Department of Physics
University of Maryland, College Park

Final Exam, Physics 106 — Fall 2000

Please first write your name and social socurity number (as identification number) on the answer sheet.

This exam consists of 100 statements which are either correct or wrong. For each statement, find the corresponding number on the answer sheet. If the statement is correct, fill in the circle A with a No. 2 *pencil*. If not, fill in the circle B.

• The following properties of light shows that it is a wave phenomenon:
(1) interference. +
(2) reflection. −
(3) diffraction. +
(4) refraction. −
(5) polarization. +
(6) scattering. +

• If two waves interfere destructively, their phase difference is
(7) 180°. +
(8) $\pi/2$. −
(9) π. +

• If two sources of waves are 1/4 wavelength apart. When they oscillate in phase, the phase difference at a point along the straight line connecting the two sources is
(10) 90°. +
(11) $\pi/4$. −
(12) 0°. −

• If two waves interfere destructively at a point, and the amplitude of one of them is 4 and the other is 3, the resulting amplitude is
(13) 7. −
(14) 1. +

• Consider the reflection of light from the surface of a thin film. If the reflections from the first and second surfaces are soft and hard, respectively, and the thickness of the film is one-half of the wavelength, the phase difference between the two reflected waves is
(15) 90°. −
(16) 180°. −
(17) 360°. +

• When two light sources are coherent, we mean
(18) they have the same wavelength. −
(19) they have a fixed phase relation. +
(20) they have the same spatial locations. −
(21) the have the same intensity. −

• In Young's double-slit experiment, the spacing between the fringes on the observation screen is
(22) proportional to the wavelength. +

(23) proportional to the distance between two slits. −
(24) proportional to the distance between the source screen and the observation screen. +
(25) proportional to the frequency of light. −

• Consider the diffraction of four narrow slits. The number of dark fringes between the two very bright ones is
(26) 1. −
(27) 3. +
(28) 4. −

• In a class demo, we shows the interference pattern from gratings. When the density of slits in a grating increases, the distance between the bright diffraction spots
(29) increases. +
(30) decreases. −

• An interferometer can be used to measure
(31) the speed of the Earth relative to ether. +
(32) the air temperature variation by lighting up a match. +
(33) the wavelength of a light. −

• Suppose the diffraction pattern of a triangle is a star, the diffraction pattern of a screen with a triangle hole will be the geometrical image of the light source plus
(34) a triangle of the same size. −
(35) a star of the same size. +
(36) a star of different size. −

• The example of standing waves include (37) string vibration in a violin. +
(48) water wave after dropping a stone in a pond. −
(39) pattern in a Lippmann plate. +

• Consider the diffraction of a plane wave through a small hole. The size of the central diffraction pattern
(40) is inversely proportional to the wavelength. −
(41) is proportional to the size of the hole. −
(42) is proportional to the distance between the hole and the screen. +

• If your vision is 20/40, which means
(43) you can see the letters 40 feet away which a person with normal vision can see at 20 feet. −
(44) you can see the letters 40 meters feet away which a person with normal vision can see at 20 meters. −
(45) you can see the letters 20 feet away which a person with normal vision can see at 40 feet. +

• The resolution power of a normal eye is about
(46) 1/30 degree. −
(47) 1/60 degree. +

• Rayleigh's scattering law can explain
(48) why the sky is blue. +

(49) why the sun is reddish when setting. +
(50) why the scattered light is polarized. −
(51) why the smoke looks bluish when illuminated from the side and viewed on the black background. +

• In a rectangular coordinate system, suppose a light is going in the z direction. The polarization of the light is most likely in
(52) the x direction. −
(53) the x and y plane. +

• Suppose a light is travelling in the z direction and gets scattered. You look at the scattered light along the x direction. The polarization of the light
(54) is in the x direction. −
(55) is in the y direction. +
(56) cannot be determined. −

• An unpolarized light in air is reflected from the surface of a glass. At the brewster's angle, the scattered light is
(57) polarized only if the original light is. −
(58) polarized in the direction perpendicular to the scattering plane. +
(59) polarized in the scattering plane. −

• Consider an unpolarized light passing through a polarizer oriented along the x direction and an analyzer along the y direction. The intensity of the light passing through the analyzer is
(60) 0. −
(61) 1/2 of the original intensity. +

• After going through a quarter-wave plate, a linearly polarized light
(62) becomes unpolarized. −
(63) remains to be linearly polarized. −
(64) becomes circularly polarized. +

The following will not be covered in the final exam.

• A hologram records
(65) the interference pattern formed from the object and reference beams.
(66) the diffraction pattern of the light going through the object.

• If a standard transmission hologram is viewed in ordinary red light rather than in laser light,
(67) no image is seen.
(68) the image is visible but appears fuzzier than with the laser illumination.

• The image in a hologram can be seen
(69) from any direction.
(70) from the direction of the reference beam.
(71) from the direction of the object beam.

• Why is it difficult to produce a hologram of a live person?
(72) The laser beam does not have long enough coherent length.
(73) The person cannot keep still long enough.

• In the photoelectric effect, the energy of the electrons leaving a metal depends on
(74) the frequency of the light.

(75) the time that the metal is exposed to light.

- In the photoelectric effect, the number of electrons leaving a metal depends on
  (76) the intensity of the light.
  (77) the frequency of the light.
  (78) the time that the metal is exposed to light.

- Einstein won the Nobel prize for his contribution to
  (79) the special theory of relativity.
  (80) the general theory of relativity.
  (81) the photoelectric effect.

- According to Einstein, the energy of a photon is related to
  (82) the light intensity.
  (83) the light frequency.

- If the light is a wave only, one cannot explain
  (84) diffraction.
  (85) the photoelectric effect.
  (86) why it travels in a straight line.

- According to modern physics, the electrons
  (87) sometimes behave like waves.
  (88) cannot produce diffraction.
  (89) are orbiting around nuclei and emitting electromagnetic radiations.

- Photons are produced in an atom when the eletrons
  (90) make transition from a high-energy state to lower ones.
  (91) are scattered by electrons in other atoms.
  (92) are in a stationary state.

- Electrons in an atom can be excited to higher energy states through
  (93) collisions with other atoms.
  (94) collisions with discharged electrons.

- The atomic composition of a distance star can be analyzed through
  (95) the intensity of the light it emits.
  (96) the light spectra.
  (97) the red shift of the light.

- Hubble discovered that the universe is expanding because light from stars
  (98) is not as bright as the light from the Sun.
  (99) is all red shifted.
  (100) is emitted from many years ago.