

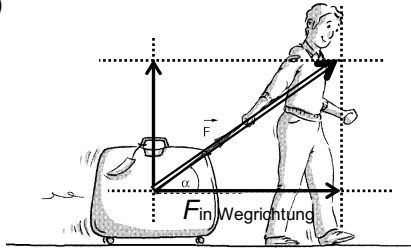
1. A) $W = F \cdot s = 6.0 \text{ kN} \cdot 3.0 \text{ m} = \underline{18 \text{ kJ}}$
 B) $W = F \cdot s = 6.0 \text{ kN} \cdot 6.0 \text{ m} = \underline{36 \text{ kJ}}$
 C) $W = F \cdot s = 6.0 \text{ kN} \cdot 9.0 \text{ m} = \underline{54 \text{ kJ}}$
 D) $W = F \cdot s = 12.0 \text{ kN} \cdot 3.0 \text{ m} = \underline{36 \text{ kJ}}$
 E) $W = F \cdot s = 12.0 \text{ kN} \cdot 6.0 \text{ m} = \underline{72 \text{ kJ}}$
 F) $W = F \cdot s = 18.0 \text{ kN} \cdot 9.0 \text{ m} = \underline{162 \text{ kJ}}$

2. no displacement $\Rightarrow$ no work! $W = 0$

3. a) no force $\Rightarrow$ no work! $W = 0$

b) $t = \frac{s}{v} = \frac{2'255 \text{ km}}{10.5 \frac{\text{km}}{\text{s}}} = \underline{215 \text{ s}} = \underline{3 \text{ min } 35 \text{ s}}$

4. a)



10.0 N corresponds to 0.50 cm

$$F_{\text{direction of motion}} = F \cdot \cos \alpha$$

$$= 60.0 \text{ N} \cdot \cos (35^\circ) = \underline{49.1 \text{ N}}$$

(corresponds approximately to 2.5 cm)

b) $W = F \cdot s = 49.1 \text{ N} \cdot 5.3 \text{ m} = \underline{260 \text{ J}}$

5. a) Heather is doing work on her bike to («accelerating work»)
 b) Ken is doing work on his backpack («lifting work»)
 c) Amanda is doing work on her rubber hair band («elastic work»)
 d) Mr Miller is doing work on the table («frictional work»).

6. $W_{\text{lifting}} = m \cdot g \cdot h = 75.8 \text{ kg} \cdot 9.81 \frac{\text{N}}{\text{kg}} \cdot 12.0 \text{ m} = 8'923 \text{ J} = \underline{8.92 \text{ kJ}}$

7. $W_{\text{spring}} = \frac{1}{2} \cdot k \cdot y^2 = \frac{1}{2} \cdot 500 \frac{\text{N}}{\text{m}} \cdot 0.035^2 \text{ m}^2 = \underline{0.31 \text{ J}}$

or: $W_{\text{spring}} = \frac{1}{2} \cdot k \cdot y^2 = \frac{1}{2} \cdot 5.00 \frac{\text{N}}{\text{cm}} \cdot 3.5^2 \text{ cm}^2 = 31 \text{ N} \cdot \text{cm} = 0.31 \text{ N} \cdot \text{m} = \underline{0.31 \text{ J}}$

$$8. \quad W_{\text{acceleration}} = \frac{1}{2} \cdot m \cdot v^2 = \frac{1}{2} \cdot 0.433 \text{ kg} \cdot 5.0^2 \frac{\text{m}^2}{\text{s}^2} = \underline{5.4 \text{ J}}$$

$$9. \quad W_{\text{friction}} = \mu_k \cdot m \cdot g \cdot s = 0.01 \cdot 3.2 \text{ kg} \cdot 9.81 \frac{\text{N}}{\text{kg}} \cdot 5'000 \text{ m} = 1'570 \text{ J} = \underline{2 \text{ kJ}}$$

$$10. \quad y^2 = \frac{2W}{k} = \frac{2 \cdot 0.25 \text{ J}}{200 \frac{\text{N}}{\text{m}}} = 0.0025 \text{ m}^2 \quad y = \sqrt{0.0025 \text{ m}^2} = 0.050 \text{ m} = \underline{5.0 \text{ cm}}$$

$$11. \quad \text{a) } W_{\text{acceleration}} = \frac{1}{2} \cdot m \cdot v^2 = \frac{1}{2} \cdot 987 \text{ kg} \cdot 22.2^2 \frac{\text{m}^2}{\text{s}^2} = \underline{244 \text{ kJ}}$$

$$\text{b) } s = \frac{W}{F} = \frac{244'000 \text{ J}}{2'750 \text{ N}} = \underline{88.6 \text{ m}}$$

$$12. \quad \text{a) } W_{\text{acceleration}} = \frac{1}{2} \cdot m \cdot v^2 = \frac{1}{2} \cdot 0.400 \text{ kg} \cdot 0.50^2 \frac{\text{m}^2}{\text{s}^2} = 0.050 \text{ J}$$

$$W_{\text{friction}} = C_{\text{rr}} \cdot m \cdot g \cdot s = 0.01 \cdot 0.400 \text{ kg} \cdot 9.81 \frac{\text{N}}{\text{kg}} \cdot 1.8 \text{ m} = 0.07 \text{ J}$$

$$W_{\text{total}} = W_{\text{acceleration}} + W_{\text{friction}} = 0.050 \text{ J} + 0.07 \text{ J} = \underline{0.12 \text{ J}}$$

$$\text{b) } F = \frac{W_{\text{total}}}{s} = \frac{0.12 \text{ J}}{1.8 \text{ m}} = \underline{0.07 \text{ N}}$$

$$13. \quad \text{a) } k = \frac{2 \cdot W}{y^2} = \frac{2 \cdot 0.90 \text{ J}}{(0.030 \text{ m})^2} = 2'000 \frac{\text{N}}{\text{m}} = \underline{20 \frac{\text{N}}{\text{cm}}}$$

b) Work done to compress the spring by 6.0 cm (final position):

$$W_{\text{elastic}} = \frac{1}{2} \cdot k \cdot y^2 = \frac{1}{2} \cdot 2'000 \frac{\text{N}}{\text{m}} \cdot 0.060^2 \text{ m}^2 = 3.6 \text{ J}$$

Work done to compress the spring by 3.0 cm (initial position):

$$W_{\text{elastic}} = \frac{1}{2} \cdot k \cdot y^2 = \frac{1}{2} \cdot 2'000 \frac{\text{N}}{\text{m}} \cdot 0.030^2 \text{ m}^2 = 0.90 \text{ J}$$

$$W_{\text{elastic}} (\text{final position}) - W_{\text{elastic}} (\text{initial position}) = 3.6 \text{ J} - 0.90 \text{ J} = \underline{2.7 \text{ J}}$$