

SHORT ANSWER TYPE QUESTIONS:**1) What are the Fire prevention measures followed in coaches?**

Ans:

- Adequate and proper maintenance of Electrical devices in the coaches as per laid norms.
- All electrical equipments should be maintained properly.
- Check all the electrical circuits for foul (burning) smell, smoke and sparks.
- After completion of the loading, guard must ensure that all the lights in the luggage portion of the SLR are switched “off” to eliminate possibility of short-circuiting.
- Electrical junction boxes should be covered and locked positively in all TL coaches especially in pantry cars.
- Ensure all electrical connections are intact and there are no loose fittings in the coaches.
- Do not allow battery boxes in ‘open’ condition and also MS sheet covering is provided in electrical circuits.
- Ensure correct rated Over load, over voltage protection, fuses/MCBs are provided in electrical circuits.
- Ensure the availability and proper knowledge of usage of fire extinguishers in AC coaches.

2) What are Levels of electrical protections in TL coaches?

Ans:

- Battery:** TL coaches are provided with 120 Ah, 110 V flooded type Lead Acid Battery or VRLA battery. **40 A HRC** fuse provided in main positive side of Battery circuit in under frame.
- Alternator & Regulator:** TL coaches are provided with 4.5 kW alternator & RRU/ERRU. **35 A HRC** fuse is provided in one phase of AC input. **6 A HRC** fuse is provided for field control circuit.
- Fuse cum rotary switch panel**
35 A HRC fuse is provided in main –ve circuit.
L1 & L2 lighting circuits are provided with **16 A HRC fuse** each in +ve side.
Fan is provided with **16 A HRC fuse** in +ve side.
SPM circuit is provided with **16 A HRC fuse** in +ve side.
- Fuse Distribution board**
35 SWG re-wirable fuse is provided in both +ve & -ve sides for all individual light & fan fitting.
Each Laptop/mobile charging point is provided with **500 mA/1.0 A** fuse in both +ve & -ve sides.
Emergency light circuit is provided with **6 A HRC** fuse in both +ve and –ve sides.

3) What are the main components of Lead Acid Cell?

Ans. Main Components of Lead Acid Cells are:

- (i) Positive Plates which are tubular in shape made of PbO_2 .
- (ii) Negative Plates usually consists of a lead grid into which active material of Sponge lead is pressed.
- (iii) Separators which are made by Synthetic used between positive and negative plates.
- (iv) Container is made of hard rubber or PPCP with high insulating strength to resist acids which are used as Electrolyte.

(v) Cells cover which covers container having vent plugs and level indicator.

4) What type of batteries are used in TL coaches. Explain briefly about each one of them?

Ans. In TL coaches two type of batteries are used. They are VRLA & SMF batteries.

VRLA batteries: These are the Valve Regulated Cells which works on Oxygen Recombination Principle.

SMF batteries: To overcome problems of frequent topping up and leakage of electrolyte sealed maintenance free batteries are developed. Electrolyte in SMF batteries is in immobilized form and these can be used in any position.

5) What do you mean by PELE box and when it is utilized?

Ans. The equipments available in PELE box are:

- i. TRIPOD STAND
- ii. HOLDER
- iii. FLEXIBLE WIRE 25 METERS
- iv. CROCODILE CLIPS
- v. BULBS
- vi. HAND LAMP
- vii. LOG BOOK
- viii. LAMP FITTINGS

These equipments are used in emergency conditions of train service. This box is kept in the Guard Compartment.

6) What are the Safety Checks in under gear and batteries?

Ans: Alternator:-

1. Alternator safety chains
2. Suspension pin with anti- rotation plate and cotter pin
3. Suspension pin with nylon bushes
4. Alternator pulleys

Axle pulley :-

1. Axle pulley with bolts and split pins.

Battery box:-

1. Condition of battery box channels
2. Check nuts with split pins.

Regulator

Availability of nuts & bolts with split pins

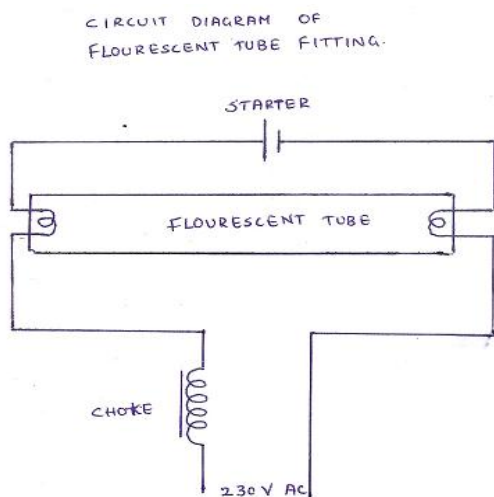
Availability of nuts & bolts with split pins of other under gear electrical suspension equipments.

