Name _____ Note-Taker sheet

Exercises

24.1 Absolute Zero (page 469)

1. Is the following sentence true or false? There is no limit to how cold an object can get. _____
2. Define absolute zero.

_____

_____

_____

3. Circle the letter of each statement about a substance near absolute zero that is true.
   a. The thermal motion of its atoms approaches zero.
   b. The kinetic energy of its atoms approaches zero.
   c. A considerable amount of energy can still be removed from the substance.
   d. Its temperature can still be significantly lowered.
4. Is the following sentence true or false? Negative Kelvin temperature values do not exist. _____
5. Circle the letter that describes how the size of one Celsius degree and one Kelvin are related.
   a. They are equal.
   b. Celsius degrees are smaller.
   c. Celsius degrees are larger.
   d. They have no consistent relationship.

Match each term or description to its Kelvin temperature.

	Term	Definition
_____	6. absolute zero	a. 373 K
_____	7. melting point of ice	b. 0 K
_____	8. boiling point of water	c. 273 K

24.2 First Law of Thermodynamics (pages 470–471)

9. Is the following sentence true or false? The flow of heat is not directly related to the flow of energy. _____
10. The law of conservation of energy when applied to thermal systems is known as the _____.
11. Circle the letter that best describes what happens when heat is added to a system.
    a. Much of it is destroyed immediately.
    b. It transforms to an equal amount of some other form of energy.
    c. Much of it is lost.
    d. It is used to overcome friction.

12. A group of particles or objects that you want to analyze is called a(n) _____.

13. Describe two things energy added to a system can do.

_____

_____

14. Is the following sentence true or false? The first law of thermodynamics states that the heat added to a system is equal to the system's increase in internal energy and the external work done by the system. _____

15. Is the following sentence true or false? The internal energy of a system increases when the system does external work. _____

24.3 Adiabatic Processes (pages 472–474)

16. Circle the letter that describes the compression or expansion of a gas such that no heat enters or leaves a system.

a. ideal b. equibaric

c. constant d. adiabatic

17. Is the following sentence true or false? Adiabatic processes often occur very quickly. _____

18. Is the following sentence true or false? The compression and expansion of gases within the cylinders of an automobile engine is nearly adiabatic. _____

19. Circle the letter that describes what happens to a gas that undergoes an adiabatic compression.

a. It gains internal energy and its temperature increases.

b. It is compressed into a liquid by adiabatic liquefaction.

c. It loses internal energy and condenses.

d. Its volume decreases but its temperature remains constant.

20. What happens to a gas when it adiabatically expands and does work on its surroundings?

_____

_____

21. What are two ways the temperature of air can be increased?

_____

_____

22. Circle the letter that describes the adiabatic form of the first law of thermodynamics.

a. pressure = constant

b. energy out > energy in

c. change in air temperature ~ pressure change

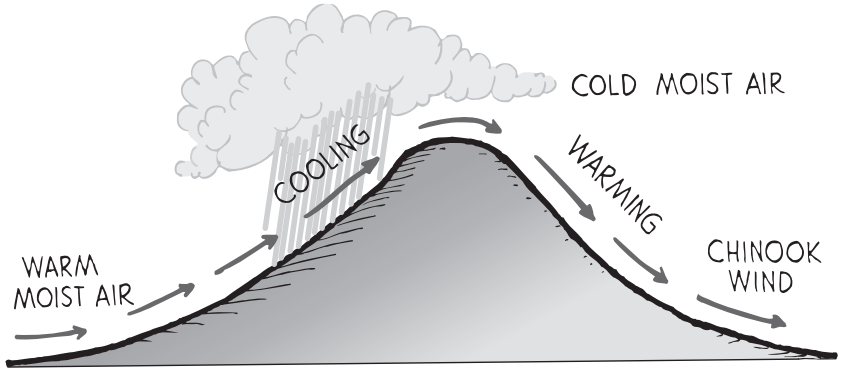
d. energy in = energy out + work

23. Is the following sentence true or false? Adiabatic processes occur in large air masses in the atmosphere. _____

24. Describe what happens to a large warm air blob as it gains several kilometers in altitude.

_____

Use the illustration below to answer questions 25 and 26.



