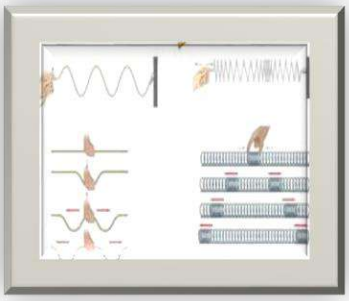
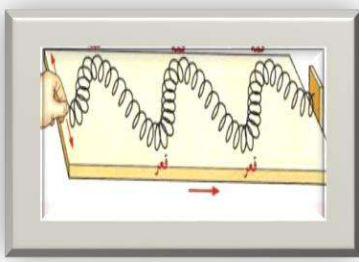
Physics G 10 Advanced

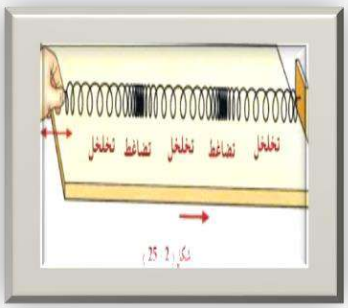




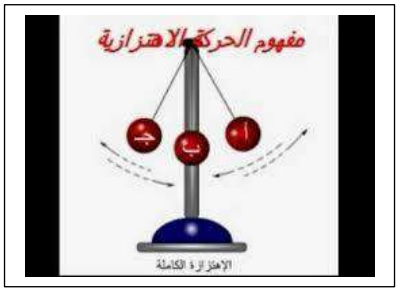
إعداد

الأستاذ / مجدي عوض

الاهتزازات والموجات



Vibration movement:



Is an object movement around a fixed point. Any body movement on either side of a fixed point is called the position of stability.

This type of movement is also called periodic movement. Because they are repeated over equal periods of time. It is also called the Harmonic Harmonic Movement

Definition of periodic movement:

It is the movement that repeats itself in equal periods of time

Examples: Pendulum movement - movement of a suspended object in spring - movement of strings of a musical instrument

Definition of Simple Harmonic Movement:

This is the movement that occurs when the force that returns the object to the equilibrium position is proportional to the displacement of the body. Such as the simple pendulum movement

Quantities affecting the vibration movement (simple compatibility):

① Periodic time (T):

Is the time elapsed for a complete shake-up

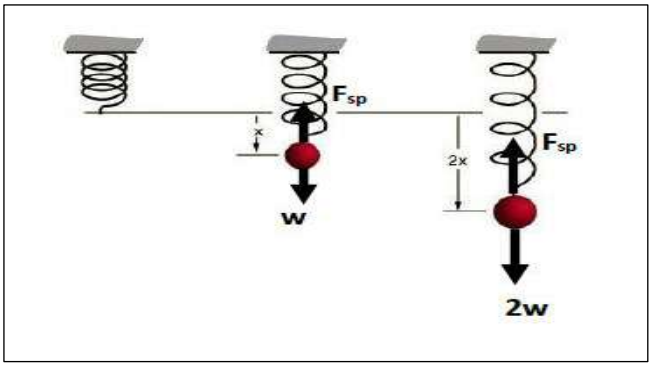
Is the time required for the movement of a vibrating body one point in two consecutive times in the same direction

② Volatility (A):

Is the maximum displacement of the body away from its position (position of stability - equilibrium)

Hook Law:

The force by which a spring is affected is equal to a fixed pulse multiplier in the amount of elongation or compression.



Elongation:

The amount of increase or decrease in the length of the spring and symbolized by the symbol (ΔX) or the symbol (Δl)

Force

expansion

$$F = -K\,\Delta X$$

Fixed hook - Constant spring - Constant elasticity

Explanation of the presence of a negative sign:

The negative sign in the law means that force is a backward force that springs to the original (original)

Monoclonal energy stored in the spring:

The power of the molten position in the spring is equal to half the sum of the beating of the spring constant (K) in the elongation box (x^2)

$$PE_{Sp} = \frac{1}{2} KX^2$$

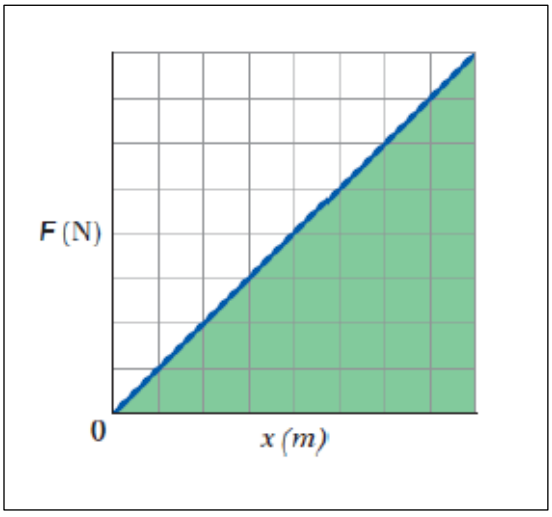
The relationship between the force affecting the spring and the amount of elongation:

The greater the force affecting the spring, the greater the elongation (ie, the relationship is positive).

