

Physics 10 Final (300 Pts MAX.)

6:20 pm WED, Spring 2004 - TEST B

1. The work output of a heat engine is equal to (a) the work input (b) the heat input (c) the heat output (d) the heat input minus the heat output
2. A heat engine with 40 percent thermal efficiency has a heat input of 100 J per cycle, the heat output of the engine is (a) 40 J (b) 50 J (c) 80 J (d) none of the preceding
3. The second law of thermodynamics states that (a) a cyclic heat engine cannot convert heat completely to work (b) a cyclic heat engine cannot have 100 percent efficiency (c) heat will not flow spontaneously from a colder body to a hotter body (d) all of the preceding
4. For a refrigerator, the high-temperature reservoir is (a) the freezer compartment (b) the room (c) the inside of the refrigerator (d) the refrigerator compressor
5. The difference between a diesel engine and a gasoline engine is (a) the type of fuel used (b) the type of ignition (c) cycle processes (d) all of these
6. The electric force between two charged particles (a) is repulsive for unlike charges (b) varies as $1/r$ (c) depends only on the magnitudes of the charges (d) is much, much greater than the gravitational force
7. Electrostatic charging (a) occurs best on dry days (b) must be done with a conductor (c) does not involve a transfer or movement of charge (d) none of the preceding
8. Lightning rods prevent damage by making contact with (a) streamers (b) stepped leaders (c) return strokes (d) dart leaders
9. Electric fields are represented graphically by (a) dots (b) lines of force (c) arrows that point in the direction of the force on a negative charge (d) a series of straight lines
10. Electric potential energy is given by (a) Coulomb's law (b) the law of charges (c) electric field lines (d) charge times voltage
11. The process of an atom absorbing radiation of one wavelength and emitting another is called (a) interference (b) incandescence (c) fluorescence (d) polarization
12. What is "destroyed" in destructive interference? (a) Wave form (b) Energy (c) Electric and magnetic fields (d) All of the preceding
13. Which type of wave would be diffracted by a door opening? (a) Sound waves (b) AM radio waves (c) FM radio waves (d) All of these
14. The polarizing direction of polarizing sunglasses is (a) vertical (b) horizontal (c) at a 45 degree angle (d) immaterial
15. When the temperature of an incandescent solid is increased, (a) the emitted light intensity is less (b) there is an ultraviolet catastrophe (c) the most intense spectral component is shifted to a higher frequency (d) nothing changes
16. The excited mercury vapor in a fluorescent lamp emits what type of radiation? (a) Infrared (b) Ultraviolet (c) Visible (d) Heat
17. Polarization involves (a) orientation of field vectors (b) bending of light around corners (c) interference (d) longitudinal waves
18. Light in which the electric field is in only one direction is (a) monochromatic (b) polarized (c) produced by interference (d) not an electromagnetic wave
19. For ray reflection from a surface, (a) the angle of reflection equals the angle of incidence (b) the reflection angle is measured from a normal to the surface (c) all the rays lie in the same plane (d) all of these
20. A refracted ray is bent away from the normal when entering which type of medium? (a) air to water (b) less optically dense (c) more optically dense (d) all of these
21. If a medium has a critical angle of 43° , which of the following angles of incidence would give refraction? (a) 40° (b) 44° (c) 45° (d) none of these
22. In most transparent materials, which color of light has the greatest angle of refraction from the incident ray direction? (a) red (b) green (c) yellow (d) blue
23. A spherical converging lens (a) is free of aberrations (b) cannot form images on a screen (c) is thicker at its center than at its periphery
24. The critical angle for a water-air interface is about 48° . Light will be transmitted from the water for an angle of incidence of (a) 60° (b) 52° (c) 48° (d) 44°
25. A visual defect that occurs naturally with age is (a) astigmatism (b) color blindness (c) nearsightedness (d) not being able to see near objects clearly

