Harmonic Motion In Class Review
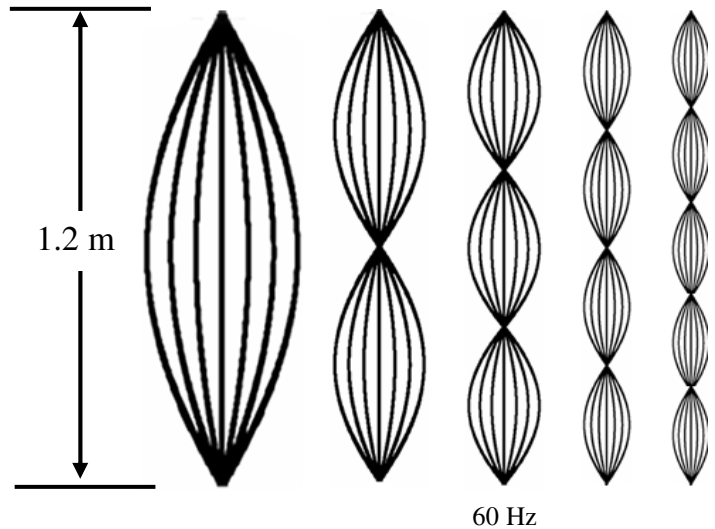
1) Which harmonic is 2λ long?
2) Which has 4 antinodes?
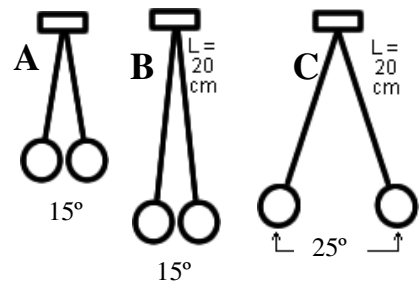3) Which has 3 nodes?
4) Calculate the wavelength of harmonic 3.

5) Calculate the string's wave speed.

6) What is the wavelength of the fundamental?

7) What is the natural frequency of this string?
8) Which one has the greatest amplitude?
9) What is the wave speed for harmonic 1?

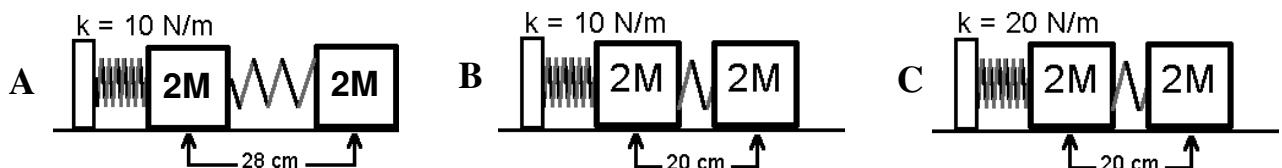10) These are the frequencies at which the string is r_____.

1.2 m

60 Hz

11) A pendulum swings faster.

   A. Does the cycle occur more or less frequently?
   B. Therefore, does the frequency go up or down?
   C. Is the period faster or slower?
   D. Therefore, does the period go up or down?
   E. If the period goes up the frequency goes up or down?
   F. Is this direct or inverse relationship?

12) How do you make a pendulum go faster (*2 ways*)?

13) Pendulum A, B, or C:

   A. Has the smallest period?   B. Has the biggest amplitude?
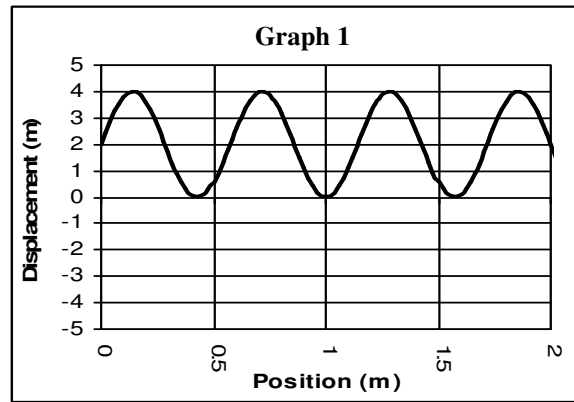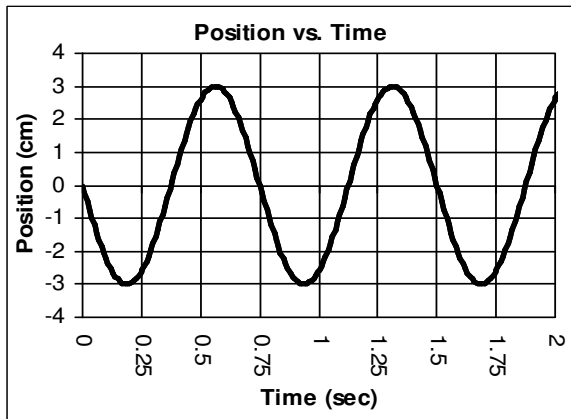
14) What is the same between pendulum A and B?
15) What is the same between pendulum B and C?
16) Does A or B have the highest frequency?
17) What is the amplitude of pendulum C?
18) Find the period of pendulum B.

