Checking Gas Fill With a Balloon Mass

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A class models balloons for a display. Empty balloons have the same mass. Each filled balloon has the same volume, temperature, and pressure during the first comparison. In the model, the mass of a gas blend at those conditions is between the masses of equal volumes of its two pure gases. The possible fills are helium, air, or a blend of the two. The reported masses are already corrected for air buoyancy.

Balloon	**Filled volume (L)**	**Total mass (g)**
Empty reference	0	3.0
Filled with helium	2.0	3.4
Filled with air	2.0	5.4
Unknown fill	2.0	4.4

1 What is the mass of the gas alone in the unknown balloon?

(1) 0.4 g

(2) 1.4 g

(3) 3.0 g

(4) 4.4 g

2 Compare the unknown gas mass with those of helium and air. Explain how the measurements support a blend of the two under the model. [1]

Answer and work

A second empty balloon also has a mass of 3.0 g. The class fills it with 3.0 L of the same unknown blend at the same temperature and pressure. The model treats gas mass as proportional to volume under these conditions.

3 Predict the total mass of the second filled balloon. Show how the gas mass and the empty balloon mass enter your calculation. [1]

Answer and work

4 Explain why multiplying the first unknown balloon’s total mass by 3.0/2.0 would overstate the new total mass. [1]

Answer and work