



**2018 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS**

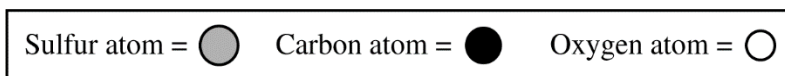
Sulfur atom = 	Carbon atom = 	Oxygen atom = 
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Compound	Molecular Structure	Boiling Point at 1 atm (K)
CS <sub>2</sub>		319
COS		223

4. The table above gives the molecular structures and boiling points for the compounds CS<sub>2</sub> and COS.
- (a) In terms of the types and relative strengths of all the intermolecular forces in each compound, explain why the boiling point of CS<sub>2</sub>(*l*) is higher than that of COS(*l*).
- (b) A 10.0 g sample of CS<sub>2</sub>(*l*) is put in an evacuated 5.0 L rigid container. The container is sealed and heated to 325 K, at which temperature all of the CS<sub>2</sub>(*l*) has vaporized. What is the pressure in the container once all of the CS<sub>2</sub>(*l*) has vaporized?

# AP<sup>®</sup> CHEMISTRY 2018 SCORING GUIDELINES

## Question 4



Compound	Molecular Structure	Boiling Point at 1 atm (K)
CS <sub>2</sub>		319
COS		223

The table above gives the molecular structures and boiling points for the compounds CS<sub>2</sub> and COS.

- (a) In terms of the types and relative strengths of all the intermolecular forces in each compound, explain why the boiling point of CS<sub>2</sub>(*l*) is higher than that of COS(*l*).

<p>CS<sub>2</sub> has only London dispersion forces, while COS has London dispersion forces and dipole-dipole forces.</p> <p>The London dispersion forces in CS<sub>2</sub> are stronger than the combination of London dispersion forces and dipole-dipole forces in COS.</p>	<p>1 point is earned for correctly identifying all of the intermolecular forces in <b>both</b> molecules.</p> <p>1 point is earned for a valid explanation.</p>
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- (b) A 10.0 g sample of CS<sub>2</sub>(*l*) is put in an evacuated 5.0 L rigid container. The container is sealed and heated to 325 K, at which temperature all of the CS<sub>2</sub>(*l*) has vaporized. What is the pressure in the container once all of the CS<sub>2</sub>(*l*) has vaporized?

$10.0 \text{ g CS}_2 \times \frac{1 \text{ mol CS}_2}{76.13 \text{ g CS}_2} = 0.131 \text{ mol CS}_2$ $P = \frac{nRT}{V} = \frac{(0.131 \text{ mol})(0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1})(325 \text{ K})}{5.0 \text{ L}}$ $= 0.70 \text{ atm}$	<p>1 point is earned for the correct number of moles of CS<sub>2</sub>.</p> <p>1 point is earned for the correct calculation of pressure with appropriate units.</p>
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