

1. a) smaller

b) greater

$$2. \quad a) \quad W = F \cdot s = 90 \text{ N} \cdot 40 \text{ m} = \underline{3'600 \text{ J}} \quad P = \frac{W}{t} = \frac{3600 \text{ J}}{30 \text{ s}} = \underline{120 \text{ W}}$$

$$b) \quad W = F \cdot s = 180 \text{ N} \cdot 40 \text{ m} = \underline{7'200 \text{ J}} \quad P = \frac{W}{t} = \frac{7200 \text{ J}}{60 \text{ s}} = \underline{120 \text{ W}}$$

$$c) \quad W = F \cdot s = 180 \text{ N} \cdot 20 \text{ m} = \underline{3'600 \text{ J}} \quad P = \frac{W}{t} = \frac{3600 \text{ J}}{25 \text{ s}} = \underline{144 \text{ W}}$$

3. a) **Dan** is doing work on **himself**.

$$b) \quad W = m \cdot g \cdot h = 45.7 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 607 \text{ m} = 272'000 \text{ J} = \underline{272 \text{ kJ}}$$

$$c) \quad P = \frac{W}{t} = \frac{272'000 \text{ J}}{3600 \text{ s}} = \underline{75.6 \text{ W}}$$

4. a) **The engine** is doing work on **the car**.

$$b) \quad W = \frac{1}{2} \cdot m \cdot v^2 = \frac{1}{2} \cdot 1'200 \text{ kg} \cdot (27.8 \frac{\text{m}}{\text{s}})^2 = \underline{463 \text{ kJ}}$$

$$c) \quad P = \frac{W}{t} = \frac{463 \text{ kJ}}{10 \text{ s}} = \underline{46.3 \text{ kW}}$$

5. a) **Ken** is doing work on **the spring**.

$$b) \quad W = \frac{1}{2} \cdot k \cdot y^2 = \frac{1}{2} \cdot 450 \frac{\text{N}}{\text{m}} \cdot (0.024 \text{ m})^2 = \underline{0.13 \text{ J}}$$

$$c) \quad P = \frac{W}{t} = \frac{0.13 \text{ J}}{0.2 \text{ s}} = \underline{0.65 \text{ W}}$$

$$6. \quad W = P \cdot t = 12.0 \text{ W} \cdot 3600 \text{ s} = 43'200 \text{ J} = \underline{43.2 \text{ kJ}}$$

$$7. \quad t = \frac{W}{P} = \frac{m \cdot g \cdot h}{P} = \frac{48.0 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 8.0 \text{ m}}{320.0 \text{ W}} = \underline{12 \text{ s}}$$

$$8. \quad P \cdot t = W = F \cdot s \quad \Rightarrow \quad s = \frac{P \cdot t}{F} = \frac{500 \text{ W} \cdot 3600 \text{ s}}{200 \text{ N}} = \underline{\underline{9.00 \text{ km}}}$$

$$9. \quad a) \quad t = \frac{s}{v} = \frac{2.48 \text{ m}}{3.00 \frac{\text{m}}{\text{h}}} = 0.8267 \text{ h} = \underline{\underline{49 \text{ min } 36 \text{ s}}} = \underline{\underline{2'976 \text{ s}}}$$

$$b) \quad P = \frac{W}{t} = \frac{0.3607 \text{ J}}{2976 \text{ s}} = 0.000121 \text{ W} = \underline{\underline{0.121 \text{ mW}}} = \underline{\underline{121 \mu\text{W}}}$$

$$c) \quad F_n = F_G = m \cdot g = 0.019 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} = 0.186 \text{ N} \quad F_f = \frac{W}{s} = \frac{0.3607 \text{ J}}{2.48 \text{ m}} = 0.145 \text{ N}$$

$$F_f = \mu_k \cdot F_n = \mu_k \cdot m \cdot g = \frac{W}{s} \quad \mu_k = \frac{F_f}{F_n} = \frac{W}{s \cdot m \cdot g} = \frac{0.3607 \text{ J}}{2.48 \text{ m} \cdot 0.019 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2}} = \underline{\underline{0.78}}$$