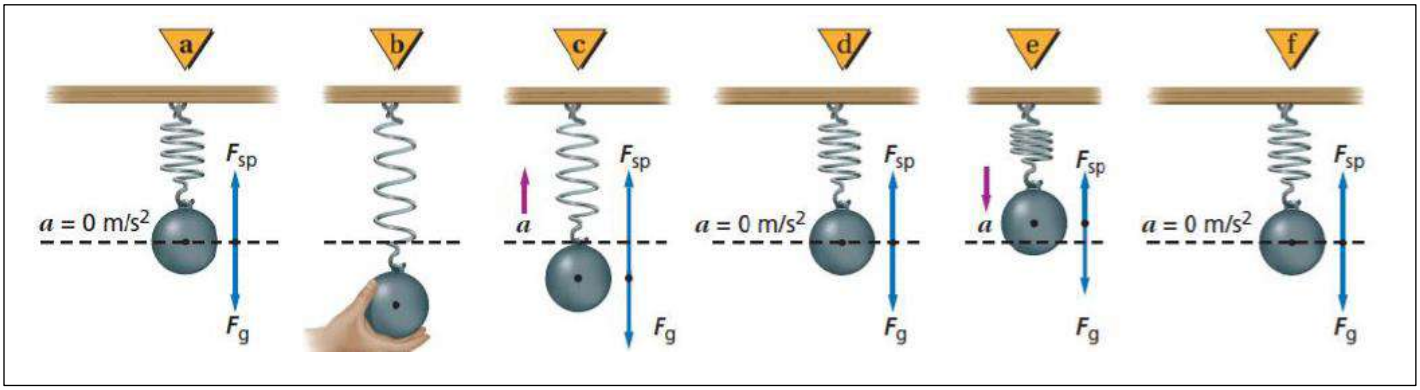
Through drawing you can find the following:

① The spring constant (K) equals the slope of the graph of the force-elongation curve

The energy of the mononuclear position stored in a spring (PE_{Sp}) is equal to the shape area below the curve (force-elongation)



Very Important Notes :



When the body is pulled firmly down, at the moment of liberation the body is:

The force in the body and acceleration is the greatest possible and the speed of the vector is zero

When the body passes the equilibrium point, it is:

Both the force of the body and the acceleration are equal to zero and the speed is as high as possible

Applications on the power of the runoff position (shock absorbers):

Shock absorbers are designed in modern vehicles to contain springs that have the ability to absorb kinetic energy prior to collision and convert it to the capacity of a bollard position stored in the chassis after a collision resulting in a bounce or stopping the vehicle at the barrier

Example 1:

Calculate a pulsed spring constant by 25 cm when the mass of the mass (0.500 Kg) is suspended and then calculate the energy of the mononuclear position stored in the spring (g = 9.8 m / s 2)

The solution

$$F = mg = 0.500 \times 9.80 = 4.90\ N$$

$$K = \frac{F}{\Delta X} = \frac{4.90}{0.250}\ 19.6\ N/m$$

$$PE_{sp} = \frac{1}{2}\ K\ X^2 = \frac{1}{2}\ 19.6 \times 0.25^2 = 0.612\ J$$

Example 2:

If the mononuclear energy stored in the spring (4.39 J) and spring constant (135 N / m) calculate the amount of compression of the spring?

The solution

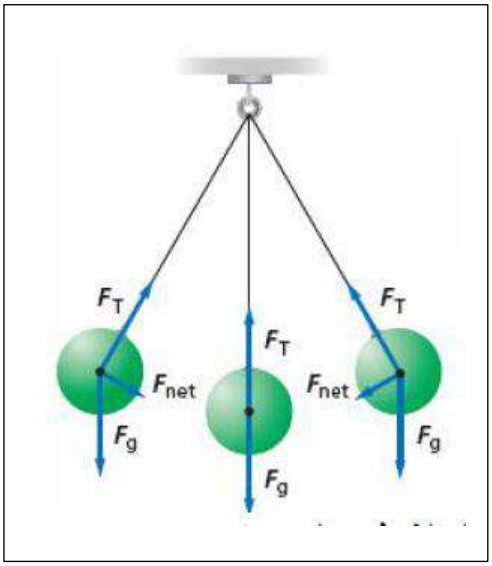
$$PE_{sp} = \frac{1}{2} K X^2$$

$$X = \sqrt{\frac{2 \times 4.39}{135}} = 0.255$$

Simple Pendulum

The simple pendulum consists of a solid object suspended by a thread. When the solid body is pulled out and left moving, it oscillates around the position of stability.

The simple pendulum movement is a simple (periodic) movement because the force of the reaction is directly proportional to the displacement from the position of stability within a range of (10 º - 15 º).



At left and right positions:

The force obtained and acceleration shall be as large as possible and the velocity shall be zero.

At equilibrium:

Both the force of the body and the acceleration is equal to zero and the maximum speed is possible.

Periodic period of the simple pendulum (T):

It is time to pass one point in two consecutive times in the same direction

Periodic time can be calculated from the following law:

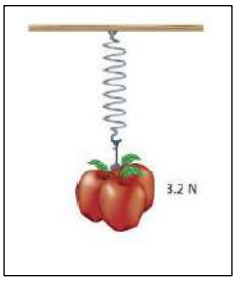
Periodic time

Length of thread

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

Time depends on the role of simple pendulum on two factors:

① thread length ② gravity wheel



It also does not depend on pendulum mass or vibrating capacity

Issues and training:

①If a pulsed pulse of 0.12 m is suspended when a number of apples are suspended below it (3.2 N) as shown below. I count

A) Constant spring

.....

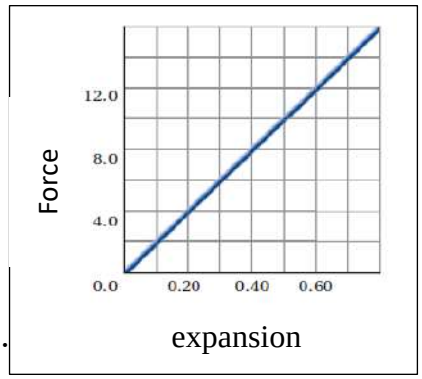
.....

