MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Electromagnetic waves consist of
   A) high-frequency gravitational waves.
   B) oscillating electric and magnetic fields.
   C) compressions and rarefactions of electromagnetic pulses.
   D) particles of light energy.

2) The main difference between a radio wave and a light wave is its
   A) frequency. B) wavelength. C) speed. D) all of these. E) two of these.

3) Which of these electromagnetic waves has the shortest wavelength?
   A) ultraviolet waves
   B) infrared waves
   C) radio waves
   D) light waves
   E) X-rays

4) The source of all electromagnetic waves is
   A) electric fields.
   B) vibrating charges.
   C) magnetic fields.
   D) heat.
   E) none of these.

5) Light will almost always travel from one place to another along a path of least

6) The law of reflection holds for
   A) curved mirrors. B) plane mirrors. C) both of these. D) neither of these.

7) Diffuse reflection occurs when the size of surface irregularities is
   A) small compared to the wavelength of the light used.
   B) large compared to the wavelength of the light used.

8) When light reflects from a surface, there is a change in its
   A) speed. B) wavelength. C) frequency. D) all of these. E) none of these.

9) The bending of light as it refracts actually
   A) lengthens the time of travel.
   B) has nothing to do with the time of travel.
   C) shortens the time of travel.
10) Atmospheric refraction makes the daylight hours a bit
   A) longer in summer but shorter in winter.
   B) longer.
   C) shorter.

11) To say that energy levels in an atom are discrete is to say the energy levels are well defined and
   A) private.
   B) separate from one another.
   C) separated from one another by the same energy increments.
   D) continuous.

12) An atom that absorbs a photon of a certain energy can then emit
   A) only a photon of the same or higher energy.
   B) only a photon of the same or lower energy.
   C) only a photon of that energy.
   D) a photon of any energy.

13) The ratio of the energy of a photon to its frequency is
   A) π.
   B) the photon's wavelength.
   C) Planck's constant.
   D) the photon's speed.
   E) not known.

14) Which has less energy per photon?
   A) red light
   B) blue light
   C) Both have the same energy.

15) Which of the following photons has the greatest energy?
   A) red light
   B) ultraviolet
   C) green light
   D) blue light
   E) infrared

16) The photoelectric effect best demonstrates the
   A) wave nature of light.
   B) particle nature of light.
   C) both of these.
   D) none of these.

17) A lump of energy associated with light is called a
   A) photon.
   B) quantum.
   C) both of these.
   D) neither of these.

18) Quantization of electron energy states in an atom is better understood in terms of the electron's
   A) particle nature.
   B) wave nature.
   C) neither of these.

19) In the Bohr model of hydrogen, discrete radii and energy states result when an electron circles the atom in an
   A) de Broglie wavelengths.
   B) wave frequencies.
   C) diffraction patterns.
   D) none of these.

20) A beam of electrons has
   A) particle properties.
   B) wave properties.
   C) both of these.
   D) neither of these.
21) Compared to the average diameter of a hydrogen atom, the average diameter of a helium atom is
   A) larger.          B) about the same.          C) smaller.

22) Which radiation has no electric charge associated with it?
   A) beta rays        B) alpha rays         C) gamma rays
   D) all of these     E) none of these

23) When a nucleus emits a beta particle, its atomic number
   A) remains constant, and so does its mass number.
   B) changes, but its mass number remains constant.
   C) changes, and so does its mass number.
   D) remains constant, but its mass number changes.
   E) none of these.

24) An atom with an imbalance of electrons to protons is
   A) a baryon.        B) a hadron.         C) an ion.
   D) an isotope.      E) none of these.
Answer Key
Testname: UNTITLED1.TST

1) Answer: B
2) Answer: E
3) Answer: E
4) Answer: B
5) Answer: E
6) Answer: C
7) Answer: B
8) Answer: E
9) Answer: C
10) Answer: B
11) Answer: B
12) Answer: B
13) Answer: C
14) Answer: A
15) Answer: B
16) Answer: B
17) Answer: C
18) Answer: B
19) Answer: A
20) Answer: C
21) Answer: C
22) Answer: C
23) Answer: B
24) Answer: C