80 to 160 volts

120 to 220 volts

64 to 142 volts

Correct answer: 96 to 192 volts.

DC motors receive power from direct current and run on voltages between 96 to 192. This is different from the AC motor, which requires 240 volts of alternating current to run.

11.

What do traction and auxiliary batteries have in common?

Power is stored in cells

Power transfers to the wheels

Power transfers to the electronic accessories

Charge is given to both when the EV is plugged in

Correct answer: Power is stored in cells

The only similarity between the two is how power is stored. Various cells make up the battery, where the voltage can be stored for later usage.

The traction battery is responsible for sending power to the transmission, so it can turn the wheels. It also supplies a charge to the auxiliary battery, while the traction battery receives a charge from being plugged in. The auxiliary battery transfers power to the electronic accessories.

12.

What does the onboard charger do?

Takes incoming AC power and converts it to DC to be used by the traction battery

Directs power to the wheels

Runs the accessories off of auxiliary power

Stores power to be used later

Correct answer: Takes incoming AC power and converts it to DC to be used by the traction battery

The onboard charger needs to convert the AC power coming into the vehicle to DC power for the battery. It also limits the amount of power going to the battery to avoid damage.

The onboard charger cannot direct any power to the wheels, as this is the job of the electric transmission. The onboard charger doesn't run the accessories, nor can it store any power to be used later. These are both jobs for the batteries.

13.

When performing chest compressions during CPR, what is the appropriate depth for each compression?

2 in (5 cm)

2.75 in (7 cm)

3.5 in (9 cm)

1.2 in (3 cm)

Correct answer: 2 in (5 cm)

Chest compressions can be performed at a rate of 100 to 120 per hour, working on a 30 compression:2 breath ratio. These chest compressions should occur at a depth of 2 in (5 cm).

It's advisable never to exceed 2.4 in (6 cm) with any chest compression.

14.

What part/system is the thermal cooling system not responsible for regulating the temperature?

Brakes

Batteries

Electric motor

Power electronics

Correct answer: Brakes

The thermal cooling system regulates the operating temperature of the electric motor. It also monitors the temperature of power electronics, batteries, and other components in the EV.

Regenerative brakes are used in EVs. This braking system utilizes electric motors instead of the traditional friction braking system to slow down the vehicle, so there's less heat produced.

15.

While waiting for emergency personnel, what should you do for an injured victim of electrical shock?

Prevent them from getting cold

Move them

Follow advice from YouTube videos

Leave them to flag down help

Correct answer: Prevent them from getting cold

You can use a blanket or jacket to keep the injured person warm while waiting for help to arrive. Ask them how they are feeling, if they are conscious and act accordingly.

It's only wise to move the person if they are in immediate danger, such as if the chance of electrical shock is still a threat. Stay present with them and relay any changes to the 911 operator while you wait.

16.

What does a Level 1 technician need to know?

Emergency Response training (includes using specialized response equipment)

How to use the Manual Service Disconnect (MSD)

Steps to repairing high-voltage vehicles

How EV motors work

Correct answer: Emergency Response training (includes using specialized response equipment)

Level 1 technicians are tested on emergency response training and the use of specialized response equipment. They also need to know first-aid, including CPR.

The Level 1 technician should never touch the Manual Service Disconnect (MSD) or repair a high-voltage vehicle. They also aren't required to know the inner workings of the EV motor.

17.

When should you move a person with an electrical injury?

If there's immediate danger

When they are confused

After the electrical current stops flowing

If they hit their head

Correct answer: If there's immediate danger.

You don't want to move someone who's been shocked unless there's an immediate danger that you need to prevent. Your best bet is to call 911 before doing anything. Emergency responders can provide you with more insight.

Only specially trained technicians should attempt to separate the person from the electrical conductor. This person would need to wear proper high-voltage gloves and Personal Protective Equipment (PPE), plus use an insulated retrieval hook.

18.

Which of the following helps maximize CPR efforts?

Ensure proper hand placement

Create an erratic rhythm of compressions

Lean on the victim while pushing

Push as deep as possible during compressions

Correct answer: Ensure proper hand placement

The heel of your hand should be in the center of the person's chest. Interlace your fingers together and kneel down beside the person, while spreading your knees about shoulder-width apart.

You don't want to have any interruptions in the rhythm of chest compressions and you shouldn't lean on the victim. It's also important to make sure you don't push deeper than recommended.

19.

What is the name of the component that converts high-voltage DC current to the lower voltage needed to run accessories and recharge the auxiliary battery?

DC/DC converter

Onboard charger

Power electronics controller

Traction battery pack

Correct answer: DC/DC converter

This EV component is responsible for converting the high-voltage DC power coming out of the traction battery pack to the lower voltage DC power required to run the accessories and recharge the auxiliary battery.

The onboard charger converts AC power to DC power and regulates how much is given to the battery. The power electronics controller controls the speed produced by the electric motor, while the traction battery pack stores the electricity needed for the motor to run.

20.

What does the warning symbol with a turtle mean?

Limited power

Speed up

Slow down

Charge the battery

Correct answer: Limited power

The turtle warning symbol signifies limited power from the EV. The vehicle may go into a type of limp mode to preserve power. This warning is dangerous, especially if it is red-colored versus amber. In some cases, there's a serious electrical malfunction, so the EV should be looked at by a qualified technician.

When the battery needs to be charged, there's a battery symbol with a lightning bolt through it.

21.

When should CPR be used?