.B) The energy of the mononuclear position stored in the spring due to this elongation

.....

.....

② The graph below shows the relationship between the force affecting the spring and the amount of its elongation. Calculate the following:



A) Constant spring

.....

.....

B) The energy stored in the spring when it becomes longer and longer (0.5 m)

.....

.....

C) If the elongation increases by a factor of twice. What effect does this have on the energy of the mononuclear situation stored in the spring?

.....

.....

③ If every spring of a car weighs 12000 N, it is equal to 25000 N / m. How does each spring compress if a quarter of the car weighs?

.....

.....

④ If the periodic time of a pendulum length (0.75 m) is equal to (1.8 s) on the surface of a planet, how much (g) on this planet?

.....

.....

⑤ If elongation increases by a factor of twice. What impact does this have on:

A) The resulting force in the spring (return power).

.....

.....

B) the energy of the mononuclear position stored in the spring.

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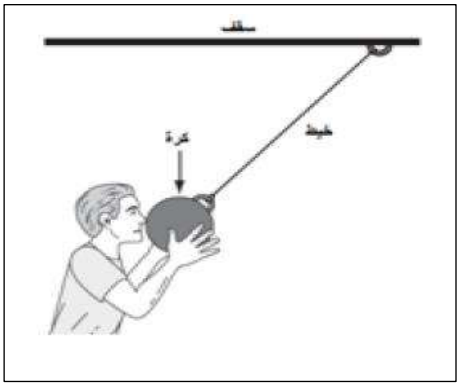
Questions and questions:



① In the shape next to the thread is tied to the ceiling and ends a metal roller if you have a stopwatch and a meter meter. Explain how you can use these tools to calculate gravity acceleration.

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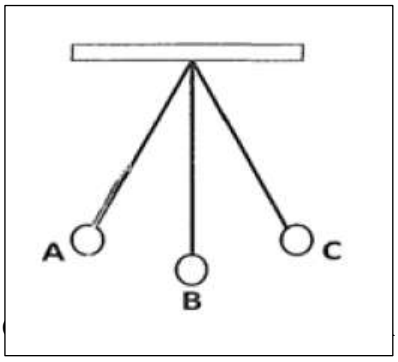
② Simple pendulum swings back and forth as the shape.



Answer the following questions:

A) What is called the pendulum movement (swing around the sleeping position)? ....

B) Draw on the adjacent shape the forces affecting the susp
A with the name of each force.

C) Using symbols in the adjacent shape, complete the following spaces:

1 - The fastest speed at the position / positions ..... -

2. The acceleration shall be as large as possible at the position of the positions ....., while the acceleration shall be zero at .....

3- If the mass of the solid body ((3Kg and the length of the thread 50 cm Calculate the periodic time of the pendulum.

.....

.....

4- Do you expect that the periodic time of this pendulum will remain the same when it is transported to the surface of the moon where gravity accelerates (1.6 m / s ^{2})

.....

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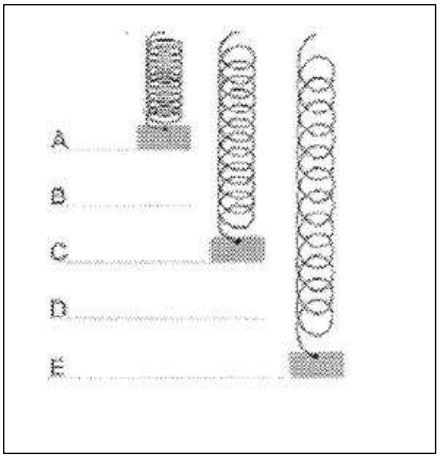
③ The figure below represents a hanging block at the pulsating end, vibrating up and down. If you know that the distances CA and CE represent the largest distance Squeezed or flexed. Answer the following questions:



A) Identify the point / points where the suspended mass has super kinetic energy. -

.....

.....

.....

B) Identify the point / points where the mononuclear energy stored in the spring is a super value. -

.....

C) In any direction (up / down) the direction of the return force is when the elongation of the spring is as large as possible.

.....

④Tariq and Hassan swing back and forth on a rope bridge over a river where they tie ropes at one end of the bridge and then fall into the river. If you know that the length of the cord is 10m, answer the following questions:

A) Calculate the time required for Tariq until the top of the cycle reaches the other side of the bridge. -

.....

.....

.....

B) Compare the periodicity of Hassan and Tariq if it is a mass that is twice that of Tariq's mass. -

.....

C) Specify the points that will have the following:

less (PE)	less (KE)	greater (PE)	greater (KE)

⑤ A block of 5Kg suspended by a flexible spring, elongation incident in the spring of 20 cm Calculate both:

A) Constant spring

.....

.....

B) The amount of energy stored in the spring produced by this elongation.

.....

.....

⑥ A 2000Kg car, settling on a 6m high hill, before landing on a frictionless road in the direction of a collision barrier at the bottom of the hill. If the collision barrier contains a steady spring, it is equal to 26670 N / m. Designed to stop the car with minimal damage. Calculate:

A) The distance the spring presses when the vehicle collides.

.....

.....

B) the distance the spring presses if the car descends from a hilltop twice as high as the previous hill

.....

.....

C) What happens after the car stops?

.....

.....

