

Physics 10 Final (250 pts) – Test A

T Th 1:30, Spring 2003

1. 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
2. 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
3. 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
4. Lightning rods prevent damage by making contact with (a) streamers (b) stepped leaders (c) return strokes (d) dart leaders
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. Electric potential energy is given by (a) Coulomb's law (b) the law of charges (c) electric field lines (d) charge times voltage
7. Electrostatic charges can be placed on an object by (a) friction (b) contact (c) induction (d) all of these
8. 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
9. An insulator may be electrostatically charged by (a) friction (b) contact (c) induction (d) all of these
10. What is the normal human body temperature 98.6°F in $^{\circ}\text{C}$? (a) 37°C (b) 98.6°C (c) 74°C
11. A child has a temperature of 40°C . Is this serious? Explain in $^{\circ}\text{F}$. (a) 40°F (b) 72°F (c) 104°F (d) 80°F
12. If a heat engine has heat input of 1000 Joules and rejects 600 joules while doing work. What is the thermal efficiency? (a) 60% (b) 40% (c) 100% (d) 50%
13. A heat energy with 40% thermal efficiency has a heat input of 100 joules per cycle. What is the heat output? (a) 60 Joules (b) 100 Joules (c) 40 Joules (d) 20 Joules
14. If you wish to warm 100 kg of water by 20°C for your bath, how much heat is required? (a) 100 kcal (b) 1000 kcal (c) 2000 kcal (d) 2000 cal
15. What will be the final temperature of 100 g of 20°C water when 100 g of 40° iron nails are submerged in it? (The specific heat of iron is $0.12 \text{ cal/g } ^{\circ}\text{C}$. Here you should equate the heat gained by the water to the heat lost by the nails.) (a) 20°C (b) 22°C (c) 40°C (d) 12°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 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. (a) 20 N (b) 10 N (c) 5 N (d) 12 N
23. A certain device in a 120-V circuit has a current rating of 20 A. What is the resistance of the device? (a) 6 ohms (b) 20 ohms (c) 20 A (d) 20 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 1 week if the power utility rate is 15 ¢/kWh? (a) \$2.52 (b) \$25.2 (c) \$5.04 (d) \$0.252
26. The process of an atom absorbing radiation of one wavelength and emitting another is called (a) interference (b) incandescence (c) fluorescence (d) polarization
27. What is “destroyed” in destructive interference? (a) Wave form (b) Energy (c) Electric and magnetic fields (d) All of the preceding
28. Which type of wave would be diffracted by a door opening? (a) Sound waves (b) AM radio waves (d) FM radio waves (d) All of these
29. The polarizing direction of polarizing sunglasses is (a) vertical (b) horizontal (c) at a 45 degree angle (d) immaterial
30. 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
31. 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
32. In 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
33. 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
34. 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
35. Which of the following is *not* a subtractive primary color? (a) Cyan (b) Green (c) Magenta (d) Yellow
36. 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)
37. The sky appears blue as a result of (a) selective absorption (b) selective reflection (c) selective transmission (d) preferential scattering
38. Planck’s hypothesis (a) explained the photoelectric effect (b) justified the ultraviolet catastrophe (c) required classical wave theory (d) allowed for only discrete energies for thermal oscillators
39. 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
40. When the electron of a hydrogen atom moves from an excited state to the ground state, (a) a photon is emitted (b) thermal energy is absorbed (c) several photons of different frequencies are emitted (d) the electron has a positive energy value
41. A laser (a) amplifies light (b) produces monochromatic light (c) produces coherent light (d) all of these
42. What material is the Space Shuttle mostly made of? (a) Aluminum (b) Gossamer (c) Nanotubes (d) Ionomers
43. What makes the Maglev Float? (a) Magnets (b) Electricity (c) Motor
44. What is the best degrees ($^\circ\text{F}$) for the fresh food compartment? (a) 0°F (b) 35°F to 40°F (c) 10°F to 22°F (d) 25°F to 50°F
45. Which component of HEV converts hydrogen to electricity and stores it in the battery? (a) Ultra Capacitor (b) Flywheel (c) Battery (d) Motor
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. A cloud is composed of various sizes of water droplets. The tiniest scatter blue light, slightly larger ones scatter _____ light, and still larger ones scatter red light. The result is a white cloud (a) Yellow (b) Orange (c) Green (d) Purple
48. _____ reflection in a rain drop produces a secondary rainbow (a) single (b) double (c) Triple (d) quadruple
49. Because of _____, a submerged object appears to be nearer to the surface than it actually is. (a) reflection (b) refraction (c) diffraction (d) interference
50. What is the resistance of an electric frying pan that draws 12A when connected to a 120 V circuits (a) 5Ω (b) 10Ω (c) 100Ω (d) 15Ω