- **Heart stops beating**
- After all electrical shock events
- Never
- Victim looks shocked and disoriented

Correct answer: Heart stops beating

CPR (Cardiopulmonary Resuscitation) is a life-saving procedure used when a victim's heart stops beating. By immediately providing CPR, you can increase the chances of survival by double or triple.

It's important to keep the blood flow moving until first responders arrive on the scene.

22.

What does CPR do?

Keeps the blood flow active

Helps victim breathe better

Provides a shock to the heart

Allows the body to relax

Correct answer: Keeps the blood flow active

CPR (Cardiopulmonary Resuscitation) is used to keep blood moving even when the heart is no longer beating. By providing even a partial amount of blood moving, the chance of resuscitation is higher for emergency personnel.

This life-saving procedure should be performed if the heart isn't beating on its own. Chances of survival increase by double or triple if immediate CPR is given.

23.

When performing CPR, what is the appropriate ratio of chest compressions and mouth-to-mouth breathing?

30 compressions:2 breaths

15 compressions:2 breaths

10 compressions:2 breaths

25 compressions:2 breaths

Correct answer: 30 compressions:2 breaths

During CPR, it's important to provide 30 compressions for every two breaths. Chest compressions occur at a rate of 100 to 120 per minute, at a depth reaching two inches (five centimeters). Chest compressions should never exceed 2.4 inches (six centimeters).

24.

How long should you continue providing chest compressions during CPR?

Until first responders arrive

Until your hands get tired

After two minutes

After five minutes

Correct answer: Until first responders arrive

If the victim remains unconscious and isn't breathing, continue giving chest compressions until help arrives. By providing consistent chest compressions, you increase the chances of the victim's survival.

If you have someone else call 911, the operator can tell you how long it will be until the help arrives.

25.

How many speeds does an electric car transmission have?

One

Two

Four

It varies by manufacturer

Correct answer: One

The typical EV usually includes a single-speed electric transmission. Its job is to transfer the power from the electric motor to turn the wheels. Manufacturers can use a single-speed transmission in EVs because of how efficient the motor is in varying conditions.

In the future, more EV manufacturers may switch to a multi-speed transmission.

26.

Who needs medical attention after an electrical shock?

Everyone

A person with burn mark on the skin

If they have trouble breathing

Only if confusion exists

Correct answer: Everyone

Electrical shock may leave a burn mark on the skin, but not always. In some cases, there can be no symptoms of lingering problems, even if there's damage done to the internal organs. Electrical shock can also lead to cardiac arrest or death.

It's always recommended to take the shocked person to a healthcare provider.

27.

How do you take care of an electrical shock burn?

Cover it loosely with a sterile gauze bandage

Cover it with a blanket

Wrap a towel around it

Don't cover it

Correct answer: Cover it loosely with a sterile gauze bandage

If there are burned areas that need to be covered, use sterile gauze bandaging. A clean cloth could also be used if there's no gauze available.

Don't apply a blanket or towel because the loose fibers could stick to the burns. You shouldn't keep it open, either because dirt or debris could get into the wound.

28.

How are BEVs (Battery Electric Vehicles) charged?

Plugging into electric charging equipment

Solar power

Gasoline

Diesel

Correct answer: Plugging into electric charging equipment

All BEVs are charged by physically plugging into electric charging equipment. These vehicles contain a battery but no fuel tank.

Hybrid and Plug-in Hybrid vehicles use a combination of power from a battery and an internal combustion engine. The internal combustion engine requires fuel to work.

29.

Which of the following does not create a safe working environment for EVs?

Conductive workbench and equipment

Adequate lighting so technicians can see the work they are doing

Limited foot traffic in EV areas

Secured storage area for holding high-voltage components, working or broken

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Correct answer: Conductive workbench and equipment

A safe working environment needs a workbench and equipment that's non-conductive. There should also be rubber mats in the area.

It's best to have adequate lighting in the work area for technicians to avoid mistakes. Regulations also specify that foot traffic should be limited where EVs are, and employers should provide a secured storage area for holding the high-voltage components, whether they are functional or not.

30.

What are the two main types of motors in EVs?

AC and DC

DC and ICE

AC and ICE

ICE and hybrid

Correct answer: AC and DC

Most electric cars contain either direct current (DC) motors or alternating current (AC) motors.

DC motors have direct current and run between 96 to 192 volts. These are easier to install and cheaper to manufacture.

The AC or three-phase motor is powered by 240 volts of alternating current. It can be either an induction motor or synchronous motor. Induction motors are more cost-effective, which is why they are used in vehicles, such as the Tesla Model 3.

The internal combustion engine (ICE) is used in gas- and diesel-powered vehicles. Hybrid engines run on a combination of internal combustion engines and electric motors.

31.

What does the pedestrian warning system alert look like?

A person standing on a road

A person waving

Two people standing on a road

Two people waving

Correct answer: A person standing on a road

EVs are quiet vehicles, so pedestrians may not hear the car coming. That's why the vehicles are equipped with pedestrian warning systems to prevent accidents. This system alert shows up as a person standing on a road.

In many vehicles, automatic braking kicks in when the driver doesn't take action fast enough.

32.

What does the power electronics controller regulate?

Speed of the electric traction motor and its torque

Delivers power to the wheels

Converts high-voltage DC to lower voltage power for the accessories and auxiliary battery

Regulates the operating temperature of the engine

Correct answer: Speed of the electric traction motor and its torque

The power electronics controller is a high-voltage part that regulates the speed of the motor and the torque it produces. It does this by managing the electrical current coming from the traction battery.

