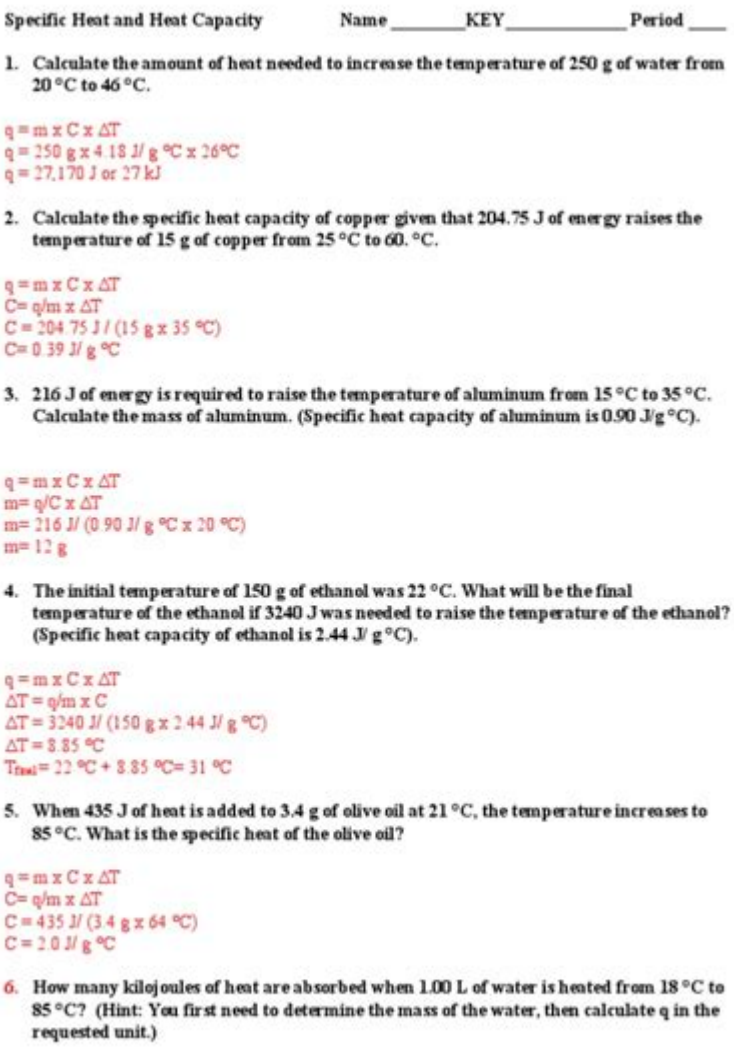
Specific Heat Worksheet With Answers



Specific Heat and Heat Capacity Name _____KEY_____ Period ____

1. Calculate the amount of heat needed to increase the temperature of 250 g of water from 20 °C to 46 °C.

q = m x C x ΔT
q = 250 g x 4.18 J/ g °C x 26°C
q = 27,170 J or 27 kJ

2. Calculate the specific heat capacity of copper given that 204.75 J of energy raises the temperature of 15 g of copper from 25 °C to 60. °C.

q = m x C x ΔT
C= q/m x ΔT
C = 204.75 J / (15 g x 35 °C)
C= 0.39 J/ g °C

3. 216 J of energy is required to raise the temperature of aluminum from 15 °C to 35 °C. Calculate the mass of aluminum. (Specific heat capacity of aluminum is 0.90 J/g °C).

q = m x C x ΔT
m= q/C x ΔT
m= 216 J/ (0.90 J/ g °C x 20 °C)
m= 12 g

4. The initial temperature of 150 g of ethanol was 22 °C. What will be the final temperature of the ethanol if 3240 J was needed to raise the temperature of the ethanol? (Specific heat capacity of ethanol is 2.44 J/ g °C).

q = m x C x ΔT
ΔT = q/m x C
ΔT = 3240 J/ (150 g x 2.44 J/ g °C)
ΔT = 8.85 °C
T_{final} = 22 °C + 8.85 °C= 31 °C

5. When 435 J of heat is added to 3.4 g of olive oil at 21 °C, the temperature increases to 85 °C. What is the specific heat of the olive oil?

q = m x C x ΔT
C= q/m x ΔT
C = 435 J/ (3.4 g x 64 °C)
C = 2.0 J/ g °C

6. How many kilojoules of heat are absorbed when 1.00 L of water is heated from 18 °C to 85 °C? (Hint: You first need to determine the mass of the water, then calculate q in the requested unit.)

Specific heat worksheet with answers is an essential educational tool that helps students understand the concept of specific heat and its applications in both chemistry and physics. Specific heat is defined as the amount of heat energy required to raise the temperature of a unit mass of a substance by one degree Celsius (or one Kelvin). This article will delve into the concept of specific heat, how to solve problems related to it, and include a sample worksheet with answers to enhance learning.

Understanding Specific Heat

Specific heat, often denoted as c, is a material property that varies

from one substance to another. It is crucial to understand how different materials respond to heat energy. The formula for calculating heat energy (Q) absorbed or released by a substance is given by:

$$
Q = mc\Delta T
$$

Where:
- Q = heat energy (in joules)
- m = mass of the substance (in kilograms)
- c = specific heat capacity (in joules per kilogram per degree Celsius, $J/(kg \cdot °C)$)
- ΔT = change in temperature (in degrees Celsius)

Why Is Specific Heat Important?