7) How to check Earth fault with Double Test Lamp?

Ans: Double test lamp having three leads. Centre lead should be connected to earth, left side lead to be connected on positive side (+ve), right side to be connected on negative side (-ve) If both bulbs glow dimly it indicates no earth in the coach. If left side bulb glows brightly it indicates negative earth (-ve) in the coach. If right side bulb glows brightly it indicates positive earth (+ve) in the coach.

8) Draw the tube light circuit diagram. Explain its functioning?

Ans.

**9) (a) Define Ohms Law?**

Ans. Temperature remaining constant the flow of current is directly proportional to applied Voltage.

$$I \propto V, \quad I = V/R \text{ (resistance of the conductor)}$$

(b) Define Kirchoff's Voltage Law?

Ans. It states, " the sum of the Voltage drops around a DC series circuit equals the source or applied voltage.

$$E = E_1 + E_2 + E_3.$$

(c) Define Kirchoff's Current Law?

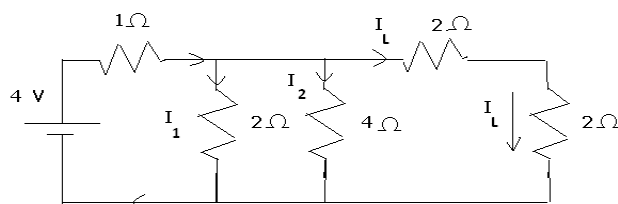
Ans. It states " the current flowing toward a point in a circuit must equal to the current flowing away from that point.

$$I = I_1 + I_2 + I_3.$$

(d) State Faraday's laws of electromagnetic induction?

Ans. **First Law:** Whenever the flux linked with a circuit is changed an e.m.f. is induced in the circuit

Second Law: The magnitude of the induced e.m.f is equal to the rate of change of flux linkages.

10) Find the current load (I_L) in the below mentioned circuit diagram ?

Ans.

$$\text{Resistance of thrid loop} = \frac{(2+2) \times 4}{4} = 2\Omega$$

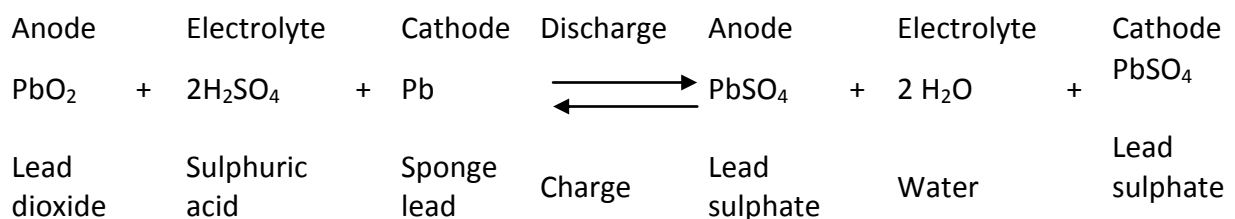
$$\text{Resistance of second loop} = \frac{(2+2) \times 4}{(2+2) \times 4} = 2\Omega$$

$$\begin{aligned} \text{(i)} \quad I_1 \times 2 &= I_2 \times 4 = I_L \times 4. \\ \text{(ii)} \quad I_1 + I_2 + I_L &= 2A. \\ I_1 + I_1 \times 2/4 + I_1 \times 2/4 &= 2A. \\ I_1 [1 + 0.5 + 0.5] &= 2. \\ I_1 &= 2/2 = 1A. \\ I_L &= I_1 \times 2/4 = \frac{1 \times 2}{4} = 0.5A. \end{aligned}$$

Hence, $I_L = 0.5A$.

11) Give the charge and discharge reaction of the lead acid battery?

Ans.



12) What is the difference between SG TL coaches and LHB TL coaches?

Ans:

| Sl.No | Item description | SG TL Coach | LHB TL Coach |
|-------|-------------------------|--|--|
| 1 | Coach load distribution | From Roof junction Box | Power panel |
| 2 | Fuse distribution board | Available | Integrated in the power panel |
| 3 | Fans | DC fans | AC fans (2.5 KVA 110 V Dc/AC inverters- 2 no's) |
| 4 | Pantry car | Single alternator, single set of battery | Two alternators, Double set of Battery |

13) What are the safety items to be inspected on battery?

Ans: Safety items to be checked on battery are full complements of battery box fixing bolts and its tightness, observation of its bottom plate and side plates for damage, full tightness of cell packing, proper securement of anti theft arrangement and battery box cover, full tightness of inter cell connections with double fasteners, correct size of battery fuse, elimination of earth leakage and maintenance of correct polarity, e.t.c,

14) What are the safety items to be inspected on Rotary Junction Box?

