

Physics 10 Final (250 pts) – Test A
T Th 5:30, Spring 2003

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. 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
3. An insulator may be electrostatically charged by (a) friction (b) contact (c) induction (d) all of these
4. Lightning takes place by (a) intracloud discharges (b) cloud-to-cloud discharges (c) could to ground discharges (d) all of these
5. The electric field has units of (a) m/s (b) N-m (c) N/C (d) none 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. Electric charge is measured in units of (a) volts (b) coulombs (c) newtons (d) de Graaffs
8. 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
9. 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
10. What is the Fahrenheit temperature for 100°C ? (a) 100°F (b) 200°F (c) 212°F (d) 32°F
11. Can the reading on the Celsius and Fahrenheit scales be the same at a particular temperature? If so, what is it? (a) 40 (b) 80 (c) -40 (d) -80
12. What is Kelvin temperature when the Fahrenheit and Celsius temperature are equal? (a) 233 K (b) 313 K (c) 40 K (d) -40 K
13. A heat energy with 40% thermal efficiency has a heat input of 100 joules per cycle. What is the heat output? (a) 100 Joules (b) 60 Joules (c) 40 Joules (d) 20 Joules
14. What would be the final temperature of a mixture of 50 g of 20°C water and 50 g of 40°C water? (a) 20°C (b) 30°C (c) 40°C (d) 50°C
15. What would be the final temperature when 100 g of 25°C water is mixed with 75 g of 40°C water? (a) 25°C (b) 31.4°C (c) 40°C (d) 20°C
16. Suppose a bar 1 m long expands 0.5 cm when heated. By how much will a bar 100 m long of the same material expand when similarly heated? (a) 100 m (b) 100.05 m (c) 100.5 m (d) 105 m
17. Will burns a 0.6-g peanut beneath 50 g of water, which increases in temperature from 22°C to 50°C . Assuming 40% efficiency, what is the food value in calories of the peanut? (a) 3500 cal (b) 500 cal (c) 2200 cal (d) 600 cal
18. Find the mass of 0°C ice that 10 g of 100°C steam will completely melt. (a) 10 g (b) 80 gm (c) 100 g (d) 50 g
19. A 50-gram chunk of 80°C iron is dropped into a cavity in a very large block of ice at 0°C . How many grams of ice will melt? (The specific heat capacity of iron is $0.11 \text{ cal/g}^{\circ}\text{C}$.) (a) 5.5 g (b) 11 gm (c) 5 g (d) 50 g
20. 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 J (b) 1000 J (c) 2000 J (d) 4000 J
21. What is the ideal efficiency of an automobile engine where fuel is heated to 2700 K and the outdoor air is at 270 K? (a) 27% (b) 54% (c) 90% (d) 80%
22. Two 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) 20 N (b) 10 N (c) 5 N (d) 3 N

23. 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 60-W bulb connected in a 120-V circuit? (a) 0.5 A (b) 1.0 A (c) 0.5 V (d) 1.0 V
24. Using the equation Power = current \times voltage, find the current drawn by a 1200-W hair dryer connected to 120 V. (a) 10 A (b) 120 A (c) 20 A (d) 30 A
25. How much does it cost to operate a 100-W lamp continuously for 2 weeks if the power utility rate is 15 ¢/kWh? (a) \$2.52 (b) \$25.2 (c) \$5.04 (d) \$0.252
26. White light is (a) fluorescent (b) ultraviolet (c) waves with only magnetic field (d) polychromatic
27. When two waves interfere in phase, the result is (a) fluorescence (b) decreased wave amplitude (c) destructive interference (d) none of the preceding
28. Waves may be deviated from a straight-line path by (a) reflection (b) refraction (c) diffraction (d) all of these
29. Light may be polarized by (a) absorption (b) reflection (c) scattering (d) all of these
30. A light ray is a line drawn perpendicular to (a) a wavelength (b) a wave front (c) a beam (d) none of the preceding
31. The law of reflection applies for (a) specular reflection (b) diffuse reflection (c) irregular reflection (d) all of these
32. In refraction, which of the following wave properties is unchanged? (a) frequency (b) wavelength (c) speed (d) all of these
33. 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)
34. Color vision results from photosensitive cells called (a) pupils (b) rods (c) cones (d) none of these
35. Which of the following is *not* an additive primary color? (a) Red (b) Green (c) Yellow (d) Blue
36. 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
37. Light with wavelengths greater than 600nm appears to have the general color of (a) blue (b) green (c) yellow (d) red
38. 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
39. Classical theory predicted (a) photocurrent to be proportional to light intensity (b) electron energy to depend on light frequency, but not on intensity (c) no photoemission below a certain light frequency regardless of intensity (d) both (b) and (c)
40. 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) $n = 10$
41. The *s* in the acronym laser stands for (a) simple (b) spontaneous (c) specific (d) stimulated
42. Which is NOT a component of a Maglev? (a) Magnetic Levitation/Suspension (b) Guidance (c) Propulsion (d) Wheel-and-Railroad
43. Which shape has the lowest Cd (picture)? (a) square (b) cone (c) half of cone
44. How fast can the Maglev train travel? (a) 150 mph (b) 200 mph (c) 250 mph (d) 300 mph
45. When you are taking a picture, the distance between you and the camera has to be more than _____ times of the focal distance. (a) 4 (b) 3 (c) 2 (d) 1
46. A ray of light is incident on a piece of glass at an angle of 45° . If the angle of refraction is 25.37° , find the refractive index (a) 1.50 (b) 1.450 (c) 1.6500 (d) 1.7500
47. What would be the ideal efficiency of a machine having a hot reservoir and exhaust were the same temperature – say 400 k? (a) 100% (b) 0% (c) 50% (d) 75%
48. Double reflection in a rain drop produces a _____ rainbow (a) Primary (b) Secondary (c) Third (d) Fourth
49. A cloud is composed of various sizes of water-droplets. The tiniest scatter _____ light, slightly larger ones scatter green light, and still larger ones scatter red light. The result is a white cloud. (a) Blue (b) Yellow (c) Orange (d) Purple
50. If your skin is very moist – so that your resistance is only 1000Ω – and you touch the terminals of a 12-volt battery, how much current do you receive? (a) 0.12A (b) 0.012A (c) 1.2A (d) 12A