Do Now:

What is common between *sound and light*? What are the differences between *sound and light*?

_____

_____

Sound Waves

1. Define *Sound Waves* from three different perspectives

(1) _____ wave:
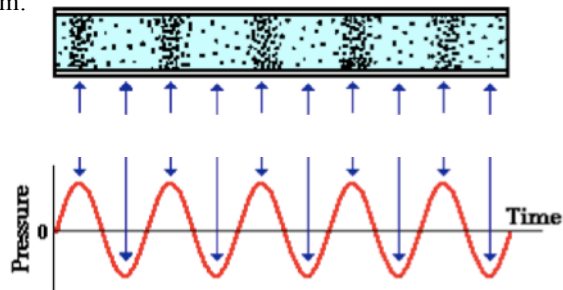
_____

_____

(2) _____ wave:

_____

_____

(3) _____ wave:

_____

2. Define *compression*:

_____

Define *rarefaction*:

_____

Identify the *compression (C)* and the *rarefaction (R)* in the diagram:

3. What are the relation between *Period* and *Frequency*:

_____

_____

Speed of Sound

4. The frequency of sound equals to that of the _____.

5. Dynamic range of human ear: _____.

The frequency of sound f < 20 Hz: _____.

The frequency of sound f > 20 kHz: _____.

6. Speed of sound = _____.

   Formula: v = _____.

   d: _____.

   t: _____.

7. Speed of sound = _____.

   Formula: v = _____.

   λ: _____.

   f: _____.

   T: _____.

8. *Speed of Sound vs. Temperature*:

   Formula: v = _____.

   T: _____.

9. When slower than the speed of sound: _____.

   When faster than the speed of sound: _____.

   The speed of sound is also called: _____.

10. *Sound and Medium*:
   All sounds are produced by _____.

   The transmission of sound requires a _____.

   Sound cannot travel in a _____.

11. *Sound and Elasticity*:

   The speed of sound in a material depends on its

   _____ (not _____).

   Define *elasticity*:

   _____

   _____

   Sound travels about _____ times faster in steel than in air.

   Sound travels about _____ times faster in water than in air.

12. What is *SONAR*?

   _____

   _____

   _____

Mr. Lin   *1*

Loudness

13. What is the intensity of the sound:

   _____.

   The intensity of a sound is proportional to the

   _____ of a sound wave.

   Loudness is a subjective sensation but is related to

   _____.

   Human hearing is approximately _____.

14. The unit of intensity for sound is the _____(___).

   The scale range is _____dB ~ _____ dB.

   A sound of *10n* dB is _____ times as intense as sound of 0 dB

15. What is the *decibel (dB)*:

   _____

   _____.

   If P_1 and P_0 are the intensities of sound,

   L_{dB} = _____.

       If $P_1 = P_0$, then L_{dB} _____.

       If $P_1 > P_0$, then L_{dB} _____.

       If $P_1 < P_0$, then L_{dB} _____.

   Example: 120dB means P_1/P_0 = _____.

Resonance

16. What is the *forced vibration*:

   _____

   _____.

17. What is the *natural frequency*:

   _____

   _____.

   Natural frequency depends on _____ of the object.

   Natural frequency at which _____ is required to produce and continue forced vibrations.

18. What is the *natural frequency*:

   _____

   _____.

List three examples of resonance:

(1) _____

(2) _____

(3) _____.

Interference

19. Interference can occurs for both

   _____.

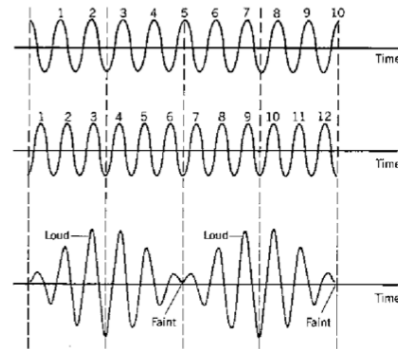20. What is *constructive interference*?

   _____.

21. What is destructive interference?

   _____.

22. Define *beats*?

   _____

   _____.

If the frequency of the first sound is m, and the frequency of the second is *n*, a **beat frequency (f_{beat})**:

   _____

23. Two tuning forks are sounded together producing 3 beats per second. If the first fork has a frequency of 300 Hz, what are the possible frequencies of the second fork?

