

Conceptual Physics Thermodynamics Practice Test 2011**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- _____ 1. Adiabatic processes occur in
- Earth's mantle.
 - the oceans.
 - the atmosphere.
 - all of the above.
 - none of the above
- _____ 2. As a system becomes more disordered, entropy
- remains the same.
 - decreases.
 - increases.
- _____ 3. When mechanical work is done on a system, there can be an increase in its
- temperature.
 - internal energy.
 - both of the above
 - none of the above
- _____ 4. In buildings that are electrically heated, turning the lights on
- doesn't waste energy.
 - wastes energy.
 - does neither of the above.
- _____ 5. Entropy measures
- temperature as volume increases.
 - temperature as pressure increases.
 - temperature at constant pressure.
 - messiness.
 - temperature at constant volume.
- _____ 6. The ideal efficiency for a heat engine operating between temperatures of 2950 K and 318 K is
- 11%.
 - 50%.
 - 25%.
 - 89%.
 - none of the above.
- _____ 7. 100 joules of heat is added to a system that performs 45 Joules of work. The internal energy change of the system is
- 0 J.
 - 55 J.
 - 45 J.
 - 145 J.
 - none of the above.

- _____ 8. Suppose the temperature of the input reservoir in a heat engine doesn't change. As the sink temperature is lowered, the efficiency of the engine
- stays the same.
 - decreases.
 - increases.
- _____ 9. The lowest possible temperature in nature is
- 273 degrees C.
 - 4 K.
 - 0 degrees C.
- _____ 10. Running a refrigerator with its door open in a hot room makes the room
- cooler.
 - warmer.
 - none of the above.
- _____ 11. Mix 2 liters of 10°C water with 3 liters of 30°C water and you'll have 5 liters of water at _____.
- 22°C
 - 28°C
 - 20°C
 - 24°C
- _____ 12. The greater the difference in temperature between the input reservoir and output reservoir for a heat engine, the
- less the efficiency.
 - greater the efficiency.
 - neither—efficiency doesn't depend on temperature difference.
- _____ 13. A change in temperature of 20°C is equal to a change of
- 273 K
 - 20 K
 - 253 K
 - 273 K
 - 293 K
- _____ 14. The first law of thermodynamics is a restatement of the
- Carnot cycle.
 - law of heat addition.
 - principle of entropy.
 - conservation of energy.
 - none of the above
- _____ 15. Two identical blocks of iron, one at 10 degrees C and the other at 20 degrees C, are put in contact. Suppose the cooler block cools to 5 degrees C and the warmer block warms to 25 degrees C. This would violate the
- first law of thermodynamics.
 - second law of thermodynamics.
 - both of the above
 - none of the above

- _____ 16. Your grandmother places a pitcher of iced tea next to a plate of warm, freshly baked cookies so that the pitcher and the plate are touching. You tell your grandmother that the plates are in thermal contact, which means that
- heat flows within the warm plate but not within the cold pitcher.
 - heat flows from the warm plate to the cold pitcher and from the cold pitcher to the warm plate.
 - heat flows from the cold pitcher to the warm plate.
 - heat flows from the warm plate to the cold pitcher.
- _____ 17. One thousand calories of heat are added to 150 grams of water when its temperature is 32°C . The resulting temperature of the water is
- 7°C
 - 32°C
 - 39°C
 - 80°C
 - 100°C
- _____ 18. Which is denser, ice at 0 degrees C or water at 4 degrees C?
- The water
 - The ice
 - They both have the same density.
- _____ 19. A volume of air has a temperature of 0 degrees Celsius. An equal volume of air that is twice as hot has a temperature of about
- 0 degrees C.
 - 2 degrees C.
 - 100 degrees C.
 - 273 degrees C.
 - none of the above
- _____ 20. You have a jar full of marbles. When you tip the jar over, all of the marbles roll away. You would not expect the marbles to spontaneously order themselves back into the jar because
- processes in which mechanical energy is turned into heat energy are probable and commonly observed.
 - processes in which heat energy is turned into mechanical energy are probable and commonly observed.
 - processes in which orderly states tend toward disorderly states are improbable and simply not observed.
 - processes in which disorderly states tend toward orderly states are improbable and simply not observed.
- _____ 21. Which temperature scale labels the freezing point of water at 0 degrees?
- Celsius
 - Caloric
 - Kelvin
 - Fahrenheit
 - none of the above

- _____ 22. If you squeeze a balloon to one third its original size, the pressure inside _____.
- increases by a factor of 3
 - increases by a factor of 9
 - decreases by a factor of 9
 - decreases by a factor of 3
 - stays the same

True/False

Indicate whether the statement is true or false.

- _____ 23. It is possible to wholly convert a given amount of heat energy into mechanical energy.
- _____ 24. Whenever heat is added to a system, it transforms to an equal amount of some other form of energy.
- _____ 25. It is possible to totally convert a given amount of mechanical energy into heat.

