

Final Spring Review 1

1. What is the total charge on all of the electrons in one liter of water?
2. Two negatively charged bodies with $-5.0 \times 10^{-5} \text{ C}$ are 0.2 m from each other. What force acts on each particle?
3. The load across a 12 V battery consists of a series combination of three resistors of 15 ohm, 21 ohm and 24 ohm.
 - a. What is the total resistance of the load?
 - b. What is the voltage of the battery if the current in the circuit is 0.1 A?
4. A lamp draws a current of 0.5 A when it is connected to a 120 V source. What is the resistance of the lamp?
5. 200 g sample of water at 80° C is mixed with 200 g of water at 10° C . Assume no heat loss to the surroundings. What is the final temperature of the mixture?
6. A steel tank is built to hold alcohol. The tank is 2 m in diameter and 5 m high. It is completely filled with alcohol at 10° C . If the temperature rises to 40° C , how much alcohol will flow out of the tank? Remember the tank and the alcohol expand as the temperature rises.
7. A geologist, analyzing an irregular piece of ore, finds that the sample is balanced by 88 g when weighed in air and 76 g when weighed in water. What is the volume of the sample?

Material	Coefficient of linear expansion α	Coefficient of volume expansion β	Material	Coefficient of linear expansion α	Coefficient of volume expansion β
Aluminum	25×10^{-6}	75×10^{-6}	Platinum	9×10^{-6}	
Iron	12×10^{-6}	35×10^{-6}	Copper	16×10^{-6}	48×10^{-6}
Glass	9×10^{-6}	27×10^{-6}	Water		210×10^{-6}
concrete	12×10^{-6}	36×10^{-6}	Methanol		1100×10^{-6}

Coefficients of Thermal Expansion ($^\circ \text{ C}$)⁻¹

SP REVIEW 1

$$1. \quad ? \text{ C} = 1000 \text{ ml H}_2\text{O} \times \frac{1 \text{ g}}{1 \text{ ml}} \times \frac{1 \text{ mol}}{18 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \times \frac{10 \text{ e}}{1 \text{ molec}}$$

$$\times \frac{1.6 \times 10^{-19} \text{ C}}{1 \text{ e}} = \boxed{5.35 \times 10^7 \text{ C}}$$

$$2. \quad F = \frac{k q_1 q_2}{d^2} = \frac{(9 \times 10^9) (5 \times 10^{-5})^2}{(0.12 \text{ m})^2} = \boxed{5.63 \times 10^2 \text{ N}}$$

$$3. \quad R_1 = 15 \Omega \quad R_2 = 21 \Omega \quad R_3 = 24 \Omega \quad V = 12 \text{ V}$$

$$a) \quad R = R_1 + R_2 + R_3$$

$$= 15 + 21 + 24 = \boxed{60 \Omega}$$

$$b) \quad R = \frac{V}{I}$$

$$V = R I$$

$$= 60 \Omega \cdot 1 \text{ A}$$

$$= \boxed{6 \text{ V}}$$

$$4. \quad I = 0.5 \text{ A} \quad R = \frac{V}{I} = \frac{120}{0.5}$$

$$V = 120 \text{ V}$$

$$R = ? = \boxed{2.40 \times 10^2 \Omega}$$

$$5. \quad m_1 = 200 \text{ g} \quad T_i = 80^\circ \text{C} \quad T_f = ?$$

$$m_2 = 200 \text{ g} \quad T_i = 10^\circ \text{C} \quad T_f = ?$$

$$200 \text{ g (s/w)} (T_f - 80^\circ \text{C}) = 200 \text{ g (s/w)} (T_f - 10)$$

$$T_f - 80^\circ \text{C} = T_f - 10^\circ \text{C}$$

$$2T_f = 70^\circ \text{C}$$

$$\boxed{T_f = 35^\circ \text{C}}$$

$$6. \quad r = 1 \text{ m}$$

$$h = 5 \text{ m}$$

$$V = \pi (3.14) (1 \text{ m})^2$$

$$V = \underline{15.7 \text{ m}^3}$$

$$T_i = 10^\circ \text{C}$$

$$T_f = 40^\circ \text{C}$$

$$\Delta T = 40^\circ \text{C} - 10^\circ \text{C}$$

$$\Delta T = 30^\circ \text{C}$$

$$\Delta V_A = V \beta \Delta T$$

$$= 15.7 (1100 \times 10^{-6}) (30^\circ \text{C})$$

$$= \boxed{5.18 \times 10^{-1} \text{ m}^3}$$

7.

$$W_{\text{AIR}} = (1.088) (9.8)$$

$$= \underline{0.862 \text{ N}}$$

$$W_{\text{APP}} = (0.076) (9.8)$$

$$= \underline{0.745 \text{ N}}$$

$$W_{\text{APP}} = W_{\text{AIR}} - F_B$$

$$(0.745 \text{ N}) = (0.862 - F_B)$$

$$F_B = \underline{0.117 \text{ N}}$$

$$F_B = W_{\text{H}_2\text{O}}$$

$$0.117 = m (9.8)$$

$$m_{\text{H}_2\text{O}} = \underline{0.0119 \text{ kg}}$$

$$D = \frac{m}{V}$$

$$V = \frac{0.0119 \text{ kg}}{1000 \text{ kg/m}^3}$$

$$= \boxed{1.19 \times 10^{-5} \text{ m}^3}$$