

Physics 10 Final (300 Pts MAX.)

6:20 pm WED, Spring 2004 - TEST A

1. A heat engine converts (a) work to heat energy (b) heat energy to work (c) heat from a low-temperature reservoir to heat in a high-temperature reservoir (d) none of the preceding
2. Thermal efficiency is equal to the ratio of (a) work out/heat in (b) heat out/heat in (c) heat in/heat out (d) heat out/work out
3. According to the first law of thermodynamics, if heat is added to a closed system, it goes into (a) entropy (b) work (c) internal energy (d) work and/or internal energy
4. The heat output of a heat pump is equal to (a) work input (b) heat input (c) sum of (a) and (b) (d) none of the preceding
5. A heat engine with 100% efficiency would not violate the (a) first law (b) second law (c) third law
6. Electric charge (a) is not a fundamental property (b) is given an arbitrary sign designation (c) always experiences an attractive force (d) is found associated only with electrons
7. An insulator may be electrostatically charged by (a) friction (b) contact (c) induction (d) all of these
8. Lightning takes place by (a) intracloud discharges (b) cloud-to-cloud discharges (c) cloud to ground discharges (d) all of these
9. The electric field has units of (a) m/s (b) N-m (c) N/C (d) none of these
10. Electric potential is (a) the force per charge (b) the same as electric potential energy (c) the electric potential energy per charge (d) given by Coulomb's law
11. White light is (a) fluorescent (b) ultraviolet (c) waves with only magnetic field (d) polychromatic
12. When two waves interfere in phase, the result is (a) fluorescence (b) decreased wave amplitude (c) destructive interference (d) none of the preceding
13. Waves may be deviated from a straight-line path by (a) reflection (b) refraction (c) diffraction (d) all of these
14. Light may be polarized by (a) absorption (b) reflection (c) scattering (d) all of these
15. What type of light can be coherent? (a) Spontaneous emission (b) Monochromatic and in phase (c) Narrow beam divergence (d) Monochromatic only
16. The dual nature of light refers to the (a) quantum properties of light (b) wave and particle characteristic properties of light (c) frequency and wavelength properties of light (d) none of these
17. The bending of waves around corners is called (a) interference (b) diffraction (c) reflection (d) polarization
18. Incandescent lamps produce predominantly (a) monochromatic light (b) polarized light (c) visible light (d) infrared radiation
19. A light ray is a line drawn perpendicular to (a) a wavelength (b) a wave front (c) a beam (d) none of the preceding
20. The law of reflection applies for (a) specular reflection (b) diffuse reflection (c) irregular reflection (d) all of these
21. In refraction, which of the following wave properties is unchanged? (a) frequency (b) wavelength (c) speed (d) all of these
22. Total internal reflection could occur for light in which of the following media transitions? (a) vacuum to glass (b) water to air (c) glass to water (d) both (b) and (c)
23. Dispersion is a factor in (a) a diamond's fire (b) the rainbow (c) chromatic aberration (d) all of these
24. Lens aberrations give rise to (a) external reflection (b) internal reflections (c) a diamond's brilliance (d) blurred images
25. Color vision results from photosensitive cells called (a) pupils (b) rods (c) cones (d) none of these
26. Which of the following is *not* an additive primary color? (a) Red (b) Green (c) Yellow (d) Blue
27. A simple microscope magnifies by (a) internal reflection (b) refractively widening the angle of view (c) reducing the accommodation (d) affecting the rod cells in the retina

28. Light with wavelengths greater than 600nm appears to have the general color of (a) blue (b) green (c) yellow (d) red
29. The film of a camera corresponds to what part of the eye? (a) aperture (b) retina (c) cornea (d) iris
30. Various types of telescope, use (a) visible light (b) radio waves (c) infrared radiation (d) all of the preceding
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. A heat engine does 125 J of work each cycle while receiving 375 J of heat per cycle. What is the engine's thermal efficiency? (a) 20% (b) 33% (c) 40% (d) 60%
34. Suppose the heat engine in with 40% efficiency had a heat input of 180 kcal per cycle. What would be the heat output? (a) 40 Kcal (b) 120 Kcal (c) 108 Kcal (d) 180 Kcal
35. Two point charges are separated by 6 cm. The attractive force between them is 20 N. Find the force between them when they are separated by 12 cm. (What can you answer this problem without knowing the magnitudes of the charges?) (a) 6 N (b) 5 N (c) 12 N (d) 20 N
36. A droplet of ink in an industrial ink-jet printer carries a charge of $1.6 \cdot 10^{-10}$ C and deflected onto paper by a force of $3.2 \cdot 10^{-4}$ N. Find the strength of the electric field to produce this force. (a) 2.0×10^6 N/C (b) 3.2×10^6 N/C (c) 2.0×10^6 N (d) 3.2×10^6 N
37. Rearrange the equation Current = voltage/resistance to express resistance in terms of current and voltage. Then solve the following: A certain device in a 120-V circuit has a current rating of 20 A. What is the resistance of the device (how many ohms)? (a) 20 Ω (b) 120 Ω (c) 6 Ω (d) 10 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 electric force of attraction between charges of +3 C and -6 C separated by distance 2m? (a) -40.5×10^8 N (b) -20.25×10^8 N (c) -40.5×10^9 N (d) -20.25×10^9 N
40. What is the resistance of a light bulb that draws 0.5 A when it is plugged into a 120-V outlet? (a) 48 Ω (b) 240 Ω (c) 24 Ω (d) 480 Ω
41. Two 1 1/2 -V batteries are connected in series to a 3- Ω resistor. How much current flows through each battery? (a) 6 amp (b) 2.5 amp (c) 1.5 amp (d) 1 amp
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. A 6-cm-tall object is placed 60 cm from a concave mirror with a focal length of 20 cm. Find the location and size of the image. (a) 20 cm (b) 60 cm (c) 30 cm (d) 120 cm
44. If light in air is incident at 30°, at what angle is it refracted in water? ($n_w = 1.3333$) (a) 22° (b) 44° (c) 12° (d) 41.8°
45. Light from the bottom of a swimming pool is incident on the surface at an angle of 30 degrees. What is the angle of refraction? ($n_w = 1.3333$) (a) 30° (b) 60° (c) 41.8° (d) 20°
46. The focal length of a converging lens is 30 cm. Locate the image of an object placed 60 cm from the center of this lens. (a) 30 cm (b) 60 cm (c) 90 cm (d) 15 cm
47. How many diopters are there for a converging lens with a focal length of 0.4 cm? (a) 100 diopter (b) 200 diopter (c) 250 diopter (d) 300 diopter
48. The speed of light in diamond is $1.24 \cdot 10^8$ m/s. What is the index of refraction for diamond? (a) 1.24 (b) 2.4194 (c) 3.0 (d) 1.5
49. If an optical cable has an index of refraction of 1.5, how long will it take a signal to travel between two points on opposite coasts of the United States separated by a distance of 5000 km? (a) 1.5 sec (b) 1.0 sec (c) 0.5 sec (d) 0.025 sec
50. For crown glass, the index of refraction for violet light is 1.532, and the index of refraction for red light is 1.515. How much faster is red light than violet light in this medium? (a) 2.22×10^6 m/sec (b) 3.00×10^6 m/sec (c) 3.22×10^6 m/sec (d) 4.22×10^6 m/sec