Ans: Safety items to be checked on rotary junction box are full tightness of all terminal connections, provision of correct size of HRC fuses, maintaining correct polarity of incoming and outgoing cables, avoiding earthing and shorting of cables.

15) What are the safety items to be inspected on wiring?

Ans: Safety items to be checked on wiring are securing of wiring through cleats with trough casing, provision of correct size of fuses in wiring circuits, elimination of lower size cables, provision of PVC bushes when ever wires passing through metal parts, eliminations of temporary wiring, avoiding of earthing and shorting of cables etc.

16) What are the reasons for loss of residual magnetism? How do you regain it? What is the permissible and maximum DC voltage is to be applied to regain the residual magnetism?

Ans. The reasons for loss of residual magnetism are keeping the alternator in idle condition for long time and connecting field wires in wrong polarity. To regain the residual magnetism flash the field terminals for correct polarity of DC supply. The permissible DC voltage is to be applied to regain the residual magnetism is 6 to 12V DC. Maximum voltage is 24V DC.

17) What is the purpose of belt-tensioning device? What are the parts it consists of?

Ans. The purpose of belt tensioning device is to keep V belts in tight condition.

Its parts are

1. Tension rod
2. Tension spring
3. Belt tension indicator with spring seat
4. Fork eye
5. Fork eye side spring seat
6. Belt tightening nut
7. Free end pipe and nut

18) What are the main components of Lead Acid cell?

Ans. Main components of Lead Acid cells are:

- a) Positive Plates, which are tubular n shape, made of PBO₂
- b) Negative Plates, usually consists of lead grid into which active material of Sponge lead is pressed.
- c) Separators, which are made by Synthetic, used between Positive and negative plates.
- d) Container is made of hard rubber or PPCP with high insulating strength to resist acids which are used as Electrolyte.
- e) Cell covers which covers container having vent plugs and level indicator.

19) Enumerate the cable sizes used in TL coaches?

Ans. **Roof wiring**

| | | |
|----------------|---|---------------------|
| Branch wiring | : | 4 sq.mm Aluminium, |
| LI, LII & F+ve | : | 16 sq.mm Aluminium, |
| SPMI&II | : | 16 sq.mm Aluminium. |

Under frame wiring

| | | |
|--|---|------------------|
| Alternator to regulator, field winding | : | 6 sq.mm copper. |
| Main windings | : | 16 sq.mm copper, |

Regulator to under frame junction box : 35 sq.mm Al.
UFJB to Battery box : 35 sq.mm Al.

20) Why earthing is necessary for any electrical equipments, domestic installation & service building etc? For TL coaches what is the minimum I.R. value required for new wiring?

Ans: To drain away any leakage of currents due to poor insulation and to save human life from dangerous shock and also to avoid burnt of electrical equipment.

The minimum IR value required for wiring is $2M\Omega$'s and minimum IR value required in service for giving coach fit for service is $1M\Omega$.

21) Practically demonstrate to use Fire extinguisher?

- Ans:
- P** -Pull the pin at the top of the extinguisher.
 - A** -Aim the nozzle towards the base of the fire.
 - S** -Stand approximately 8 feet away from the fire and squeeze the handle to discharge the extinguisher.
 - S** -Sweep the nozzle back and forth at the base of the fire.

22) What are the precautions to be taken before starting work on electrical installations?

Ans: Before starting any electrical works on installations disconnect the power supply to the Electrical equipment and discharge & connect earth. If any capacitors are connected, it has to be discharged properly. Test with meters for any availability of supply then start the work.

23) How do you conduct insulation resistance test on 100 VA inverter used for Laptop and mobile charging sockets used in RC SG coaches?

- Ans: The insulation resistance of the inverter shall be measured with 500v megger as given below:
- Between input terminals shorted together and the housing with output being kept in open circuit condition.
 - Between the output terminals shorted together and keeping the input terminals in open circuit. The insulation resistance values measured thus shall not be less than 10 Mega ohms in each test.

24) Write about the working principle of TL/AC alternator?

Ans. The core of the stator which is completely embraced by the field coils, will retain a residual magnetism if excited by a battery once. The flux produced by the filed coils find its path through the rotor. When the rotor is rotated the passage of rotor teeth and slots, alternatively, under the field, offers a varying reluctance path for the flux produced by the field coils. The flux, which varies periodically, links with AC coils and induces an alternating voltage in AC coil. The frequency of the induced voltage depends on the speed of rotor, where as the magnitude depends on the speed of the rotor and the level of excitation. The field is controlled through regulator to attain desired output voltage by means of positive feedback again.

25) What are the precautions to be taken while loading and unloading of alternator?

- Ans.
- While unloading and loading alternator, see that the terminal box and pulley should not be broken.
 - The alternator to be loaded in correct way that bushes to be provided in proper place.
 - While loading and unloading proper precautions to be taken not to fall on ground otherwise men/materials will be injured/damaged.
 - See that the anti rotating clamp provided on trolley coincides with alternator suspension pin.
 - Replace the worn out alternator and alternator suspension bracket bushes.