Multiple Choice Questions:

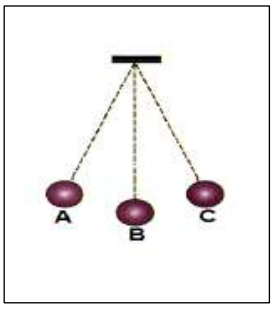
① A simple pendulum with a length of 2m and its periodic time T changes to 8m, its periodic time changes to

☐ 4 T ☐ 2 T ☐ 0.5 T ☐ 0.25 T

② When the length of the string is increased in a simple pendulum four times, the periodic time of the simple pendulum:

☐ Increases twice ☐ more than four times ☐ less for half ☐ less than a quarter

③ represents a simple pendulum that moves a simple harmonic movement, if the time required for the pendulum to move from point A to point C is 0.2 s, what is the frequency of the pendulum?



☐ 5 HZ ☐ 2.5 HZ ☐ 0.4 HZ ☐ 10 HZ

④ Pendulum frequency can be changed by:

☐ Increase the suspended weight ☐ Increase the vibration capacity

☐ Reduce the vibratory capacity ☐ Increase thread length

⑤ In the simple pendulum, when the length of the pendulum and the mass of the pendulum is increased to twice as much as what it was, what happens to the periodic time of the pendulum?

☐ Increasing by 1.4 - than it was ☐ Twice as much as it used to be

☐ Increasing by 0.71 than it was ☐ Periodic time remains constant

Ringing:

Ringing conditions:

① Effect of small force in vibrating body

② Supplying power to the vibrating body in energy at equal intervals

③ The period of time between force applied to the body is equal to the periodicity of the movement

Results of ringing:

Increase motion amplitude

Examples of ringing:

① Edit car tires stuck in the sand ② frequent jump on the swimming platforms

③ Musical instruments to amplify the sound ④ hours to increase the volume

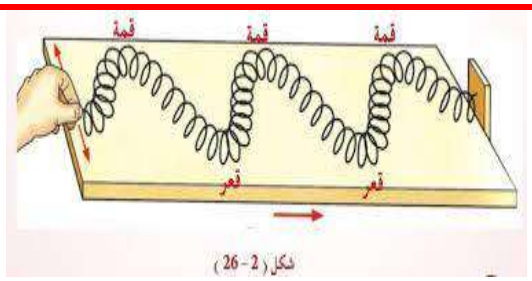
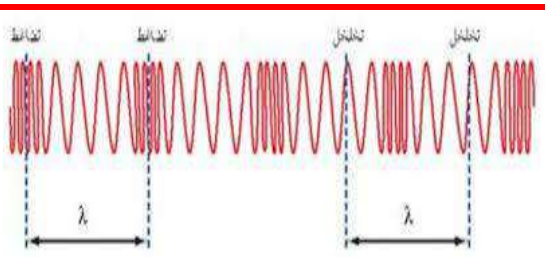
Characteristics of waves

Wave Definition:

Disruption of energy during vacuum or material without moving the substance of the medium. (Consisting of several wave pulses

Wave types

Comparison between mechanical waves and electromagnetic waves:

Electromagnetic waves	Mechanical waves	Comparison
Are waves resulting from the oscillation of two fields, one electric and the other magnetic	Are waves resulting from vibration of solid or liquid substances	The definition
You do not need a physical medium (it can spread in the vacuum)	There must be a physical medium	Central propagation
All cross-sectional waves	Often are longitudinal waves	Wave type
The direction of the movement of the center molecules is perpendicular to the direction of the wave motion	The direction of the movement of the center molecules is in the same direction as the wave propagation	Direction of propagation
Is the distance between two successive peaks or two consecutive floors	Is the distance between the centers of successive presses or alternates	wave length
		Waveform

Examples of waves	Sound - Water waves - waves in springs	Light - Radiology - X - ray - Alpha rays - Gamma rays - Microwave radiation

Wave speed (ϑ)

The speed of the wave depends on several factors

① distance traveled by the wave ② wave duration

③ Frequency f ④ Wavelength λ

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

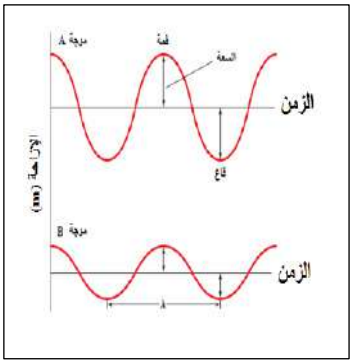
The wave speed measurement unit is m / s

Notes:

The speed of the mechanical waves depends on the type of medium to which it is transmitted and does not depend on the amplitude of the wave

The characteristics of the medium (density - temperature) affect the speed of the wave

Wave Capacity (A):



The amplitude of the wave is defined as the maximum displacement of the wave from equilibrium (stability)

Factors Affecting Wave Capacity:

The wave capacity depends on the source (ie how it is generated) and does not depend on the medium (or wave speed). The large-capacity wave travels larger than the low-amplitude waveband where the wave power is proportional to the capacitance box.) If the amplitude of the wave is doubled, the wave energy increases fourfold

Wavelength (λ):

There is more than one definition of wavelength. Here we will review all the wavelength definitions with the explanation

① is the shortest distance between any two points repeating the same router style.

What is meant by the vector pattern is (position and direction of the two points)

② The distance between two consecutive or central compressor stations (longitudinal waves)

③ The distance between two consecutive or two consecutive peaks (transverse waves)

④ The distance between two consecutive points having the same phase (fit for all waves)

The meaning of the stage is (position of the two points and direction of movement)

Time (T):

① is the time required to make a complete shake (full wavelength)

② is the time required to pass one point in two consecutive times in the same direction

③ is the time elapsed between two points with the same phase

Frequency (f):

Is the total number of vibrations that the vibrating body works per second and is measured by Hertz (Hz / S)

$$f = \frac{Vibrations\ number}{total\ time}$$

Factors affecting frequency:

Frequency depends on the source only and does not depend on the medium through which it travels (or wave speed).