Problem

26. A 82-g iron bar at 140°C is placed in 300 g of water at 26°C . If the specific heat capacity of iron is $0.11 \text{ cal/g}^{\circ}\text{C}$, to what final temperature will the iron bar cool?
27. There is a type of power plant, known as OTEC, that operates on the temperature difference between warm surface waters and cool deep waters. What is the Carnot efficiency of such a plant if the surface water is 24°C and the deep water is 3°C ?
28. At what temperature would the molecules of a gas have twice the average kinetic energy they have at a 29°C room temperature?
29. What amount of heat is required to raise the temperature of 20 grams of water by 50°C ?
30. A metal bar expands 4.0 cm when heated. How much longer is a bar that expands 20.0 cm?

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Answer Section

MULTIPLE CHOICE

1. ANS: D PTS: 1 DIF: L1 OBJ: 24.3 Adiabatic Processes
STA: Ph.5.a KEY: adiabatic | heat BLM: knowledge
2. ANS: C PTS: 1 DIF: L2 OBJ: 24.7 Entropy
STA: Ph.3.d | Ph.3.e | Ph.3.f KEY: entropy | disorder
BLM: comprehension
3. ANS: C PTS: 1 DIF: L2 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: work | temperature | energy BLM: comprehension
4. ANS: A PTS: 1 DIF: L2 OBJ: 24.6 Order Tends to Disorder
STA: Ph.3.d | Ph.3.e | Ph.3.f KEY: energy | conservation
BLM: comprehension
5. ANS: D PTS: 1 DIF: L1 OBJ: 24.7 Entropy
STA: Ph.3.d | Ph.3.e | Ph.3.f KEY: entropy | disorder
BLM: knowledge
6. ANS: D PTS: 1 DIF: L2 OBJ: 24.5 Heat Engines and the Second Law
STA: Ph.3.b | Ph.3.g
KEY: efficiency | heat | engine BLM: application
7. ANS: B PTS: 1 DIF: L2 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: heat | work BLM: comprehension
8. ANS: C PTS: 1 DIF: L2 OBJ: 24.5 Heat Engines and the Second Law
STA: Ph.3.b | Ph.3.g
KEY: heat | engine | input BLM: comprehension
9. ANS: A PTS: 1 DIF: L1 OBJ: 24.1 Absolute Zero
STA: Ph.3.c | CA.IE.1i KEY: temperature | Kelvin
BLM: knowledge
10. ANS: B PTS: 1 DIF: L2 OBJ: 24.4 Second and Third Laws of Thermodynamics
STA: Ph.3.f
KEY: refrigerator | heat BLM: comprehension
11. ANS: A PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: water | volume BLM: application
12. ANS: B PTS: 1 DIF: L2 OBJ: 24.5 Heat Engines and the Second Law
STA: Ph.3.b | Ph.3.g
KEY: heat | engine | input BLM: comprehension
13. ANS: B PTS: 1 DIF: L2 OBJ: 31.1 Huygens' Principle
KEY: temperature | kelvin BLM: application
14. ANS: D PTS: 1 DIF: L1 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: thermodynamics | energy BLM: knowledge
15. ANS: B PTS: 1 DIF: L2 OBJ: 24.4 Second and Third Laws of Thermodynamics
STA: Ph.3.f
KEY: thermodynamics | first | law BLM: analysis
16. ANS: D PTS: 1 DIF: L2 OBJ: 21.2 Heat
STA: Ph.3.a KEY: heat | thermal contact BLM: application

17. ANS: C PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: calorie | heat | mass BLM: application
18. ANS: A PTS: 1 DIF: L2 OBJ: 21.9 Expansion of Water
STA: Ph.3.c KEY: dense | water | ice BLM: analysis
19. ANS: D PTS: 1 DIF: L2 OBJ: 24.1 Absolute Zero
STA: Ph.3.c | CA.IE.1i KEY: temperature | volume
BLM: comprehension
20. ANS: D PTS: 1 DIF: L2 OBJ: 24.6 Order Tends to Disorder
STA: Ph.3.d | Ph.3.e | Ph.3.f KEY: order | disorder
BLM: application
21. ANS: A PTS: 1 DIF: L1 OBJ: 21.1 Temperature
KEY: Celsius BLM: knowledge
22. ANS: A PTS: 1 DIF: L2 OBJ: 20.5 Boyle's Law
STA: Ph.2.c KEY: pressure | volume BLM: application

TRUE/FALSE

23. ANS: F PTS: 1 DIF: L2 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: heat | mechanical BLM: comprehension
24. ANS: T PTS: 1 DIF: L2 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: heat | energy BLM: comprehension
25. ANS: T PTS: 1 DIF: L2 OBJ: 24.2 First Law of Thermodynamics
STA: Ph.3.b KEY: heat | mechanical BLM: comprehension

PROBLEM

26. ANS:
29°C
- PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: specific heat | temperature BLM: application
27. ANS:
0.07
- PTS: 1 DIF: L2 OBJ: 24.5 Heat Engines and the Second Law
STA: Ph.3.b | Ph.3.g KEY: Carnot | efficiency
BLM: application
28. ANS:
331°C
- PTS: 1 DIF: L2 OBJ: 24.1 Absolute Zero
STA: Ph.3.c | CA.IE.1i KEY: kinetic | gas BLM: application
29. ANS:
1,000 cal
- PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: heat | temperature BLM: application

30. ANS:
5 times as long

PTS: 1
STA: Ph.3.c

DIF: L2
KEY: heat | expand

OBJ: 21.8 Thermal Expansion
BLM: application