

Team Name: _____

Team Number: _____

Student Names: _____ & _____

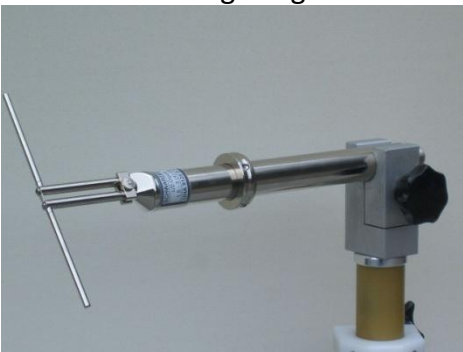


Exploring the World of Science

Directions: You will be given up to 30 minutes to complete the following written test on topics related to Radio Antennas, as described in the official rules. Please write legibly as answers that cannot be interpreted will not receive credit. When relevant, all answers must have appropriate SI units and the appropriate number of significant figures. If significant figures are not given, round to three significant figures. **Each question is worth two points and no partial credit will be awarded.** The blank spaces on the paper may be used to do calculations and work, but ***credit will only be given for the answer provided in the box on the left side of the question.***

Be sure to put your team number on every page. You **are** allowed to separate the test and each team member may work independently, but please staple the test in the correct order before turning it in.

Good Luck and Enjoy the Experience!

| | |
|--|---|
| | 1. What is the speed of a radio wave in kilometers per hour to three significant figures? |
| | 2. What is the wavelength of a 99.1 MHz radio wave in meters? |
| | 3. What is the frequency of an EM wave with a wavelength of 2.5 cm in Hz? |
| | 4. Is the EM wave from (3) above traditionally located in the FM radio band? |
| | 5. What is the frequency of an EM wave with a wavelength of 3.15 m in MHz? |
| | 6. Is the EM wave from (5) above traditionally located in the FM radio band? |
| | 7. Which of the following are the most energetic photons: X-Rays, Microwaves, Visible Light, Ultraviolet Light? |
| | 8. Which of the following are the least energetic photons: X-Rays, Microwaves, Visible Light, Ultraviolet Light? |
| | 9. Which of the following types of waves are used to transmit cellular telephone messages: Radio Waves, Ultraviolet Waves, X-Rays, Visible Light, Infrared, or Gamma Rays? |
| | 10. Which of the following devices do NOT utilize radio waves: Cellular telephones, radar, satellite, television remote controls. |
| | <p>11. The following image is an example of what common type of antenna?</p>  <p>Choices: Monopole, Dipole, Loop, Satellite Dish, Television, WHIP</p> |

| | |
|--|---|
| | <p>12. "Rabbit ears" antennas that were used years ago for analog television are versions of what type of antenna?</p> <p>Choices: Monopole, Dipole, Loop, Satellite Dish, Television, WHIP</p> |
| | <p>13. SMA connectors were developed in what decade?</p> |
| | <p>14. What is the level of impedance of a standard SMA connector?</p> |
| | <p>15. A WHIP antenna is a member of what more broad family of antennae?</p> <p>Choices: Monopole, Dipole, Loop, Satellite Dish, Television</p> |
| | <p>16. $P_r = \frac{P_t G_t A_r \sigma F^4}{(4\pi)^2 R^4}$ is more commonly known as what equation?</p> |
| | <p>17. What is the measure of the directivity, or focus in a certain direction, of the antenna's radiation pattern called?</p> |
| | <p>18. What does the variable A_r stand for in the above equation (16)?</p> |
| | <p>19. What does the variable F stand for in the above equation (16)?</p> |
| | <p>20. Beam width is _____ (directly, inversely, not at all) related to antenna gain.</p> |
| | <p>21. What federal organization in the US regulates radio spectrum allocation?</p> |
| | <p>22. What term refers to radio frequency signals coming from sources outside of a radar that transmit in the same frequency as the radar, masking potential targets of interest?</p> |
| | <p>23. What radar frequency band is characterized by waves with wavelengths between 2.5 cm and 3.75 cm?</p> |
| | <p>24. What are the common uses for the radar frequency band described above in question (23)?</p> |
| | <p>25. What radar frequency band is very strongly absorbed by atmospheric oxygen?</p> |