

هيكل الفيزياء physics



UNITED ARAB EMIRATES
MINISTRY OF EDUCATION



2025-2026

**Inspire
Physics**

UAE Edition
Grade 10 Advanced
Student Edition

الفيزياء دكتور عبدالله المهدي
مصاب أبو الخير



Mc
Graw
Hill

G10 inspire



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عام المجتمع

YEAR OF COMMUNITY

٢٤١

UAE

تابعنا على

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Ministry of Education. **UAE**
Curriculum and Assessment Sector.
Testing and Assessment Dep.
Centralized Exams.
End of Term **1** Exam Coverage

Academic Year العام الدراسي	2K ²⁵ / 2K ²⁶
Term/الفصل	①
Subject الموضوع	Physics (INSPIRE)
Grade الصف	10
Stream. المسار	Advanced المتقدم

المناهج الإماراتية المدرسة الإماراتية

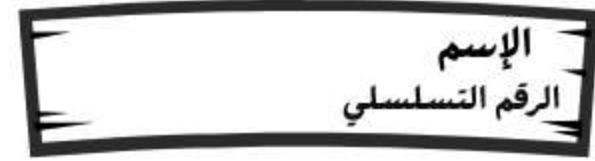
دكتور اعداد وتطوير مناهج ومعلم بالتعليم

عزيزي الطالب / عزيزتي الطالبة

نحن لا نجمع الهيكل في أسئلة فقط
ولكن نقوم بالشرح الجزئيات المطلوبة
في الهيكل ثم نقوم بجمع الأسئلة عليها
من الكتاب

الجزء الأول والشرح على اليوتيوب

لحجز الأجزاء الأخرى تواصل معنا



قناة تلجرام



تواصل على تلجرام

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للتواصل



- | | | | |
|---|---|--------------|---|
| 1 | <ul style="list-style-type: none"> ❖ Define periodic motion and quantities associated with periodic motion like period and amplitude. ❖ Describe the characteristics of simple harmonic motion. | Student Book | 3 |
|---|---|--------------|---|

Periodic motion

Amplitude

period (T)

Frequency

Simple harmonic motion

Periodic motion

Motion that repeats in a regular cycle, such as the bobbing of a mass on a spring or the swaying of a pendulum

Period Or periodic Time (T) : The time required for one full cycle of the motion



$$T = \frac{\text{Total Time } t}{\text{Number of Cycles } n}$$



Frequency f

The number of cycles that a body makes in one second.

$$f = \frac{\text{Number of cycles}}{\text{Total time}}$$

Unit of Measurement: oscillation/second or cycle/second or vibration/second

All are equivalent to Hertz HZ or $\frac{1}{\text{second}}$ or S^{-1}



The Relationship between Frequency and Period:

Each is the reciprocal of the other.

$$(\text{Period})T = \frac{1}{f}$$

$$(\text{Frequency})f = \frac{1}{T}$$

Example: A body makes 360 oscillations, waves, or cycles in one minute. Calculate its period and frequency.

$$T = \frac{\text{Total time}}{\text{Number of cycles}} = \frac{60}{360} = \frac{1}{6} \text{ s}$$

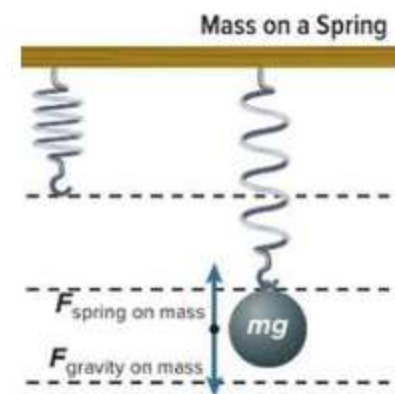
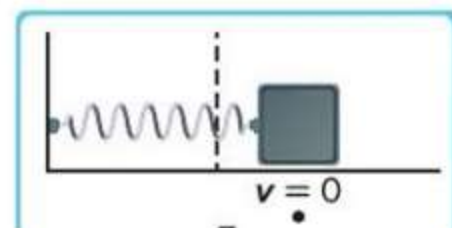
$$f = \frac{\text{Number of cycles}}{\text{Total time}} = \frac{360}{60} = 6 \text{ Hz}$$



$$(\text{Period})T = \frac{1}{f} = \frac{1}{6}$$

Amplitude: The maximum distance the object moves from its equilibrium position.

units cm or meter



Simple harmonic motion:

A type of periodic motion where the force acting to restore an object to its equilibrium position is directly proportional to the object's displacement.