It's the job of the electric transmission to deliver the power to the wheels. The DC/DC converter handles the conversion of high-voltage DC power to lower voltage, while the thermal cooling system handles motor temperature regulation.

33.

In what circumstances should you not attempt to fight a small fire?

If the high-voltage battery is the source of the fire

When it's controllable

It's not spreading to other areas

If you can fight it while standing at the nearest exit, ready to leave

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Correct answer: If the high-voltage battery is the source of the fire

If you believe the high-voltage battery started the fire, everyone in the shop must leave the building and area immediately. An explosion could occur, leading to fatalities.

Otherwise, if the fire is controllable and not spreading, you may attempt to fight it. Make sure someone has already called 911 and that you can escape the area through an open exit if you need to. Always follow the shop's Emergency Action Plan (EAP) Standard Operating Procedure (SOP) that aligns with the NFPA 70E (National Fire Protection Association), OSHA (Occupational Safety and Health Administration), and regional/local laws.

34.

What does the RBS symbol mean?

Regenerative braking system

Regenerative brake warning

Rearview mirror system malfunction

Rear bumper sensor malfunction

Correct answer: Regenerative braking system

The RBS (Regenerative Breaking System) symbol indicates that the regenerative braking system is active. It's a normal symbol to see when everything is running correctly.

When there's a warning with the regenerative braking system, there is an exclamation point in a circle. It may also show up with a red brake warning light at the same time.

35.

What is the warning symbol that includes a wrench?

General issue

Overheating battery

Maintenance required

Low battery

Correct answer: General issue

The wrench warning light indicates a general issue. It's a broad warning that is used by automakers to get the drivers' attention. Some issues may include traction system, sensor, or charging system failures.

This warning light could come on with others, helping to understand what's wrong. For example, it may illuminate at the same time as an overheating or electrical issue warning light.

36.

What life-saving procedure can increase the chance of survival after cardiac arrest by double or triple?

CPR

Heimlich maneuver

EKG

EEG

Correct answer: CPR

CPR stands for Cardiopulmonary Resuscitation. This life-saving procedure can increase the victim's chance of survival following a cardiac arrest by double or triple.

The chances are higher when CPR is started immediately following the cardiac arrest. By keeping the blood flow active, you increase the chance of survival when emergency responders arrive.

37.

How should the victim lie during CPR?

Flat on their back

Standing up

On their left side

On their right side

Correct answer: Flat on their back

You must place the victim flat on their back to successfully perform CPR. If they aren't flat on their back, carefully move them into this position with the help of others around you.

Before performing CPR, make sure someone has called 911. CPR is only meant to keep the blood flowing until emergency personnel can arrive.

38.

If a fire breaks out in the shop, what plan should be followed?

NFPA 70E (National Fire Protection Association), OSHA (Occupational Safety and Health Administration), and regional/local regulations

NFPA 70E (National Fire Protection Association), ASE standards, and regional/local regulations

OSHA (Occupational Safety and Health Administration), ASE standards, and regional/local regulations

Follow the person in front of you

Correct answer: NFPA 70E (National Fire Protection Association), OSHA (Occupational Safety and Health Administration), and regional/local regulations

The shop shall have existing plans in place that align with the NFPA 70E (National Fire Protection Association). It's also important to follow all recommendations by OSHA (Occupational Safety and Health Administration).

Regional and local regulations are also important, although they are likely to match up with the two other standards.

39.

Who needs to be trained regularly for emergency response and equipment usage in case of electrocution or injury?

All technicians

Level ONE technicians

Level TWO technicians

Level THREE technicians

Correct answer: All technicians

ASE requires regular emergency response training and equipment for all technicians working around EVs. This training must cover steps to handle electrocution and injury. OSHA 1910.335 regulations show that technicians must be able to prove their abilities to employers.

40.

What type of vehicle typically has an electric-only driving range between 150 and 400 miles?

BEV (Battery Electric Vehicle)

PHEV (Plug-in Hybrid Electric Vehicles)

HEV (Hybrid Electric Vehicles)

Gas-powered vehicles

Correct answer: BEV (Battery Electric Vehicle)

The BEV is powered only by a battery. It typically has a driving range between 150 and 400 miles per charge.

The PHEV and HEV contain an electric motor and battery. Hybrid vehicles may provide up to sixty miles of driving on electric-only, depending on the setup. Gas-powered vehicles don't contain a battery.

41.

What warning light comes on if the battery is overheating?

Battery with a thermostat

Battery with a flame

Same thermometer symbol as with a gas-powered car

The word "TEMP" illuminated

Correct answer: Battery with a thermostat

With an electric vehicle, the overheating symbol is a battery with a thermostat. It's similar to the one that's used in cars with an internal combustion engine, except for the battery.

The battery temperature warning lights up when the battery temperature is too high. The car shouldn't be driven with this warning light on.

42.

What is the purpose of the battery management system (BMS)?

Controls the charging and discharging of traction battery packs

Manages the operating temperature of the engine

Controls the speed of the motor

Converts power from the traction battery to be used by the accessories and auxiliary battery

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Correct answer: Controls the charging and discharging of traction battery packs

The battery management system (BMS) is a high-voltage component that's responsible for controlling how the traction battery charges and discharges. It also sends information to the vehicle control unit (VCU) if the set parameters are exceeded.

