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2.4.2 Relationship between volume and absolute temperature

11. *a)* $T = 25°C + 273 = 298\ K$

b) $T = 37°C + 273 = 310\ K$

c) $T = 150°C + 273 = 423\ K$

12. *a)* $°C = 373\ K - 273 = 100°C$

b) $°C = 98\ K - 273 = -175°C$

c) $°C = 425\ K - 273 = 152°C$

13. *1. Conversion of the temperature into kelvin:*

$T_1 = 10°C + 273 = 283\ K$

$T_2 = 200°C + 273 = 473\ K$

2. Calculation of the volume:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{20\ L}{283\ K} = \frac{V_2}{473\ K}$$

$$V_2 = \frac{20\ L \cdot 473\ \cancel{K}}{283\ \cancel{K}} = 33\ L$$

Answer: The volume occupied by the gas will be 33 L.

14. *1. Conversion of the temperature into kelvin:*

$T_1 = 24.2°C + 273 = 297.2\ K$

$T_2 = (-17.5°C) + 273 = 255.5\ K$

2. Calculation of the volume:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{2.5\ L}{297.2\ K} = \frac{V_2}{255.5\ K}$$

$$V_2 = \frac{2.5\ L \cdot 255.5\ \cancel{K}}{297.2\ \cancel{K}} = 2.1\ L$$

Answer: The volume of the balloon will be 2.1 L.

15. *1. Conversion of the temperature into kelvin:*

$T_1 = 20°C + 273 = 293\ K$

2. Calculation of the temperature:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{10\ L}{293\ K} = \frac{30\ L}{T_2}$$

$$T_2 = \frac{30\ \cancel{L} \cdot 293\ K}{10\ \cancel{L}} = 879\ K$$

3. Conversion of the temperature into degrees Celsius:

$T_2 = 879\ K - 273 = 606°C$

Answer: The final temperature of the neon (Ne) is $6.1 \times 10^2°C$.

17. *1. Conversion of the temperature into kelvin:*

$T_1 = 25°C + 273 = 298\ K$

$T_2 = 98°C + 273 = 371\ K$

2. Calculation of the volume:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{0.10\ L}{298\ K} = \frac{V_2}{371\ K}$$

$$V_2 = \frac{0.10\ L \cdot 371\ \cancel{K}}{298\ \cancel{K}} = 0.12\ L$$

Answer: The final volume of carbon dioxide (CO_2) in the dough is 0.12 L.

20. *1. Conversion of the temperature into kelvin:*

$T_1 = 17°C + 273 = 290\ K$

$T_2 = 100°C + 273 = 373\ K$

2. Calculation of the volume:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{300\ mL}{290\ K} = \frac{V_2}{373\ K}$$

$$V_2 = \frac{300\ mL \cdot 373\ \cancel{K}}{290\ \cancel{K}} = 386\ mL$$

Answer: The nitrogen (N_2) will occupy a volume of 386 mL.

21. *1. Conversion of the temperature into kelvin:*

$T_1 = 22°C + 273 = 295\ K$

2. Calculation of V_2*:*

$V_2 = 18.4\ L \cdot 1.25 = 23.0\ L$

3. Calculation of the temperature:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{18.4\ L}{295\ K} = \frac{23.0\ L}{T_2}$$

$$T_2 = \frac{23.0\ \cancel{L} \cdot 295\ K}{18.4\ \cancel{L}} = 368.8\ K$$

4. Conversion of the temperature into degrees Celsius:

$T_2 = 368.8\ K - 273 = 95.8°C$

Answer: The water temperature was 95.8°C.