Characteristics of Harmonic Motion:

- 1-The restoring force is directly proportional to the displacement and always works to return the object to the equilibrium position.
- 2-Objects oscillate around an equilibrium point.
- 3-It can be described using a sine or cosine function.

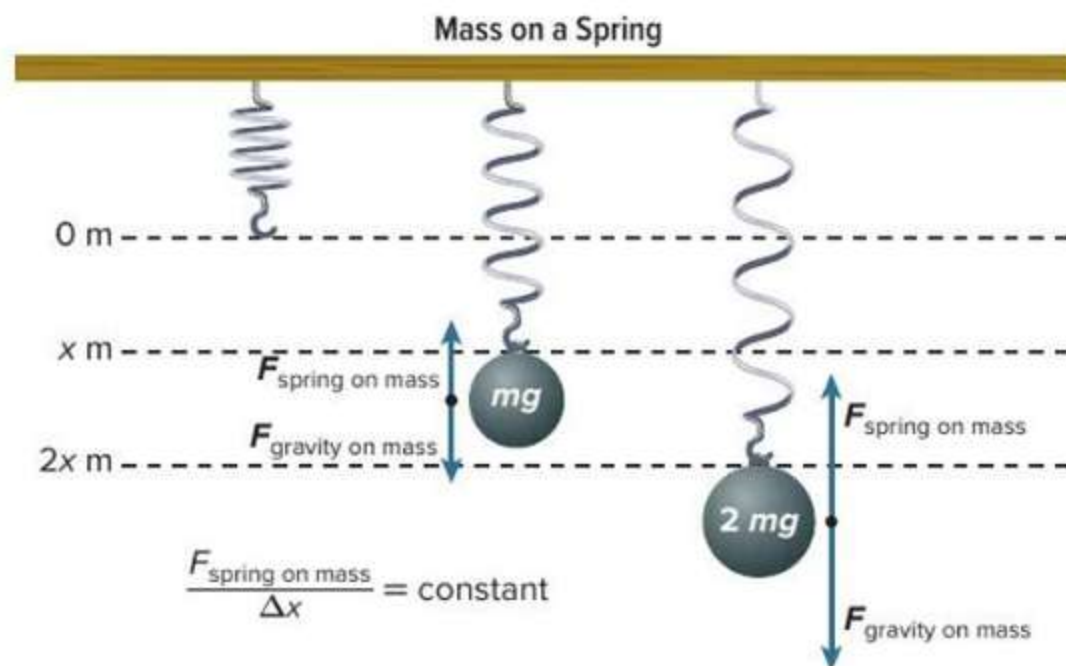


Figure 1 The force exerted on the mass by the spring is directly proportional to the mass's displacement.

Determine the displacement if the mass is $0.5 mg$.



- 2 Apply Hooke's law to calculate the force exerted by a spring, the spring constant, or the distance by which a spring is stretched or compressed.

Student Book
Example Problem 1
Practice Problem Q. (3)

4
6
6

Hooke's Law

The magnitude of the force exerted by a spring is equal to the spring constant times the distance the spring is stretched or compressed from its equilibrium position.

$$F = -kx$$

The constant **k** has the same units as the slope, newtons/meter (N/m).

The negative sign in Hooke's law indicates that the force is in the direction opposite the stretch or compression direction. The force exerted by the spring on the mass is always directed toward the spring's equilibrium position.

