Name_____ Essex High School

Physics 100

Sound/Waves Notes and Problems

More Notes:

Resonant Frequency: A preferred oscillating frequency of an object

What does it mean when someone says, "that idea resonates with me?"

The idea matches or is "in sync" with your existing ideas or feelings

The resonant frequency of a child on swing A is 0.5hz. The resonant frequency of the child on swing B is 0.2hz. If you plan to provide the child with the enjoyable experience of being pushed, explain how you should push the child differently on swing B, as opposed to swing A.

Push less frequently

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distance / velocity / time

**Good Stuff**

$d = v \times t$ $v = d \div t$ $t = d \div v$

$v = f \times \lambda$ $f = v \div \lambda$ $\lambda = v \div f$

Speed of sound in air = 340 m/s

Speed of sound in water = 1500 m/s

**Problems**

1. How long does it take sound to travel the length of the hallway (50 meters)?

$t = \frac{d}{v} = \frac{50m}{340 m/s} = 0.147s$

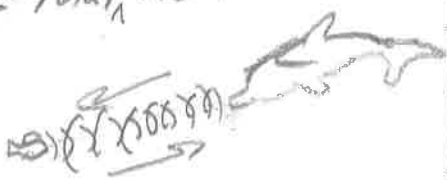
wavelength

2. A dolphin finds food by sending a sound pulse through the water and listening for the echo. How far away is the food if the dolphin hears the echo in 0.10 seconds?

round trip

$d = v(t) = 1500 m/s\,(0.1s) = 150m$ = total distance

distance to food $= \frac{150m}{2} = 75m$



3. How can someone use the sound of thunder to tell how far away a lightning strike was? (2 pts)

(Seconds between flash and thunder) ÷ 5 = miles away or $d = vt$ (v = speed of sound)

★4. A fisherman sits on a boat in a lake and is not having very much luck, so he relaxes and watches the waves go by. He notices that 5 waves hit his boat in 15 seconds and it take each wave 4 seconds to travel the length of his 5 meter long boat. Find

a. The frequency of the waves.

$f = \frac{\text{waves}}{\text{seconds}} = \frac{5 \text{ waves}}{15 \text{ seconds}} = 0.33 \text{ hz}$

b. The speed of the waves.

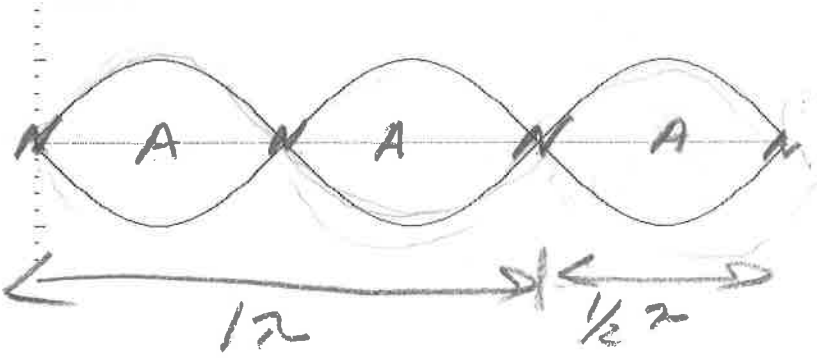
$v = \frac{d}{t} = \frac{5 \text{ m}}{4 \text{ s}} = 1.25 \text{ m/s}$

c. The wavelength of the waves

$\lambda = \frac{v}{f} = \frac{1.25 \text{ m/s}}{0.33 \text{ hz}} = 3.75 \text{ m}$

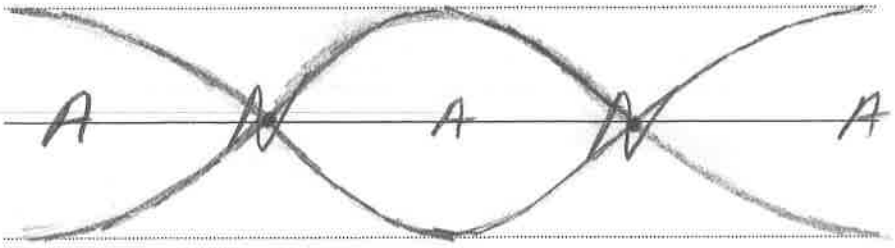
8. The adjacent diagram shows a standing wave pattern. (3 pts)
a. Label all the nodes with an N
b. Label all the anti-nodes with an A
c. How many wavelengths long is the segment?

