

# Chapter 17 End-of-Chapter Problems

Halliday & Resnick, 10th Edition

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Hit me where it Matters

*Where needed in the problems, use*

speed of sound in air = 343 m/s

*and*

density of air = 1.21 kg/m<sup>3</sup>

*unless otherwise specified.*

## 1 Problem 1

Two spectators at a soccer game see, and a moment later hear, the ball being kicked on the playing field. The time delay for spectator A is 0.23 s, and for spectator B it is 0.12 s. Sight lines from the two spectators to the player kicking the ball meet at an angle of  $90^\circ$ . How far are (a) spectator A and (b) spectator B from the player? (c) How far are the spectators from each other?

### 1.1 Solution (a)

This is a simple question to answer. The distance traveled to A would be equal to the speed of sound times the time taken to travel the distance.

$$x = vt = (343 \text{ m/s})(0.23 \text{ s}) = \boxed{78.89 \text{ m}} \quad (1)$$

## 2 Problem 3

When the door of the Chapel of the Mausoleum in Hamilton, Scotland, is slammed shut, the last echo heard by someone standing just inside the door reportedly comes 15 s later. (a) If that echo were due to a single reflection off a wall opposite the door, how far from the door is the wall? (b) If, instead, the wall is 25.7 m away, how many reflections (back and forth) occur?

### 2.1 Solution

### 3 Problem 5

Earthquakes generate sound waves inside Earth. Unlike a gas, Earth can experience both transverse (S) and longitudinal (P) sound waves. Typically, the speed of S waves is about 4.5 km/s, and that of P waves 8.0 km/s. A seismograph records P and S waves from an earthquake. The first P waves arrive 3.0 min before the first S waves. If the waves travel in a straight line, how far away did the earthquake occur?

#### 3.1 Solution

## 4 Problem 7

A stone is dropped into a well. The splash is heard 3.00 s later. What is the depth of the well?

### 4.1 Solution

## 5 Problem 11

Diagnostic ultrasound of frequency 4.50 MHz is used to examine tumors in soft tissue. (a) What is the wavelength in air of such a sound wave? (b) If the speed of sound in tissue is 1500 m/s, what is the wavelength of this wave in tissue?

### 5.1 Solution

## 6 Problem 15

### 6.1 Solution

## 7 Problem 17

### 7.1 Solution



## 8 Problem 19

### 8.1 Solution

## 9 Problem 20

### 9.1 Solution

## 10 Problem 25

### 10.1 Solution

## 11 Problem 27

### 11.1 Solution

## 12 Problem 29

### 12.1 Solution

## 13 Problem 35

### 13.1 Solution

## 14 Problem 39

### 14.1 Solution

## 15 Problem 41

### 15.1 Solution



## 16 Problem 47

### 16.1 Solution

## 17 Problem 49

### 17.1 Solution

## 18 Problem 51

### 18.1 Solution

## **19 Problem 53**

### **19.1 Solution**

## 20 Problem 55

### 20.1 Solution

## 21 Problem 57

### 21.1 Solution

## 22 Problem 61

### 22.1 Solution

## **23 Problem 63**

### **23.1 Solution**



## 24 Problem 71

### 24.1 Solution

## 25 Problem 81

### 25.1 Solution

## 26 Problem 87

### 26.1 Solution

## 27 Problem 99

### 27.1 Solution

## 28 Problem 107

### 28.1 Solution

# Contents

<b>1 Problem 1</b>	<b>2</b>
1.1 Solution (a) . . . . .	2
<b>2 Problem 3</b>	<b>3</b>
2.1 Solution . . . . .	3
<b>3 Problem 5</b>	<b>4</b>
3.1 Solution . . . . .	4
<b>4 Problem 7</b>	<b>5</b>
4.1 Solution . . . . .	5
<b>5 Problem 11</b>	<b>6</b>
5.1 Solution . . . . .	6
<b>6 Problem 15</b>	<b>7</b>
6.1 Solution . . . . .	7
<b>7 Problem 17</b>	<b>8</b>
7.1 Solution . . . . .	8
<b>8 Problem 19</b>	<b>9</b>
8.1 Solution . . . . .	9
<b>9 Problem 20</b>	<b>10</b>
9.1 Solution . . . . .	10
<b>10 Problem 25</b>	<b>11</b>
10.1 Solution . . . . .	11
<b>11 Problem 27</b>	<b>12</b>
11.1 Solution . . . . .	12
<b>12 Problem 29</b>	<b>13</b>
12.1 Solution . . . . .	13
<b>13 Problem 35</b>	<b>14</b>
13.1 Solution . . . . .	14

<b>14 Problem 39</b>	<b>15</b>
14.1 Solution . . . . .	15
<b>15 Problem 41</b>	<b>16</b>
15.1 Solution . . . . .	16
<b>16 Problem 47</b>	<b>17</b>
16.1 Solution . . . . .	17
<b>17 Problem 49</b>	<b>18</b>
17.1 Solution . . . . .	18
<b>18 Problem 51</b>	<b>19</b>
18.1 Solution . . . . .	19
<b>19 Problem 53</b>	<b>20</b>
19.1 Solution . . . . .	20
<b>20 Problem 55</b>	<b>21</b>
20.1 Solution . . . . .	21
<b>21 Problem 57</b>	<b>22</b>
21.1 Solution . . . . .	22
<b>22 Problem 61</b>	<b>23</b>
22.1 Solution . . . . .	23
<b>23 Problem 63</b>	<b>24</b>
23.1 Solution . . . . .	24
<b>24 Problem 71</b>	<b>25</b>
24.1 Solution . . . . .	25
<b>25 Problem 81</b>	<b>26</b>
25.1 Solution . . . . .	26
<b>26 Problem 87</b>	<b>27</b>
26.1 Solution . . . . .	27

<b>27 Problem 99</b>	<b>28</b>
27.1 Solution . . . . .	28
<b>28 Problem 107</b>	<b>29</b>
28.1 Solution . . . . .	29