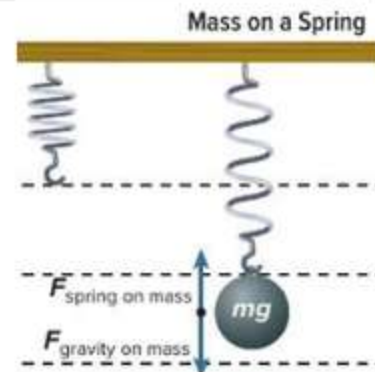


Table 1 Force Magnitude-Stretch Distance in a Spring

Stretch Distance (m)	Magnitude of Force Exerted by Spring (N)
0.0	0.0
0.030	1.9
0.060	3.7
0.090	6.3
0.12	7.8

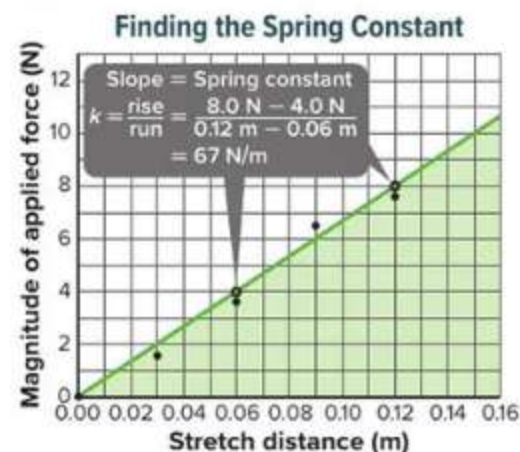


Figure 2 The spring constant can be determined from the slope of the force magnitude-stretch distance graph. The area under the curve is equal to the potential energy stored in the spring.

Potential Energy in a Spring

The potential energy in a spring is equal to one-half times the product of the spring constant and the square of the displacement.

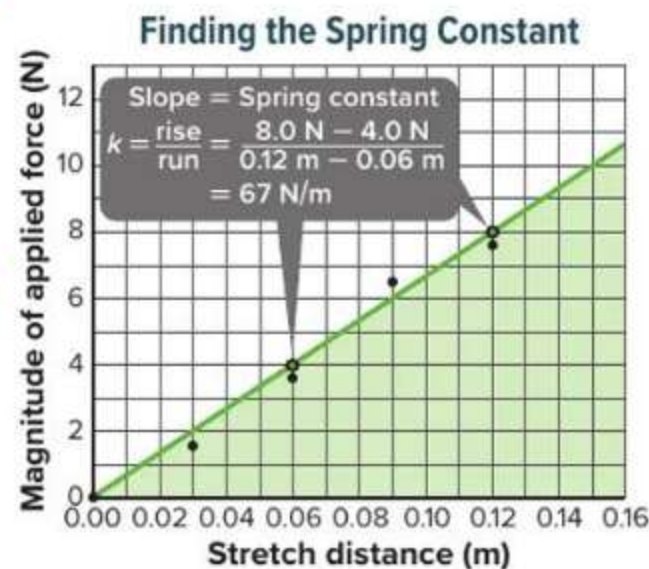
$$PE_{\text{spring}} = -\frac{1}{2}kx^2$$

PE calculated from the area under the curve between (F & X)

Important note

Potential energy is directly proportional to the **squares** of the elongation. X^2

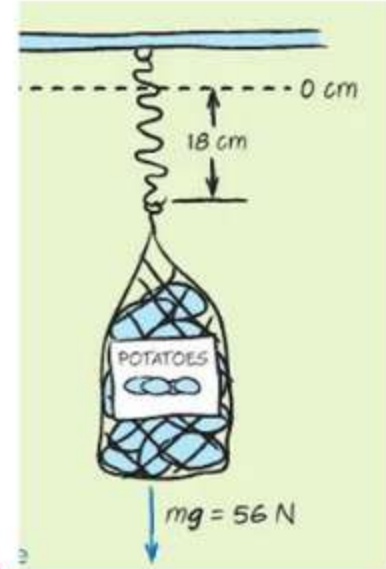
- If the elongation doubles, the potential energy increases four times.
- If the elongation increases 3 times, the potential energy increases
- If the potential energy doubles, it is likely that the elongation has increased to (Think, don't rush).
- You have two springs, one with an elongation of 5 cm and the second with an elongation of 10 cm, the ratio between their potential energies is



EXAMPLE Problem 1

THE SPRING CONSTANT AND THE ENERGY OF A SPRING A spring stretches by 18 cm when a bag of potatoes weighing 56 N is suspended from its end.

- Determine the spring constant.
- How much elastic potential energy does the stretched spring have?



- A spring has a spring constant of 56 N/m. How far will a block weighing 18 N stretch it?

$$F = kx$$



- 3 Apply the law of conservation of energy for both a horizontal oscillating mass – spring system and simple pendulum to relate the total energy of each system at one instant to the total energy at another instant.

