

**10A WB - temperature conversions**

1. Usually, people die if their body temperature drops below  $35^{\circ}\text{C}$ . There was one case, however, of a two-year-old girl who had been accidentally locked outside in the winter. She survived, even though her body temperature dropped as low as  $14^{\circ}\text{C}$ . Express this temperature in Kelvin and in degrees Fahrenheit.
2. In experiments conducted by the United States Air Force, subjects endured air temperatures of  $400^{\circ}\text{F}$ . Express this temperature in degrees Celsius and in Kelvin.
3. The temperature of the moon's surface can reach  $117^{\circ}\text{C}$  when exposed to the sun and can cool to  $-163^{\circ}\text{C}$  when facing away from the sun. Express this temperature change in degrees Fahrenheit.
4. Because of Venus' proximity to the sun and its thick, high-pressure atmosphere, its temperature can rise to  $860.0^{\circ}\text{F}$ . Express this temperature in degrees Celsius.
5. On January 22, 1943, the air temperature at Spearfish, South Dakota, rose  $49.0^{\circ}\text{F}$  in 2 min to reach a high temperature of  $7.00^{\circ}\text{C}$ . What were the initial and final temperatures in degrees Fahrenheit? What was the temperature in degrees Celsius before the temperature increase?
6. In 1916, Browning, Montana, experienced a temperature decrease of  $56^{\circ}\text{C}$  during a 24 h period. The final temperature was  $-49^{\circ}\text{C}$ . Express in Kelvin the temperatures at the beginning and the end of the 24 h period.
7. In 1980, Willie Jones of Atlanta, Georgia, was hospitalized with heat- stroke, having a body temperature of  $116^{\circ}\text{F}$ . Fortunately, he survived. Express Willie's body temperature in Kelvin.

**10A PR - temperature conversions**

8. On July 10, 1913, the temperature reached 330.0 K Death Valley, California—the hottest temperature ever reached in the United States. Calculate this temperature in degrees Fahrenheit and in degrees Celsius.
9. On January 21, 1918, Granville, North Dakota had a surprising change in temperature. Within 12 hours, the temperature changed from 237 K to 283 K. What is this change in temperature in the Celsius and Fahrenheit scales?

10. In only 15 minutes, the temperature in Fort McDonald, Montana, went from  $-5^{\circ}\text{F}$  to  $+37^{\circ}\text{F}$  on January 19, 1892. Calculate this change in temperature in Kelvin.
11. The Hawaiian lavas at Kilauea Crater have the highest temperatures measured on Earth's surface (over  $2192^{\circ}\text{F}$ ). Express this temperature in degrees Celsius.
12. Much of the hot water in Reykjavik, Iceland comes from wells bored into the hot springs of Reykir. The water temperature from the wells is  $188.6^{\circ}\text{F}$ . Express this temperature in degrees Celsius.
13. The present temperature of the background radiation in the universe is 2.7 K. What is this temperature in degrees Celsius?

<b>Table 12-2</b>		
<b>Heats of Fusion and Vaporization of Common Substances</b>		
<b>Material</b>	<b>Heat of Fusion <math>H_f</math> (J/kg)</b>	<b>Heat of Vaporization <math>H_v</math> (J/kg)</b>
Copper	$2.05 \times 10^5$	$5.07 \times 10^6$
Mercury	$1.15 \times 10^4$	$2.72 \times 10^5$
Gold	$6.30 \times 10^4$	$1.64 \times 10^6$
Methanol	$1.09 \times 10^5$	$8.78 \times 10^5$
Iron	$2.66 \times 10^5$	$6.29 \times 10^6$
Silver	$1.04 \times 10^5$	$2.36 \times 10^6$
Lead	$2.04 \times 10^4$	$8.64 \times 10^5$
Water (ice)	$3.34 \times 10^5$	$2.26 \times 10^6$

<b>Table 12-1</b>			
<b>Specific Heat of Common Substances</b>			
<b>Material</b>	<b>Specific Heat (J/kg·K)</b>	<b>Material</b>	<b>Specific Heat (J/kg·K)</b>
Aluminum	897	Lead	130
Brass	376	Methanol	2450
Carbon	710	Silver	235
Copper	385	Steam	2020
Glass	840	Water	4180
Ice	2060	Zinc	388
Iron	450		

**Practice Problems**

5. How much heat is absorbed by 60 g of copper when it is heated from 20°C to 80°C?
6. A 38 kg block of lead is heated from -26°C to 180°C. How much heat is absorbed during the heating?
7. The cooling system of a car engine contains 20 L of water. 1 L of water has a mass of 1 kg. a. What is the change in the temperature of the water if the engine operates until 836 kJ of heat are added? b. Suppose it is winter and the system is filled with methanol. The density of methanol is .8 g/cm<sup>3</sup>. What would be the increase in temperature of the methanol if it absorbed 836 kJ of heat?
9. A 200 g sample of water at 80°C is mixed with 200 g of water at 10°C. What is the final temperature of the mixture?
10. A 400 g sample of methanol at 16°C is mixed with 400 g of water at 85°C what is the final temperature of the mixture?
11. A 100 g brass block at 90°C is placed in a Styrofoam cup containing 200 g of water at 20°C. Find the final temperature of the mixture.
13. How much heat is absorbed by 100 g of ice at -20°C to become water at 0°C?
14. A 200 g sample of water at 60°C is heated to steam at 140°C. How much heat is absorbed?
15. How much heat is needed to change 300 g of ice at -30°C to steam at 130°C?

**Problems**

4. How much heat is needed to raise the temperature of 50.0 g of water from 4.5°C to 83.0°C?
5. How much heat must be added to 50.0g of aluminum at 25 °C to raise its temperature to 125 °C?
6. A 500g block of metal absorbs 5016J of heat when its temperature changes from 20 °C to 30 °C. Calculate the specific heat of the metal.
9. A 100 g mass of tungsten at 100 °C is placed in 200 g of water at 20 °C. The mixture has final temperature of 21.6 °C. What is the specific heat of tungsten?

10. A 600 g sample of water at 90 °C is mixed with 400 g of water at 22 °C. What is the final temperature of the mixture?

13. A 200 g sample of brass at 100°C is placed in a calorimeter cup that contains 261 g of water at 20°C. What is the final temperature of the brass and water?

19. How much heat is removed from 60 g of steam at 100°C to change it to 60 g of water at 20°C?

21. How much heat is added to 10 g of ice at -20°C to convert it to steam at 120°C?

22. A 50 g sample of ice at 0°C is placed in a glass beaker containing 400 g of water at 50°C. All the ice melts. What is the final temperature of the mixture?

23. A 4.2 g lead bullet moving at 275 m/s strikes a steel plate and stops. If all its kinetic energy is converted to thermal energy and none leaves the bullet, what is its temperature change?