EV355 Assignment 1

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Q.1.) Battery Capacity = 60 KWh

Consumption Rate = 0.2 KWh / mile.

$$\text{Range} = \frac{\text{Battery Capacity}}{\text{Consumption Rate}} = \frac{60}{0.2} \text{ miles} = 300 \text{ miles}$$

Vehicle can travel 300 miles.

Q.2.) Battery Cap. = 40 Kwh, , charged % = 20

Charger output = 7.2 KW.

Battery Charge needed = $(1-0.2) \times 40 \text{ Kwh} = 32 \text{ kwh}$.

$$\text{Time Required} = \frac{\text{Capacity needed}}{\text{charging rate}} = \frac{32 \text{ hr}}{7.2} = 4.44 \text{ hrs}$$

4.44 hrs are required for complete charge.

Q.3.) Distance = 100 miles, Battery cap. = 15 Kwh.

Distance for 75 KWh.

$$\text{Range for 75 KWh} = \frac{100}{15} \times 75 = 500 \text{ miles}$$

Ans

Q.4.) Efficiency = 90%. , weight = 3000 lbs, speed = 60 mph in 6 seconds

1 lbs = 0.45 Kg

weight = 1350 Kg.

26.82 m/s ← speed = 96.56 Km/h

$$\text{Kinetic Energy} = \frac{1}{2}mv^2 - \frac{1}{2}mu^2 = \frac{1}{2} \times 1350 \times (26.82)^2 \text{ J}$$

$$= 485535.9 \text{ KJ}$$

$$\text{Power} = \frac{\text{Energy}}{\text{Time}} = 80,923 \text{ KW}$$

$$\text{Input Power} = \frac{\text{Power}}{\text{Efficiency}} = 89.914 \text{ KW}$$

Input power = 89.914 KW required to drive vehicle

Q.5) efficiency = 85%. Power delivered = 60KW to wheels

$$\text{Input power} = \frac{\text{Output Power}}{\text{Efficiency}} = \frac{60}{0.85} = 70.6 \text{ KW}$$

Input power Drawn = 70.6 KWh

Q.6) 0 to 100 Km/h ↓ 27.7 m/s in 8 second wt = 1500 kg

$$\text{Power} = \frac{\text{K.E.}}{\text{Time}} = \frac{\frac{1}{2}mv^2}{t} = \frac{1}{2} \times 1500 \times \frac{100 \times 100}{8} \times \frac{5 \times 5}{18 \times 18}$$

$$= 72.34 \text{ KW}$$

Q.7) cost = 0.12 dollar / KWh. 50Kwh battery. from 20% to 100%

Charge cap Needed = 0.8 x 50 = 40KWh

$$\text{Cost needed} = \frac{\text{Charge Capacity}}{\text{Rate of Charging}} \times$$

$$= 0.12 \times 40 = 4.8 \text{ dollars.}$$

Q.8) 30% recover rate. 25m/s → speed. wt. 1200 kg of K.E.

$$\text{K.E.} = \frac{1}{2} \times 1200 \times (25)^2 = 375 \text{ KJ}$$

$$\text{K.E. recovered} = \frac{30}{100} \times 375 \times 10^3 \times \text{J}$$

$$= 112.5 \text{ KJ}$$

Energy Recovered. = 112.5 KJ

Q.9.) 1000 cycles 20% loss, original capacity = 60 kWh

Remaining Capacity = 80% × 60 kWh.

= 0.8 × 60 = 48 KWh

Q.10.) 1 KW heat, cooling system removes heat at 800 W. rate. per hour.

Net heat = 1000 W − 800 Wh. = 200 W

Neat heat per hour = 200 Wh Ans