Student Book
Check Your Progress Q. (9)

5
8

The law of conservation of energy states that the total mechanical energy (E) of a system is constant,

$$E = KE + PE$$

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

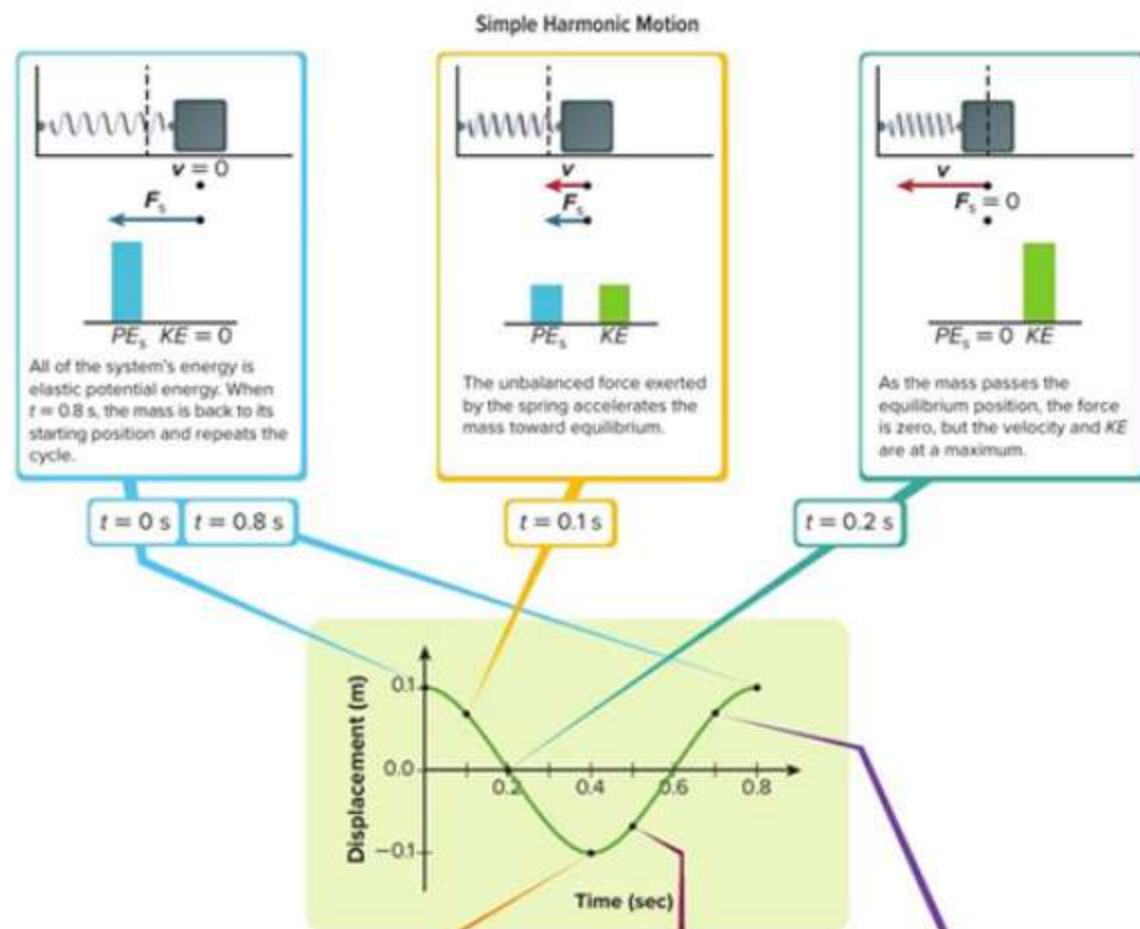
$$PE = \frac{1}{2}kx^2$$

Physics

الدكتور

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what happen to
PE, KE, V , restoring force

اتبع
الشرح
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At any position maximum or minimum
PE, KE, V , restoring force

