ASSESSMENT CRITERIA FOR IMI ELECTRIC VEHICLE QUALIFICATIONS (VRQs)

IMI QUALIFICATION

IMI Level 1 Award in Electric Vehicle Awareness

QFQUAL I.D: 600/0687/0

IMI Level 2 Award in Electrically Propelled Vehicle Hazard Management

QFQUAL I.D: 600/0525/7

IMI Level 2 Award in Routine Maintenance Activities on Electrically Propelled Vehicles

QFQUAL I.D: 600/0526/9

IMI Level 3 Award in Electrically Propelled Vehicle Repair and Replacement

QFQUAL I.D: 600/0527/0

Note: This guidance is supported by the following documents,

- *Oral and Practical Assessments*
- *Candidate Assessment Summaries*

CENTRE INFORMATION

Please be aware that any **legislation** referred to in this qualification may be subject to amendment/s during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of and comply with any amendments, e.g. to health and safety legislation and employment practices.

Please be aware that **vehicle technologies** referred to in this qualification reflect current practice, but may be subject to amendment/s, updates and replacements during the life of this qualification. Therefore IMI Approved Centres must ensure they are aware of the latest developments and emerging technologies to ensure the currency of this qualification.

Please note: the relevance of the information contained in the **unit content** will vary depending upon the vehicle types being worked upon. The unit content is for guidance only and is not meant to be prescriptive.

ELECTRIC VEHICLE QUALFICATIONS (VRQs)

Four Awards been developed for individuals who work with electrically propelled vehicles.
Each qualification is made up of mandatory units. Each unit is graded pass/fail.

Level 1 Award in Electric Vehicle Awareness

Minimum 1 credit to be achieved at, or above, the level of the qualification

Unit Ref:	Unit Title & I.D. Number	Unit Level	Credit Value	Guided Learning Hours
EP1	Electric Vehicle Awareness (K/502/7731)	1	1	4

Level 2 Award in Electrically Propelled Vehicle Hazard Management

Minimum 2 credits to be achieved at, or above, the level of the qualification

Unit Ref:	Unit Title & I.D. Number	Unit Level	Credit Value	GLH
EP2	Electrically Propelled Vehicle Hazard Management (A/502/7734)	2	2	12

Level 2 Award in Routine Maintenance Activities on Electrically Propelled Vehicles

Minimum 3 credits to be achieved at, or above, the level of the qualification

Unit Ref:	Unit Title & I.D. Number	Unit Level	Credit Value	GLH
EP3	Routine Maintenance Activities on Electrically Propelled Vehicles (M/502/7732)	2	3	16

Level 3 Award in Electrically Propelled Vehicle Repair and Replacement

Minimum 4 credits to be achieved at, or above, the level of the qualification

Unit Ref:	Unit Title & I.D. Number	Unit Level	Credit Value	GLH
EP3	Routine Maintenance Activities on Electrically Propelled Vehicles (M/502/7732)	2	3	16
EP4	Electrically Propelled Vehicle Repair and Replacement (F/502/7735)	3	4	20

UNIT REF: EP1	UNIT TITLE: ELECTRIC VEHICLE AWARENESS

Level: 1	Route: Knowledge	Credit Value: 1	GLH: 4
Mapping: Based on IMI SSC Electric Vehicle NOS 2011			
Rationale: This unit is designed for those people who may encounter electric/hybrid vehicles and require safety awareness. It is suitable for non-technical people such as managers, valeters, parts, sales staff and electric vehicle drivers. It contains the ***knowledge*** of the dangers surrounding electric/hybrid vehicles and the precautions to avoid potential injury. **Note:** *This is a knowledge unit only and does not deem someone competent to work on the high energy electrical system.*			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Know about the types of electric vehicles available	1.1 Describe how to identify electric vehicles 1.2 Give examples of the electrically propelled vehicles that are currently available 1.3 Outline the main differences between hybrid and electric vehicles 1.4 Give examples of the typical voltages used for a range of electrical vehicles
2. Understand the hazards around high energy electrical systems	2.1 Describe the basic hazards associated with high energy electricity 2.2 State the hazards that may be present in the event of an accident or suspected overcharging 2.3 Identify potential hazards when making connections for charging electric vehicles
3. Know how to work safely around electric vehicles	3.1 State safety precautions to be taken before approaching and working on or around electric vehicles 3.2 Describe how to identify high energy cabling and associated components 3.3 Describe how the vehicle may be safely charged using an external source

