

Physics 10 2nd Midterm (350 pts MAX.) – TEST D Spring 2005

1. 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
2. For a refrigerator, the high-temperature reservoir is (a) the freezer compartment (b) the room (c) the inside of the refrigerator (d) the refrigerator compress
3. Entropy is a measure of (a) thermal efficiency (b) internal energy (c) the capability to do work (d) temperature
4. 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
5. 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
6. Electrostatic charges can be placed on an object by (a) friction (b) contact (c) induction (d) all of these
7. What is "destroyed" in destructive interference? (a) Wave form (b) Energy (c) Electric and magnetic fields (d) All of the preceding
8. The polarizing direction of polarizing sunglasses is (a) vertical (b) horizontal (c) at a 45 degree angle (d) immaterial
9. The excited mercury vapor in a fluorescent lamp emits what type of radiation? (a) Infrared (b) Ultraviolet (c) Visible (d) Heat
10. 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
11. 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
12. 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
13. 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
14. Ray optics is a convenient way to represent (a) interference (b) diffraction (c) reflection (d) wavelength
15. A lens thicker at the center than at the edge is called a lens. (a) converging (b) convex (c) diverging (d) both (a) and (b)
16. Which of the following is *not* a subtractive primary color? (a) Cyan (b) Green (c) Magenta (d) Yellow
17. The sky appears blue as a result of (a) selective absorption (b) selective reflection (c) selective transmission (d) preferential scattering
18. In the late evening, no color is seen because of lack of stimulation of (a) rods (b) cones (c) cornea (d) crystalline lens
19. For a photon to cause the emission of an electron, it must have a frequency (a) equal to Planck's constant (b) in the visible region (c) greater than the threshold frequency (d) none of the preceding
20. A laser (a) amplifies light (b) produces monochromatic light (c) produces coherent light (d) all of these
21. Which of the following is NOT a laser application (a) printing computer output (b) stimulating rainfall from clouds (c) making very precise measurements (d) playing compact disc audio recordings (e) engraving wood
22. A carbon dioxide laser has a nominal wavelength of 10.6 micrometers. What is its frequency? (a) 300,000 hertz (b) 2.8×10^{13} hertz (c) 1.06 gigahertz (d) 2.8×10^{10} hertz (e) none of above
23. Light amplification in a laser is due to (a) spontaneous emission (b) the photoelectric effect (c) stimulated emission (d) the ultraviolet catastrophe
24. In a thermodynamic process a quantity of gas expands, doing 100 J of work. If only zero 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
25. During a certain thermodynamic process a sample of gas expands and cools, reducing its internal energy by 4000 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
26. Determine the maximum possible efficiency for a steam engine operating between 200°C and 27.0°C . (a) 3.65% (b) 36.5 % (c) 365% (d) 0.365%

27. 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
28. A chlorine ion contains 17 protons, 18 neutrons, and 18 electrons. What is the charge of the ion? (a) Positive (b) Negative (c) No charge (d) None of the above
29. What is the resistance of a light bulb that draws 1.0 A when it is plugged into a 120-V outlet? (a) 60Ω (b) 120Ω (c) 180Ω (d) 240Ω
30. A $3\text{-}\Omega$ resistor is connected with a $12\text{-}\Omega$ resistor and the combination is connected to a 12-V battery. How much current does the battery supply? (a) 1.0 Amp (b) 0.9 Amp (c) 0.8 Amp (d) 0.7 Amp
31. What is the radius of the spherical surface that would produce a mirror with a focal length of 5 m? (a) 5 m (b) 10 m (c) 15 m (d) 20 m
32. 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°
33. 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) $d_o > f$
34. 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
35. The red light from a helium-neon laser has a wavelength of 633 nm. What is its frequency? (a) 6.71×10^4 cycle /sec (b) 2.0×10^{14} cycle /sec (c) 4.74×10^{14} cycle /sec (d) 8.74×10^{14} cycle /sec
36. As we saw earlier, the Moon subtends an angle of about 0.009 rad as seen from Earth. Using the fact that the human eye has its optical center 17.1 mm in front of the retina, how big is the image of the Moon formed by the eye? (a) 0.1 mm (b) 0.2 mm (c) 0.3 mm (d) 0.4 mm
37. 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
38. 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
39. A heat engine with 100% efficiency would not violate the (a) first law (b) second law (c) third law
40. 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
41. Lightning takes place by (a) intracloud discharges (b) cloud-to-cloud discharges (c) could to ground discharges (d) all of these
42. 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
43. White light is (a) fluorescent (b) ultraviolet (c) waves with only magnetic field (d) polychromatic
44. Waves may be deviated from a straight-line path by (a) reflection (b) refraction (c) diffraction (d) all of these
45. What type of light can be coherent? (a) Spontaneous emission (b) Monochromatic and in phase (c) Narrow beam divergence (d) Monochromatic only
46. The bending of waves around corners is called (a) interference (b) diffraction (c) reflection (d) polarization
47. 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
48. What is the ideal efficiency of an OTEC power plant where fuel is heated to 2700 K and the outdoor air is at 540 K? (a) 10% (b) 20% (c) 90% (d) 80%
49. Two point charges are separated by 6 cm. The attractive force between them is 24 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
50. 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 12 A. What is the resistance of the device (how many ohms)? (a) 20Ω (b) 120Ω (c) 6Ω (d) 10Ω