A   B L = 20 cm   C L = 20 cm

15°   15°   25°

19) How do you change the period of a spring? (2 ways)

A k = 10 N/m 2M 2M 28 cm

B k = 10 N/m 2M 2M 20 cm

C k = 20 N/m 2M 2M 20 cm

20) Which of the three springs will have the fastest period?
21) Why?

22) Which spring was disturbed the most?
23) Why?

24) What is Spring B's amplitude?

25) How far does Spring A travel side-to-side?
26) How far will Spring C travel in one complete cycle?

27) If M = 400 g, find the period of Spring A.

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Position vs. Time

(graph: Position (cm) vs Time (sec))

Graph 1

(graph: Displacement (m) vs Position (m))

28) A. Amplitude =   B. Equilibrium position =
    C. Mark a crest and a trough.
    D. # of cycles =
    E. Period =   F. Frequency =

29) A. Where will it come to rest?
    B. Amplitude?   C. # of wavelengths
    D. Length of the graph =
    E. Calculate the wavelength.

30) If a sound wave has a wavelength of 15 cm,
    A. Calculate its frequency.

    B. What is its speed if you double the amplitude?

31) Sound is generally faster in:
    A. Solids or gases?
    B. Helium or oxygen?
    C. Tight things or loose things?
    D. Denser objects or less dense objects?

32) What is the speed of sound in space?
33) Which has a higher frequency: long or short wavelengths?
34) Higher frequency: bird or elephant?
35) Which has the shorter wavelength: a bird or an elephant?

36) f_1 = 820 Hz; f_2 = 815 Hz.
    A. How many beats will you hear?
    B. What causes the beats?

37) A race car is moving towards you.
    A. Is the pitch of car higher or lower than normal?
    B. Is the wavelength of the sound longer or shorter?
    C. What is this called?
    D. What will happen when it passes you?

38) What is "timbre"?

39) Sound waves are longitudinal or transverse?

40) How different is 60 dB from 50 dB?

41) A longitudinal wave is moving up, which way are the vibrations moving?

42) For motion to be harmonic:
    A. It has to have a r_____ force.
    B. This force has to pull to the m_____.

43) Give an example of motion that repeats, but is NOT harmonic motion.

44) A person yells up to a ceiling and hears the echo 0.6 seconds later. How high is the ceiling?

45) A 250 g object is hung onto a spring. It stretches 18 cm. Find the spring's spring constant.
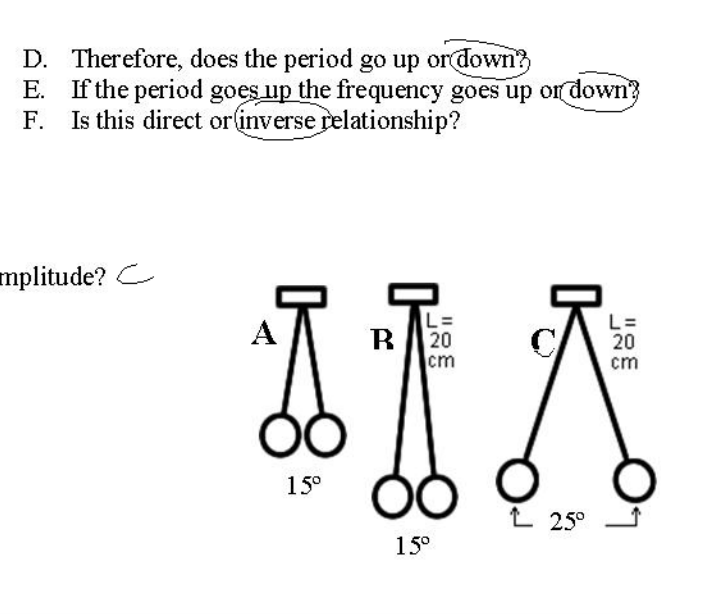
46) Draw what will happen when the wave passes.

47) The above pictures show:

48) Echoes occur when sound _____.

49) Light bends as it passes from air to glass:

50) Sound dying out in a soft boundary is called:

51) When two waves interact with each other, causing a greater amplitude:

52) When two waves interact with each other, causing a smaller amplitude:

53) When one object vibrates from the energy of another wave (like one tuning fork causing another to vibrate):

Harmonic Motion – In Class Review

1) Which harmonic is 2λ long? H4
2) Which has 4 antinodes? 4
3) Which has 3 nodes? 2
4) Calculate the wavelength of harmonic 3.

$$1.5\lambda = 1.2\,m$$
$$\lambda = .8\,m$$

5) Calculate the string's wave speed.

$$V = F\lambda$$
$$V = 60(.8) = 48\,m/s$$

Biggest amplitude is H₁.