Content:

a. How to identify electrically propelled vehicles:
   i. construction
   ii. badging
b. Examples of the electrically propelled vehicles that are currently available
   i. hybrid incl. plug in
   ii. electric
   iii. two wheel moped/scooters
   iv. commercial vehicles
   v. passenger transport
   vi. car
c. The main differences between hybrid and electric vehicles
   i. layouts
   ii. components
   iii. batteries
   iv. motors
d. Examples of the typical voltages used for a range of electrically propelled vehicles
   i. 100-650V

ECE R100 (relating to vehicle regulations) paragraph 2.14 clearly defines high voltage:
"High Voltage means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms)."
NOTE: This is different to definitions in commercial and domestic use which are:
   i. Extra Low Voltage <50 V rms AC and <120 V DC
   ii. Low Voltage 50-1000 V rms AC and 120-1500 V DC
   iii. High Voltage >1000 V rms AC and >1500 V DC

a. The typical location of high energy cables and components on electrically propelled vehicles
   i. provide examples from various manufacturers
b. The basic hazards and health and safety procedures associated with high energy electricity
   i. electric shock
   ii. burns
   iii. arc flash
   iv. arc blast
   v. fire
   vi. explosion
   vii. chemicals
   viii. gases/fumes
c. The hazards that may be present in the event of an accident or suspected overcharging
   i. as above
d. Safety precautions to be taken before approaching and working on or around electrically propelled vehicles
   i. risk assessment
   ii. awareness of damaged components
   iii. dealing with leakage
   iv. isolation of high energy electrical system
   v. safe connection when charging
e. How to identify high voltage cabling as defined by ECE R100 2.14 and associated components
   i. colouring
   ii. warning symbols

UNIT REF: EP2	UNIT TITLE: ELECTRICALLY PROPELLED VEHICLE HAZARD MANAGEMENT

Level: 2	Route: Knowledge	Credit Value: 2	GLH: 12
Mapping: Based on IMI SSC Electric Vehicle NOS 2011			
Rationale: This unit is designed for those people who may encounter accident damaged or broken down electric and hybrid vehicles, e.g. emergency services and roadside recovery operators. It contains the ***knowledge*** required to work safely around a vehicle that may have had damage to its high and/or low energy electrical system. **Note:** *This is a **knowledge** unit only and does not deem someone competent to work on the high energy electrical system.*			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Know about the types of electrically propelled vehicles available	1.1. Describe how to identify electrically propelled vehicles 1.2. Give examples of the electrically propelled vehicles that are currently available 1.3. Outline the main differences between hybrid and electric vehicles
2. Know about electrically propelled vehicle systems	2.1 Give examples of the typical voltages used for a range of electrically propelled and assisted vehicles 2.2 Identify the typical location of high energy electrical cables and components on electrically propelled vehicles 2.3 Describe how to identify high energy electrical cabling and associated components 2.4 Compare the differences between alternating and direct current
3. Understand the hazards surrounding electrically propelled vehicles	3.1. Describe the basic hazards associated with high energy electricity 3.2. State the levels of current and voltage that present a hazard for both alternating and direct current systems 3.3. Describe the potential hazards that may be present when an electrically propelled vehicle has been damaged by fire or impact 3.4. Describe the effects of alternating and direct current on humans

4. Know how to reduce the risk of injury when encountering electrically propelled vehicles	4.1. Describe the methods that vehicle manufacturers use to provide protection from high energy electrical cabling and components 4.2. Identify who may be at risk in the event of electrically propelled vehicle incidents 4.3. Describe how to make an initial assessment of the extent of vehicle damage and or faults. 4.4. Describe how to take steps to secure the safety of themselves and others at incident scenes involving electrically propelled vehicles. 4.5. Describe the precautions that can be taken to reduce risks by those encountering damaged electrically propelled vehicles

Content:

a. How to identify electrically propelled vehicles:
   i. construction
   ii. badging
b. Examples of the electrically propelled vehicles that are currently available
   i. hybrid incl. plug in
   ii. electric
   iii. two wheel moped/scooters
   iv. commercial vehicles
   v. passenger transport
   vi. car
c. The main differences between hybrid and electric vehicles
   i. layouts
   ii. components
   iii. batteries
   iv. motors
d. Examples of the typical voltages used for a range of electrically propelled vehicles
   i. 100-650V

