

Physics 10 2nd Midterm (300 pts MAX.) – TEST A

Spring 2005

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. 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
3. A heat engine with 100% efficiency would not violate the (a) first law (b) second law (c) third law
4. 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
5. Lightning takes place by (a) intracloud discharges (b) cloud-to-cloud discharges (c) could to ground discharges (d) all of these
6. 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
7. White light is (a) fluorescent (b) ultraviolet (c) waves with only magnetic field (d) polychromatic
8. Waves may be deviated from a straight-line path by (a) reflection (b) refraction (c) diffraction (d) all of these
9. What type of light can be coherent? (a) Spontaneous emission (b) Monochromatic and in phase (c) Narrow beam divergence (d) Monochromatic only
10. The bending of waves around corners is called (a) interference (b) diffraction (c) reflection (d) polarization
11. What type of diffraction is observed in everyday activities (a) light (b) sound (c) electron (d) X-ray
12. The law of reflection applies for (a) specular reflection (b) diffuse reflection (c) irregular reflection (d) all of these
13. 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)
14. Lens aberrations give rise to (a) external reflection (b) internal reflections (c) a diamond's brilliance (d) blurred images
15. The "beam" of a flashlight is seen as a result of (a) diffuse reflection (b) refraction (c) dispersion (d) internal reflection
16. Color vision results from photosensitive cells called (a) pupils (b) rods (c) cones (d) none of these
17. 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
18. The film of a camera corresponds to what part of the eye? (a) aperture (b) retina (c) cornea (d) iris
19. The catastrophe of the ultraviolet catastrophe was (a) a shift or change in color with temperature (b) a violation of the conservation of energy (c) the emission of thermal radiation (d) none of these
20. For a hydrogen atom, which of the following quantum states has the greatest energy value? (a) $n = 1$ (b) $n = 2$ (c) $n = 5$ (d) $n = 10$
21. The first laser was made by (a) Charles Townes (b) Theodore Maiman (c) Gordon Gould (d) Nikolai Basov and Aleksander Prokhorov (e) H. G. Wells
22. The coherence of laser light is important for (a) no practical applications (b) drilling holes (c) getting laser light to pass through air (d) holography (e) none of above
23. The quantum hypothesis was introduced by (a) Einstein (b) Planck (c) Bohr (d) DeBroglie
24. In a stimulated emission process, an excited atom is struck by a photon of the same energy of the allowed transition, and the atom emits an identical photon. After emission, the two photons (a) have the same frequency (b) are emitted in the same direction (c) are in phase (d) all of these
25. 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
26. 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%
27. 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
28. 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

29. What is the electric force of attraction between charges of +3 C and -6 C separated by distance 2m? (a) -405×10^9 N (b) -40.5×10^9 N (c) -4.05×10^9 N (d) -0.405×10^9 N
30. If the coils of a heater have a resistance of 100Ω when hot, what current does the heater require? It is plugged into a 120-V outlet. (a) 0.12 Amp (b) 1.2 Amp (c) 12 Amp (d) 120 Amp
31. An unpolarized light beam of 800 W/m^2 is incident on an ideal pair of crossed linear polarizers. Now a third such polarizer is inserted between the other two with its transmission axis at 45° to that of each of the others. Determine the emerging irradiance after the insertion of the third polarizer and explain what's happening. (a) 2000 W/m^2 (b) 200 W/m^2 (c) 20 W/m^2 (d) 2.0 W/m^2
32. A 6-cm-tall object is placed 60 cm from a concave mirror with a focal length of 20 cm. Find the location of the image. (a) 20 cm (b) 60 cm (c) 30 cm (d) 120 cm
33. 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°
34. 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
35. 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
36. What is the wavelength of the red light from the helium-neon laser when it is in glass with an index of refraction of 1.6? The wavelength of a vacuum is 633 nm. (a) 3.956 nm (b) 39.56 nm (c) 395.6 nm (d) 3,956 nm
37. Two lenses with focal lengths of + 0.100 m and -0.333 m are held close together on a common center line. Compute the focal length and the power of the combination. (a) 5.0 D (b) 6.0 D (c) 7.0 D (d) 8.0 D
38. 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
39. 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
40. 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
41. 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
42. Lightning rods prevent damage by making contact with (a) streamers (b) stepped leaders (c) return strokes (d) dart leaders
43. Electric potential energy is given by (a) Coulomb's law (b) the law of charges (c) electric field lines (d) charge times voltage
44. The process of an atom absorbing radiation of one wavelength and emitting another is called (a) interference (b) incandescence (c) fluorescence (d) polarization
45. 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
46. 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
47. Polarization involves (a) orientation of field vectors (b) bending of light around corners (c) interference (d) longitudinal waves
48. A heat engine does 125 J of work each cycle while receiving 625 J of heat per cycle. What is the engine's thermal efficiency? (a) 20% (b) 33% (c) 40% (d) 60%
49. A system in contact with a furnace receives 5000 J of heat while doing 3000 J of work on its surroundings. What, if any, is the change in the internal energy of the system? (a) 2300 J (b) 2.0 kJ (c) 23 J (d) 2.3 J
50. 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? (a) 6 N (b) 10 N (c) 3 N (d) 20 N