Relationship between Frequency and Periodic Time:

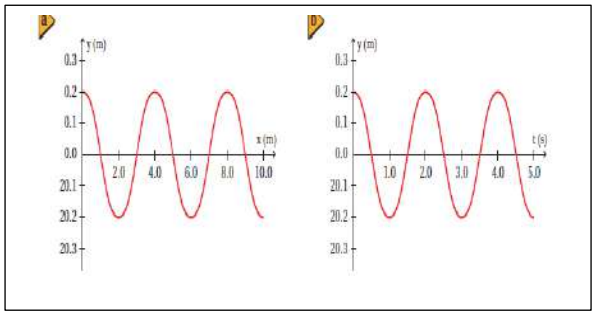
$$f = \frac{1}{T}$$

The relationship between wavelength, frequency and velocity:

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

Wave representation:

The waves can be represented graphically through a curve (displacement-location) or(Offset - time) as shown in the figure



echo :

Is the echo of the sound due to its collision with a barrier

Sound echo properties:

① The time needed to hear the sound echo is twice the time required to cut the sound distance from the source to the barrier

② The distance calculated by the sound echo is twice the distance between the source and the barrier

Uses sound echo:

① Measure some dimensions in the vast areas to determine the position of the barrier

② Measurement of depths in wells, lakes and oceans

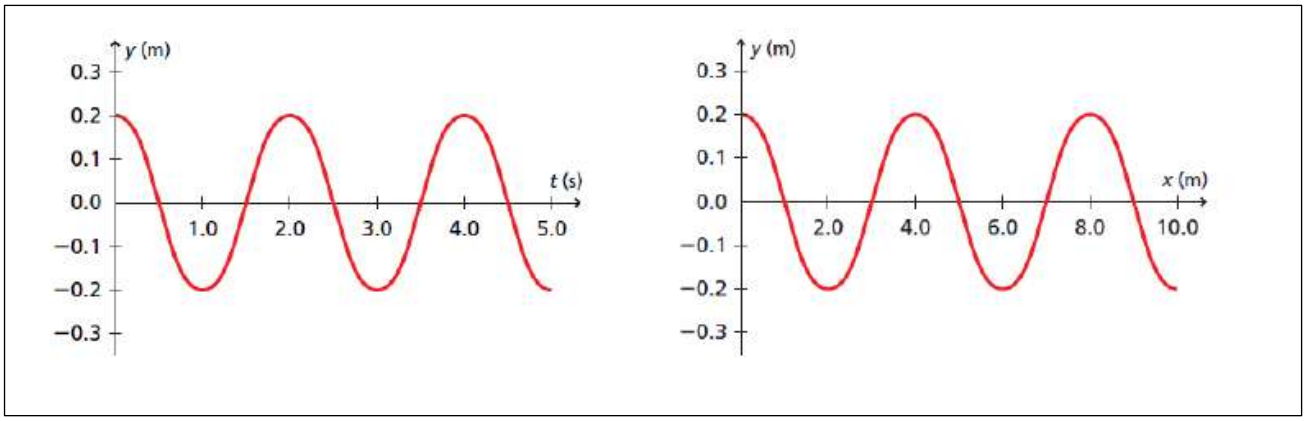
Feedback is very very important

① The speed of the sound at 20 C (343 m / s)

② The speed of the sound increases by 0.6 m / s for each temperature greater than 20 ° C

Wave issues:

① In the following two forms, the same wave is represented by the graph (displacement-location), as represented by the graph relationship (shift-time).



A) Wavelength: ....

B) Periodicity: ....

C) Wave Capacity: ....

D) Wave frequency: ....

E) Wave speed: ....

F) Number of waves in Fig. ....

② Khaled fired a high voice in the direction of a mountain (465 m) and heard the sound of the sound after a time (2.75 s)

A) Sound speed in the air.

B) Sound wave frequency if its wavelength (0.750 m)

C) Periodic time of the wave.

D) If sound waves enter the lake water near the mountain. How often is the frequency and periodic time in the water?

.....

.....

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③ Five pulses are generated in each water reservoir (0.100s). Calculate the propagation velocity if the length is (1.2 cm)

.....

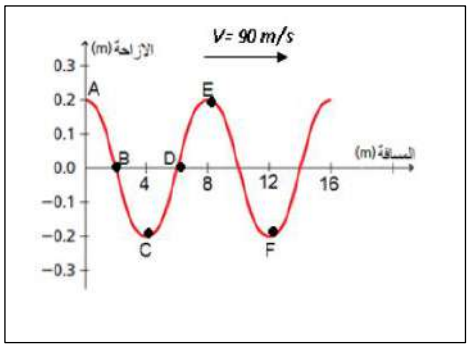
.....

④ Categorize the following characteristics depending on the medium, source, or both

Speed - Wavelength - Periodic Time - Frequency - Capacity

	Properties depend on the medium
	Characteristics depend on the source

⑤ The adjacent shape represents a wave moving at a speed of 90 m / s. Find the following:



1 - Wave Capacity:

.....

2 - Wavelength:

.....

3 - Wave frequency:

.....