ECE R100 (relating to vehicle regulations) paragraph 2.14 clearly defines high voltage:
"High Voltage means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms)."
NOTE: This is different to definitions in commercial and domestic use which are:
   i. Extra Low Voltage<50 V rms AC and <120 V DC
   ii. Low Voltage 50-1000 V rms AC and 120-1500 V DC
   iii. High Voltage >1000 V rms AC and >1500 V DC

a. The typical location of high energy cables and components on electrically propelled vehicles
   i. provide examples from various manufacturers
b. How to identify high energy cabling and associated components
   i. colouring
   ii. warning symbols
c. Difference between AC and DC voltage:
   i. definitions of ac/dc -alternating current/direct current
   ii. voltage comparisons
   iii. current flow

Content:

d. The basic hazards associated with high energy electricity
   i. electric shock
   ii. burns
   iii. arc flash
   iv. arc blast
   v. fire
   vi. explosion
   vii. chemicals
   viii. gases/fumes
e. Levels of current and voltage that may present hazards
   i. contact time
   ii. AC/DC current and voltage levels
   iii. factors affecting resistance to current flow
f. The potential hazards and health and safety procedures when vehicles are damaged by fire or impact
   i. electric shock
   ii. burns
   iii. arc flash
   iv. arc blast
   v. fire
   vi. explosion
   vii. chemicals
   viii. gases/fumes
g. The effect of different AC and DC electrical currents passing through human body
   i. IEC 60479
   ii. IEC 479-2
h. The methods that vehicle manufacturers use to provide protection from high energy cabling and components
   i. direct protection- enclosure, insulation, location
   ii. indirect protection- fuse, RCD, RCBO,MCB
i. Who may be at risk in the event of electrically propelled vehicle incidents
   i. occupants
   ii. on-lookers
   iii. recovery personnel
   iv. emergency services
j. How to make an initial assessment of the extent of vehicle damage and or faults.
   i. risk assessment
   ii. personal protection
   iii. visual inspection
k. How to take steps to secure the safety of themselves and others at incident scenes involving electrically propelled vehicles.
   i. evacuation procedures
   ii. site protection
l. The precautions that can be taken to reduce risks by those encountering damaged electrically propelled vehicles
   i. overalls with non conductive fasteners
   ii. gloves
   iii. protective footwear; rubberised soles; non-metallic protective toe caps
   iv. goggles
   v. dealing with leakage from battery packs
   vi. isolation of high energy electrical system; vehicle shut down procedures
   vii. risk assessment

UNIT REF: EP3	UNIT TITLE: ROUTINE MAINTENANCE AND REPAIR ACTIVITIES ON ELECTRICALLY PROPELLED VEHICLES

Level: 2	Route: Knowledge	Credit Value: 3	GLH: 16
Mapping: Based on IMI SSC Electric Vehicle NOS 2011			
Rationale: This unit introduces learners to electric and hybrid vehicle technology including, and in particular, the safety requirements of working on these types of vehicles, e.g. whilst carrying out servicing, or general repairs that are **not** related to the high energy electrical system. **Note:** *This unit does not prove that someone is competent to work on the high energy electrical system, and assumes an already good level of electrical understanding. This unit does* ***not*** *cover commercial or domestic electrical installations including charging equipment and cables.*			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Know about electrically propelled vehicle system components and operation	1.1. Identify the components that make up the high energy electrical drive train system 1.2. Describe the construction and function of battery modules 1.3. Describe the construction and function of electric motors 1.4. Describe the construction and function of associated high energy electrical components including circuit protection and cabling 1.5. Describe how to identify high energy electrical cabling and associated components
2. Understand the hazards surrounding electrically propelled vehicles	2.1 Describe the basic hazards associated with high energy electricity 2.2 State the levels of current and voltage that present a hazard for both alternating and direct current systems 2.3 Describe the potential hazards that may be present when an electrically propelled vehicle has been damaged by fire, impact or overcharging 2.4. Describe the effects of alternating and direct current on humans
3. Know how to reduce the risks to yourself and others when working on electrically propelled vehicles	3.1. Describe the methods that vehicle manufacturers use to provide protection from high energy electrical cabling and components 3.2. State safety precautions to be taken to reduce risks to self and others before carrying out routine maintenance and repairs on electrically propelled vehicles 3.3. Describe the specific personal protective equipment required to work on electrically propelled vehicles 3.4. Describe the precautions required prior to working near high energy electrical components