Understanding specific heat is vital for several reasons:

1. Thermal Management: Engineers use specific heat values to design systems that manage temperature effectively, such as heating and cooling systems.
2. Chemical Reactions: In chemistry, specific heat helps predict how substances will react under temperature changes, crucial for reaction kinetics.
3. Environmental Science: Specific heat plays a role in understanding climate change and weather patterns, particularly in bodies of water.

Common Specific Heat Values

The specific heat values of various materials can significantly influence calculations in both academic and practical applications. Here’s a list of common substances and their specific heat capacities:

- Water: 4.18 $J/(g \cdot °C)$
- Aluminum: 0.897 $J/(g \cdot °C)$
- Copper: 0.385 $J/(g \cdot °C)$
- Iron: 0.449 $J/(g \cdot °C)$
- Sand: 0.837 $J/(g \cdot °C)$

Sample Specific Heat Worksheet

To practice the concept of specific heat, below is a sample worksheet containing five problems, followed by the answers. Students are encouraged to work through the problems to reinforce their understanding of specific heat calculations.

Worksheet Problems

1. Problem 1: Calculate the heat energy required to raise the temperature of 200 grams of water from 25°C to 75°C. (Specific heat of water = 4.18 J/(g·°C))

2. Problem 2: A metal block with a mass of 150 g absorbs 5000 J of heat energy, causing its temperature to rise from 20°C to 70°C. Calculate the specific heat of the metal.

3. Problem 3: How much heat is released when 300 g of aluminum cools from 100°C to 25°C? (Specific heat of aluminum = 0.897 J/(g·°C))

4. Problem 4: If 100 g of sand absorbs 2000 J of heat energy, what will be the change in temperature? (Specific heat of sand = 0.837 J/(g·°C))

5. Problem 5: A 250 g block of iron is heated from 20°C to 120°C. If the specific heat of iron is 0.449 J/(g·°C), how much heat energy is required?

Worksheet Answers

1. Answer 1:
$$
Q = mc\Delta T = 200 \, g \times 4.18 \, J/(g \cdot °C) \times (75°C - 25°C)
$$
$$
Q = 200 \times 4.18 \times 50 = 41800 \, J
$$

2. Answer 2:
$$
Q = mc\Delta T \implies c = \frac{Q}{m\Delta T} = \frac{5000 \, J}{150 \, g \times (70°C - 20°C)}
$$
$$
c = \frac{5000}{150 \times 50} = \frac{5000}{7500} \approx 0.667 \, J/(g \cdot °C)
$$

3. Answer 3:
$$
Q = mc\Delta T = 300 \, g \times 0.897 \, J/(g \cdot °C) \times (100°C - 25°C)
$$
$$
Q = 300 \times 0.897 \times 75 = 20177.5 \, J
$$

4. Answer 4:
$$
Q = mc\Delta T \implies \Delta T = \frac{Q}{mc} = \frac{2000 \, J}{100 \, g \times 0.837 \, J/(g \cdot °C)}
$$
$$
\Delta T = \frac{2000}{83.7} \approx 23.9°C
$$

5. Answer 5:
$$
Q = mc\Delta T = 250 \, g \times 0.449 \, J/(g \cdot °C) \times (120°C - 20°C)
$$
$$
Q = 250 \times 0.449 \times 100 = 11225 \, J
$$

Conclusion

The concept of specific heat is pivotal in various scientific fields. A **specific heat worksheet with answers** serves as a valuable resource for students aiming to master this concept. By practicing problems, students can gain a deeper understanding of how materials respond to heat and the practical applications of specific heat in real-world scenarios. Mastery of specific heat not only enhances problem-solving skills in physics and chemistry but also prepares students for more advanced topics in thermal dynamics and material science.

Frequently Asked Questions

What is specific heat and why is it important in thermodynamics?

Specific heat is the amount of heat required to raise the temperature of one gram of a substance by one degree Celsius. It is important in thermodynamics because it helps predict how substances will respond to heat changes.

How do you calculate the specific heat of a substance using a worksheet?

To calculate specific heat using a worksheet, you typically use the formula: specific heat (c) = q / (m ΔT), where q is the heat added, m is the mass of the substance, and ΔT is the change in temperature.

What units are commonly used for specific heat in worksheets?

Specific heat is commonly expressed in units of joules per gram per degree Celsius (J/g°C) or calories per gram per degree Celsius (cal/g°C).

What types of problems can you find on a specific heat worksheet?

Specific heat worksheets may include problems such as calculating the specific heat of various substances, determining the heat transfer in chemical reactions, or figuring out how much heat is needed to change the temperature of a given mass.

Are there any common mistakes to avoid when solving specific heat problems?

Common mistakes include forgetting to convert units properly, not accounting for the correct mass or temperature change, and misapplying the specific heat formula.

Can specific heat worksheets be used for both solids and liquids?

Yes, specific heat worksheets can be used for both solids and liquids, though the specific heat values will differ between substances.

What resources are available for finding specific heat worksheets with answers?

Resources for finding specific heat worksheets with answers include educational websites, science textbooks, teacher resource sites, and online platforms that offer free printable worksheets.

How can specific heat worksheets help students in understanding heat transfer?

Specific heat worksheets help students understand heat transfer by providing practical problems that illustrate how different materials absorb and release heat, reinforcing concepts of energy conservation.

What is the relationship between specific heat and temperature change?

The relationship is direct; greater specific heat means a substance requires more energy to achieve the same temperature change compared to a substance with a lower specific heat.

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