The thermal cooling system is responsible for managing temperature, while the power electronics controller handles the speed of the motor. A DC/DC converter is necessary to convert power from the traction battery, so it can be used by the auxiliary battery and accessories.

43.

How can high-voltage cables be identified in an EV?

Color coding

Warnings on cables

Every EV has the same high-voltage cables

They can't be identified

Correct answer: Color coding

EV manufacturers are required to use orange-colored wires to designate which cables are high-voltage. It's best to consult the service manual of the particular vehicle you are working on to confirm which cables are high-voltage.

The color coding warns of high voltage danger and should only be touched or repaired by qualified technicians.

Section D: Safety-Related Work Practices

44.

What is the name of the energy that is stored in the capacitors or battery following an accident?

Stranded

Trapped

Held

Taken

Correct answer: Stranded

The lithium-ion battery can contain stranded energy after an accident. This energy is stored in the capacitors or battery and could create a safety concern.

With the possibility of thermal runaway, it's important that the battery is handled properly. Otherwise, injury or death could occur.

45.

What color is acceptable for high-voltage cables?

- **Only orange**
- Orange or red
- Orange or yellow
- Orange or pink

Answer: Only orange

As per the US FMVSS 305 S5.4.1.2 guidelines, all high-voltage cables must be orange. The insulation or wrapping is orange, no matter which company manufacturers the vehicle.

This orange color warns of the potential danger, making it easy to see which cables are considered high-voltage.

46.

According to federal regulations, how quickly must live parts contain fewer than 60 VDC or 30 VAC once the connector is separated from mating components?

Within one second

Within two seconds

Within five seconds

There are no regulations

Correct answer: Within one second

The Original Equipment Manufacturer (OEM) designed the EV so that any high-voltage parts would reach these guidelines within one second of separating the connector from the component.

With this guideline in place, there's less chance of electrical shock or fires after the connector is removed. The same regulations apply when using the Manual Service Disconnect (MSD).

47.

Which of the following battery conditions does not signify shorting?

Full charge

Leaking

Popping

Sparking

Correct answer: Full charge

Shorting of the battery can occur at any level of charge. It's often noticed by sizzling or popping sounds.

Shorting can also occur when there's leaking or dripping fluids, a chemical odor, spark, or smoke. Any of these issues should prompt a call to emergency responders.

48.

The electrolytes in lithium-ion batteries are what?

- **Flammable**
- Sweet-smelling
- Odorless
- Non-toxic

Correct answer: Flammable

Lithium-ion batteries contain flammable electrolytes. If damaged, overheated, or incorrectly charged, the batteries can ignite.

These electrolytes and substances are toxic. EV batteries should always be handled with care, due to the flammable and toxic nature.

49.

What is the highest amount of voltage contained in a high-voltage battery?

More than 1200 V DC

800 V DC

600 V DC

400 V DC

Correct answer: More than 1200 V DC

Battery packs in large buses and trucks can exceed 1200 V DC. In most electric vehicles, the range is lower.

For example, the majority of EVs have battery packs measuring between 100 V and 400 V DC. On the higher end, they may reach to 800 V DC, but it's bound to go up as technology increases.

50.

Why are high-voltage cables orange?

- **To warn of danger**
- It is different
- To match the car
- To look better

Correct answer: To warn of danger

The Original Equipment Manufacturer (OEM) is required to make EV high-voltage cables orange-colored. This orange color helps technicians and owners know that the cables contain high-voltage and are dangerous.

If the high-voltage cables are behind electrical protection barriers, they are not required to be orange.

51.

Technicians are responsible for understanding all of the guidelines to identify and follow labeling on the vehicle, as determined by who?

Original Equipment Manufacturer (OEM)

Fire department

OSHA

Police department

Correct answer: Original Equipment Manufacturer (OEM)

All OEM guidelines for identifying the electric vehicle must be followed by the technician. These guidelines also dictate the labeling of the vehicle and system.

While the fire department and OSHA are authorities when dealing with electric vehicles, these organizations don't apply labeling to the EVs.

52.

If lithium-ion batteries are on fire, what is the primary goal of emergency personnel?

Cool the battery

Check power sources

Care for injured people

Set up a perimeter around the scene

Correct answer: Cool the battery

Emergency personnel must cool the battery as quickly as possible. This is done by flooding the battery compartment with water.

By ensuring the battery gets cooled off, the risk of fire decreases. Emergency personnel will perform other tasks, such as caring for injured people, but the primary goal is to remove any threat of fire.

53.

Who is qualified to open and work on labeled electrical components, according to the OEM instructions?

A Level 2 or Level 3 technician

Only a Level 2 technician

Only a Level 3 technician

Only a Level 1 technician

Correct answer: A Level 2 or Level 3 technician

Only the Level 2 and Level 3 technicians have the training required to work on these high-voltage parts.

As a Level 1 technician, you should not touch or come close to any labeled components. Instead, you can support the other technicians by ensuring all of the appropriate safety measures are in place so injury is prevented.

54.

Popping and sizzling noises, along with leaking or dripping fluids can all indicate what condition?

Shorting condition

Dead battery

Fully-charged battery

Trouble with the electric motor

Correct answer: Shorting condition

Popping and sizzling noises, along with leaking or dripping fluids are symptoms of a shorting condition. You may also smell chemicals, notice smoke or see sparks coming from the battery. Emergency responders should be notified to deal with the situation.

55.

