

## Study guide CH. 21

### Multiple Choice

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

1. Temperature is related mostly to...
2. Which temperature scale labels the freezing point of water at 0 degrees?
3. Heat defined as...
4. Internal energy is ...
5. Heat is measured in \_\_\_\_\_.
6. The energy content of a piece of food is normally determined by...
7. Some molecules are able to absorb large amounts of energy in the form of internal vibrations and rotations. Materials composed of such molecules would have \_\_\_\_\_ specific heat capacities.

8. Specific heat capacity is related to the amount of internal energy ...
  
9. Which has the higher specific heat capacity, water or sand?
  
10. The reason an ocean's temperature doesn't vary much from one season to the next is that ...
  
11. The largest extremes in temperature are usually experienced ...
  
12. The fact that desert sand is very hot in the day and very cold at night is evidence that sand has a \_\_\_\_\_ specific heat capacity.
  
13. Which, at the same temperature, will cool more slowly on a hot day? Explain
  - a. Dry beans
  - b. Watermelon
  - c. Potatoes
  - d. Bread
  - e. All will cool at the same or similar rates.
  
14. If the specific heat capacity of water were higher than it is, lakes would be \_\_\_\_\_.
  - a. more likely to freeze
  - b. less likely to freeze
  - c. neither of the above
  
15. When an iron ring is heated, the hole becomes \_\_\_\_\_.
  
  
16. During a very cold winter, water pipes sometimes burst. The reason for this is ...

17. Which of the following expands most when the temperature is lowered?
- Helium
  - Iron
  - Wood
  - Water at 4 degrees C
18. A bimetallic strip will bend when heated because \_\_\_\_\_.
19. A container of water has its smallest volume at what temperature?
20. The reason fish live from year to year in ponds that freeze over in the winter is...
21. When water at 4 degrees C is heated, it expands. When water at 4 degrees C is cooled, it \_\_\_\_\_.
22. One thousand calories of heat are added to 150 grams of water when its temperature is 33°C. The resulting temperature of the water is
- 7°C
  - 32°C
  - 40°C
  - 80°C
  - 100°C
23. Consider a gap cut into a metal ring. If the ring is heated, the gap becomes \_\_\_\_\_.
- wider
  - narrower
  - neither
24. Which releases the most energy, 100 grams of 100°C water cooling to 50°C, or 100 grams of iron at 100°C cooling to 50°C? (The specific heat of iron is 0.12 cal/g°C.)
25. Which is denser, ice at 0 degrees C or water at 4 degrees C?

26. 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.
27. You are feeling sick, so you place a thermometer under your tongue to check your temperature. The directions on the box tell you to leave the thermometer there for three minutes before you read your temperature. Why should you wait?
- It takes some time for the thermometer to reach its activation energy.
  - It takes some time for the thermometer and your body to reach thermal equilibrium.
  - It takes some time for the thermometer to raise your body's internal energy.
  - It takes some time for the thermometer and your body to attain a state of contact.

### **True/False**

*Indicate whether the statement is true or false. IF THE STATEMENT IS FALSE, REWRITE THE STATEMENT TO MAKE IT TRUE.*

- \_\_\_ 28. A temperature scale that has 100 degrees between the boiling point and the freezing point of water is the Fahrenheit scale.
- \_\_\_ 29. Heat is the energy that moves from one object to another because of a temperature difference.
- \_\_\_ 30. The total of all energies in a substance is its temperature.
- \_\_\_ 31. A calorie is a common unit of force.
- \_\_\_ 32. The amount of heat required to change the temperature of a unit mass of a substance by 1 degree is its specific heat capacity.
- \_\_\_ 33. Liquids usually expand when heated.
- \_\_\_ 34. Gases don't expand very much when heated.
- \_\_\_ 35. A bimetallic strip consists of two strips of the same material welded together.
- \_\_\_ 36. Water contracts when heated from 0 degrees C to 4 degrees C.
- \_\_\_ 37. If you measure the temperature of room air, then the heat absorbed by the thermometer does not lower the air temperature noticeably.
- \_\_\_ 38. A substance at a high temperature is said to contain heat.

## Essay

39. What is a calorie? How many calories are in a joule? How many joules are taken in by a man who eats 4000 calories of food each day? What is this person's average thermal power output?
  
  
  
  
  
  
  
  
  
  
40. Write a short paragraph on how the high specific heat capacity of water helps us. Give at least three different examples.
  
  
  
  
  
  
  
  
  
  
41. Write a short paragraph on why fish live through the winter even though the pond they are in freezes over. What happens to the water temperature as the air temperature drops below freezing for the first time?
  
  
  
  
  
  
  
  
  
  
42. Explain why putting a dented table-tennis ball in a pot of boiling water will help remove the dent.

## Problem

43. What amount of heat is required to raise the temperature of 150 grams of water by  $20^{\circ}\text{C}$ ?