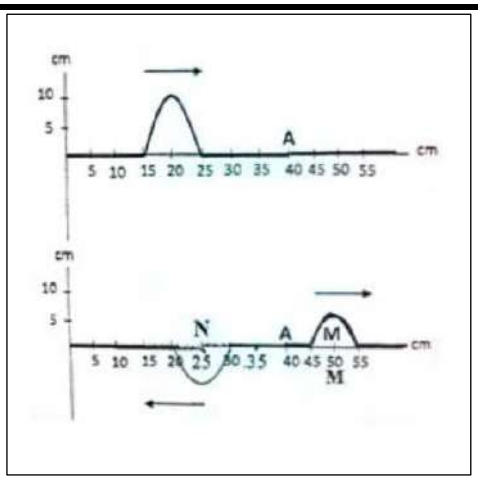
4. Periodicity : .....

5. Two points in line :.....

6 - عدد الموجات في الشكل : .....

⑥ Part A of the adjacent shape represents a pulse that travels at a speed of 1m / s to another spring connected to it at point A, and b is the pulse in the spring after a period of time. The distance reflected by the reflected pulse (AN) is considered as the (AM) pulse

Answer the following questions:



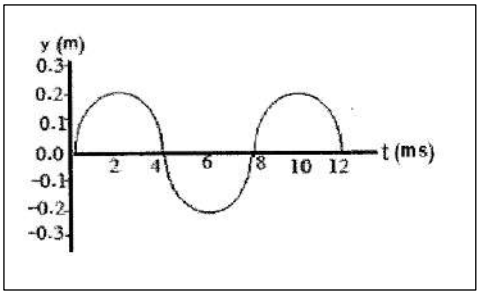
A) What is the speed of the reflected pulse?

.....

B) Calculate the speed of the window pulse.

.....

⑦ wave shown in the figure below a distance of 80m in time of 0.21s, answer the following questions:



A) Find Wave Speed:

.....

B) How long is the wavelength?

.....

C) How much wave capacity?

.....

⑧ If I stood at the edge of the valley and screamed and heard Sadi after the passage of 0.80s. What the width of this valley if the speed of sound in the air at 20C temperature is 343m / s

.....

.....

⑨ A person is standing at a distance of d from a rocky cliff. If the temperature is 15 ° C, the person applauds with his hands and he hears the sound echo after 2s, what after the rocky shelf?

.....

.....

⑩ A fan sits in a football match at 152m of goalkeeper on a warm 30C. Calculate:

A) Sound speed in air at 30 ° C

.....

B) The time that the cheerleader needs to hear the sound of hitting the ball after watching him hit the keeper

.....

⑪ A wave of sound frequency 1000HZ penetrates the air and soon to hit the surface of a lake and permeate the water What is the wavelength and frequency in the water Assuming that the speed of sound in the water is 1500m / s

.....

.....

Multiple Choice Questions:

① One of the following factors affects the energy transmitted by the mechanical wave:

☐ Wavelength ☐ Frequency ☐ Wave Speed ☐ Wave Capacity

② Which of the following characteristics does not depend on the type of wave medium?

☐ Wavelength, Frequency ☐ Frequency and Periodic Time

☐ Wave speed and wavelength ☐ Wave capacity and wavelength

③ The following waves are examples of mechanical waves except:

☐ Water waves ☐ Sound waves ☐ Waves cord ☐ Light waves

④ Two quantifiers describe the wave and the result of their multiplication equals the correct one, which of the following represent these quantities:

☐ Speed and capacity ☐ Wavelength and frequency

☐ Wavelength and amplitude ☐ Frequency and periodic time

Wave attitude

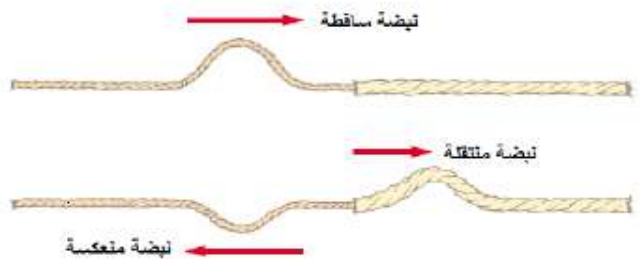
When a wave reaches the boundary between two different densities, it is:

① A part of it is reflected in the same center (called wave reflection)

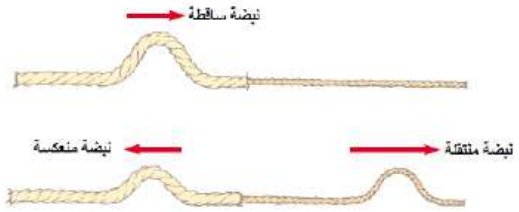
② Some waves cross the border between the two centers deviated from their straight path (this is called wave break)

Types of reflection waves in objects Free movement:

When a pulse of the thinnest (least dense) thread moves to the thickest thread (the largest density)
Part of the pulse is reflected (inverted)
The other part moves in the thickest (moderate)



When a pulse of the thickest (larger) thread moves to the thinner (less dense)
Part of the pulse is reflected (moderate)
The other part moves in the thinner (moderate)



