ISEP Exam – 05 november 2024

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Question 1 : Give one reason why electric cars begin to democratize nowadays

1. The need of for environmentally friendly alternatives
2. The decreasing availability of fossil fuels
3. The cost of battery raw materials has decreased due to technological development.
4. The electrical system of electric vehicles is optimized, power consumption is reduced, battery life is significantly improved, and charging speed is accelerated.

Question 2 : Give the three main components of an electric car

- HV Battery
- Electric motor
- Converter

Question 3 : Why is it important to have a 12V battery in an electric or hybrid car in addition with the HV battery ?

12V battery is for powering low-voltage systems.
It operates independently of the HV battery, allowing the low-voltage systems to remain functional when the HV battery is turned off or depleted.

Question 4 : List the four architectures of a hybrid vehicle

- Series hybrid
- Parrallel hybrid
- Series-parallel hybrid
- Complex hybrid hybrid

Question 5 : How it's called the « brain » of an electric or hybrid vehicle ?

BMS(Battery Management System)

Question 6 : Give the equation of the usable power P (W) in function of current and voltage

$P = I * U$

Question 7 : What is the open voltage of a lead acid cell ? and give the total voltage of what we call a « 12V battery » ?

The open voltage : 2.1V per cell
The total voltage of <12V battety>: around 12.6V

Question 8 : Why Lithium-ion is the main technology used for propulsion in HEV today ?

Due to its high energy density, low self-discharge, no memory effect.
At the same time, its technology is relatively reliable, the cost is stable, and it is lower than other more efficient new energy sources.

Question 9 : Define a supercapacitor (when it's used, its role)

A supercapacitor stores electrical energy using electrostatic fields.
It's used for rapid charge and discharge cycles.
It's used with batteries to help the high-power demands.

Question 10 : What is a SOC for a battery ? Whit what we can compare it ?

SOC (State of Charge) indicates the charge level.
We can compare it with a fuel gauge in a combustion vehicle.

Question 11 : Give the main role of a Battery Management System

BMS monitor and manage the battery's charge, health, and safety.
It connects at the terminals of the cells and resistors to discharge them.

Question 12 : Give two safety rules when you use a battery

- Never drill a battery
- Never short-circuit a battery

Question 13 : In which range of power, fuel cell electric vehicles are used ?

In the range of kilowatts (kW) to megawatts (MW).

Question 14 : How it's called a converter which converts a DC to AC signal ?

An inverter.

Question 15 : Define a bidirectional converter and why we use it in a HEV with energy recovery system when braking ?

A bidirectional converter allows electrical energy to flow in both directions between the high-voltage (HV) battery and other components.

When the vehicle brakes, the electric motor operates in reverse to generate electricity, which the bidirectional converter directs back to the HV battery for storage, improving energy efficiency and extending the vehicle's range.

Question 16 : List the two main electric motors used in a HEV

- DC motor
- Synchronous AC motor

Question 17 : What is more efficient between hydraulic brake and electric one ?

Electric.
Because of the regenerative capabilities.

Question 18 : Explain how battery is recharged using induction technology

Induction charging uses electromagnetic fields to transfer energy wirelessly to the vehicle’s battery. When passes over charging plates embedded.

Question 19 : List the name of two vehicles (one electric and one hybrid)

- Electric : Peugeot E-3008
- Hybrid : Renault Clio E-Tech

Question 20 : What do you think about the future of HEV ?

I think hybrid HEV will exist in the future and will exist for a long time.
Now, due to the reduction of fossil fuels and people's concern for the environment, more people choose HEV.
In addition, a lot of manpower and material resources have been invested in infrastructure deployment (charging piles) and technology (charging speed).
Car companies are also trying their best to solve people's anxiety about HEV mileage.