



NZQA accredited and registered provider

Unit Standard 30572

PRACTICE PAPER - ANSWER BANK

Assessors Note:

This answer bank should be used as the primary resource when marking students work. However, responses to some questions may be subjective and tutors are advised to exercise their professional judgement when making assessment decisions.

OUTCOME ONE

Demonstrate knowledge of automotive batteries and their service requirements.

- 1. From the list provided, State the application and main characteristic/s of each battery.**

Starting battery:

Application: Petrol and diesel light vehicles

Traditional battery used for engine start up. They deliver a high electric current for a short period of time to start the engine.

Deep cycle batteries:

Application: Caravans, boats, golf carts, mobility scooters

These batteries are designed to deliver a steady current over a longer period but have a much lower initial current. They have thicker battery plates and denser materials to allow for repeated cycles of charging and discharging.

Calcium batteries:

Application: New cars, heavy vehicles, boats

These high performance batteries use calcium instead of antimony in the plates to provide greater protection from corrosion. These batteries use less water and are very slow to self-discharge. They are usually maintenance free and have a longer service life than a standard lead acid battery. They also put out higher cold cranking amps.

Absorbed glass mat (AGM) batteries:

Application: Vehicles that run lots of electrical accessories, motorcycles, motorsport, marine, caravans

These maintenance free batteries use glass fibre as a separator between the plates. This improves discharge and recharge efficiency. They can deliver high current on demand and provide a steady current over a longer period of time (deep cycle).

Gel batteries:

Application: Golf carts, wheel chairs, water pumps, boats

These maintenance free batteries are ideal for deep cycle low rate discharge applications. They have a gel electrolyte which prevents electrolyte evaporation and spillage. They do need to be kept upright. They are very robust, spill proof, have a long service life and are much safer than standard batteries.

Lithium ion batteries:

Application: Electric car battery packs, hybrids, boats

These maintenance free batteries store more electricity than standard batteries and are usually lighter and more compact. They also charge significantly faster while having a similar life cycle. The battery contains a lithium metal oxide cathode, a graphite anode, separator and lithium salts electrolyte.

Lithium iron phosphate batteries:

Application: Electric cars, hybrids, mobility devices

These batteries are similar to lithium ion batteries; however they are safer when overheated or short-circuited and have a longer life cycle. Their high discharge rates and lower weight make them ideal for electric vehicle applications.

2. List the information needed to select the required battery for correct vehicle starting operation or application.

Choose the correct COLD CRANKING AMPERE rating for the vehicle.

Make and model, type of usage, Have additional accessories been fitted.

3. Where should batteries that are used and damaged be stored and how are they disposed of?

Old batteries should be stored in the designated hazardous waste area so that they can be taken away and recycled.

4. How many cells are there in a 12 volt battery?

6

5. Explain how the electrolyte temperature effects voltage charge rate.

As the temperature in each cell increases the required charging voltage needs to decrease. At 0°C the charge voltage is 2.540 volts per cell, at 25°C the charge is 2.390 volts and at 50°C the charge voltage is 2.3 volts.

6. What chemical reaction occurs to the positive plate lead sulphate during charging?

Positive Plate Lead sulphate changes to lead dioxide (PbO₂). Sulphate returns to electrolyte. The electrolyte is approximately 35% sulphuric acid (H₂SO₄).

7. What chemical reaction occurs to the negative plate sponge lead during discharge?

Negative Plate Sponge lead changing to sulphate (PbSO_4) and the electrolyte loses much of its diluted sulphuric acid (H_2SO_4) and becomes primarily water (H_2O).

8. What tool is used to measure battery electrolyte?

Battery Hydrometer

9. Explain the procedure to remove and replace a vehicle battery including the circuit connections

Ensure that the ignition switch, lights and all accessories are turned off. Remove the battery clamp. Fit memory saver device to the battery leads. With the correct sized spanner loosen and carefully (without short circuiting to the positive terminal) remove the negative lead from the negative battery terminal. With the correct sized spanner loosen and carefully remove the positive lead from the positive battery terminal. Remove old battery; place it in the battery recycling area. Select the correct replacement battery for the vehicle as per the battery manufacturers charts. Install new battery. Carefully refitting leads in reverse order and install battery clamp.

10. Provide the meanings to these battery terms:

Cold cranking amps

Number of amperes a lead acid battery at minus 18 degrees Celsius can deliver for 30 seconds and maintain at least 1.2 volts per cell

Service life

The length of satisfactory performance measured in years or charging / discharging cycles

Sulphated

If a battery is over discharged or left in a discharged condition the lead sulphate will become hard making the battery very difficult to recharge

Final discharged voltage limit

The prescribed lower-limit voltage at which battery discharge is considered complete

Self-discharge

A slow permanent chemical reaction process at a cell's or battery's electrodes, even when the battery is disconnected

Capacity

The ability of a fully charged battery to deliver a specified quantity of electricity at a given rate over a definite period of time.

11 Are there more positive or negative plates per battery cell?

No there are more negative plates

12 What is the chemical make-up of electrolyte?

Is made up of 35% Sulphuric acid (H₂SO₄) and 65% water

13 Explain the procedure to charge a battery used in marine equipment that is within a confined area

Lead-acid batteries, give off lighter-than air hydrogen gas when charging, so for inboard marine applications they must be vented at the top directly to the outside of the boat. If there is not enough natural ventilation you may have to add a spark proof extractor fan to eliminate hydrogen gas build-up and to lower the battery temperature or remove the battery to a well ventilated area.