4. Know how to safely prepare the vehicle when carrying out maintenance and routine repair activities on electrically propelled vehicles	4.1. Identify the possibility of the high energy electrical system affecting repairs on other vehicle systems 4.2. Describe the procedures required to make safe the high energy electrical system before carrying out maintenance and repair activities 4.3. Describe the precautions taken prior to removing and replacing high energy electrical components 4.4. Describe appropriate methods to re-instate vehicles after repairs affecting high energy electrical systems 4.5 Identify additional tools and equipment required to carry out work on electrically propelled vehicles 4.6. Describe how to connect an external power source to an electrically propelled vehicle
5. Be able to work safely on an electrically propelled vehicle	5.1. Use suitable personal protective equipment at all times whilst working on electrically propelled vehicles 5.2. Select suitable sources of information to support the work being carried out 5.3. Carry out the safe isolation of the high energy electrical system, following the vehicle manufacturers instructions 5.4. Use the correct methods to safely re-instate the vehicle following the vehicle manufacturers instructions 5.5. Use the correct procedures to connect an alternative power source to an electrically propelled vehicle

Content:

a. Identification of the components that make up the electrical propulsion system should include:
   i. batteries/stack, pod, module.
   ii. motors
   iii. cabling;
   iv. relays/control units
   v. charger and charging points
   vi. isolators
   vii. inverter
   viii. battery management interface
   ix. ignition/key-on control switch
   x. driver display panel
   xi. multi-battery server unit

b. The construction and function of battery modules should include:
   i. types; lead-acid; sodium-nickel chloride; lithium-ion derivatives; nickel-cadmium (Ni-Cad); nickel-ion (Ni-Fe); nickel-metal-hydride
   ii. capacities; primary/secondary cells; power density; energy density
   iii. housings; materials used
   iv. reactive materials; positive/ negative potential
   v. connections; shape; material; position
   vi. charging process; fast/slow charge; higher and lower voltages
   vii. location; effects on cooling, ease of maintenance, space, weight transfer; removing and refitting.

Content:

c. The construction and function of electric motors should include:
   i. principle of DC/AC types; permanent magnet; induction, brushed, brushless, single/three phase
   ii. connections; screwed; push; integrity; security
   iii. power rating/output
   iv. housing materials/insulation
   v. armatures
   vi. windings
   vii. principle of regenerative braking

d. The construction and function of associated electrical components should include:
   i. cabling; materials; colour coding; routing; insulation; cross-sectional area
   ii. circuit protection; fuses; thermal cut outs; insulation
   iii. relay/control units; battery management interface; inverter;
   iv. distribution units
   v. electrical symbols and terminology; circuit protection methods.
   vi. circuit theory; interaction between voltage, current, resistance (ohm`s law);power equation to
   vii. calculate power dissipated in a circuit
   viii. conductors, insulators; earth return, insulated return

e. Examples of the typical voltages used for a range of electrically propelled vehicles
   i. e.g 100-650V

ECE R100 (relating to vehicle regulations) paragraph 2.14 clearly defines high voltage:
"High Voltage means the classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V DC or > 30 V and ≤ 1000 V AC root mean square (rms)."
NOTE: This is different to definitions in commercial and domestic use which are:
   i. Extra Low Voltage <50 V rms AC and <120 V DC
   ii. Low Voltage 50-1000 V rms AC and 120-1500 V DC
   iii. High Voltage >1000 V rms AC and >1500 V DC

a. The basic hazards and health and safety procedures associated with high energy electricity:
   i. electric shock
   ii. burns
   iii. arc flash
   iv. arc blast
   v. fire
   vi. explosion
   vii. chemicals
   viii. gases/fumes

b. The hazards that may be present in the event of an accident or suspected overcharging
   i. as above

c. Levels of current and voltage that may present hazards
   i. contact time
   ii. AC/DC current and voltage levels
   iii. factors affecting resistance to current flow

d. The effect of different AC and DC electrical currents passing through the human body.
   i. IEC 60479
   ii. IEC 479-2

e. Safety precautions to be taken before carrying out any maintenance and repair procedures on high voltage vehicles should include:
   i. overalls with non conductive fasteners
   ii. gloves
   iii. protective footwear; rubberised soles; non-metallic protective toe caps
   iv. goggles
   v. precautions when using electrical equipment; differentiating between low/high energy
   vi. disposal of waste materials; recycling obligations
   vii. dealing with leakage from battery packs
   viii. isolation of high energy electrical system; vehicle shut down procedures
   ix. risk assessment

