# Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_

### **Thermal Energy Test**

**Matching** – Answers may be used as often as necessary.

\_\_\_\_\_ 1. Any substance that flows. A) calorie

\_\_\_\_\_ 2. 1/1000th of a food calorie. B) conduction

\_\_\_\_\_ 3. Type of heat transfer that can occur through outer space. C) heat

\_\_\_\_\_ 4. Type of heat transfer in which objects are touching. D) specific heat

\_\_\_\_\_ 5. Units used to measure thermal energy. (2) E) temperature

\_\_\_\_\_ 6.Type of heat transfer that occurs fastest in solids. F) thermal energy

\_\_\_\_\_ 7. Substances that do not allow heat to flow through them easily. G) conductors

\_\_\_\_\_ 8. The kinetic energy and potential energy of a substance’s molecules. H) radiation

\_\_\_\_\_ 9. Thermal energy that flows from areas of high temperature to low. I) joule

\_\_\_\_\_ 10. The main way that heat is transferred in gases. J) fluid

\_\_\_\_\_ 11. A substance’s molecules average kinetic energy. K) convection

\_\_\_\_\_ 12. Type of heat transfer involving the movement of a fluid. L) insulators

\_\_\_\_\_ 13. Thermal energy that is required to heat 1 kg of any substance 1oC.

**True or False**

\_\_\_\_\_ 14. -273 K is known as absolute zero.

\_\_\_\_\_ 15. Objects with a low specific heat up slowly and cool down slowly.

\_\_\_\_\_ 16. One joule is equal to 4.814 calories.

\_\_\_\_\_ 17. The air in a room has stronger intermolecular forces than a bowl of water.

\_\_\_\_\_ 18. An object that is gaining energy would be endothermic.

\_\_\_\_\_ 19. 230 K is the same temperature as 40˚C.

\_\_\_\_\_ 20. If an object is exothermic, its Q value would be negative.

## Short Answer

21. Describe how a convection current forms.

22. What is an R-value?

23. Lorene has 2 insulated cups that are made of 2 layers of plastic. One has air in between and the other has the air between removed (it’s a vacuum). Which would keep her drinks colder? Why?

24. Two stacks of pennies are sitting on a desk at room temperature. One stack is made of 25 pennies made

 from copper only and the other has 25 pennies made from copper and zinc. Which would heat up the fastest? (assume the mass of the pennies are equal.) Why?

25. Rank these from greatest to least amount of kinetic energy in their molecules - ice, steam, and water.

26. What was used to determine what temperatures would be 0**°** and 100**°** on the Fahrenheit scale?

27. Which has more thermal energy – an object with a thermal energy of 298.8 J or an object with 1250 calories of thermal energy?

In each of the following situations, identify the type of energy transfer taking place as conduction (CD),

convection (CV), or radiation (R). Write your answer in the blank.

\_\_\_\_\_ 28. Wind is a result of \_\_\_\_\_ in the earth’s atmosphere.

\_\_\_\_\_ 29. A frying pan tranfers heat to frying eggs by \_\_\_\_\_.

\_\_\_\_\_ 30. In a swimming pool, the water near the bottom is slightly cooler. The cool water sinks because

 of \_\_\_\_\_.

\_\_\_\_\_ 31-32. A boy unbends a metal clothes hanger and uses it to cook a hot dog over a campfire. The hot

 dog cooks primarily because of \_\_\_\_\_\_.

\_\_\_\_\_ The handle of the hanger that the boy is holding becomes hot because of \_\_\_\_\_.

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### **Now That You’re All Warmed Up Test**

For each of the following examples of heat flow, describe what object heat is flowing from and what object

 the heat is flowing into.

 1. A piece of ice is set on top of a piece of dry ice.

 2. A sample of molten aluminum with a temperature of 323oC is poured onto a piece of iron that has been heated to a temperature of 256oC.

 3. A hot beaker is rinsed off under a faucet with tap water.

 4. Rufus says that when you hold a piece of ice in your hand the cold is transferred from the ice to your hand. Doofus disagrees. Who is right? Explain.

\_\_\_\_\_ 5. A boy wearing a jacket on a wintery day is preventing heat loss by \_\_\_\_.

 A) conduction B) convection C) radiation D) compression

\_\_\_\_\_ 6. A sunbather is sunburned because of which type of heat transfer?

A) convection B) refraction C) conduction D) radiation

7. How is the potential energy of an object related to the distance between its atoms or molecules?

List the following substances in order from the best conductor to the worst: carbon dioxide, iron, and water.

 8.

 9.

 10.

11. Which would be more exothermic, objects with low k-values or objects with low R-values?

12. If the bottom of a cast iron skillet is doubled in thickness, what happens to the rate of heat transfer?

13-14. If the room temperature is 24˚C, would the rate of heat transfer through a window be greater if the outside temperature were 37˚C or if it were 12˚C?

 Would the room be exothermic or endothermic in that case?

## Problems

Q = m(TF – TI)cp

Rate of

heat transfer

=

k·A·(T1-T2)

d

|  |  |  |
| --- | --- | --- |
| cp gold = .129 J/(g  ˚C) | cp copper = .385 J/(g  ˚C) | cp tin = .288 J/(g  ˚C) |
| cp mercury = .140 J/(g  ˚C) | cp platinum = .133 J/(g  ˚C) | cp zinc = .385 J/(g  ˚C) |
| cp silver = .235 J/(g  ˚C) | cp water = 4.184 J/(g  ˚C) | cp lead = .127 J/(g  ˚C) |

15. If you put pieces of gold and lead of the same mass on a hot plate for the same length of time, which one would be cooler? Why?

16-17. A piece of metal is placed in a flame for 9 minutes and the temperature rises from 38.3 oC to 45.6 oC. It is then massed on a triple beam balance and has a mass of 43.4 g. If the metal gains 75.5 J of thermal energy, what is the cp of the metal? Show your work.

18. What metal is it?

19-20. A 1740 g piece of tin is placed in a freezer for 20 minutes and is placed in a beaker containing 198.2 g of water at room temperature, which was 23.6 oC. After 30 seconds, the temperature of the tin and water is 19.9 oC. How much thermal energy is gained or lost by the water? Show your work.

21. What is the initial temperature of the tin? Show your work.

22-23. Calculate the rate of heat transfer on a hot day through a rectangular window that is 2.50 m high by

 1.44 m wide, has a thickness of 1.22 mm, and a thermal conductivity of value of 0.253 W/m/˚C. The temperature inside the home is 25.2 ˚C and the outside temperature is 31.3 ˚C.