1. Make sure the charger is turned off at the wall plug
2. Remove cell caps if not a maintenance free battery
3. Connect the positive (red) cable to the positive terminal on the battery
4. Connect the negative (black) cable to the negative terminal on the battery
5. Set the charger to the correct voltage setting for the battery
6. Turn on at the wall
7. Turn on at the charger

14. List 4 battery faults or conditions that can lead to a battery failing?

Vibration, Frequent over-discharge, Frequent over-charging, Dirty battery case

OUTCOME TWO

Demonstrate knowledge of testing an automotive battery.

1. Describe the procedure for checking and testing a maintenance-free battery and list the equipment required

Equipment: digital voltmeter

Select the correct voltage scale (usually 20volt for a twelve volt system).

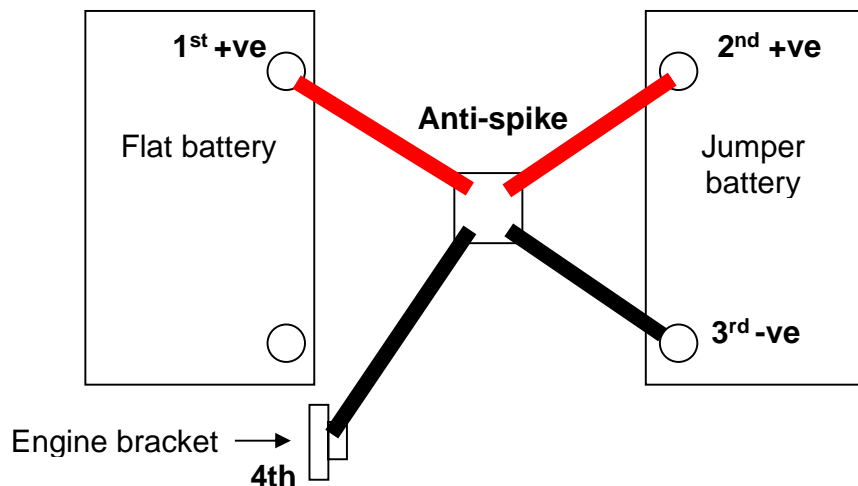
Connect the leads in parallel to the correct terminals (positive (red) to positive and negative (black) to negative).

The battery can be tested both in a state of rest and/or loaded (cranking or headlights on). The results should be compared to the manufacturer's specs for evaluation.

2. A battery is checked using a high-rate discharge tester. Identify the loaded pass voltage from the provided list.

9.6volt

3. Draw a diagram showing jumper cables connecting two batteries for jump starting. Number each cable in the correct connecting sequence. (Include positive and negative positions on the battery, positive and negative cable connections and the position of an anti-spike device).



4. **Complete the following sentences using the provided words.**
(Engine, Battery, First, Negative, Last, Chassis, Earth, Cables, Positive, Terminal, Earth, Bolted)

Remove the Negative cable from the Battery first. Now remove the Positive cable, but make sure the Cables do not touch.

(Remember, the negative is the First and Last cable you will work with assuming that the negative is the Earth. You can tell if the negative Terminal is Earth by seeing if the cable is Bolted to the car Chassis or Engine.

5. **Explain the procedures for slow charging the battery**
Maximum charge period is 16 hours, Do not charge above 15 amps, A voltage limited battery charger is preferable.

1. Make sure the charger is turned off at the wall plug
2. Remove cell caps if not a maintenance free battery
3. Connect the positive (red) cable to the positive terminal on the battery
4. Connect the negative (black) cable to the negative terminal on the battery
5. Set the charger to the correct voltage setting for the battery
6. Turn on at the wall
7. Turn on at the charger

6. **Explain the procedure to Jump start a vehicle using a portable jumper pack.**

Ensure that the ignition switch, lights and all accessories are turned off. Ensure that main switch on starting pack is in "off" position. Connect the positive (red) cable to the positive terminal on the flat battery. Connect the negative (black) cable to the negative terminal on the flat battery. Turn the main switch on starting pack to "on" position. Wait 1 minute. Start the vehicle, turn jumper pack switch to "off" before removing leads in reverse order.

7. What is the function of each listed component?

1. Separator relay

This unit automatically connects starter and service batteries in parallel. When one of the batteries is connected to a charger both batteries will charge. During discharge a microprocessor controlled relay within the unit automatically disconnects the starter battery from the service battery.

2. Battery switch

Found on some marine battery set ups. The unit can isolate the energy in the battery banks so that one battery can be dedicated to starting and another to service or the batteries can be alternated between starting and service.

3. Split charging

Used to charge a system that has separate battery systems. Vehicles such as camper vans and some boats have two batteries or banks of batteries, one dedicated to supplying power for starting and running the engine only and one to supply power to accessories

4. Blocking diodes

Used to prevent batteries from discharging when battery banks are used. This item when placed in series to each of the batteries or banks will stop current from flowing backwards towards the other battery or bank if it was flat or discharging.

8. Explain the procedure to replace a vehicle battery

Ensure that the ignition switch, lights and all accessories are turned off. Remove the battery clamp. Fit memory saver device to the battery leads. With the correct sized spanner loosen and carefully (without short circuiting to the positive terminal) remove the negative lead from the negative battery terminal. With the correct sized spanner loosen and carefully remove the positive lead from the positive battery terminal. Remove old battery; place it in the battery recycling area. Select the correct replacement battery for the vehicle as per the battery manufacturers charts. Install new battery. Carefully refitting leads in reverse order and install battery clamp. Remove memory saver from the leads and start the vehicle.

9. **A battery is tested using a hydrometer. Circle the readings from the float scale that would best indicate a charged battery.**

1.155

1.260

1.225

1.120

10. **What is the maximum time allowed to load a battery using a high rate discharger tester?**

Max of 10 seconds

11. **During a high rate discharge test one or more of the cell bubbles and gives off a rotten egg smell, what does this indicate?**

Faulty cell or the battery has failed.