24. A tuning fork with a frequency of 256 Hz is sounded the same time as a second tuning fork producing 20 beats in 4 seconds. What are the possible frequencies of the second tuning fork?

25. When will the beats disappear?

   _____.

Sound of Music

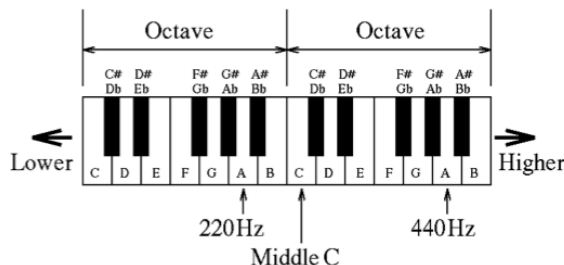26. Music consists of a pleasing succession of pitches

(_____).

Music pitches are selected from a specific sequence called

a _____.

The 12-note scale consists of a sequence of 12 pitches, the

13th note has _____ the frequency of the first note.

Each of which is the _____ times the frequency of the next lower note.

27. *Example*: The frequency of note A is 440 Hz, calculate the frequency of note B.

28. *Example*: The frequency of note A is 440 Hz, calculate the frequency of note A in the next higher octave.

29. To set up a continuous sound, it is necessary to set up a

_____.

30. Three large classes of traditional musical instruments differ from one another in how they produce standing waves

–Stringed instrument: _____.

–Percussion instrument: _____.

–Wind instrument: _____.

31. The wave with wavelength 2L is called the

_____, or _____.

32. The first resonant length of an open pipe is 33.0 cm. If the frequency of a sound resonating over this pipe is 512 Hz, what is the speed of sound?

33. A sound with a frequency of 560 Hz is traveling at 350 m/s. What is the length of an open-air column that resonates this sound at its shortest resonant length?

34. The air temperature in a room is 25°C. A tuning fork resonates over a closed tube 30.0 cm long, its shortest resonant length. What is the wavelength of the sound?

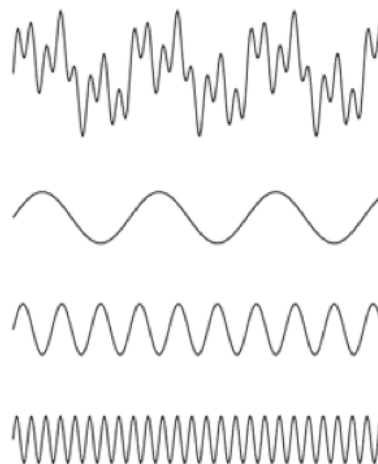35. A complex wave is made up of a _____

and several _____.

The distinctive *timbres* of different musical instruments

are a consequence of _____.

36. The technique of taking complex wave and breaking down into a sum of simple, single frequency waves is

called _____.

Light

37. The only thing we can see is _____.

38. Briefly describe the two basic theory of light?

(1) _____: _____

_____.

(2) _____: _____

_____.

39. What is the *photon model* of light?

_____

_____.

40. What is the *photoelectric effect*? Summarize it in the following points:

(1) _____
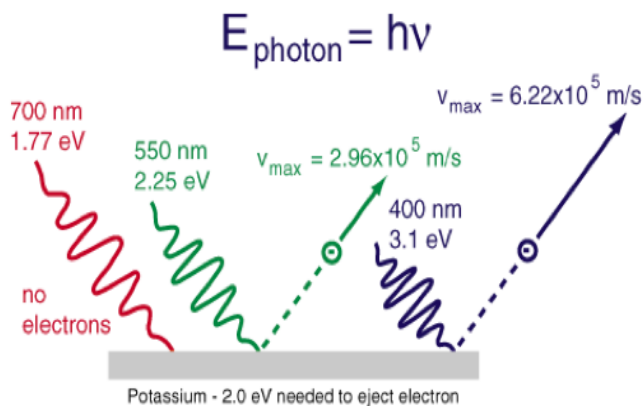
_____.

