AP Physics 2 Review Questions

Integrating Content, Inquiry and Reasoning

Two balloons of negligible mass are filled with gases to equivalent volumes. Balloon A contains helium ($d_{He} = 0.163 \text{ g/L}$). Balloon B contains sulfur hexafluoride ($d_{SF_6} = 6.17 \text{ g/L}$). The density of air (at sea-level) is approximately 1.20 g/L.

- 1. Predict what will occur when the balloons are released from a height of 1.0 m.
- 2. With respect to Archimedes' principle, explain how you made your predictions.

A new balloon, Balloon C, is filled with 1.5 L of sulfur hexafluoride.

- 3. Draw a free-body diagram of Balloon C.
- 4. Predict some changes that could be made to Balloon C to cause it to no longer sink in air.
- 5. A student proposes the following change to Balloon C: "By adding air to the balloon, the increased volume of the balloon will increase the buoyant force. Do you agree or disagree with the student's proposal? Explain your reasoning.
- 6. Another student suggests the following: "Adding helium to the balloon will increase the volume of the balloon and decrease the overall density of the contained gases. This will allow the balloon to float."
 - *a*. Do you agree or disagree with the student's proposal? Explain your reasoning.
 - b. Verify the student's assertion by calculating the volume of helium needed so that Balloon C neither sinks nor floats.

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