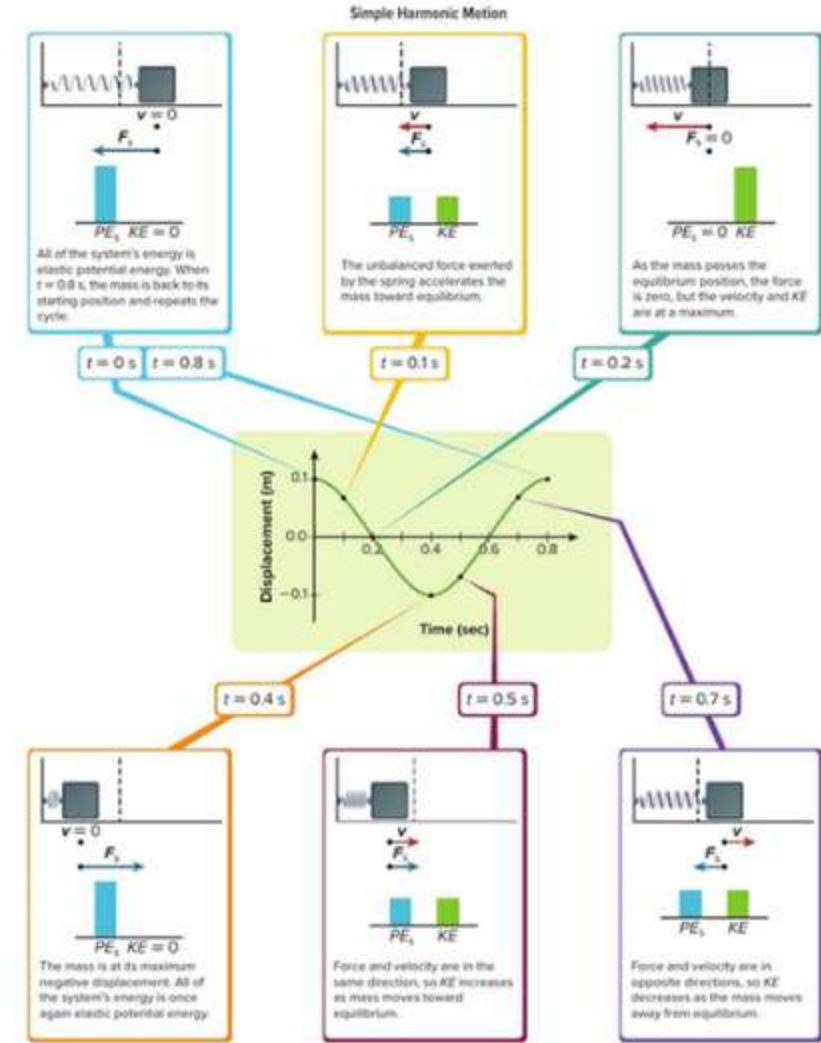


Figure 3 The total mechanical energy of the system is constant throughout the oscillation.

Explain How can Hooke's law and the concept of conservation of energy be used to predict and describe the behavior of a system such as this?

What is the ratio in PE? and why this answer?

9. **Energy of a Spring** The springs shown in **Figure 5** are identical. Contrast the potential energies of the bottom two springs.

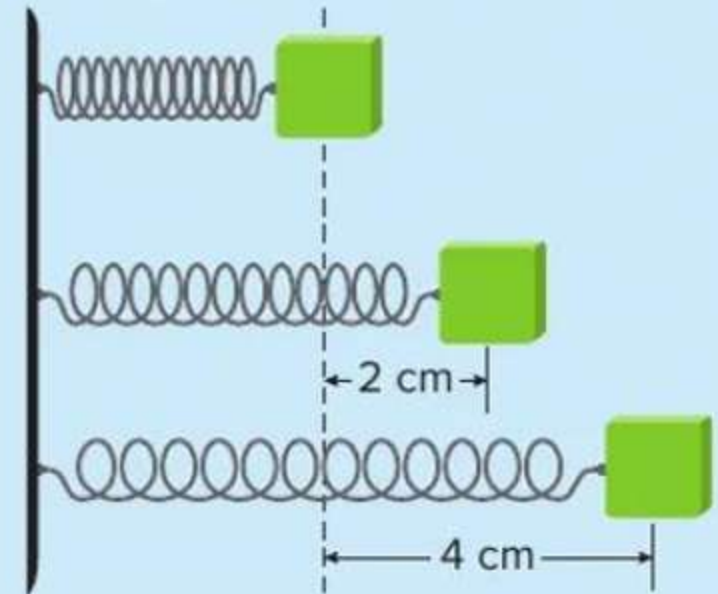


Figure 5



- 4 Determine what affects the period of a simple pendulum.