Which one of the following aspects does the Battery Management System (BMS) not monitor?

Usage of interior electronics

Battery state-of-health

Cell voltages

Battery temperature

Correct answer: Usage of interior electronics

The Battery Management System (BMS) has nothing to do with the interior features of the vehicle. Instead, it's responsible for monitoring the battery's state-of-health.

It also measures the cell voltages and temperature. The BMS reports the information back to the computer, so charging and discharging of the batteries occurs as intended.

56.

Why are warning labels placed on electric vehicles?

To indicate potential danger caused by an electrical current

To help users discern what features the car has

Indicating the make and model of the vehicle for resale purposes

Showing users where to take the vehicle for repair

Correct answer: To indicate potential danger caused by an electrical current

OEM (Original Equipment Manufacturer) labels are placed on the EV and high-voltage parts to warn others of the potential danger from electrical currents. These labels should be followed to prevent injury.

Other labels and documentation about the vehicle can indicate its make and model, along with the trim level.

57.

When can high-voltage cables be marked in other colors than orange?

When they are within electrical protection barriers

In Tesla vehicles

Never

Anytime

Correct answer: When they are within electrical protection barriers

Any high-voltage cables found within electrical protection barriers don't need to be orange. It's expected that cables within these barriers are high-voltage.

Any cables found outside of these protection barriers must have an orange covering. With this warning, technicians understand the risk of electric shock.

58.

If stranded energy occurs, where will it be stored?

In the battery or capacitors

In the electric motor

In the Manual Service Disconnect (MSD)

In the Battery Management System (BMS)

Correct answer: In the battery or capacitors

Stranded energy is stored in the battery or capacitors. This issue usually occurs following an accident and is considered dangerous.

There's no stranded energy left behind in the electric motor or Battery Management System (BMS). The Manual Service Disconnect (MSD) won't store energy either.

59.

What cables need to be covered in orange to warn of high voltage?

Any over 30V AC or 60 V DC

Any over 20V AC or 50 V DC

Any over 15V AC or 45 V DC

Any over 10V AC or 40 V DC

Correct answer: Any over 30V AC or 60 V DC

US FMVSS 305 S5.4.1.2 (Federal Motor Vehicle Safety Standards) specify that high-voltage cables with sources over 30V AC or 60 V DC must be wrapped or insulated in orange to alert of the danger. This ruling does not apply to any cables that are located within the electrical protection barriers.

Cables not marked in orange can be assumed to be low-voltage, although it's always safest to read the service manual before touching any wires in the EV.

60.

High-voltage components are labeled with a warning sign that resembles what?

Lightning bolt with an arrow pointing downward

Lightning bolts from the sky

Stop sign

Person being shocked

Correct answer: Lightning bolt with an arrow pointing downward

High-voltage warning signs are triangular. They contain a lightning bolt with an arrow pointing downward to signify the flow of electrical current.

When these signs are encountered, it's a warning that only a qualified technician should touch and work on the component.

61.

Warning labels are placed on EVs for which of the following purposes?

To warn of electrical current

To explain the trim level

To illustrate available features

To determine electric driving range

Correct answer: To warn of electrical current

OEMs (Original Equipment Manufacturers) place warning labels on the EVs to indicate that there's a threat of electrical current. This current can lead to serious injury or death.

Because the OEM may put the labels in a different place than others, it's important to follow all manufacturer guidelines when working on or around an EV.

62.

How many actions are required to remove a connector from its mating component in a high-voltage system?

Two

One

Five

There are no regulations

Correct answer: Two

Federal guidelines specify that any connector attached to high-voltage components must contain a locking mechanism with two distinct actions to remove it. Additionally, the use of tools is required for removal.

This regulation ensures that the connectors aren't removed easily by untrained people, thereby reducing the risk of electrical shock and fire.

63.

According to the Environmental Protection Agency (EPA), how many municipal waste facilities have suffered a fire because of lithium-ion batteries in 2021?

At least 65

55–60

45–55

35–45

Correct answer: At least 65

There were at least 65 fires reported in 2021 at municipal facilities because of lithium-ion batteries. Not all of these fires are the result of EV batteries.

Some of the reports were for smaller battery types, such as laptops and cell phones. Yet, this report shows the danger of lithium-ion batteries.

64.

What color is used to warn about the danger of high-voltage cables?

Orange

Red

Yellow

Black

Correct answer: Orange

High-voltage cables in EVs are insulated or wrapped in orange to warn of the risks. This guideline falls in line with FMVSS 305 S5.4.1.2 (Federal Motor Vehicle Standards).

This guideline doesn't apply to any cables that are located within electrical protection barriers.

65.

Which of the following toxic substances isn't found in lithium-ion batteries?

Mercury

Cobalt

Nickel

Manganese

Correct answer: Mercury

Mercury is not one of the many substances found in lithium-ion batteries. These batteries do contain cobalt, nickel, and manganese.

They also contain lithium. Because of these toxic substances in the construction, lithium-ion batteries can cause explosions and fires if damaged.

66.

A technician should know the labeling and its meaning on what vehicles?

Any being worked on

All EVs

Every make/model

None

Correct answer: Any being worked on

It's the responsibility of the technician to understand the Original Equipment Manufacturer (OEM) labeling when working on a vehicle. Technicians need to identify and understand what the labels are saying.

The labeling may be different among OEMs, so it's up to the technician to determine how to proceed with each vehicle by following the manufacturer's guidelines.

67.