Content:

f. The identification of high energy cabling and associated components should include:
   i. using wiring diagrams
   ii. wiring colour
   iii. wiring size/cross-sectional area
   iv. warning signs
   v. using voltmeters/measuring equipment correctly

g. The precautions required when working with high energy vehicle components:
   i. awareness of highly magnetic components and strong magnetic fields
   ii. medical conditions that may be affected by high energy or magnetic fields
   iii. checking voltage prior to working near or on high energy systems

h. The possibility of the electrically propelled vehicle drive train system affecting repairs on other vehicle systems should include:
   i. connections to other systems
   ii. electro-magnetic interference
   iii. interlink between low and high energy sources
   iv. residual magnetism

i. The procedures required to make safe the high energy vehicle system before carrying out repair activities should include:
   i. identification of isolation switches
   ii. preparing vehicle for isolation/shut down
   iii. following set procedures
   iv. observation of data displays

j. The precautions taken prior to removing and replacing high energy components should include:
   i. check system is made safe/isolated/shut down
   ii. check voltage safe prior to starting work
   iii. make others aware of work being carried out/warning signs

k. Appropriate methods to re-instate vehicles after repairs affecting high energy vehicle systems could include:
   i. re-connection of high energy battery
   ii. use of fault code readers
   iii. on board displays

l. Additional tools and equipment required to carry out work on electrically propelled vehicles could include
   i. hand tools
   ii. code readers
   iii. specialist tools e.g. manufacturer specific software
   iv. electrical meters e.g. voltmeter rated to a minimum 600 CAT. III or CAT. IV

m. An awareness of when and how to connect an additional 12 volt power source to a High Voltage vehicle (where appropriate) and should include:
   i. identification of connections
   ii. correct connection methods
   iii. awareness of current draw capability of vehicle
   iv. use of correct cables
   v. correct use of PPE
   vi. awareness of short circuits and component damage

n. Connect an external power source to an electrically propelled vehicle

UNIT REF: EP4	UNIT TITLE: ELECTRICALLY PROPELLED VEHICLE SYSTEM REPAIR AND REPLACEMENT

Level: 3	Route: Knowledge	Credit Value: 4	GLH: 20
Mapping: Based on IMI SSC Electric vehicle NOS 2011			
Rationale: This unit enables learners to demonstrate, in a practical way, their knowledge of electric and hybrid vehicle technology and repair procedures. The unit also ensures that the learner is aware of the effect that electric vehicle technology has on other vehicle systems. **Note:** *This unit only provides the **knowledge and skills** required to work on **non-live** high energy electrical components and associated systems. It does not enable a learner to dismantle 'live' components, e.g. battery packs, and assumes an already good level of electrical understanding. This unit does **not** cover commercial or domestic electrical installations including charging equipment and cables.* *The unit should also only be undertaken after completion of Unit EP3 Routine Maintenance and Repair Activities on Electrically Propelled Vehicles.*			

LEARNING OUTCOMES The Learner will:	ASSESSMENT CRITERIA The Learner can:
1. Be able to work safely on an electrically propelled vehicle	1.1. Use suitable personal protective equipment throughout all vehicle inspection activities. 1.2. Work in a way which minimises the risk of damage to the vehicle and its systems, other people and their property
2. Be able to use information to carry out the task	2.1. Select suitable sources of technical information to support electrically propelled vehicle repair activities. 2.2. Use suitable sources of technical information to support electrically propelled vehicle repair activities.
3. Be able to use appropriate tools and equipment	3.1. Select appropriate tools and equipment to carry out electrically propelled vehicle repairs 3.2. Ensure that equipment has been calibrated to meet manufacturers' requirements. 3.3. Use the tools and equipment in the correct way
4. Know how to carry out repairs on High energy electrical systems	4.1. Explain the correct procedures required prior to removing and replacing high energy electrical system components 4.2. Explain how to isolate and re-connect live high energy electrical supplies correctly
5. Be able to carry out repairs on High energy electrical systems	5.1. Make the high energy electrical system safe to work on prior to carrying out any work 5.2. Use the correct procedures to disconnect and reconnect an isolated high energy battery pack 5.3. Use the correct procedures to remove and refit non-live high energy electrical vehicle system components 5.4. Use appropriate procedures to re-instate the vehicle and confirm repairs successfully carried out 5.5. Reset vehicle systems post-repair

6. Be able to record information and make suitable recommendations	6.1. Complete records accurately, in the format required. 6.2. Compare inspection and test results with suitable data 6.3. Make suitable recommendations based upon the results of carrying out the replacement activities.