Student Book
Get It

7
7

Period of a Pendulum

The period of a pendulum is equal to 2π times the square root of the length of the pendulum divided by the gravitational field.

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

Notice that the period depends only on the length of the pendulum and the gravitational field, not on the mass of the bob or the amplitude of oscillation. One practical use of the pendulum is to measure g , which can vary slightly at different locations on Earth.



Get It?

Compare the period of a very massive pendulum, like the one shown at the beginning of the module, with the period of a pendulum with the same length but a tiny mass.

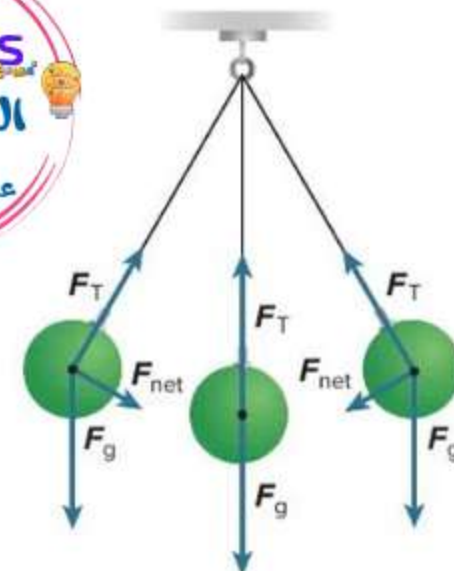


Figure 4 The pendulum's motion is an example of simple harmonic motion because the restoring force is directly proportional to the displacement from equilibrium.





1-If the pendulum's length increases 4 times, then the pendulum's periodic time.....

2-If the pendulum's length is doubled, then the pendulum's periodic time

3-If gravity increases 4 times, then the pendulum's periodic time
.....

4-A pendulum whose periodic time was calculated on Earth is then taken to the moon. Its periodic time will
(increase - decrease - remain the same)

5-The ratio between the periodic time of a pendulum with mass 20g and a pendulum with mass
80g, both having the same length and in the same location, is
(less than - greater than - equal to) one.



5 Differentiate between transverse, longitudinal, and surface waves and give examples.

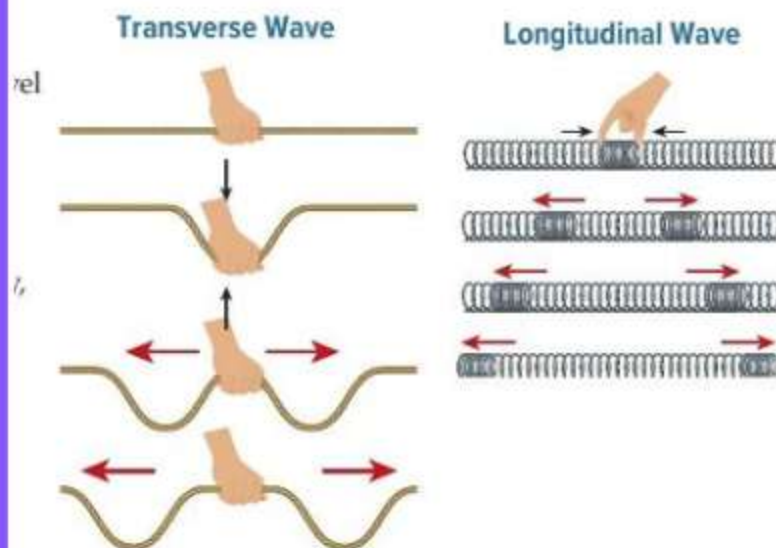
Student Book

9 → 10

Transverse Waves

The particles in the medium move perpendicular to the direction of the wave's travel.

An example shown is shaking a rope up and down to create a wave that travels horizontally, Sea Wave



Longitudinal Waves

The particles in the medium move parallel to the direction of the wave's travel.

An example shown is squeezing and releasing a coiled spring to create a wave that travels in the same direction as the disturbance. Sound waves are also an example of longitudinal waves.

Particles in a surface wave move in a circular path, which is both parallel and perpendicular to the direction of wave motion. The circular motion is disrupted when the wave reaches the shore, causing it to break.



