1. Define the following terms and by giving an example make the concept clear.

   (a) Work

   (b) Energy

   (c) Power (P)

   (d) Volt (V)

   (e) Ampere (A)

2. Define and differentiate between primary and secondary batteries. Provide two examples of each type and discuss their typical applications.

3. The combustion of gasoline releases approximately 46.7 MJ/kg and 33.6 MJ/L by volume. Please convert these values to kWh/kg and kWh/L, respectively. Additionally, given that an electric vehicle (EV) has an average energy consumption of 0.20 kWh/km, how much battery capacity is required for the car to cover a daily distance of 50 km? Also, provide the equivalence of kilogram gasoline in relation to this calculation.

4. While larger batteries provide extended range for electric Vehicle, they also have three drawbacks. Please list them.

5. Describe the basic components of an electrochemical cell. Explain the role of each component in the energy storage process.

6. (a) Explain the concept of oxidation and reduction reactions in the context of battery electrodes.

   (b) Write the half-reactions for the anode and cathode in a lithium-ion battery.

   (c) Determine the overall cell reaction and calculate the theoretical cell voltage.

7. Create a comparison table that includes at least five different types of batteries (e.g., lithium-ion, lead-acid, nickel-metal hydride, solid-state, and supercapacitors). Include the following criteria in your table:

   - Energy density (Wh/kg)
   - Cycle life (number of charge/discharge cycles)
   - Typical applications
   - Advantages and disadvantages

8. Define the following terms and explain their significance in battery performance:

   (a) Energy Density

   (b) Power Density

   (c) Battery Capacity

   (d) Battery C-Rate

   (e) State of charge (SOC)

   (f) Depth of discharge (DOD)

   (g) Open–circuit voltage (OCV)

   (h) Self-discharge

   (i) The cut off voltage

9. Please search the internet for software that simulates batteries? Additionally, could you list all the capabilities of these software programs, such as the types of batteries they can simulate and any specific features they offer like:

   - Cell, Battary Module or Battery Pack
   - Type of Modeling and simulation (i.e. CFD, ECM, etc.)
   - Method of solution(FVM, FDM, ...)
   - Battery Dynamics
   - Thermal Management
   - Aging