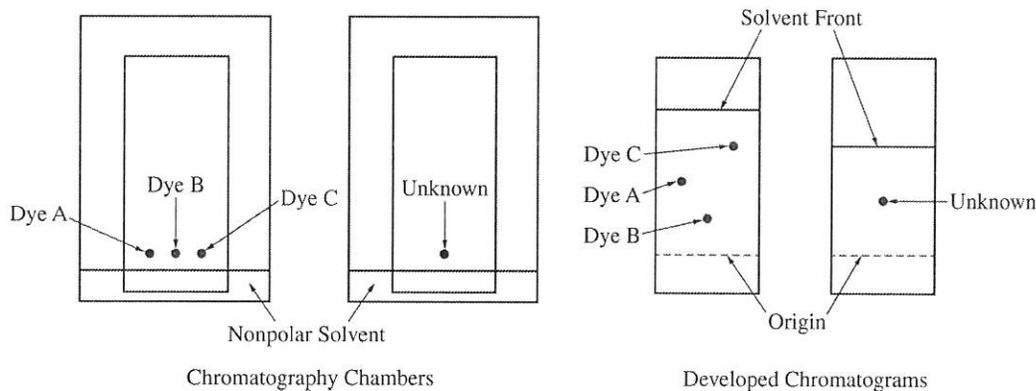


**AP<sup>®</sup> CHEMISTRY**  
**2017 SCORING GUIDELINES**

**Question 4**



A student investigates various dyes using paper chromatography. The student has samples of three pure dyes, labeled A, B, and C, and an unknown sample that contains one of the three dyes. The student prepares the chromatography chambers shown above on the left by putting a drop of each dye at the indicated position on the chromatography paper (a polar material) and standing the paper in a nonpolar solvent. The developed chromatograms are shown above on the right.

- (a) Which dye (A, B, or C) is the least polar? Justify your answer in terms of the interactions between the dyes and the solvent or between the dyes and the paper.

<p>Dye C is the least polar because it moved the farthest.</p> <p>Nonpolar dyes are more strongly attracted to the nonpolar solvent.</p> <p>AND/OR</p> <p>Nonpolar dyes are least strongly retained by the polar paper.</p>	<p>1 point is earned for the correct choice <b>and</b> reference to the chromatogram.</p> <p>1 point is earned for a correct description of dye-solvent <b>and/or</b> dye-paper interactions.</p>
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- (b) Which dye is present in the unknown sample? Justify your answer.

<p>Dye A is present in the unknown sample.</p> <p>The unknown sample moves to a position that is midway between the origin and the solvent front, and so does dye A.</p> <p>OR</p> <p>Dye A has a retention factor (<math>R_f</math>) that is close to 0.50 on the chromatogram with the three dyes, and the unknown also has a retention factor close to 0.50.</p>	<p>1 point is earned for the correct choice.</p> <p>1 point is earned for a valid justification.</p>
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