Figure 6 Shaking a rope up and down produces transverse wave pulses traveling in both directions. Squeezing and releasing the coils of a spring produces longitudinal wave pulses in both directions. Explain the difference between transverse and longitudinal waves.

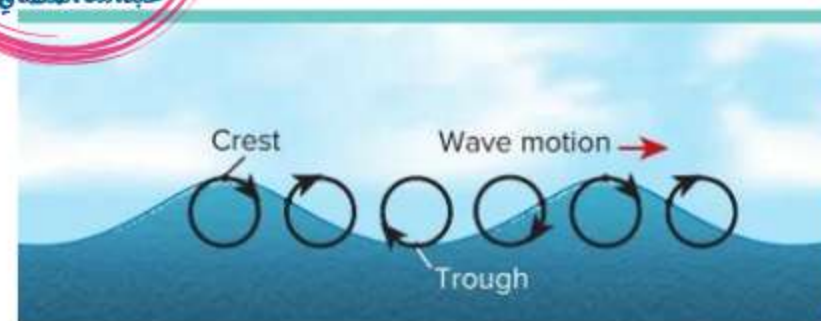


Figure 7 Surface waves in water cause movement both parallel and perpendicular to the direction of wave motion. When these waves interact with the shore, the regular, circular motion is disrupted and the waves break on the beach.

6

Describe wave properties like amplitude, energy of a wave, wavelength, speed, phase, period and frequency.

Student Book

10 → 11

Amplitude

The maximum displacement or distance of a wave from its equilibrium position. It is always a positive value. The text uses the example of shaking a rope to show how the force of the shake affects the amplitude.

Energy of a wave

The energy a wave transfers is related to its amplitude. Waves with a greater amplitude transfer more energy. the energy transferred is **proportional to the square of the amplitude**, meaning doubling the amplitude increases the energy transfer by a factor of four.

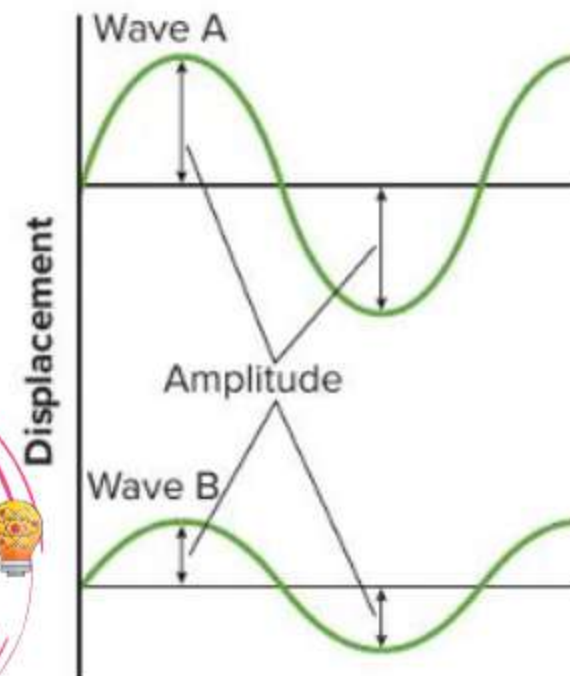


Figure 8 A wave's amplitude is measured from the equilibrium position to the highest or lowest point on the wave.



Wavelength λ

The shortest distance between repeating points on a wave.

The high points of a transverse wave are called crests, and the low points are called troughs in transverse,

longitudinal compressions and rarefactions,

Speed and velocity

The speed of a wave is determined by the displacement of a crest or compression divided by the time interval

