

PS 104

public final EXAM

$4186 \text{ J} = 1 \text{ kcal}$
$L_f = 80 \text{ kcal/kg}$
$L_v = 540 \text{ kcal/kg}$
$c_{\text{ice}} = 0.5 \text{ kcal/kg } ^\circ\text{C} = 2093 \text{ J/kg } ^\circ\text{C}$
$c_{\text{steam}} = 0.48 \text{ kcal/kg } ^\circ\text{C} = 2009 \text{ J/kg } ^\circ\text{C}$
$c_{\text{water}} = 1 \text{ kcal/kg } ^\circ\text{C} = 4186 \text{ J/kg } ^\circ\text{C}$

- Young's modulus for aluminum is 7.00×10^{10} Pa. To increase the length by 1 mm, the force needed to stretch an 800-mm long aluminum wire whose diameter is 2.00 mm is
 - 2.75 N
 - 275 N
 - 1.10 kN
 - 2.75 kN
 - 220 N
- Given $1 \text{ atm} = 1.01325 \times 10^5$ Pa and the density of seawater is 1030 kg/m^3 . Find the total pressure on a scuba diver when she is 15 m below the surface of the sea.
 - 1.51×10^5 Pa
 - 2.52×10^5 Pa
 - 5.0×10^4 Pa
 - 2.02×10^5 Pa
 - 1.63×10^5 Pa
- An object suspended from a produce scale is lowered into a pail filled to the brim with a liquid. Four Newtons of the liquid overflows. In the liquid, the scale indicates that the object weighs 6 N. What did the scale read when the object was weighed in the air?
 - 2 N
 - 4 N
 - 6 N
 - 10 N
 - 16 N
- A horizontal pipe of 10 cm^2 cross-sectional area is joined to another pipe of 50 cm^2 cross-sectional area. The speed of the water ($\rho = 1000 \text{ kg/m}^3$) in the small pipe is 6 m/s and the pressure there is 200 kPa. The speed of the water in the large pipe is
 - 0.24 m/s
 - 1.2 m/s
 - 3 m/s
 - 13 m/s
 - 6.7 m/s

5. Absolute zero may be regarded as that temperature which
- water freezes
 - all gases become liquids
 - all substances become solid
 - molecular motion in an ideal gas would be the minimum
 - the Celsius and Kelvin scales have identical readings
6. The temperature of a gas is held constant which its volume is reduced. The pressure the gas exerts on the walls of the container increases because its molecules
- strike the container walls more often
 - strike the container walls with higher speeds
 - have more kinetic energy
 - have a reduced density
 - are below absolute zero
7. A copper bar is 1.0 m long at 20°C. Assuming the coefficient of linear expansion of copper is $1.7 \times 10^{-5}/^{\circ}\text{C}$, at what temperature is the bar shorter by 1.0 mm?
- 17°C
 - 39°C
 - 59°C
 - 79°C
 - 7°C
8. A 1.00 L sample of an ideal gas at 0°C and 100 kPa pressure is compressed to 0.25 L while the temperature is raised to 273 °C. The new pressure of the gas is
- 50 kPa
 - 100 kPa
 - 200 kPa
 - 400 kPa
 - 800 kPa
9. When a vapor condenses into a liquid
- it absorbs heat
 - it releases heat
 - its temperature rises
 - its temperature drops
 - all physical concepts remain constant

10. Heat transfer in a gas can occur by
- radiation only
 - convection only
 - radiation and convection only
 - conduction only
 - radiation, convection, and conduction
11. A 1.0 kg lead bar (specific heat = $125.6 \text{ J/kg } ^\circ\text{C} = 0.03 \text{ kcal/kg } ^\circ\text{C}$) at 80°C is placed in 2.0 kg of water (specific heat = $4186 \text{ J/kg } ^\circ\text{C} = 1 \text{ kcal/kg } ^\circ\text{C}$) at 20°C . The final temperature of the lead bar is
- 21°C
 - 28°C
 - 40°C
 - 50°C
 - 62°C
12. Fifteen megajoules of heat is removed from 5 kg steam initially at 200°C . The resultant form is
- a mixture of steam and liquid water
 - liquid water
 - a mixture of liquid water and ice
 - ice
 - a mixture of ice and steam
13. A frictionless heat engine can be 100 % efficient only if its exhaust temperature is
- exactly equal to its input temperature
 - much less than its input temperature
 - 0°C
 - 0 K
 - infinite
14. A pellet of aluminum with mass 4.5g and is initially at a temperature of 20°C . Determine the final temperature of the pellet (in $^\circ\text{C}$) after adding 200J of heat to the pellet. The specific heat of aluminum is $920 \text{ J/kg } ^\circ\text{C} = 0.22 \text{ kcal/ kg } ^\circ\text{C}$.
- 68
 - 56
 - 43
 - 24
 - 23

15. Compute the efficiency (in percent) of a Heat Engine which performs work at a rate of 4000 J/cycle while rejecting 4200 J/cycle to the environment.