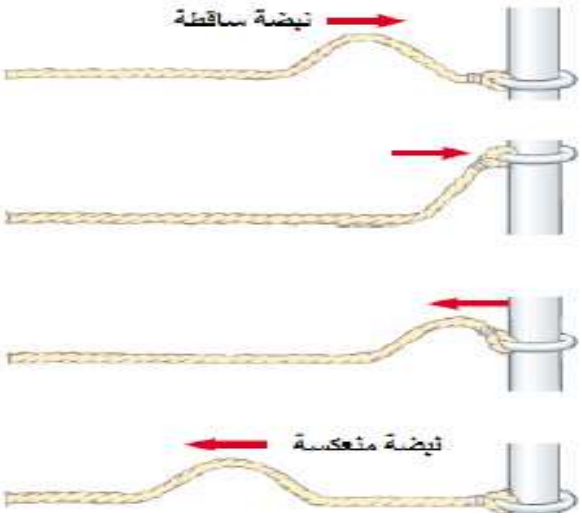
From the previous two drawings it becomes clear to us that the falling pulse upon reaching the boundary between the two is divided into two parts

① Reverse pulse ② Transient pulse

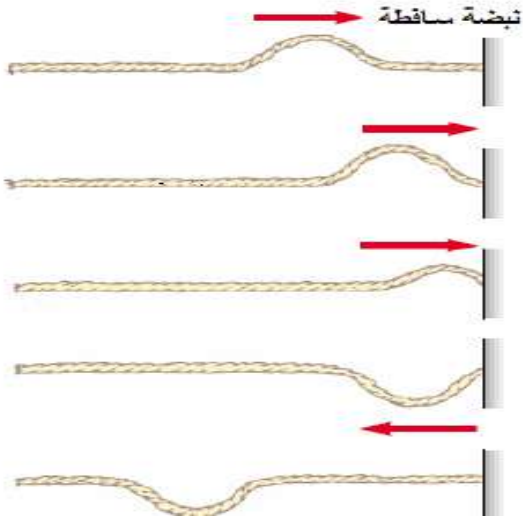
Note that the shape of the moving pulse is the same as the pulse that is always falling. While the reflected pulse shape depends on the density of the center

Reflections of waves in restricted objects at one end:

When the spring is connected to a free loop around a rod, the reflected pulse is moderate and approximately equal to the capacity of the falling wave.



When a pulse moves towards a solid wall, the pulse is reflected and the reflected pulse is reversed and almost equal to the falling pulse.



Overlay waves

First: the principle of overlap:

The displacement in the center, resulting from two or more pulses, is equal to the forced total of the waves produced by each wave separately

Second: Interference waves:

Is the effect of two or more superimposed overlays in the same center and at the same time.

Interference types

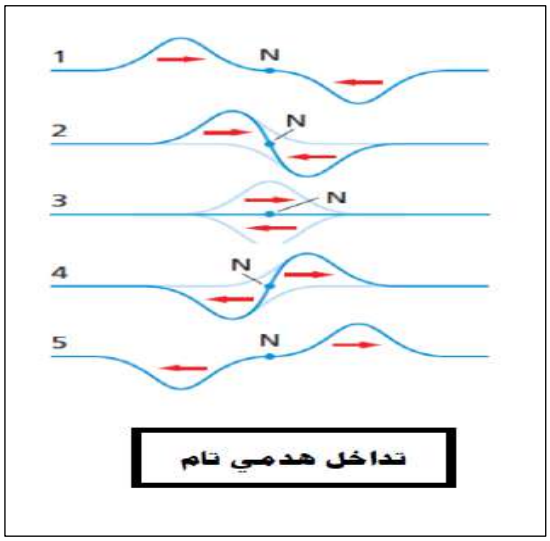
- Constructive interference
- Destructive interference
  - imperfec
  - perfect

First: Perfect Destructive Interference:

Condition: occurs when the amplitude of the waves is equal

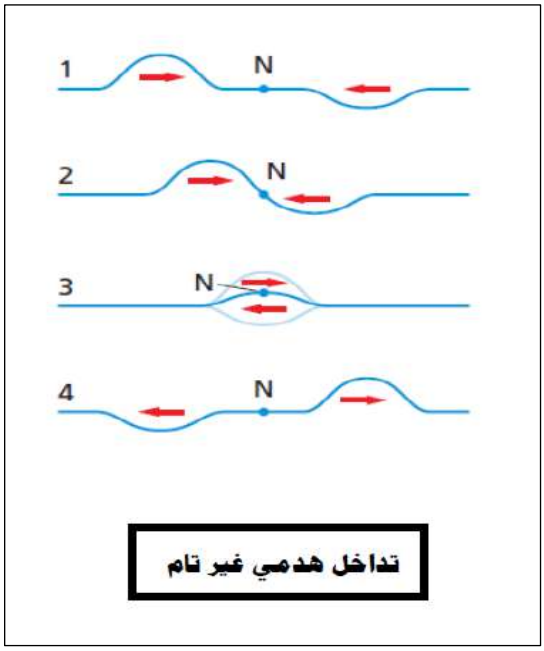
The amount of displacement or amplitude of the resulting wave is zero. It has nodes called N nodes.

N is the point at which the amplitude of the wave resulting from a superposition of two waves = 0, which is not moving at all

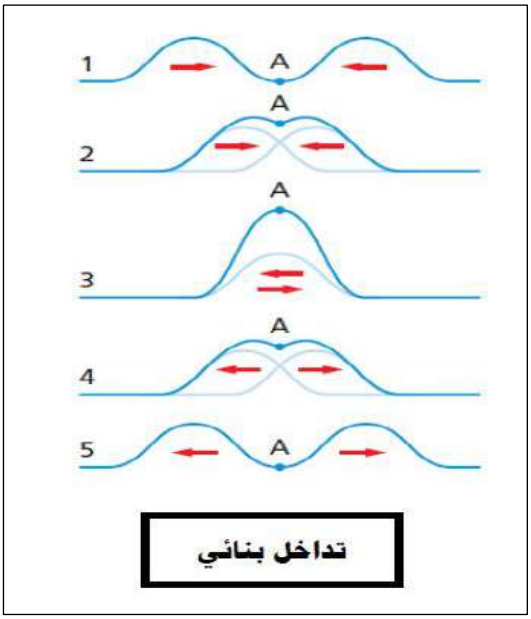


Second: Incomplete destructive interference:

Condition of occurrence: occurs when wave capacity is uneven



Third: constructive overlap:



Condition of occurrence:

① results from two or more waves overlap

② Be waves waves in the same direction

③ The first wave peak meets the top of the second wave or the bottom of the first wave with the bottom of the second wave

Results of constructive interference:

①The resulting pulse capacity is greater than the capacity of either pulse

② The convergence of the two pulse points (called the ventricles A)

Note:

After the interference occurs, the pulse returns its original shape and size and continues to move

Stable Wave:

Is a wave that looks static. It is a two-way interference that moves in opposite directions

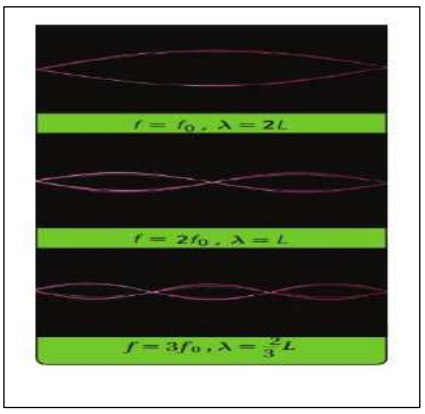
Condition of stable wave:

① The time is equal to the time of a complete wave or vibration to and fro

② The reflected wave frequency and power are equal to the frequency and amplitude of the falling wave

③ Be holding and venting

④ When the vibration frequency is doubled, the nodes and bellies increase

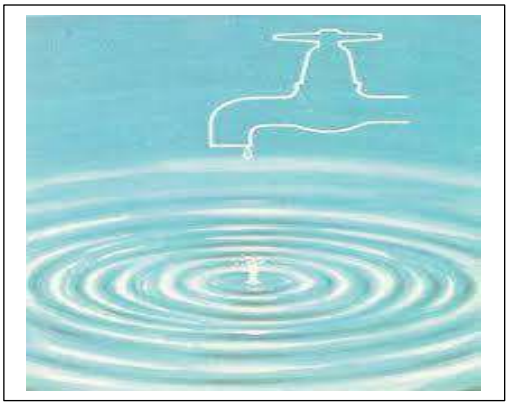


Types of waves according to their propagation method

The waves are in three dimensions such as waves that propagate in the vacuum-sound-light	Waves in two dimensions Such as waves that spread on the surface of the water	Wave in one dimension Such as waves that spread in a rope or metal chain

Wave in two dimensions:

We mentioned an example of the propagation of waves in two dimensions. As happens on the surface of the water when a strike on the surface of the water by the fall of stone A group of circles as shown in the adjacent form spread in the direction of the axes (x and y) are the tops and bottoms.



The waves can be drawn in two dimensions by drawing circles representing the vertices and the distance between two circles with the same center as bottoms.

The circle drawn to represent the wave in two dimensions called the wavehead or (wave wave)

Waveforms

Flat waves

Such as waves caused by touching the water surface with a straight edge, which are parallel straight lines

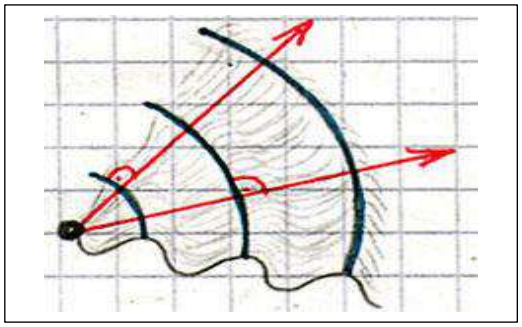
Circular waves

Such as waves caused by a stone fall in water, which are concentric circles

Very Important Notes:

① The distance between the waves in two dimensions shows the wavelength of these waves and does not indicate their capacity

②The direction of the wave propagation can be represented by a perpendicular beam with the waves (angle).

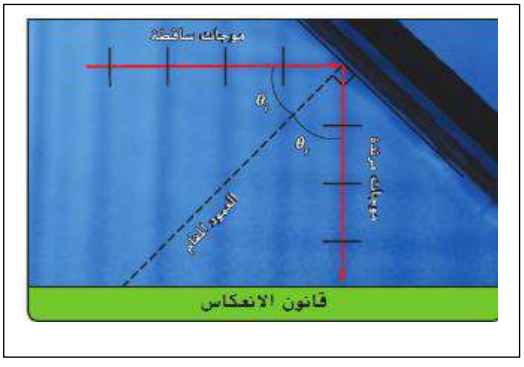


Swirl Basin:

In the drawing next to it shows the components of the ripple basin which is used to show the wave properties

Reflection waves in two dimensions:

When waves fall on a reflective surface, they are reflected in a specific direction depending on the reflection law



Law of reflection:

Fall angle = reflection angle

Important terms:

A) Fall angle: The angle between the falling beam and the column from the point of falling on the reflective surface.

B) Angle of reflection: The angle between the reflected beam and the column from the point of falling on the reflecting surface

C) column: orthogonal line with barrier at fall point.

Refraction of waves in two dimensions:

When waves pass between two different waters, they break at the dividing surface.

Refraction: The change in the direction of wave propagation at the boundary between two different demons.