1.2 m

6) What is the wavelength of the fundamental?

$$\frac{\lambda}{2} = 1.2\,m \qquad \lambda = 2.4\,m$$

7) What is the natural frequency of this string? 20 Hz

8) What is the wave speed for harmonic 1?

$$F\lambda = 20(2.4) = 48\,m/s$$

9) These are the frequencies at which the string is r esonant.
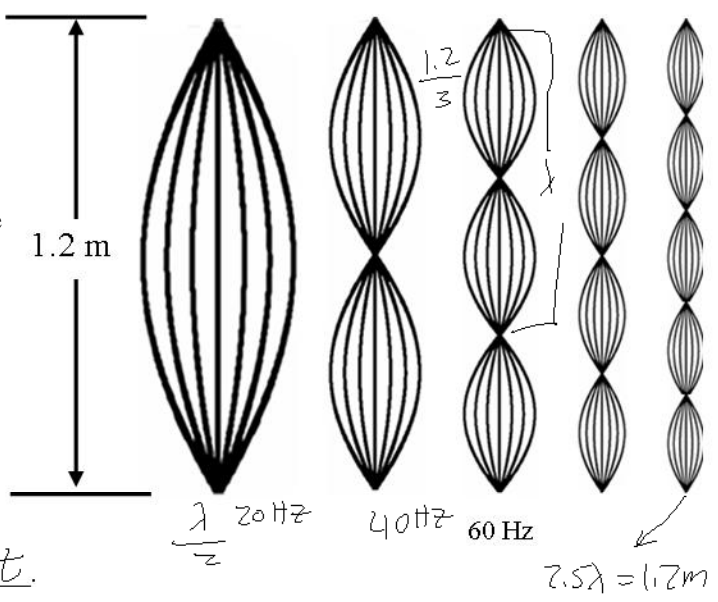
λ/2   20 Hz   40 Hz   60 Hz   1.2/3

2.5λ = 1.2 m

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10) A pendulum swings faster.
   A. Does the cycle occur (more) or less frequently?
   B. Therefore, does the frequency go (up) or down?
   C. Is the period (faster) or slower?
   D. Therefore, does the period go up or (down)?
   E. If the period goes up the frequency goes up or (down)?
   F. Is this direct or (inverse) relationship?

11) How do you make a pendulum go faster (2 ways)?
   shorter l , more g

12) Pendulum A, B, or C:
   A. Has the smallest period? A   B. Has the biggest amplitude? C

13) What is the same between pendulum A and B? Ampli
14) What is the same between pendulum B and C? period
15) Does (A) or B have the highest frequency?
16) What is the amplitude of pendulum C? 25°/2 = 12.5°
17) Find the period of pendulum B.

$$T = 6.28\sqrt{\frac{.2}{10}} = .89\,sec$$

A   R L=20 cm   C L=20 cm

15°   15°   25°

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18) How do you change the period of a spring? (2 ways)

Mass or spring constant

k = 10 N/m   k = 10 N/m   k = 20 N/m

A [2M WWW 2M]   B [2M Λ 2M]   C [2M Λ 2M]

28 cm   20 cm   20 cm

19) Which of the three springs will have the fastest period? C
20) Why? biggest K (stronger spring)

21) Which spring was disturbed the most? A
22) Why? biggest ampl

23) What is Spring B's amplitude? 10 cm
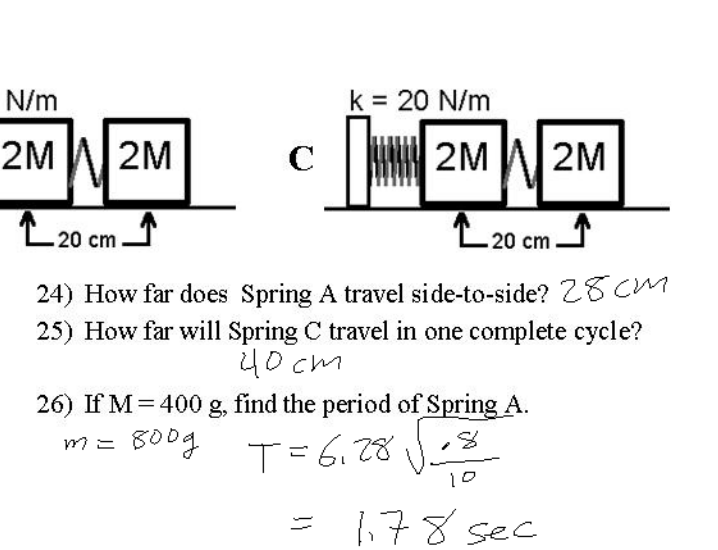
24) How far does Spring A travel side-to-side? 28 cm
25) How far will Spring C travel in one complete cycle?
   40 cm