26. Which of the following is *not* a subtractive primary color? (a) Cyan (b) Green (c) Magenta (d) Yellow
27. An upright image is seen when looking through (a) a terrestrial telescope (b) an astronomical telescope (c) a Galilean telescope (d) both (a) and (c)
28. The sky appears blue as a result of (a) selective absorption (b) selective reflection (c) selective transmission (d) preferential scattering
29. Rayleigh scattering explains (a) color vision (b) the blueness of the sky (c) additive color production (d) subtractive color production
30. In the late evening, no color is seen because of lack of stimulation of (a) rods (b) cones (c) cornea (d) crystalline lens
31. In a thermodynamic process a quantity of gas expands, doing 100 J of work. If only 25 J of energy are added to the system in the process, what is the energy deficit, and where does this energy come from? (a) -75 J (b) -25 J (c) -100 J (d) 25 J
32. A system receives 25 kcal of heat energy. If 5.0 kcal go into internal energy, how many joules of energy of mechanical work are done by the system? (a) 20KJ (b) 84 KJ (c) 25 KJ (d) 5.0 KJ
33. During a certain thermodynamic process a sample of gas expands and cools, reducing its internal energy by 3000 J, while no heat is added or taken away. How much work is done during this process? (a) 3000 cal (b) 3000 Joule (c) 4000 Joule (d) 4000 cal
34. What is the ideal efficiency of an OTEC power plant where fuel is heated to 2700 K and the outdoor air is at 270 K? (a) 10% (b) 20% (c) 90% (d) 80%
35. To pellets, each with a charge of 1 microcoulomb (10^{-6} C), are located 3 cm (0.03 m) apart. What is the electric force between them? What mass object would experience this same force in the Earth's gravitational field? (a) 6 N (b) 10 N (c) 3 N (d) 20 N
36. The wattage marked on a light bulb is not an inherent property of the bulb but depends on the voltage to which it is connected, usually 110 or 120 V. How many amperes flow through a 120-W bulb connected in a 120-V circuit? (a) 0.5 A (b) 2.0 A (c) 0.75 A (d) 1.0 A
37. Using the equation Power = current • voltage, find the current drawn by a 1200-W hair dryer connected to 120 V. Then using the method you used in the previous problem, find the resistance of the hair dryer. (a) 10 A, 12 Ω (b) 12 A, 10 Ω (c) 120 A, 1200 Ω (d) 5 A, 6 Ω
38. How much does it cost to operate a 100-W lamp continuously for 1 week if the power utility rate is 15 cents/kWh. (a) \$15.00 (b) \$2.52 (c) 5.00 (d) 10.00
39. What is the force on a proton located in an electric field of 3000 N/C? What is the proton's acceleration? (a) 4.8×10^{-16} N (b) 9.6×10^{-16} N (c) 2.4×10^{-16} N (d) 1.2×10^{-16} N
40. If the coils of a heater have a resistance of 10 Ω when hot, what current does the heater require? (a) 10 amp (b) 12 amp (c) 20 amp (d) 24 amp
41. A light bulb has a resistance of 250 Ω . What voltage is required for the bulb to draw a current of 0.4 A? (a) 10 Volt (b) 1000 Volt (c) 100 Volt (d) 200 Volt
42. A 3- Ω resistor is connected with a 12- Ω resistor and the combination is connected to a 12-V battery. How much current does the battery supply? (a) 4.0 amp (b) 0.8 amp (c) 8.0 amp (d) 0.4 amp
43. How far does the light travel in one year? This distance is known as a light-year and is commonly used length in astronomy. (a) 9.46×10^8 km (b) 9.46×10^{12} km (c) 9.46×10^{13} km (d) 2.592×10^{10} km
44. Light in air is incident on a surface at an angle of 60° . What is its angle of refraction in glass? ($n_G = 1.5$) (a) 22° (b) 35.264° (c) 40° (d) 60°
45. Locate the image of an arrow placed 60 cm from a diverging lens with a focal length of 30 cm. (a) 20 cm (b) -20 cm (c) 60 cm (d) -60 cm
46. Over what range of positions can an object be located so that the image produced by a converging lens is real and smaller than the object? (a) $d_o > 2f$ (b) $d_o < 2f$ (c) $d_o < f$ (d) $d_o > f$
47. What is the speed of light in glass with an index of refraction of 1.6? (a) 1.6×10^8 m/sec (b) 1.875×10^8 m/sec (c) 3.0×10^8 m/sec (d) 4.0×10^8 m/sec
48. If it takes light 5ns to travel 1 m in an optical cable, what is the index of refraction in the cable? (a) 1.3333 (b) 1.5 (c) 2.0 (d) 3.0
49. The index of refraction for red light in material X is measured at 1.80. It is determined that blue light travels $5 \cdot 10^6$ m/s slower than red light in this material. What is the index of refraction for blue light in material X? (a) 1.8634 (b) 1.7900 (c) 1.7800 (d) 1.90
50. The red light from a helium-neon laser has a wavelength of 633 nm. What is its frequency? (a) 4.739×10^{13} cycle/sec (b) 6.33×10^{14} cycle/sec (c) 4.739×10^{14} cycle/sec (d) 6.33×10^{13} cycle/sec