How should the technician verify the color coding of high-voltage components?

Through the Original Vehicle Manufacturer (OEM)

Online schematics

ASE study guide

Asking employer

Correct answer: Through the Original Vehicle Manufacturer (OEM)

All color coding must be verified with the Original Vehicle Manufacturer (OEM) prior to starting any repair work or maintenance. High-voltage cables should be orange unless they are within electrical protection barriers.

Technicians should never assume that they know which cables are high-voltage until comparing the system against documentation from the manufacturer.

68.

Which of the following is not a characteristic of lithium-ion batteries?

Low power-to-weight ratio

High energy efficiency

Higher temperature performance

Low self-discharge

Correct answer: Low power-to-weight ratio

The lithium-ion battery has a high power-to-weight ratio. It is also highly energy efficient.

Further characteristics of the lithium-ion battery include higher temperature performance and low self-discharge. The lithium-ion battery contains electrolytes and toxic substances that could cause fires, explosions, or a dangerous release of gases when mishandled.

69.

The electrolytes in lithium-ion batteries are considered everything but which of the following?

Compostable

Toxic

Corrosive

Flammable

Correct answer: Compostable

The electrolytes that make up a lithium-ion battery are toxic and extremely dangerous. They are also corrosive and flammable.

If a lithium-ion battery gets overcharged, overheated, or damaged, it can lead to a potential fire or explosion. There's also the chance for toxic gases to be released.

70.

Where can special warning labels be found?

High-voltage battery

Auxiliary battery

Heated seats

Transmission

Correct answer: High-voltage battery

Manufacturers place labels on high-voltage batteries to indicate potential danger. The warning label should include a lightning symbol with an arrow pointing downward.

With these warning labels in places, technicians know what parts can cause a dangerous electrical current.

71.

How should an EV with a damaged battery be stored?

Minimum of 50 feet from other combustible and flammable material

In the shop with other EVs

Outside the shop door

Minimum of ten feet from other vehicles

Correct answer: Minimum of 50 feet from other combustible and flammable material

Once a battery has been damaged or punctured, it needs to be stored properly. It should never get within 50 feet of other combustible or flammable materials.

The NTSB specifies that even the EV in the junkyard must be kept at least 50 feet from other vehicles. This space is required because of the heightened risk of fire or explosion.

72.

When an EV battery has been punctured or damaged, how far must the vehicle be isolated from other flammable and combustible materials?

At least 50 feet

At least 40 feet

At least 30 feet

At least 20 feet

Correct answer: At least 50 feet

If the EV battery were to start on fire, you don't want it close to anything else that's flammable or combustible. It's recommended to have a minimum of 50 feet between those items and the EV battery.

Anything less than this could lead to a disaster if the fire were to spread.

73.

High-voltage components are marked with a lighting bolt and arrow warning sign that is recognized by which countries?

Worldwide

United States and Canada

Canada and Mexico

Mexico and the United States

Correct answer: Worldwide

The high-voltage warning sign is internationally understood. It features a yellow triangle, with a lighting bolt and an arrow facing downward.

When this warning sign is present, it means that there are high-voltage systems that could lead to electric shock and injury.

74.

What part of the EV contains a high-voltage warning label?

Traction battery

Auxiliary battery

Radio

Power windows

Correct answer: Traction battery

The traction battery contains high-voltage and should only be worked on by qualified technicians. It has a high-voltage warning label.

While other parts of the electrical system, such as the auxiliary battery, radio, and power windows, should also be worked on by qualified professionals, they don't contain high-voltage and don't pose the same risks.

75.

What prevents fire and electric shock hazards with electric vehicles?

Redundant systems

Water

Fire extringuisher

Orange cables

Correct answer: Redundant systems

Electric vehicles are created with redundant systems by the Original Equipment Manufacturer (OEM). These redundant systems are designed to reduce the risk of fire and electric shock.

Fire extinguishers and water are needed to put out fires after an incident. The orange cables are important because they point out which ones contain high-voltage.

76.

What can the toxic and flammable gases created after an accident do that may lead to a safety risk?

Ignite

Remain contained

Dissipate

Enter the atmosphere

Correct answer: Ignite

Following an accident, thermal runaway can create toxic and flammable gases. These gases can reach excessive levels and ignite.

After any accident, emergency personnel should be contacted. The first responders can determine if the vehicle is safe or needs to be looked at.

77.

Thermal runaway occurs when the battery suffers from what uncontrollable condition?

Self-heating

Water intrusion

Excessive charge

Parasitic drain

Correct answer: Self-heating

When the battery suffers from uncontrollable self-heating, it's known as thermal runaway. This heat can't be adequately dissipated into the ambient surroundings.

Thermal runaway can generate an excessive amount of flammable and toxic gases. It's most common after an accident.

78.

What vehicles are required to have orange cables to identify high-voltage systems?

Any hybrid or electric car with a high-voltage battery

Gas-powered vehicles

Diesel-powered vehicles

All vehicles

Correct answer: Any hybrid or electric car with a high-voltage battery

According to Federal Motor Vehicle Safety Standards, all vehicles with a high-voltage battery should have orange cables to warn against danger. These include both hybrid and electric vehicles.

Gas- and diesel-powered vehicles don't contain the same high-voltage systems. Therefore, orange cabling isn't required.

79.

After an EV accident, what may cause toxic and flammable gases from the battery that could reach a high enough level that they ignite?

