1. A battery is rated at 200 Ah. If it operates under a load of 50 A, calculate:
   (a) How long will it last?
   (b) What will be the remaining capacity after 3 hours of use?
2. Given a battery with a total capacity of 100 Ah. If the battery is discharged to 30 Ah,
   (a) Calculate the DoD.
   (b) What is the remaining State of Charge (SoC)?
3. A battery originally rated at 100 Ah has been tested and shows a current capacity of 80 Ah. Calculate the SoH.
4. A Lithium-ion battery pack has: Energy capacity = 50 kWh, Volume = 0.2 m^3 and Mass = 120 kg. Calculate:
   (a) Energy Density (in Wh/L)
   (b) Power Density (assuming maximum power output is 10 kW)
5. A battery rated at 100 Ah is charged at a rate of 50 A.
   (a) Calculate the C-rate.
   (b) If the battery is charged for 2 hours, what will be the State of Charge after charging?
6. You are designing a solar energy storage system with the following specifications: Daily energy requirement: 10 kWh, Battery efficiency: 90%, Maximum DoD: 80% Calculate:
   (a) Required battery capacity in kWh.
   (b) If using a specific battery with an energy density of 200 Wh/L, what volume will the battery occupy?
7. A lithium-ion battery with a nominal capacity of 150 Ah is used in an electric vehicle. The vehicle consumes energy at a rate of 20 kW. If the battery operates at an efficiency of 95%, calculate:
   (a) The effective capacity of the battery in kWh.
   (b) How long can the vehicle run on a fully charged battery?
8. A battery system has a total capacity of 120 Ah. After discharging it to 60 Ah, calculate:
   (a) DoD in percentage.
   (b) SoC in percentage.

(c) If the maximum allowable DoD is 70%, how much additional capacity can be safely used?

9. A battery originally rated at 200 Ah has been cycled extensively and now shows a capacity of 150 Ah. Calculate:

   (a) The State of Health (SoH) in percentage.

   (b) If the battery's performance degrades at a rate of 5% per year, estimate its capacity after 3 years assuming linear degradation.

10. Consider a battery pack with:

    - Energy capacity = 80 kWh
    - Volume = 0.25 m^3
    - Mass = 200 kg

    Calculate:

    (a) Energy Density in Wh/L and Wh/kg.

    (b) Power Density if the maximum output power is 15 kW.

11. A battery rated at 120 Ah is charged at a rate of 30 A.

    (a) Calculate the C-rate during charging.

    (b) If the initial SoC is at 20%, how long will it take to reach a SoC of 80%?

12. You are tasked with designing a renewable energy storage system for a residential building with the following specifications:

    - Daily energy consumption: 12 kWh
    - Battery efficiency: 85%
    - Maximum DoD: 75%
    - Required backup time during outages: 6 hours

    Calculate:

    (a) Required total battery capacity in kWh to meet daily consumption considering efficiency.

    (b) How much usable capacity will be available considering the maximum DoD?

    (c) If using batteries with an energy density of 250 Wh/L, what volume will the total battery system occupy?