25. Circle the letter that describes the process that occurs to create the warm wind.

a. adiabatic expansion b. adiabatic compression

c. isobaric contraction d. thermal gain from landmass

26. What type of weather do communities in the path of chinooks experience in mid-winter? _____

24.4 Second and Third Laws of Thermodynamics (pages 474–475)

27. Circle the letter of the thermodynamic law that states heat will never of itself flow from a cold object to a hot object.

a. first law of thermodynamics b. second law of thermodynamics

c. third law of thermodynamics d. fourth law of thermodynamics

28. Heat flows one way, from _____ to _____.

29. Describe how heat can be made to flow the other way—from cold to hot.

_____

30. What is the third law of thermodynamics?

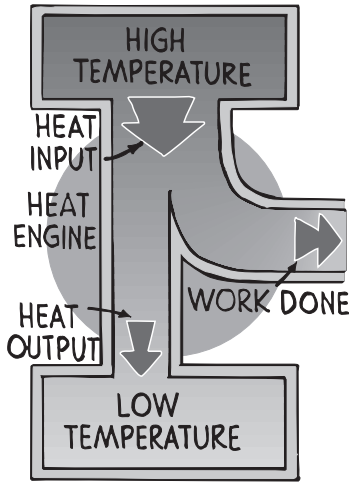
_____

24.5 Heat Engines and the Second Law (pages 475–478)

31. A device that changes internal energy into mechanical energy is called a(n) _____.

32. Is the following sentence true or false? For a heat engine to do mechanical work, heat must flow from a high temperature to a low temperature. _____

Use the illustration below of a heat engine to answer Questions 33–34.



33. Circle the letter of the source of the energy used by the heat engine to increase its internal energy.

a. work output b. the sun

c. low-temperature reservoir d. high-temperature reservoir

34. The energy that is not converted to usable mechanical energy is expelled at the _____.

35. Is the following sentence true or false? Many heat engines are able to convert all heat input into mechanical energy output.

_____

36. The ideal efficiency of a heat engine is known as its _____ efficiency.

37. Is the following sentence true or false? No heat engine can have an ideal efficiency of 100%. _____

38. What determines the ideal efficiency of a heat engine?

_____

39. When performing a calculation involving temperature ratios, the temperatures must be expressed using the _____ temperature scale.

24.6 Order Tends to Disorder (page 479)

40. Is the following sentence true or false? Usable energy tends to become disorganized and unusable. _____

41. Is the following sentence true or false? Once energy in an engine degenerates into nonuseful forms, it is unavailable to do the same work again. _____

42. Circle the letter that best describes how the second law of thermodynamics applies to order and disorder.

a. For all systems, overall order is constant.

b. Natural systems tend toward a state of greater disorder.

c. Natural systems are equally likely to become more ordered or more disordered.

d. All natural systems tend toward increasing order.

43. A sample of gas is contained in a sealed flask. Circle the letter with the greatest disorder.

a. the sample at 25°C in the sealed flask

b. the sample at 50°C in the sealed flask

c. the sample immediately after opening the flask

d. the sample after it expands to fill the room

44. Is the following sentence true or false? Even if work is done on disordered energy, it cannot become more ordered. _____

24.7 Entropy (pages 480–481)

45. Define entropy.

_____

46. Does disorder increase or decrease when entropy increases?

_____

47. Circle the letter that best describes the entropy of natural systems.

a. Most natural systems will have a constant level of entropy.

b. In the long run, the entropy will always increase.

c. In all but a few cases, entropy in the long run will decrease.

d. All natural systems have constant levels of entropy.

48. Circle the letter of each example of increasing entropy.

a. gas molecules escaping from a bottle

b. an unattended house breaking down

c. a plant using energy from the sun to form new cells

d. a breeze blowing papers off of your desk

49. Is the following sentence true or false? It is impossible for a natural system to change in a way such that its entropy decreases.

_____