(2) _____

_____.

(3) _____

_____.

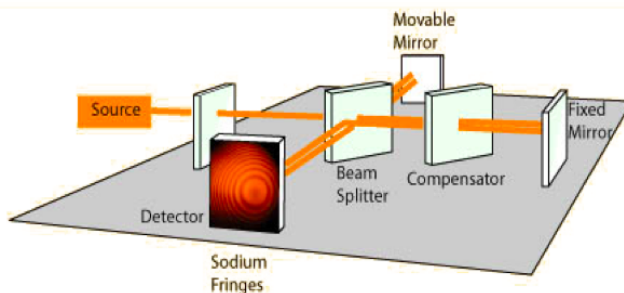(4) _____

_____.

(5) _____

_____.

(6) _____

_____.

$$E_{photon} = h\nu$$

700 nm
1.77 eV

$v_{max} = 6.22 \times 10^5$ m/s

550 nm
2.25 eV

$v_{max} = 2.96 \times 10^5$ m/s

400 nm
3.1 eV

no electrons

Potassium - 2.0 eV needed to eject electron

Speed of Light

41. Explain how has the Michelson's Interferometer been used to measure the speed of light.

_____

_____

_____

_____.

Movable Mirror

Source

Fixed Mirror

Beam Splitter

Compensator

Detector

Sodium Fringes

42. 1887 Michelson-Morley's experiment measured the speed of light to understand the properties of **ether**. What are the results?

(1) _____

_____.

(2) _____

_____.

Electromagnetic Waves

43. Light is energy that is emitted by accelerating _____

in atoms. The energy travels in _____.

44. Light is a small portion of the _____.

45. The electromagnetic waves have different _____

and _____, but all have the _____.

46. Typical human eyes respond to wavelengths from about

_____nm, or In terms of frequency,

_____Hz.

47. The frequencies lower than the red light are called

_____.

The frequencies higher than the violet light are called

_____.

Light and Materials

48. *Light and Transparent Materials:*
When light is incident upon matters, _____
are forced into vibration, since they have small enough

_____ to vibrate this fast.

Material responds depending on the _____

of light and the _____ of electrons
in the material.

49. *UV Light and Transparent Materials:*
Electrons in glass have a natural vibration frequency in the

_____ range.

When ultraviolet light shines on glass, _____
occurs. The amplitude of the vibration is unusually large,
and the atom collides with other atoms and give up its

energy in the form of _____. So, glass

is _____ to short wavelength ultraviolet.

50. *Visible Light and Transparent Materials:*
When the visible light shins on glass, the electrons are

vibrate with smaller _____.

The atom has less chance of _____,

and less energy is transferred as _____.

Glass is _____ to all the frequency

of the visible light. The _____ of the reemitted
light passed from atom to atom is identical to the original

one. The main difference is the _____
between absorption and reemission.

51. *Speed of Light in Transparent Materials*
The light has a lower average speed through a transparent
material.
In water light travels at _____.

In glass light travels at _____.

In diamond light travels at _____.

When light is back into the air, it travels at _____.

52. *Infrared Light and Transparent Materials:*

Infrared waves vibrate _____

of the glass, and increases the _____
of the glass and makes it warmer.

Glass is _____ to infrared light.

53. *Light and Opaque Materials*
Most materials absorb light without _____
and thus allow no light through them. They are opaque.
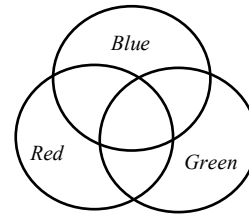In opaque materials, any coordinated vibrations given by

light are turned into _____ and
makes the materials slightly warmer .

Metals have lots of _____.
When light shins on metal, and they are set into vibration,

and their energy is reemitted as _____.
That's why metals are shiny.

Colors

54. The *primary colors* of light are _____.

55. The color an object appears depends on the

_____ it reflects.

Shadows

56. What is shadow?

_____

_____.

57. Sharp shadows are formed by:

(1) _____.

(2) _____.

(3) _____.

58. A total shadow is called an _____,

and a partial shadow a _____.

59. Define *solar eclipse*:

_____.

60. Define *lunar eclipse*:

_____.

Polarization

61. Light waves are _____ waves.
A horizontally vibrating electron emits light that is

_____.
A vertically vibrating electron emits light that is

_____.
When common light shines on a polarizing filter, the light

that is transmitted is _____.

62. 3-D vision depends on both eyes viewing a scene from

slightly _____.

3-D movies are accomplished by projecting a pair of

views through _____ onto a screen.

The polarization axes are at _____ to each other.
When viewers wear polarizing eyeglasses with the lens

axes also at _____, viewers will feel the depth.