

# Physics 10 Final (300 Pts MAX.) – TEST B

## T TH 3:50 PM, Spring 2004

1. 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
2. Lightning rods prevent damage by making contact with (a) streamers (b) stepped leaders (c) return strokes (d) dart leaders
3. Electric potential energy is given by (a) Coulomb's law (b) the law of charges (c) electric field lines (d) charge times voltage
4. 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
5. 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
6. 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
7. A roaring fire transfers heat to a person sitting nearby chiefly by (a) conduction (b) convection (c) radiation (d) both (a) and (b)
8. The freezing point of water is decreased by (a) the addition of more water (b) pressure (c) dissolved table salt (d) both (b) and (c)
9. Sunlight feels warm on the skin primarily because of (a) visible radiation (b) microwaves (c) ultra-violet radiation (d) infrared radiation
10. Heat is (a) a form of energy (b) energy transferred because of a temperature difference (c) internal energy in transit (d) all of the preceding
11. Which of the following is the highest temperature? (a)  $0^{\circ}\text{F}$  (b)  $0^{\circ}\text{C}$  (c)  $0^{\circ}\text{K}$  (d) all are equal
12. The specific heat of substance A is ten times greater than that of substance B. If equal amounts of heat are added to equal masses of the substances, the temperature increase of substance A is (a) the same as that of B (b) ten times greater than that of B (c)  $1/10$  that of B (d) none of the preceding
13. The specific heat of water is  $1.0 \text{ kcal/kg}\cdot^{\circ}\text{C}$ . If the temperature of  $2.0 \text{ kg}$  of water is lowered by  $10^{\circ}\text{C}$ , the amount of heat removed would be (a)  $2 \text{ kcal}$  (b)  $5 \text{ kcal}$  (c)  $10 \text{ kcal}$  (d)  $20 \text{ kcal}$
14. The speed of sound is (a) independent of temperature (b) generally greater in liquids than in solids (c) on the order of  $34 \text{ m/s}$  in air (d) none of these
15. The speed of sound in air is  $340 \text{ m/s}$ . If a plane flies at a speed of  $510 \text{ m/s}$ , it has a Mach number of (a)  $1.5$  (b)  $2.0$  (c)  $2.5$  (d)  $2.7$
16. The speed of sound in air on a day when the air temperature is  $25^{\circ}\text{C}$  is (a)  $331 \text{ m/s}$  (b)  $346 \text{ m/s}$  (c)  $352 \text{ m/s}$  (d)  $360 \text{ m/s}$
17. A Doppler "blue shift" occurs when (a) the source is moving away from a stationary observer (b) an observer is moving away from a stationary source (c) the observer and source are moving towards each other (d) the observer and source are stationary
18. If the motions of two oscillators were opposite, we say they are (a) in SHM (b) in phase (c) out of phase (d) both (b) and (c)
19. The energy of a wave (a) is proportional to the square of its amplitude (b) is equal to  $Iat$  (c) falls off as  $1/r^2$  (d) all of the preceding
20. When driven at resonance, a rope vibrates (a) out of phase (b) at only one possible frequency (c) at only the  $2^{\text{nd}}$  harmonic or  $2^{\text{nd}}$  overtone (d) at maximum amplitude
21. An insulator may be electrostatically charged by (a) friction (b) contact (c) induction (d) all of these
22. The electric field has units of (a)  $\text{m/s}$  (b)  $\text{N}\cdot\text{m}$  (c)  $\text{N/C}$  (d) none of these
23. Electric charge is measured in units of (a) volts (b) coulombs (c) newtons (d) de Graaffs
24. 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

25. 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
26. For every natural process, the entropy of the universe (a) decreases (b) remains constant (c) is destroyed in part (d) increases
27. The energy associated with a phase change is called (a) latent heat (b) specific heat radiation (d) none of the preceding
28. Heat transfer takes place because of a difference in (a) potential energy (b) heat content (c) specific heat (d) temperature
29. Ice, water, and steam coexist at the (a) melting point (b) dew point (c) boiling point (d) triple point
30. Thermal expansion, or an increase in dimensions with increasing temperature, occurs (a) in most substances (b) in very few substances (c) only in metals (d) both (b) and (c)
31. Gusts of wind make the Sears Building in Chicago sway back and forth at a vibration frequency of about 0.1 Hz. What is its period vibration? (a) 0.1 sec (b) 5 sec (c) 10 sec (d) 20 sec
32. Radio waves travel at the speed of light 300,000 km/s. What is the wavelength of radio waves received at 100.1 MHz on your FM radio dial? (a) 300,000 km (b) 100.1 km (c) 3 m (d) 100.1 m
33. If a train of freight cars, each 10m long, rolls by you at the rate of three cars each second. What is the speed of the train? (a) 10 m/sec (b) 20 m/sec (c) 30 m/sec (d) 30 m
34. What beat frequencies are possible with tuning forks of frequencies 259, and 261 Hz? (a) 1 Hz (b) 2 Hz (c) 3 Hz (d) 4 Hz
35. A bat flying in a cave emits a sound and receives its echo 0.1 s late. How far away is the cave wall? (a) 17 m (b) 34 m (c) 51 m (d) 102 m
36. How much more intense than the threshold of hearing is a sound of 30 dB? (a) 10 times (b) 100 times (c) 1000 times (d) 3 times
37. If you wish to warm 100 kg of water by 30° C for your bath, how much heat is required? (a) 1000 Kcal (b) 2000 Kcal (c) 3000 Kcal (d) 4000 Kcal
38. 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) 1000 Cal (b) 1500 Cal (c) 2500 Cal (d) 3500 Cal
39. Convert the temperature 120°F to the Celsius scale: (a) 120°C (b) 45°C (c) 48.89°C (d) 15°C
40. What is the Kelvin temperature when the Fahrenheit and Celsius temperatures are equal? (a) 40K (b) -40C (c) -40F (d) 233K
41. What would be the final temperature when 100 g of 25° C water is mixed 75 g of 40° C water? (a) 31.4°C (b) 31.4°F (c) 31.4°K (d) 22.1°C
42. 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
43. What is the ideal efficiency of an OTEC power plant where fuel is heated to 2700 K and the outdoor air is at 270 K? (a) 10% (b) 20% (c) 90% (d) 80%
44. 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) 6 N (b) 10 N (c) 3 N (d) 20 N
45. Using the equation Power = current • voltage, find the current drawn by a 1200-W hair dryer connected to 120 V. Then using the method you used in the previous problem, find the resistance of the hair dryer. (a) 10 A, 12 Ω (b) 12 A, 10 Ω (c) 120 A, 1200 Ω (d) 5 A, 6 Ω
46. 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
47. 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
48. 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)  $2.0 \times 10^6$  N/C (b)  $3.2 \times 10^6$  N/C (c)  $2.0 \times 10^6$  N (d)  $3.2 \times 10^6$  N