18. REVIEW QUESTIONS

1. Define the concept of an antenna in the most general terms. Think beyond electromagnetics.

2. Can a lightbulb be considered an antenna? If so what do you think is the range of frequencies it can radiate?

3. Explain the question of radiation safety.

4. Describe the Hertzian dipole and its most important properties.

5. The magnetic vector potential of a Hertzian dipole is often called a "retarded magnetic vector potential." What does "retarded" refer to and what is the practical meaning of this retardation?

6. Why is it convenient to use spherical coordinates for the calculation of antenna fields? Explain.

7. Define the following in terms of distance from the antenna:

(a) Fraunhoffer zone,

(b) Fressnel zone,

(c) Near field,

(d) Far field,

(e) Intermediate (inductive) zone.

8. Describe the characteristics of the near field. Why is the near field less important for antenna analysis than the far field?

9. Describe the characteristics of the far field. Compare to the near field. Indicate those characteristics that make antennas useful.

10. Define the concept of radiation pattern. What is the purpose of plotting radiation patterns?

11. What is the difference between electric field and magnetic field radiation patterns? Is it sufficient to plot only one of them? Why?

12. Explain why the power radiation patterns are most important for antenna characterization.

13. Define the beamwidth of an antenna.

14. Describe the difference between radiation intensity, average radiation intensity, and radiated power.

15. Explain directivity and maximum directivity. What does each define and what is the difference between them?

16. The radiation efficiency of antennas is usually quite high. The reasons for this high efficiency are (mark correct answer):

(a) Large radiation resistance and large antenna size.

(b) Low internal impedance and large radiation resistance.

(c) Small antenna size and low radiation impedance.

(d) Low internal impedance and small antenna size.

17. What is a loop antenna? Define its main properties.

18. If you could measure the magnetic and electric fields of an antenna in the near field, could you tell the difference between a loop antenna and a linear dipole antenna? How?

19. Show that the Poynting vector of a loop antenna in the near field is imaginary. What does this mean?

20. The fields of linear dipoles and loop antennas are indistinguishable from each other in the far field *T*/*F*.

21. Can an electric dipole be used to receive transmission from a magnetic dipole and vice versa? Explain.

22. What is the equivalency relation between an electric and a magnetic dipole?

23. Compare the properties of the half-wavelength dipole and those of the Hertzian dipole. Why is the half-wavelength dipole so much better?

24. From the values in **Table 18.2** what can you say about the use of larger antennas?

25. Can any antenna length be used? Explain the implications of doing so.

26. Can a monopole antenna be used without a "ground"? Explain.

27. If a ground is needed but a true ground is not available, how would you create it? For example, suppose you are in a hot-air balloon and want to use a monopole antenna for transmission.

28. What are the differences between a monopole and dipole antenna? Use a $\lambda/4$ monopole and a $\lambda/2$ dipole for discussion.

29. Define what an antenna array is. Why do we use antenna arrays?

30. How do the properties of antenna arrays vary from those of the individual elements in the array?

31. State the reciprocity theorem. Why is this theorem so important for transmission and reception?

32. Two wire antennas must be parallel to each other to serve as transmitter and receiver or must have at least a partial projection that is parallel *T*/*F*.

33. Suppose two linear (electric) dipoles are located in space at an angle α. To maximize reception, α should be close to zero *T*/*F*.

34. A transmitter used for cellular telephones uses a loop antenna, placed horizontal to the ground. What must be the direction of the receiving cellular telephone's antenna for maximum reception if it uses a monopole?

35. Define effective aperture of an antenna.

36. The effective aperture of antennas gives the antenna (equivalent) size *T*/*F*.

37. How can you increase the effective aperture of an electric dipole?

38. How can you increase the effective aperture of a loop antenna.

39. Describe the essentials of a radar installation.