

Unit (1): Lesson (1): Oscillatory Motion الحركة الاهتزازية

* **Periodic motion:** الحركة الدورية It's a motion which is regularly repeated in equal periods of time.

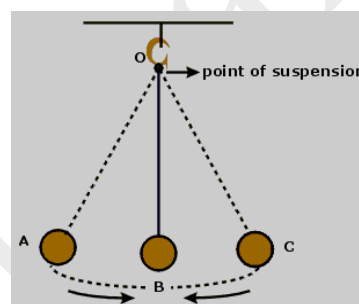
* **Types of Periodic motion:** Oscillatory Motion – Wave Motion.

* **Oscillatory Motion:** It's the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals فترات of time.

* **Kinetic energy** = $\frac{1}{2} MV^2$.

* **Types of Oscillatory Motion:**

- The simple pendulum,
- Clock
- Spring البرجل
- Tuning fork الشوكة المهتزة
- Stretched string الوتر المهتز
- Swing motion الأرجوحة
- Simple harmonic motion (simplest form of Oscillatory Motion).



• **The displacements of the oscillating body around its original position are equal. (AB=BC)**

- The velocity of the oscillating body reaches its maximum value when passes its original position (B point) & decreases gradually when it goes far from it (A point or C point).
- The kinetic energy increases when the pendulum's velocity increases & vice versa.
- **Kinetic energy** = $\frac{1}{2} [\text{mass} \times \text{squared velocity}]$
Kinetic energy = $\frac{1}{2} \times m \times v^2$

* Motion of rotary: It's periodic motion: As it's repeated regularly in equal time intervals, but not Oscillatory Motion: As it's not repeated on both sides of its rest point.

*** Application for Oscillatory Motion:**

- Microwave oven: It's function depend on:
 - 1- The vibration of water molecules present in food by effect of microwave.
 - 2- This vibrational (oscillatory) motion causes the collision of water molecules, which leads to increase in its heat energy.

* Food must be put in (glass, pottery or ceramic), while metallic pots are not used: As they reflect microwaves.

Give reasons for:

1)-The motion of the rotator bee is not considered as an oscillatory motion.

Because its motion is not repeated on the two sides of its rest position.

2)-Metallic pots are not used in the microwave ovens.

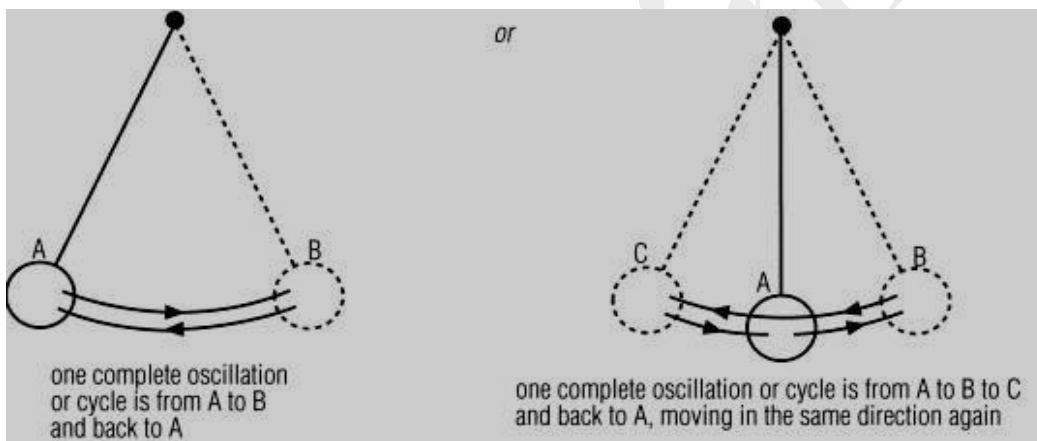
Because they reflect the microwave.

* Concepts related to Oscillatory Motion:

1- Amplitude: السعة it's the maximum displacement done by the Oscillating body away from its original position.

- Measured by: Meter (m) – Centimeter (cm).

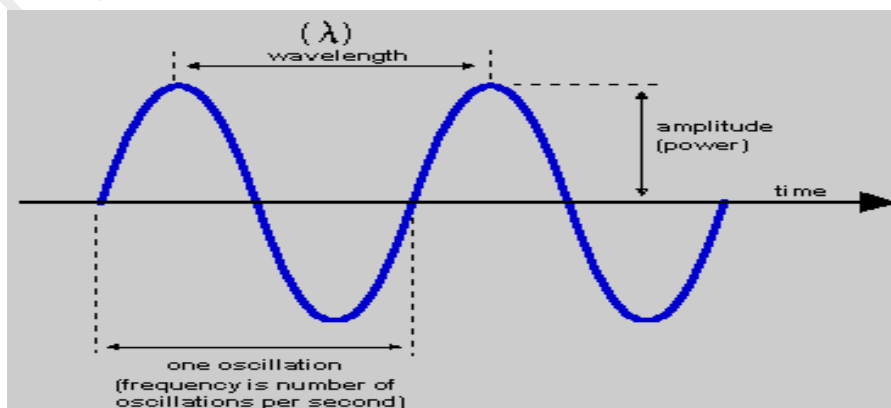
2- Complete oscillation: It's the motion of an Oscillating body when it passes by a fixed point on its path two successive times in the same direction.



3- Periodic time: It's the time taken by an Oscillating body to make one complete oscillation.

– Measured by: Second (sec).

Periodic time = Time/ no. of complete oscillations



4- Frequency: It's the number of complete oscillations made by an Oscillating body in one second.

- Measured by: Hertz (Hz).
- **Frequency = 1/ periodic time. [Inversely proportion]**
- **$\nu = 1/ T$**
- **Frequency \times periodic time = 1**
- **$\nu \times T = 1$**

Problem (1) Calculate the periodic time& frequency for an oscillating body that makes 300 complete oscillations in half a minute.

Solution

Half minute= 30 seconds.

Periodic time = Time/ no.of complete oscillations = 30/300 = 0.1 sec.

Frequency = $1/T = 1/ 0.1 = 10 \text{ HZ}$.

Problem (2) Calculate the frequency of a simple pendulum which makes 720 complete oscillations in 90 seconds.

Solution

Frequency = Number of complete oscillations / time in second.

Frequency = $720/90 = 8 \text{ HZ}$