

Exercise walk-through

3.1

Translational Kinetic Energy

AP Physics 1

Kinetic energy and the work-energy theorem

Energy of motion

$$KE = \frac{1}{2}mv^2$$

A **scalar**. Depends on v^2 – double the speed, **quadruple** the energy.

Work-energy theorem

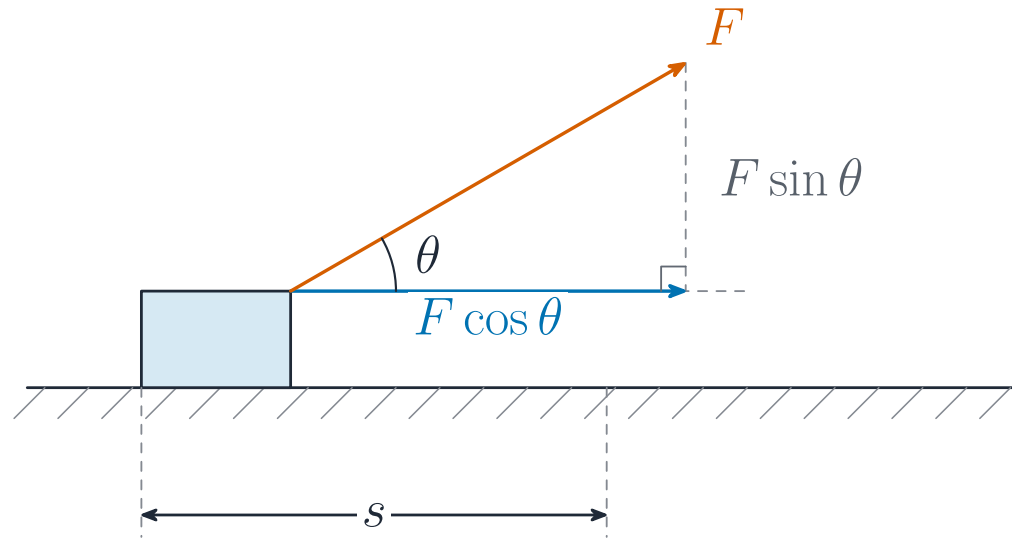
$$W_{net} = \Delta KE$$

Kinetic energy links force to motion:

- positive net work $\Rightarrow$ speeds up
- negative net work $\Rightarrow$ slows down

2 kg from 3 $\rightarrow$ 5 m/s: KE rises 9 $\rightarrow$ 25 J, so $W_{net} = 16$ J.

Only the force component along the displacement



Only the force component along the displacement does work

Exercises 2.1-2.3

2.1 Find the kinetic energy of a 0.50 kg ball moving at 6.0 m s^{-1} . [2]

2.2 State how the kinetic energy changes if the speed triples. [1]

2.3 A 1000 kg car slows from 20 m s^{-1} to rest. Find the net work done on it. [2]

Exercises 2.1-2.3

2.1 Find the kinetic energy of a 0.50 kg ball moving at 6.0 m s^{-1} . [2]

2.1

- $KE = \frac{1}{2}(0.50)(6.0)^2 = 9.0 \text{ J}$

2.2 State how the kinetic energy changes if the speed triples. [1]

2.2

- it becomes **nine times** as large (3^2)

2.3 A 1000 kg car slows from 20 m s^{-1} to rest. Find the net work done on it. [2]

2.3

- $W_{net} = \Delta KE = 0 - \frac{1}{2}(1000)(20)^2 = -2.0 \times 10^5 \text{ J}$

Exercises 2.4·3.1

2.4 State the work-energy theorem in words.

[1]

3.1 The kinetic energy of an object depends on its speed as

[1]

☐

A $KE \propto v$

B $KE \propto v^2$

C $KE \propto 1/v$

D $KE \propto \sqrt{v}$

Exercises 2.4·3.1

2.4 State the work-energy theorem in words. [1]

2.4

- The net work done on an object equals its change in kinetic energy

3.1 The kinetic energy of an object depends on its speed as [1]

☐

A $KE \propto v$

B $KE \propto v^2$

C $KE \propto 1/v$

D $KE \propto \sqrt{v}$

3.1 B

- $KE \propto v^2$.

Exercise 3.2

3.2 A net work of 40 J is done on a 2.0 kg object starting from rest. Its final speed is [1]

☐

A 40 m s⁻¹

B 20 m s⁻¹

C 6.3 m s⁻¹

D 4.5 m s⁻¹

Exercise 3.2

3.2 A net work of 40 J is done on a 2.0 kg object starting from rest. Its final speed is [1]

☐

A 40 m s⁻¹

B 20 m s⁻¹

C 6.3 m s⁻¹

D 4.5 m s⁻¹

3.2 C

- $\frac{1}{2}(2.0)v^2 = 40 \Rightarrow v = \sqrt{40} = 6.3 \text{ m s}^{-1}$

Exercise 3.3 (a)

3.3 A 0.20 kg hockey puck is pushed from rest and gains 9.0 J of kinetic energy.

(a) State its final kinetic energy.

[1]

Exercise 3.3 (a)

3.3 A 0.20 kg hockey puck is pushed from rest and gains 9.0 J of kinetic energy.

(a) State its final kinetic energy.

[1]

(a)

- 9.0 J

Exercise 3.3 (b)

3.3 A 0.20 kg hockey puck is pushed from rest and gains 9.0 J of kinetic energy.

(b) Find its final speed.

[2]

Exercise 3.3 (b)

3.3 A 0.20 kg hockey puck is pushed from rest and gains 9.0 J of kinetic energy.

(b) Find its final speed.

[2]

(b)

- $\frac{1}{2}(0.20)v^2 = 9.0 \Rightarrow v = \sqrt{90} = 9.5 \text{ m s}^{-1}$