QUIZ / How are signals sent?

NAME DATE CLASS PERIOD

Put a check in the o *next to the correct answer.*

1. A radio control transmitter is using a crystal that has a resonant frequency of 75.49 megahertz. A receiver has a crystal with a resonant frequency of 79.41 megahertz. The radio control transmitter frequency is close enough to activate the receiver.

   o True o False

   The radio control transmitter frequency and receiver must be the exact same frequency.

2. **Resonance only occurs in electronic circuits.**

   o True o False

   Resonance can occur in other situations. For an example, see the Tacoma Bridge slide show, where resonance caused the destruction of a bridge.

3. The radio control transmitter signal is transmitted:

   o only to the left of the remote control operator
   o only to the right of the remote control operator
   o only in an axial direction along the antenna length
   o only in a radial direction along the antenna length
   o none of the above

   Lessons 1 and 2 show that the Vex radio control transmitter signal is stronger from the sides of the radio control transmitter. Thus, the signal is transmitted in a radial direction along the antenna length.

4. A fresh battery is critical to the radio control transmitter and Vex robotics system when conducting experimental investigations.

   o True o False

   Without a fresh battery, the Vex robot may not perform the same motions consistently or accurately. This may introduce error into your experimental results.

5. The size and shape of the Vex radio control transmitter crystal and the Vex receiver crystal are:

   o equal
   o the receiver crystal is larger than the transmitter crystal
   o the receiver crystal is smaller than the transmitter crystal
   o none of the above

   Although the two crystals do not look the same size, on the inside of their container they are the same size.

$T = \frac{1}{f}$

$f = \frac{1}{T}$

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6. When using the radio control transmitter to run a Vex robot, the following items are important:

   - o antenna position
   - o distance to the receiver
   - o battery power in the radio control transmitter
   - o all of the above are important
   - o none of the above are important

   If the antenna position is too far from the robot, it will not transmit effectively to the robot. In addition, if the antenna is turned to point directly at the robot, the signal will not be as good as if the antenna pointed in a perpendicular direction. For the reasons in Question 5, battery power is also important.

7. The time period for a 75.93 MHz crystal is: (you must use a calculator to answer)

   - o 7.593 microseconds
   - o 75.93 nanoseconds
   - o 13.17 nanoseconds
   - o 1.317 nanoseconds
   - o 131.7 microseconds

   Using the T = (1/f) formula at left, plug in 75.93 MHz.
   So T = (1 / (75.93 x 10^6)) = 13.17 ns.

8. The frequency for a crystal having a time period of 2.5 microseconds is:

   - o 250 megahertz
   - o 25 kilohertz
   - o 4 megahertz
   - o 400 kilohertz
   - o 4 gigahertz

   Using the f = (1/T) formula at left, plug in 2.5 ms.
   So f = (1 / (2.5 x 10^{-6})) = 400 kHz.

9. The difference between a 75.41 megahertz crystal and a 75.49 megahertz crystal is:

   - o so small it is meaningless
   - o 0.08 megahertz
   - o 8 kilohertz
   - o 0.08 megahertz, but this difference is meaningless
   - o 8 kilohertz, but this difference is meaningless

   Subtracting 75.49 MHz from 75.41 MHz equals 0.08 MHz. This difference is not meaningless; the transmitter and receiver crystals must be exactly the same frequency.

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10. The time period difference between a 75.89 megahertz crystal and a 75.49 megahertz crystal is:

    - o so small it is meaningless
    - o 12.5 megahertz
    - o 0.4 nanoseconds
    - o 17.4 nanoseconds
    - o .069 nanoseconds

    To find the time period of 75.89 MHz, divide 1 by 75.89 x 10^6 = 1.3177 x 10^{-8}. To find the time period of 75.49 MHz, divide 1 by 75.49 x 10^6 = 1.32468 x 10^{-8}. Subtracting 1.3177 x 10^{-8} from 1.32468 x 10^{-8} equals 6.982 x 10^{-11}, which is approximately .069 ns.

11. Which of the materials listed impedes the radio control transmitter signal the most?

    - o Wood
    - o Paper
    - o Sheet metal

    Lesson 3 should show that sheet metal impedes the radio control transmitter signal the most.

12. Whichof the materials listed below impedes the radio control transmitter signal the least?

    - o Wood
    - o Paper
    - o Sheet metal

    Lesson 3 should show that paper has the least effect on radio control transmitter strength.

13. What is the relationship between transmission strength and radio control transmitter antenna height?

    - o As antenna height increases, signal strength decreases
    - o As antenna height increases, signal strength increases
    - o As antenna height decreases, signal strength increases
    - o As antenna height decreases or increases, signal strength remains constant

    Lesson 1 should show that signal strength is a function of antenna height. They are directly related so, as antenna height increases, signal strength will also increase.

14. The period of the sine wave in Figure 1 is:

    - o 0.5 x Pi
    - o Pi
    - o 1.5 x Pi
    - o 2 x Pi
    - o 3 x Pi

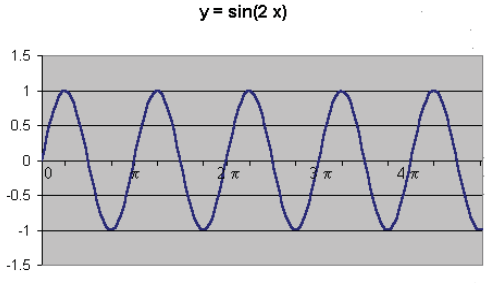

Figure 1

The wave repeats every Pi.

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$T = \frac{1}{f}$

$f = \frac{1}{T}$

15. The frequency of the sine wave in Figure 1 is:

- o 0.63662
- o 0.31831
- o 0.212207
- o 0.159155
- o 0.106103

Using the formula at left, 1 divided by Pi = 0.31831.

16. Systematic error:

- o is a factor in the experiment that throws off the data in the same way
- o is a factor that constantly changes and affects your results
- o may be caused by sloppy error measurements and starting points
- o is completely random

Random error is an error that is constantly changing and affects one's results. Random error may be caused by sloppy measurements - something that affects the data differently each experiment. Systematic error is something that changes the data in the exact same way every time.

17. Give one reason why scientists run multiple trials of an experiment.

This material is covered in "Overview / Guides / Note to the Student". This involves making sure that your first experiment is not just a fluke. You must make sure that your results are repeatable. This is merely an example of one reason.