26) If M = 400 g, find the period of Spring A.
   m = 800g

$$T = 6.28\sqrt{\frac{.8}{10}}$$
$$= 1.78\,sec$$

Position vs. Time
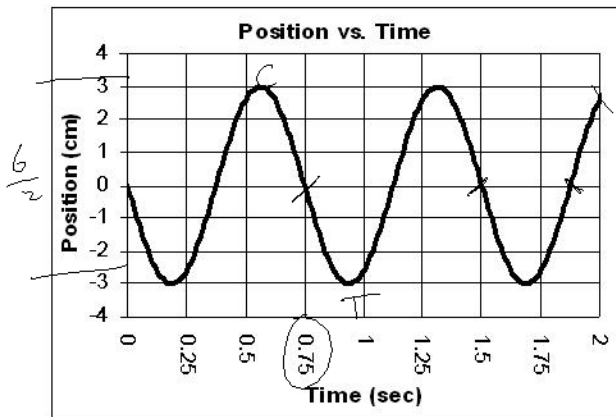
Graph 1

27) A. Amplitude = $3 cm$ B. Equilibrium position = $0 cm$
C. Mark a crest and a trough.
D. # of cycles = 2.75
E. Period = $.75 sec$ F. Frequency = $f = \frac{1}{T}$
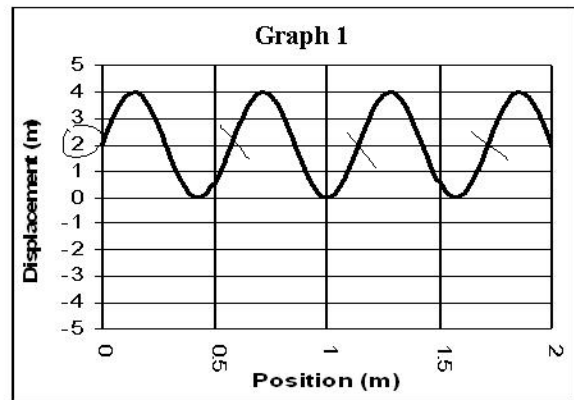
28) A. Where will it come to rest? $2 m$ (eq. pos)
B. Amplitude? $2 m$ C. # of wavelengths 3.5λ
D. Length of the graph = $2 m$
E. Calculate the wavelength.
$3.5 \lambda = 2 m$ $\lambda = \frac{2}{3.5} = .57 m$

29) If a sound wave has a wavelength of 15 cm,
A. Calculate its frequency. $v = f \lambda$
$\lambda = .15 m$ $v = 340 m/s$
$f = \underline{\quad}$
B. What is its speed if you double the amplitude?
same

30) Sound is generally faster in:
A. (Solids) or gases?
B. (Helium) or oxygen? talk higher
C. (Tight things) or loose things?
D. (Denser objects) or less dense objects?

31) What is the speed of sound in space?
no sound in space

32) Which has a higher frequency: long or (short) wavelengths?

33) Higher frequency: (bird) or elephant? shorter λ

34) $F_1 = 820$ Hz; $F_2 = 815$ Hz.
A. How many beats will you hear? 5 beats
B. What causes the beats?
Interference

35) A race car is moving towards you.
A. Is the pitch of car (higher) or lower than normal?
B. Is the wavelength of the sound longer or (shorter)? (not radar)
C. What is this called? Doppler effect
D. What will happen when it passes you?
goes lower

36) What is "timbre"?
diff. of sounds that are same freq,
clar. vs flute, etc.

37) Sound waves are (longitudinal) or transverse?

38) How different is 60 dB from 50 dB?
twice as loud

39) A longitudinal wave is moving up, which way are the vibrations moving? up + down

40) For motion to be harmonic:
A. It has to have a r estoring force.
B. This force has to pull to the m iddle .

41) Give an example of motion that repeats, but is NOT harmonic motion.
jumping jacks, wings, ball bouncing

42) A person yells up to a ceiling and hears the echo 0.6 seconds later. How high is the ceiling?
$V = \frac{D}{T}$
$340 = \frac{2D}{.6}$

43) A 250 g object is hung onto a spring. It stretches 18 cm.
A. Find the spring's spring constant.
$m = .25 kg$ $F = -kx$
$x = .18 m$ $-2.5 = -k(.18)$
                   $k = 13.9 \frac{N}{m}$
$Fw = mg = .25(10) = 2.5 N$

B. How much farther will the above spring move if you apply an additional 35 N to it?
$-35 = -13.9(x)$