Overheated damaged cell

Fuel leak

Short circuit

Regenerative brake failure

Correct answer: Overheated damaged cell

If the battery cells are damaged or punctured, thermal runaway becomes a threat. In this case, the cells may become overheated and leak flammable gases. Depending on the severity of the leak, a fire could start.

After any accident with an EV, it's best to have emergency personnel assess the situation.

80.

Stranded energy from a damaged battery can release levels of voltage ranging in what amounts?

100 V DC to 800 V DC

75 V DC to 700 V DC

50 V DC to 500 V DC

25 V DC to 250 V DC

Correct answer: 100 V DC to 800 V DC

When a battery contains stranded energy, it can release all or most of the voltage it has stored. That means it's capable of releasing 100 V DC to 800 V DC, or even more in commercial vehicles.

This issue is serious and should only be dealt with by trained technicians or emergency responders.

81.

What is the term used to describe an uncontrollable self-heating of the EV battery that begins with heat generated within and exceeds what can be safely dissipated in ambient surroundings?

Thermal runaway

Explosive connectivity

Hot battery

Short circuiting

Correct answer: Thermal runaway

The NFPA (National Fire Protection Association) defines this condition as thermal runaway. This condition occurs after an accident or mechanical malfunction.

When thermal runaway is a threat, only emergency responders or qualified technicians should work on the vehicle.

82.

EVs use redundant systems to prevent what type of issues from occurring?

Shock and fire hazards

Loss of power

Brake failure

Steering loss

Correct answer: Shock and fire hazards

Today's EVs are equipped with redundant systems that help prevent shock and fire hazards from occurring. Automakers install these systems to protect occupants, technicians, and first responders.

However, these systems are not fool-proof. There can still be glitches or accidents that lead to shock or a fire.

83.

Because lithium-ion batteries are so difficult to extinguish when they are on fire, how do emergency personnel deal with the situation?

Flood the battery compartment with water

Run the other way

Use a special EV fire extinguisher

Allow for a controlled burn with the perimeter secured

Correct answer: Flood the battery compartment with water

Emergency personnel are instructed to flood the battery compartment with water to neutralize the threat. Because extinguishing isn't a viable option, they need to do whatever is necessary to get the fire out and stop the presence of flammable gases.

During an EV fire, everyone else should remain far away from the vehicle as a safety precaution.

84.

When can a Level 1 technician open components that are labeled with a high-voltage warning?

Never

When following Original Equipment Manufacturer (OEM) guidelines

When instructed by employer

Only in an emergency

Correct answer: Never

The Level 1 technician is not equipped to open or work on high-voltage components. The only technicians equipped to work on these components are Level 2 and Level 3.

Even when these technicians work on high-voltage components, all Original Equipment Manufacturer (OEM) guidelines must be followed to prevent injury or damage.

85.

What can compromise the EV battery and lead to a safety concern?

Puncture

Cold weather

Rain

Weight in the back seat

Correct answer: Puncture

If the battery gets punctured, the internal components may no longer be protected. This issue can lead to a serious safety risk.

The same is true if the battery becomes damaged or crushed. Most physical damage of this type occurs after a car accident with the EV.

86.

How is the high-voltage system secured from switching on again?

Through an approved Lockout/Tagout (LOTO) process

It can't be secured

With someone standing guard

By shutting down power to the EV

Correct answer: Through an approved Lockout/Tagout (LOTO) process

It's vital to follow the approved Lockout/Tagout (LOTO) process to ensure the high-voltage system doesn't switch on again. This step is essential to preventing electrical shock.

OSHA provides all employers with guidelines for following a proper Lockout/Tagout (LOTO) process.

87.

The battery packs in an EV can range in voltage between what amounts?

100 V to 1,200 V DC

50 V to 500 V DC

25 V to 250 V DC

250 V to 2,500 V DC

Correct answer: 100 V to 1,200 V DC

The minimum voltage of an EV is typically 100 V. The majority of modern vehicles run anywhere from 100 V to 800 V. As production increases and ranges go higher, these numbers will also rise.

Commercial vehicles, such as large trucks or buses, can have a voltage that exceeds 1,200 V DC.

Section A: Purpose and Definitions

88.

Which of these types of employees should become a Level 1 technician?

- **EV salesperson**
- Dealership office administrator
- Dealership janitor/cleaning crew
- Marketing department

Correct answer: EV salesperson

Anyone coming in contact with EVs in the workplace should become a Level 1 technician. This recommendation includes those people working in EV sales.

If employees aren't going to be in contact with the EVs, there's no reason for training. Examples include the office administrator or cleaning team for the dealership. The marketing department also shouldn't be in direct contact with EVs and wouldn't require training.

89.

What is the meaning of a high-voltage source?

Any electrical component with a working voltage greater than 30 V AC or 60 V DC

Power outlet

Car charger

Auxiliary battery

Correct answer: Any electrical component with a working voltage greater than 30 V AC or 60 V DC

A high-voltage source is defined as an electrical component contained within the electric powertrain or connected to it that has a working voltage of more than 30 V AC or 60 V DC. High-voltage sources are only present in electric-powered vehicles.

While the power outlet, car charger, and auxiliary battery are all sources of power. These aren't defined as high-voltage sources for the EV.

90.

How can a high-voltage vehicle be identified?