1.5 wavelengths




9. Sketch a standing wave in the space provided below that has 3 antinodes and 2 nodes. How many wavelengths are present? (3 pts)

1 wavelength

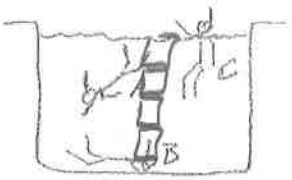


Physics 100
Air Pressure

Name: _____

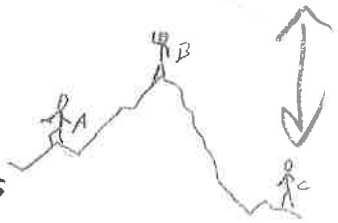
1. In the first picture on the right, which swimmer is experiencing the greatest water pressure?

B




2. In the second picture on the right, who is experiencing the greatest air pressure?

C




3. Whether you're in air or water (or any other fluid), the origin of ambient pressure is the same. What creates the air pressure that we're experiencing right now?

Miles of air stacked above us

4. Air has mass and weight. At sea level, one cubic meter of air weighs about 2.5 pounds. Its mass is a little over 1 kg.

5. If you fill up a 1cubic meter bag with air, why doesn't it feel like it weighs that much?

6. The weight of air adds up. The weight of all of the air above you adds up to a total pressure of about:

14.7 psi ( pounds per square inch ) or

101,350 pa ( pascal → $N/m^2$ )

7. This means that, for every square inch of your body's surface, the air pressure around you exerts 14.7 pounds of force. According to sources, an average human has about $1.8m^2$ ($\approx$2,800 $in^2$) of skin.

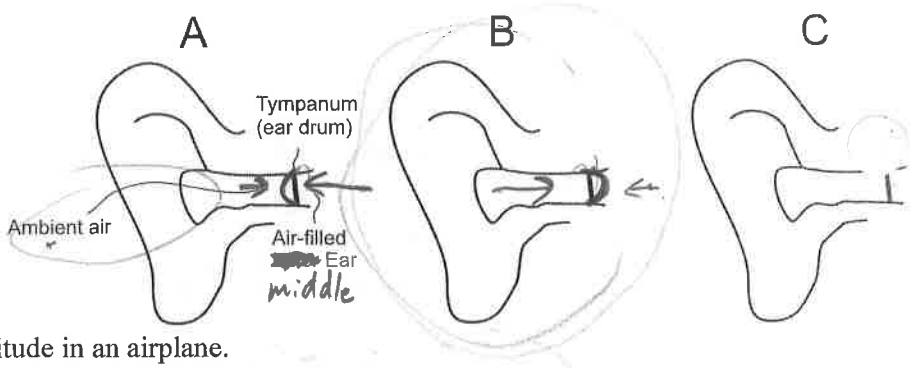
Therefore, the total force of air pressure pushing against an average human's skin is 41,000 lbs.

8. Why doesn't this force crush us? Why don't we even feel it?

- we're used to it
- There's pressure inside us, pushing out
- Pressure pushes from all directions
- Force is spread out

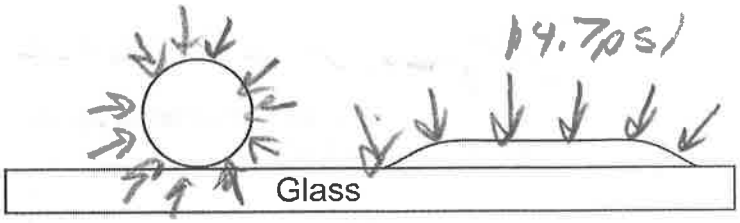
9. The two people on the right are inside trash bags. One has a vacuum hose inserted in the bag. The other does not. Use arrows to show how the sensation of vacuum packing is caused by air pressure pushing inward from the outside of the bag.


10. **Ears are sensitive to changes in air pressure.** The three pictures on the right show a human ear. Alter two of the pictures to show the effects of changing air pressure with a change in altitude…




A. Show what happens when the ear ascends to a higher altitude in an airplane.
B. Show what happens when the ear descends to a lower altitude.
C. Show what happens when the ear stays put.

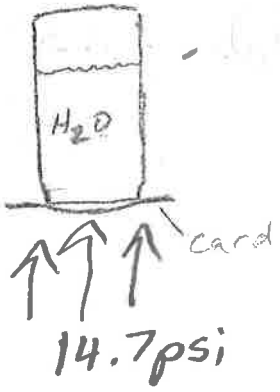
11. Use the diagram to explain how a suction cup sticks to a table, and why a baseball does not.




12. What happens if you fill a jar with water, cover it with a laminated card, and then turn the jar upside down? Explain why.

water stays in

Air pressure pushes card up




13. A helium balloon floats upward. Show how it "knows" which way to go.


Pressure pushing up is stronger than downward pressure.