- vi) See that the alternator should not have play with proper washers in improper place to align the axle pulley.
- vii) Safety chains and cotter pins to be provided without fail.

26) Give important measures adopted by railways for prevention of fires in TL coaches?

Ans. a) Cable sizes have been standardized.

- b) Provision of fuse on both positive and negative side in FDB
- c) Use of self extinguishing PVC cables.
- d) Provision of rubber grommets at points where the cable enters through metal members in the coach.
- e) Proper crimping at the cable terminals.
- f) Air clearance of 10 mm between live part and earth and between parts of opposite polarity.
- g) Replacing of cables with any joints, noticed during POH.
- h) Re-wiring of the coach planned on the basis of cable life of 15 years.
- i) Use of Flame retardant Insulation tape.
- j) If I.R. value of wiring is less than 1M, rewiring should be taken up.

27) What precautions will you take during re-wiring of a coach?

Ans.

- a) Use of PVC cables of suitable current.
- b) In under frame and end walls of coach the wiring has to be drawn through Rigid steel conduits
- c) Use of proper size of fuses.
- d) The phase and field wires from the Alternator to terminal box shall be run in one flexible PVC conduit and from terminal box to rectifier – cum-regulator & from rectifier-cum-regulator to under frame terminal board in one rigid steel conduit.
- e) Proper method of crimping by using proper die and use of corrosion inhibiting compound during crimping of Aluminium cables.
- f) Segregation of positive and negative cables.
- g) Cables in the roof (super structure) to be carried in non-metallic rigid conduits with proper cleating arrangement.
- h) Use of FRLT insulation tape.
- i) After re-wiring the test the insulation resistance with 500v dc megger. The minimum insulation resistance should be 2 Mega ohms.

28) What are the disadvantages of 110 Volts DC Train lighting System?

Ans: Disadvantages:

- a) In the 120 volts system single battery is provided load on the battery is more. The life of the battery is reduced considerably.
- b) Due to introduction of transform mounting system the complete coach has to be lifted for replacement of V belts.
- c) Due to provision smaller size batteries, the quantity of electrolyte is limited. If the level of electrolyte is not maintained by adding distilled water, the batteries may damage.
- d) Due to high voltage system, requires high value of insulation resistance for safety etc.

29) What are the major train lighting equipments available in Self Generating coaches?

Ans. The major train lighting equipments in coach are

- a) Alternator
- b) Rectifier cum Regulator Unit

- c) Battery
- d) Axle Pulley
- e) Rotary/ Roof Junction Box
- f) Under frame Junction Box
- g) Fans
- h) Lights
- i) EFT
- j) BCT

30) What are the sizes / capacity of fuses provided at various locations of 110 Volts Train Lighting coach?

Ans.

| Sl. No. | Circuit fuse | Location | Fuse size | Current rating |
|---------|-------------------|---------------|---------------|----------------|
| 1. | Positive/negative | Branch fuses | DFB 35 SWG RW | 6A |
| 2. | SPM1 & SPM2 | Junction box | 16A HRC | --- |
| 3. | Main negative | Junction box | 35A HRC | --- |
| 4. | L1, L2, and F +ve | Junction box | 16A HRC | --- |
| 5. | Battery fuse | Battery box | 40A HRC | --- |
| 6. | Field fuse | Regulator box | 6A HRC 20 | 6A |
| 7. | AC fuse | Regulator box | 35A HRC | --- |

31) What was the latest proforma issued by Railway Board for special drive to prevent fire in TL coaches during trip inspection?

Ans: The latest proforma issued by Railway Board for special drive to prevent fire in TL coaches during trip inspection is given below:

| Sl. No. | Depot | Date | Train No. | Coach No. | Earth Leakage (Y/N) | Incorrect rating of HRC fuses (Y/N) | Rewire able fuses replaced with HRC fuses (Y/N) | Availability of OVP in RRU/ERRU (Y/N) | Condition of FDBs (Y/N) | Loose wires & connections (Y/N) | Remarks |
|---------|-------|------|-----------|-----------|---------------------|-------------------------------------|---|---------------------------------------|-------------------------|---------------------------------|---------|
| | | | | | | | | | | | |

32) Explain Trickle Charging of Batteries?

Ans: When a battery is kept as an emergency reserve, it is very essential that it should be found fully charged when an emergency arises. Due to leakage action and open circuit losses, the batteries deteriorate. Hence to keep it fresh, batteries are kept on a small charging.

For example: A standby battery for station bus-bar of 400 Ah at 10 hr rating, a continuous trickle charge of 1 Amp will keep the cells fully charged and keep in perfect condition.