

PHYSICS 2204
Unit 4: Waves
Worksheet #5: Mechanical Resonance

Student Name: _____

Force vibrations: occur when we make an object produce a sound.

Example:

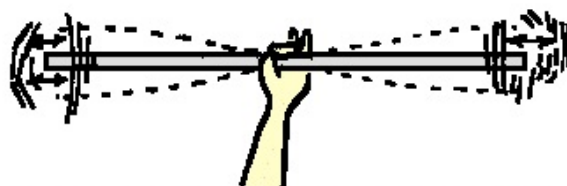
- Clapping your hands
- Hitting a tuning fork
- Playing a musical instrument

Natural frequency: The frequency or frequencies at which an object tends to vibrate with when hit, struck, plucked, strummed or somehow disturbed. Every object has a natural frequency. It is the frequency with which the object most easily vibrates. It is sometimes called its resonant frequency.

The natural frequency of a body depends on its elasticity , shape , & material composition. An object can have more than one natural frequency.

Flute	Tuba	Dropped Pencil
200 Hz	200 Hz	197 Hz
	400 Hz	211 Hz
	600 Hz	217 Hz
	800 Hz	219 Hz
	1000 Hz	287 Hz
		311 Hz
		329 Hz
		399 Hz
		407 Hz

Resonance : when a FORCED vibration matches an object’s natural frequency thus producing vibration, and or sound. It occurs when successive impulses are applied to a vibrating object in time with its natural frequency. The resulting vibration has a high amplitude and can destroy the body that is vibrating



A vibrating metal rod forces the air column inside into vibrations at the same frequency - resonance occurs.

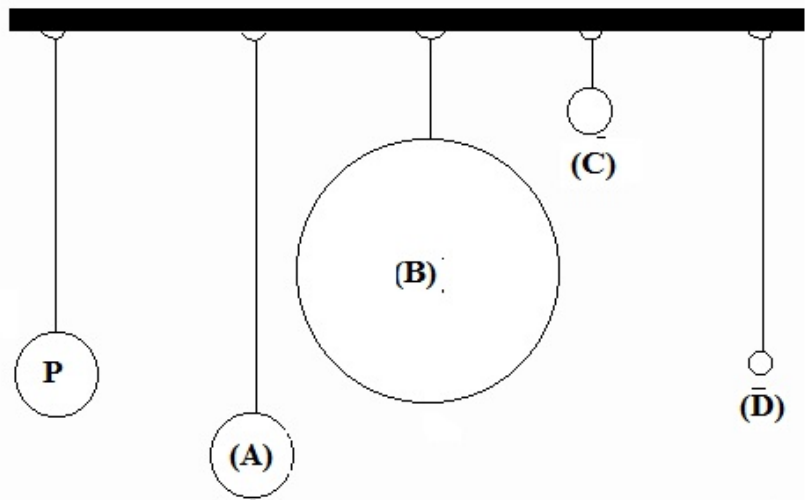
PART A: MULTIPLE CHOICE

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided

1. What is resonance?
 - (A) Any object vibrating.
 - (B) The act of shaking something to make it vibrate.
 - (C) The tendency for one vibrating object to start another object vibrating if its frequency is close to the second object's natural frequency.
 - (D) The tendency for an object to remain vibrating for some time after it has been disturbed.

2. Five pendulums are mounted on a string as shown. If pendulum "P" is set to vibrating, which other pendulum will most likely resonate and be caused to vibrate?

- (A) A
- (B) B
- (C) C
- (D) D



3. Which phenomenon is due to resonance?
 - (A) Doubling the distance from a sound source does not double the intensity.
 - (B) Shaking a pan at one special frequency causes the water to slosh back and forth.
 - (C) The period of a wave can be calculated from the frequency.
 - (D) When waves pass through narrow slits they behave as if they were created by a point.
4. Suppose that a building has a natural frequency of 0.02 Hz. What does this mean?
 - (A) All items in the building are designed to vibrate at 0.02 Hz
 - (B) If disturbed, it would tend to sway back and forth at 0.02 Hz
 - (C) It can bounce up and down at 0.02 Hz
 - (D) This is the time required for it to fall down if it was demolished
5. It is found that the propeller shaft of a boat has a natural frequency of 30 Hz. Because of this, what might the chief engineer choose to do?
 - (A) Avoid engine speeds that turn the shaft at 30 Hz
 - (B) Nothing
 - (C) Shut down the engine immediately
 - (D) Only use engine speeds that turn the shaft at 30 Hz

6. A girl on a swing may increase the amplitude of the swing's oscillations if she moves her legs at the natural frequency of the swing. What is this an example of?
- (A) Destructive interference
 - (B) Resonance
 - (C) The Doppler effect
 - (D) Wave transmission
7. It is possible to break a wine glass by singing very loudly at the right note. Which of the following phenomenon would best explain this occurrence?
- (A) Diffraction
 - (B) Interference
 - (C) Refraction
 - (D) Resonance
8. It is possible that one vibrating object can set another object into vibration if the natural frequencies of the two objects are the same.
- (A) True
 - (B) False
9. An object is vibrating at its natural frequency. Repeated and periodic vibrations of the same natural frequency impinge upon the vibrating object and the amplitude of its vibrations are observed to increase. What is this phenomenon known as?
- (A) Beats
 - (B) Fundamental
 - (C) Interference
 - (D) Resonance
10. When the vibrations of one object match the resonant frequency of a second object, the first object increases the _____ of the vibrations of the second object.
- (A) Amplitude
 - (B) Frequency
 - (C) Period
 - (D) Wavelength
11. Which of the following is an example of resonance?
- (A) An echo
 - (B) Hearing a person talking in another room
 - (C) High pitch of a car horn as it drive towards an observer
 - (D) Ultrasound to break up gall stones