Buoyancy Worksheet Answers

1) A medical ship has a mass of 100,000 kg. What volume of fresh water ($\rho$=1025 kg/m$^3$) will the ship displace?

$$\frac{100,000 \text{[kg]}}{1,025 \text{[kg/m}^3\text{]}} = 97.56 \text{ m}^3$$

2) How much mass can a 1,000,000 L balloon lift if the inside temperature of the balloon is 80 °C and the outside air temperature is 20 °C?

First, move the terms containing $V$ to the same side by subtracting $V\rho_{\text{Inside Fluid}}$ from both sides:

$$M < V \rho_{\text{Outside Fluid}} - V \rho_{\text{Inside Fluid}}$$

Next, plug in the numbers:

$$M < (1,000,000 \text{ L}) (1.204 \text{ g/L} - 1.000 \text{ g/L})$$

$$M < 204 \text{ kg}$$

3) How many 10 L helium balloons would it take to lift a man in an armchair (75 kg) if the density of air is 1.2 g/L and the density of helium is 0.1786 g/L. Assume each balloon has a mass of 3 g. (Hint: First calculate how much extra mass a helium balloon can carry)

Just like the example in the lesson, one balloon can lift 10.2 g. If each balloon has a mass of 3 g, then each balloon can carry 7.2 g.

$$\frac{75 \text{ kg}}{7.2 \text{ g}} = 10,417 \text{ Balloons.}$$