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Alternative Powertrain Technology

M6X02209

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$$Q1) a) P = \frac{F_T V}{\eta}$$

$$F_T = R_R + A_R$$

$$R_R = mg \text{coeff} = 1500 \times 9.81 \times 0.013 \\ = 191.295$$

$$A_R = 0.5 \times A \times c_d \times 1.2 \times V^2$$

$$A = 3 \text{ m}^2$$

$$c_d = 0.5$$

$$V = 70 \text{ kph} = \frac{70}{3.6} = 19.44 \text{ m/s}$$

$$A_R = 0.5 \times 3 \times 0.5 \times 1.2 \times 19.44^2 \\ = 340.122$$

$$F_T = 191.295 + 340.122 = 531.415 \text{ N}$$

$$\eta = 0.8 = 80\%$$

$$P = \frac{531.415 \times 19.44}{0.8} = 12913.38 \text{ W} \\ = 12.91 \text{ kW}$$

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$$Q1) b) \quad \text{Engine Power}_{\text{loss}} = S_{\text{kw}} \times 0.2 = 1000 \text{ W}$$

$$\text{Power before losses} = 6000 \text{ W} = 6 \text{ kW}$$

$$P \times T = 360000 \text{ joules} \quad \times \cancel{3600}$$

$$\text{Fuel Density} = 0.755 \text{ kg/L} = \cancel{755 \text{ g/ml}} \quad 0.755 \text{ g/ml}$$

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Q1)c) $P = \frac{\text{Flywheel capacity}}{\eta}$

Flywheel capacity = 1.2 Mjoules = 1200000 joules
 $\eta = 90\% = 0.9$

$P = \frac{1200000}{0.9} = 1333333.33 \frac{\text{MJ}}{\text{joules}} = 1.3 \frac{\text{MJ}}{\text{sec}}$
 $= 1333333.33 \div 60 = 22222.22 \text{ w}$
 $= 22.22 \text{ kw}$

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d) $SS_{\text{hw}} \div 22.22 = 2.4 \frac{\text{seconds}}{\text{seconds}} = 2.4 \text{ seconds}$

e) $1200000 \div 55000 = 21.81 \text{ seconds}$

f) $2.4 + 21.81 \times 3600 = 78518.4 \text{ cycles.}$