- a) 5.00
- b) 47.6
- c) 48.8
- d) 95.2
- e) 97.6

16. In order to oscillate at 10 Hz a mass of 12 g should be suspended from a spring with a spring constant of:

- a) 47 N/m
- b) 56 N/m
- c) 76 N/m
- d) 79 N/m
- e) 82 N/m

17. The distance between crests of a wave is observed to be 0.50 m . If the frequency of the waves is 20 Hz determine the wave speed (in m/s).

- a) 5.0
- b) 10
- c) 40
- d) 0.10
- e) 0.050

18. A 120 g mass is connected to a spring which stretches 3.3 mm for every 12 N of tension applied. Find the total energy in the system (in Joules) if the mass oscillates with a maximum displacement of 1.8 cm from its equilibrium position.

- a) 0.60
- b) 1.2
- c) 33
- d) 36
- e) 0.0019

19. A person is riding a bike at 10 m/s away from a stationary bell ringing at 500 Hz . What frequency will the rider hear? (speed of sound is 340 m/s)

- a) 473 Hz
- b) 485 Hz
- c) 489 Hz
- d) 509 Hz
- e) 515 Hz

20. A hiker in a canyon shouts and hears an echo 0.30s after the initial sound is made. If the speed of sound in air is 340 m/s, find the distance to the reflecting canyon wall (in meters).

- a) 317
- b) 106
- c) 50
- d) 103
- e) 52

21. Two sound waves interfere and produce a beat frequency of 252 Hz. Which of the following pairs of frequencies produces this phenomenon?

- a) 2520Hz and 3000Hz
- b) 400Hz and 242Hz
- c) 2504Hz and 2750Hz
- d) 1123Hz and 1375Hz
- e) 1252Hz and 1524Hz

22. A hollow metal sphere has a charge of +6.28 C and a diameter of 2.00 m the magnitude of the electric field in the center of the ring is (in N/C).

- a) 9×10^9
- b) 56.5×10^9
- c) 28.3×10^9
- d) 0
- e) 14.1×10^9

23. A metallic coin is given a positive charge. Which of the following is true?

- a) It has more protons than electrons
- b) It has an equal number of protons and neutrons
- c) It has an equal number of protons and electrons
- d) It has an equal number of electrons protons and neutrons
- e) It has more protons than neutrons

24. Three point charges are located on a meter stick such that $q_1 = +7.00 \mu\text{C}$ is located at 0, $q_2 = +2.00 \mu\text{C}$ is located at 0.5 m and $q_3 = -4.00 \mu\text{C}$ is located at 1 m, the magnitude of the net electric force on q_1 is (in N)

Given $1 \mu\text{C} = 10^{-6} \text{ C}$

- a) 0.437
- b) 0.756
- c) 0.252
- d) 1.01
- e) 0

25. The amount of charge that passes through a light bulb in 2.00 s is 1.67 C. The number of electrons that pass through it in 5.00 s is
- a) 1.60×10^{-19}
 - b) 2.61×10^{19}
 - c) 0.522×10^{19}
 - d) 0.835
 - e) 0.534×10^{-19}
26. If the current and the resistance of a circuit are both doubled, the power delivered to the circuit will
- a) remain the same
 - b) double
 - c) increase by a factor of 4
 - d) increase by a factor of 8
 - e) decrease
27. If the diameter of a resistor is halved while its length is doubled, the resistance in Ohms will
- a) remain the same
 - b) double
 - c) increase by a factor of 4
 - d) increase by a factor of 8
 - e) decrease
28. A 3.00 Ω , 6.00 Ω , and 9.00 Ω resistors are connected in parallel. The equivalent resistance of the combination (in Ω) is
- a) 200
 - b) 1.64
 - c) 11
 - d) 18.0
 - e) 1.00
29. A 2.00 Ω , 4.00 Ω , 5.00 Ω , and 7.00 Ω resistors are connected in series to a 6.00 V battery. The current through the 2.00 Ω resistor is (in A)
- a) 18.0
 - b) 0.333
 - c) 3.00
 - d) 6.00
 - e) 3.00
30. Which of the following is true?
- a) the sum of the currents entering any junction must equal the sum of the currents leaving that junction
 - b) the sum of the potential differences across all elements around any closed loop must be zero
 - c) charge is conserved at any point in an electrical circuit
 - d) any charge must gain as much energy as it loses as it moves around a closed loop if it starts and ends at the same point
 - e) all of these

ANSWER KEY

1. B	11. A	21. D
2. B	12. C	22. D
3. D	13. D	23. A
4. B	14. A	24. C
5. D	15. C	25. B
6. A	16. A	26. D
7. B	17. B	27. D
8. E	18. A	28. B
9. B	19. B	29. B
10. E	20. E	30. E