

Exercise walk-through

3.3

Potential Energy

AP Physics 1

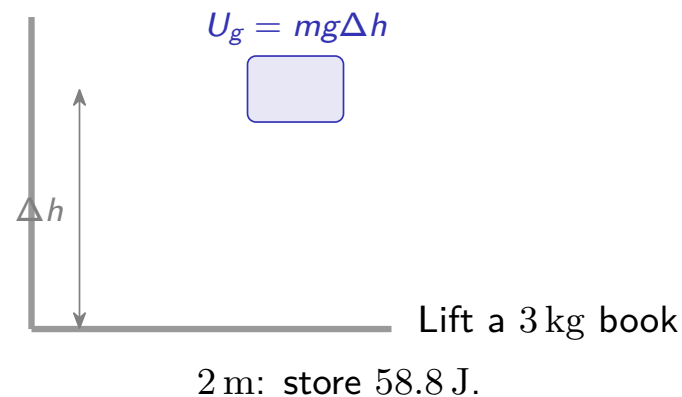
Potential energy

Potential energy is stored in an arrangement – it depends on **position**, not motion.

Two common kinds

$$\Delta U_g = mg\Delta h \quad U_s = \frac{1}{2}kx^2$$

A **conservative force** (gravity, spring): its work depends only on start and end.



Exercises 2.1·2.3

2.1 Find the gravitational potential energy gained by lifting a 5.0 kg box 2.0 m (take $g = 10 \text{ m s}^{-2}$). [2]

2.2 A spring of constant 300 N m^{-1} is compressed 0.20 m. Find the elastic potential energy stored. [2]

2.3 State what a minimum on a potential-energy versus position graph tells you about the object there. [1]

Exercises 2.1·2.3

2.1 Find the gravitational potential energy gained by lifting a 5.0 kg box 2.0 m (take $g = 10 \text{ m s}^{-2}$). [2]

2.1

- $\Delta U_g = mg \Delta h = 5.0 \times 10 \times 2.0 = 100 \text{ J}$

2.2 A spring of constant 300 N m^{-1} is compressed 0.20 m. Find the elastic potential energy stored. [2]

2.2

- $U_s = \frac{1}{2}(300)(0.20)^2 = 6.0 \text{ J}$

2.3 State what a minimum on a potential-energy versus position graph tells you about the object there. [1]

2.3

- it is a point of stable equilibrium (the object tends to stay or oscillate about it)

Exercises 3.1-3.2

3.1 The elastic potential energy stored in a spring is

[1]

☐

A kx

B $\frac{1}{2}kx$

C $\frac{1}{2}kx^2$

D kx^2

3.2 Doubling the compression of a spring changes its stored potential energy by a factor of

[1]

☐

A 2

B 4

C $\frac{1}{2}$

D no change

Exercises 3.1-3.2

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3.1 C

- $\frac{1}{2}kx^2$.

3.2 Doubling the compression of a spring changes its stored potential energy by a factor of

[1]

☐

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B 4

C $\frac{1}{2}$

D no change

3.2 B

- $U_s \propto x^2$

Exercise 3.3 (a)

3.3 A 0.30 kg ball is raised 1.5 m and then released from rest (take $g = 10 \text{ m s}^{-2}$).

(a) Find the gravitational potential energy at the top.

[2]

Exercise 3.3 (a)

3.3 A 0.30 kg ball is raised 1.5 m and then released from rest (take $g = 10 \text{ m s}^{-2}$).

(a) Find the gravitational potential energy at the top. [2]

(a)

- $U_g = 0.30 \times 10 \times 1.5 = 4.5 \text{ J}$

Exercise 3.3 (b)

3.3 A 0.30 kg ball is raised 1.5 m and then released from rest (take $g = 10 \text{ m s}^{-2}$).

(b) Using energy conservation, find its speed just before it lands. [2]

Exercise 3.3 (b)

3.3 A 0.30 kg ball is raised 1.5 m and then released from rest (take $g = 10 \text{ m s}^{-2}$).

(b) Using energy conservation, find its speed just before it lands. [2]

(b)

- $\frac{1}{2}mv^2 = U_g \Rightarrow v = \sqrt{2g \Delta h} = \sqrt{30} = 5.5 \text{ m s}^{-1}$