PHY2054 Spring 2019 Exam 3

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1. Under what motions will an electron produce electromagnetic radiation?

   (a) Slowing down
   (b) Oscillations
   (c) Uniform circular motion
   (d) All of the above

2. Which of the following classic examples of radiation is a form of electromagnetic radiation?

   (a) Alpha radiation
   (b) Beta radiation
   (c) Gamma radiation
   (d) Delta radiation

3. Beta radiation is composed of what?

   (a) Protons
   (b) Neutrons
   (c) Electrons
   (d) Electromagnetic radiation

4. An electron in a radio antenna oscillates up and down the antenna at a frequency of 500 MHz. What frequency of electromagnetic radiation is emitted by this electron?

   (a) 250 MHz
   (b) 500 MHZ
   (c) 1000 MHz
   (d) No electromagnetic radiation would be emitted in this scenario

5. Light traveling in air ($n = 1$) is incident against a piece of glass ($n = 1.55$) at an angle of 30^o measured relative to the normal. What angle would the reflected light travel at, measured relative to the normal?

   (a) 19^o
   (b) 30^o
   (c) 51^o
   (d) 72^o

6. Light traveling in air ($n = 1$) is incident against a piece of glass ($n = 1.55$) at an angle of 30^o measured relative to the normal. What angle would the transmitted light travel at, measured relative to the normal?

   (a) 19^o
   (b) 30^o
   (c) 51^o
   (d) 72^o

7. Light traveling in glass ($n = 1.55$) moves with what speed?

   (a) 1.93×10^8 m/s
   (b) 3×10^8 m/s
   (c) 4.65×10^8 m/s
   (d) 6×10^8 m/s

8. Light traveling in water ($n = 1.33$) has a wavelength of 550nm when it enters a piece of acrylic ($n = 1.49$). What would the wavelength of the light be in the acrylic?

   (a) 267nm
   (b) 472nm
   (c) 491nm
   (d) 1010nm

9. What is the maximum angle at which light can travel from acrylic ($n = 1.49$) into glass ($n = 1.55$)?

   (a) 40^o
   (b) 42^o
   (c) 74^o
   (d) There is no maximum angle at which this occurs

10. What is the maximum angle at which light can travel from acrylic ($n = 1.49$) into water ($n = 1.33$)?

    (a) 42^o
    (b) 49^o
    (c) 63^o
    (d) There is no maximum angle at which this occurs

11. What had to be assumed by Planck in order to explain the ultraviolet catastrophe?

    (a) Blackbodies only emit light at low temperatures
    (b) Light must be emitted as a continuous wave
    (c) Light must be emitted as discrete packets with a minimum energy
    (d) None of the above

12. A photon has a wavelength of 450nm. How much energy does the photon carry?

    (a) 1.54×10^{-19} J
    (b) 2.79×10^{-19} J
    (c) 4.41×10^{-19} J
    (d) 6.72×10^{-19} J

13. An LED bulb emits light of frequency 5.6×10^{14} Hz at 20W. How many photos per second are being produced by this bulb?

    (a) 3.28×10^{19}
    (b) 5.39×10^{19}
    (c) 8.95×10^{19}
    (d) 1.45×10^{20}

14. Which piece of the electromagnetic spectrum has the highest energies?

    (a) Radio waves
    (b) Visible light
    (c) X rays
    (d) Gamma rays

15. Which color of light has the longest wavelength

    (a) Red
    (b) Yellow
    (c) Green
    (d) Blue

16. Which of the following is a classical prediction of the photoelectric effect that was shown to be wrong by experiment?

    (a) There exists a minimum frequency of light to release electrons from a metal plate
    (b) There exists a minimum brightness of light to release electrons from a metal plate
    (c) Assuming shining light on a metal plate releases electrons, the electrons are released instantaneously
    (d) Increasing the brightness of light shining on a metal plate increases the number of electrons released, assuming any are released to begin with

17. How much kinetic energy would an electron depart a magnesium plate, with a work function of $\phi = 5.86 \times 10^{-19}$ J, if light with a wavelength of 100nm was shined on it?

    (a) 1.4×10^{-18} J
    (b) 2.7×10^{-18} J
    (c) 5.5×10^{-18} J
    (d) 8.9×10^{-18} J

18. What minimum frequency of light would need to shine on a nickel plate, with a work function of $\phi = 8.36 \times 10^{-19}$ J, in order to produce photoelectrons?

    (a) $1.26{\times}10^{14}$ Hz

    (b) $4.67{\times}10^{14}$ Hz

    (c) $9.66{\times}10^{14}$ Hz

    (d) $1.26{\times}10^{15}$ Hz

19. Wave-particle duality refers to what?

    (a) The fact that waves can act like particles

    (b) The fact that particles can act like waves

    (c) The fact that waves can act like particles and particles can act like waves

    (d) None of the above

20. Which of the following experiments covered in class was not integral to proving that light acted like a particle?

    (a) The ultraviolet catastrophe (blackbody radiation)

    (b) The photoelectric effect

    (c) Compton scattering

    (d) Electron diffraction