Content:

a. Personal protective equipment should include:
   i. non-conductive overalls
   ii. gloves
   iii. protective non-conductive footwear
   iv. goggles

b. Methods to minimise the risk of damage to the vehicle and its systems, other people and their property should include:
   i. vehicle protection
   ii. precautions when using electrical equipment
   iii. disposal of waste materials
   iv. awareness of actions to others e.g. magnetic field effects on pacemakers and intravenous insulin meters
   v. a knowledge of COSHH regulations with regard to hazardous battery chemicals and compounds
   vi. correct knowledge of thermal runaway in battery stacks/modules

c. Suitable sources of technical information to support electrically propelled vehicle repair activities should include:
   i. manufacturer data, safety data sheets, workshop manuals
   ii. third party data, driver, customer
   iii. correct method and technique for gathering information from customers, drivers
   iv. paper based
   v. electronic
   vi. on vehicle data/warnings

d. The use of technical information to support electrically propelled vehicle repair activities should include:
   i. wiring diagrams
   ii. repair instructions
   iii. bulletins
   iv. verbal instruction
   v. on vehicle data/warning
   vi. manufacturer specific data

e. Appropriate tools and equipment to carry out electrically propelled vehicle repairs should include:
   i. hand tools
   ii. diagnostic code readers
   iii. specialist tools
   iv. correctly rated electrical multimeters/measuring equipment

f. Equipment that may be calibrated to meet manufacturers' requirements could include:
   i. multimeters
   ii. torque wrenches
   iii. measuring equipment
   iv. manufacturers specialist tools
   v. current diagnostic updates

g. The correct use of tools and equipment should include:
   i. following manufacturer instructions
   ii. following workplace procedures
   iii. appropriate use of hand tools
   iv. appropriate use of electrical tools
   v. appropriate use of specialist tools
   vi. relevant training on new dedicated equipment

Content:

h. The correct procedures required when removing and replacing electrically propelled vehicle drive train system vehicle components should include:
   i. observation of H & S
   ii. correct use of PPE
   iii. correct use of tools and equipment
   iv. correct use of tools and equipment
   v. following repair procedures
   vi. following workplace procedures
   vii. referral to manufacturer specific information

i. The knowledge of disconnecting high energy supplies correctly should include:
   i. batteries
   ii. motors
   iii. cabling
   iv. control units
   v. relays
   vi. switches
   vii. charging system
   viii. circuit protection
   ix. associated connectors
   x. auxiliary system components

j. Make the system safe prior to carrying out repairs should include:
   i. isolate/disconnect high energy system following manufacturer's instructions
   ii. carry out appropriate checks following manufacturers recommendations to ensure isolated system is safe (allowing discharge time for capacitance in disconnected circuits).

k. High energy components that may be disconnected could include:
   i. high energy battery pack/modules
   ii. charger
   iii. battery management interface
   iv. inverter
   v. air brake compressor
   vi. power steering motor
   vii. electric heating / air conditioning

l. Low energy components that may be disconnected could include:
   i. control units/fuse boxes
   ii. low energy components associated with interior heating
   iii. associated cabling
   iv. battery
   v. switches
   vi. lighting
   vii. low energy components associated with air conditioning
   viii. alarm/immobilizer
   ix. central locking
   x. electric windows/wipers/washers
   xi. central locking

m. Appropriate procedures to confirm repairs successfully carried out could include:
   i. on vehicle testing
   ii. checking fault codes
   iii. voltage/current checks
   iv. use of specialist equipment
   v. wiring and cable routing integrity
   vi. on road testing/drive cycling

n. Demonstrate the correct methods to reset vehicle systems post-repair should include:
   i. use of scan tools
   ii. on board diagnostics
   iii. use of specialist equipment
   iv. driver display module
   v. instrument information/warning information

Content:

o. Records to be completed accurately, in the format required could include:
   i. job cards
   ii. warranty records
   iii. on line data transfer
   iv. workplace internal records as a means of monitoring research and development
p. Comparison of inspection and test results with suitable data could include:
   i. wiring diagrams
   ii. repair instructions
   iii. bulletins
   iv. torque settings
   v. technical data
   vi. research and development data
q. Suitable recommendations based upon the results of carrying out the replacement activities could include:
   i. recommendations for further investigation and repairs
   ii. recommendations for further replacement
   iii. no further action required
   iv. recommendations for customer
   v. recommendations for improvement in working methods
r. Isolate and re-connect live high energy electrical supplies correctly e.g. batteries, capacitors and motors
s. Reset vehicle systems post-repair e.g. clear fault codes