Vehicle labels and badging

Make/model of vehicle

Ask the driver

Lack of front grille

Correct answer: Vehicle labels and badging

The best way to determine if a vehicle has high voltage is to read the labels and badging. You can also look at the underhood high-voltage cables and warning labels, see if there's a charging port (on some vehicles), or inspect for batteries on the roof or along the frame rails (with buses and trucks).

Researching the make and model of a vehicle may lead to differing results. Asking the driver could lead to false information if the operator isn't sure of the systems. While EVs don't need a front grille because there's less cooling required, the lack of a grille doesn't automatically indicate it has an electrified powertrain.

91.

Working on or near high-voltage electrical equipment and systems can present hazards, such as which of the following?

Arc flashes and blasts

Power outage

Flooding

Gas leak

Correct answer: Arc flashes and blasts

When working around high-voltage electrical systems, arc flashes and blasts are a safety concern. When proper safety precautions aren't followed, high voltage can be dangerous.

In addition to arc flash and blast, you must also be concerned about electrical shock. These situations can lead to injury or death.

92.

When is it dangerous to work with high-voltage vehicle equipment?

When the proper safety precautions are not followed

If the car isn't running

When the battery isn't fully charged

After it has been driven

Correct answer: When the proper safety precautions are not followed

To remain safe, it's important to follow all safety precautions determined by the ASE. Otherwise, there's a risk of personal injury and property damage from electrical shock.

Having the car not running, or the battery depleted doesn't change the dangers involved. There's also no difference if the car has been sitting or running when it comes to working with the electrical system.

93.

Why does the Level 1 person need high-voltage electrical safety awareness?

To identify potential hazards and reduce risks

To identify an electric car

To sell more cars to customers

To diagnose electrical faults within the systems

Correct answer: To identify potential hazards and reduce risks

The Level 1 individual must be ready to identify any potential hazards and reduce associated risks when working around EVs.

They don't need the training to identify the EV or diagnose advanced electrical system faults. This training isn't beneficial for selling EVs either.

94.

The ASE Electrified Propulsion Vehicles (xEV) High-Voltage Electrical Safety Standards is for service professionals in North America working on or around electrified propulsion vehicles (xEVs) with which of the following voltages?

>30 V AC rms and >60 V DC[2]

>20 V AC rms and >50V DC[2]

>40 V AC rms and >70V DC[2]

>50 V AC rms and >100V DC[2]

Correct answer: >30 V AC rms and >60 V DC[2]

The ASE Electrified Propulsion Vehicles (xEV) High-Voltage Electrical Safety Standards guide and establish the safety requirements for all alternating voltages greater than 30 V AC and direct voltages greater than 60V DC[2].

95.

What is another name for the electric motor in an EV?

Motor-generator

Internal combustion engine

Rotary engine

Diesel engine

Correct answer: Motor-generator

Another term for the electric motor is the motor-generator. While it functions as a motor to propel the EV, it also serves as a generator to convert energy.

One means of converting energy through the electric motor is through regenerative braking. Mechanical braking energy is changed into electrical energy that can be used.

96.

Which of the following skills must the Level 1 technician possess?

High-voltage electrical safety awareness

Isolating voltage from the EV system and checking it

Ways to maintain an EV motor

Separating individual battery modules

Correct answer: High-voltage electrical safety awareness

Level 1 technicians work around EVs, so they must have high-voltage electrical safety awareness skills. They are qualified to work around high-voltage systems, but not with them.

It is the job of Level 2 and Level 3 technicians to work on the high-voltage systems of the EV and maintain it.

97.

Which of the following components does not create or transmit high-voltage electrical currents?

Heated seats

Air conditioning compressor

Orange-colored cables

Battery Management System (BMS)

Correct answer: Heated seats

Heated seats don't draw enough power to be considered high-voltage. These are a common staple in many of today's luxury automobiles, with power to the seats coming from a 12V battery.

The air conditioning compressor and Battery Management System (BMS) create or transmit high-voltage currents. The orange-colored cables also indicate high-voltage. Other high-voltage components include the battery pack, charging equipment, inverter power electronics, capacity in the vehicle's inverter-rectifier assembly, DC/DC converter, modules, Electronic Control Unit (ECU), electric motor, and high-voltage heater.

98.

Is it necessary for workers outside of service and repair to be electrically aware people?

Yes

No

In some occasions

Only when EVs make up more than 50% of the dealership inventory

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Correct answer: Yes

The ASE standards require that anyone encountering an EV in the workplace should have training to become an electrically aware person. This requirement includes those working in service and repair, but also extends to employees in sales or other related environments.

99.

Why is it important to have high-voltage electrical safety awareness?

To identify hazards and reduce risk

To maintain EVs

To repair EVs

To repair electrical power lines

Correct answer: To identify hazards and reduce risk

By learning about high-voltage electrical safety awareness, you can identify hazards and reduce risk for yourself and those around you. These are important qualifications for anyone working around EVs.

These skills won't necessarily help you maintain or repair an EV, but they do give you a foundation to move further with training.

100.

The term xEV is given to define which of the following:

Electrified vehicles containing a high-voltage system

Gas-powered vehicles

Diesel-powered vehicles

Commercial vehicles

Correct answer: Electrified vehicles containing a high-voltage system

The term xEV is used anywhere an electrified vehicle with a high-voltage system is discussed. It applies to HEV, PHEV, BEV, PEV, FCEV, and EV types.

Gas- and diesel-powered vehicles have electrical systems, but nothing that contains high voltage. Additionally, commercial vehicles can be powered by any number of sources, whether it be gas, diesel, or an electrified motor.