

2018 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS

Sulfur atom =  Carbon atom =  Oxygen atom = 

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

4. The table above gives the molecular structures and boiling points for the compounds CS₂ 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 CS₂(l) is higher than that of COS(l).
- (b) A 10.0 g sample of CS₂(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 CS₂(l) has vaporized. What is the pressure in the container once all of the CS₂(l) has vaporized?

**AP[®] CHEMISTRY
2018 SCORING GUIDELINES**

Question 4

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

The table above gives the molecular structures and boiling points for the compounds CS₂ 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 CS₂(l) is higher than that of COS(l).

<p>CS₂ has only London dispersion forces, while COS has London dispersion forces and dipole-dipole forces.</p> <p>The London dispersion forces in CS₂ 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 both molecules.</p> <p>1 point is earned for a valid explanation.</p>
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- (b) A 10.0 g sample of CS₂(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 CS₂(l) has vaporized. What is the pressure in the container once all of the CS₂(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 CS₂.</p> <p>1 point is earned for the correct calculation of pressure with appropriate units.</p>
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