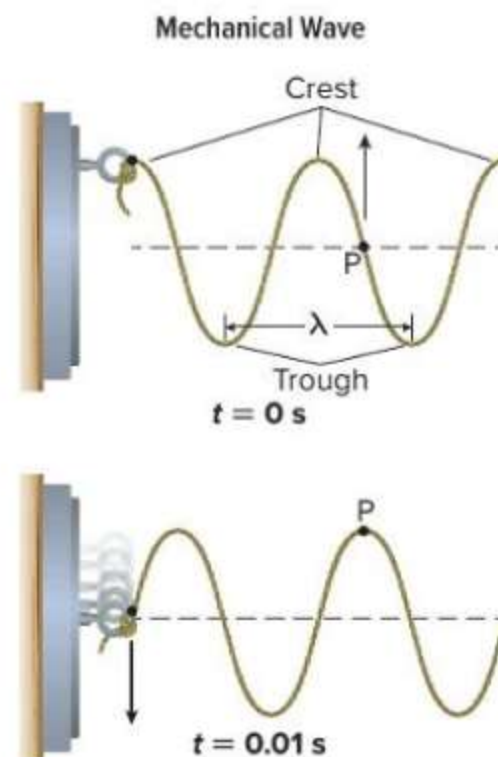
$$v = \frac{\Delta d}{\Delta t}$$

$$v = \lambda f$$

mechanical waves, speed depends on the medium and not on amplitude, frequency, or wavelength.

the speed depends on two main factors:

1-The medium through which the waves are traveling. 2-The type of wave. The temperature of the medium also affects wave speed, as demonstrated by sound waves traveling faster in warm, dry air compared to cool, dry air.





Get It?

Summarize how changing a wave's amplitude, frequency, or wavelength affects the wave's speed.

لا تقلق الدكتور يوضحها في الشرح

Phase

Two points on a wave are "in phase" if they are separated by one or more full wavelengths and have the same displacement and velocity.

Points with opposite displacements and velocities are "180° out of phase." The phase difference between two particles in a wave can range from 0° to 360°.

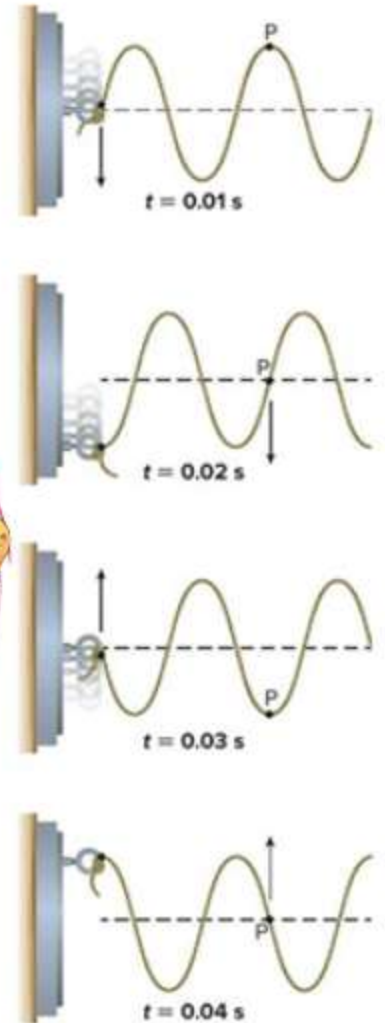


Figure 9 A mechanical oscillator moves the left end of the rope up and down, completing the cycle in 0.04 s.

The period T is the time it takes for a periodic wave to complete one full cycle



8

Calculate the frequency of a wave from its period and vice-versa ($f = \frac{1}{T}$).

Student Book
Practice Problem (21,22,23)

12
14

Frequency of a Wave

The frequency of a wave is equal to the reciprocal of the period.

$$f = \frac{1}{T}$$

Both the period and the frequency of a wave depend only on the wave's source. They do not depend on the wave's speed or the medium.

Wavelength

The wavelength of a wave is equal to the velocity divided by the frequency.

$$\lambda = \frac{v}{f}$$

$$\lambda = \frac{L}{n}$$





21. How does the frequency of a wave change when the period of the wave is doubled?

when the period of the wave is doubled, the frequency is halved.

The frequency (f) and the period (T) of a wave are inversely proportional to each other.

22. Describe the change in the wavelength of a wave when the period is reduced by one-half.

the new wavelength is one-half of the original wavelength

23. If the speed of a wave increases to 1.5 times its original speed while the frequency remains constant, how does the wavelength change?

The wavelength increases to 1.5 times its original value.



Why

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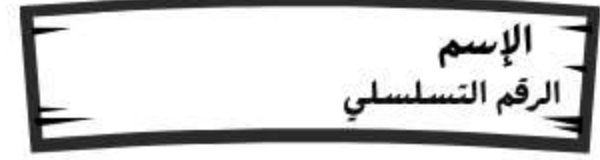


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