

Possibly useful equations:

$$pH = pKa + \log \frac{[base]}{[acid]}$$

Please read the questions carefully and follow instructions. Be sure that your handwriting is clear, and indicate your answer. Use the correct units and a reasonable number of sig figs. If calculations are required, show your work in order to receive full or partial credit.

1. (4 pts) True or False. High pressure liquid chromatography (HPLC) may be used to analyze analytes with low (<200°C) boiling points?

True or False

2. (9 pts) List the following HPLC detectors in order from lowest to highest detection limits:

UV-Visible detector	lowest: <u>Fluorescence</u>
Evaporative light scattering detector	<u>UV-Vis</u>
Fluorescence detector	highest: <u>Evaporative Light Scattering</u>

3. (9 pts) For the following gas chromatography (GC) detectors, indicate whether or not the detector is ‘universal’ or ‘selective’ and if the detector is selective, what type of analyte is it selective for?

	Circle ‘universal’ or ‘selective’ for each detector.	
Flame ionization detector:	<u>Universal</u>	<u>Selective</u> for <u>combustibles</u>
Thermal conductivity detector:	<u>Universal</u>	<u>Selective</u> for _____
Electron capture detector:	<u>Universal</u>	<u>Selective</u> for <u>analytes containing electronegative atoms</u>

4. (8 pts) Give 2 reasons why one might choose a packed column over a capillary column for a GC analysis.

1. stationary phase with superior selectivity 3. cost
2. very high concentrations of analyte in samples

5. (5 pts) Choose the one correct answer. You are analyzing a sample by capillary GC containing compounds with concentrations in the microgram per gram range. What injection technique should most likely be used?

- a. on-column
- b. splitless
- c. split
- d. none of the above

6. (5 pts) Choose the one correct answer. You are analyzing a sample by HPLC that contains both neutral analytes and ionized analytes that cannot be converted to the neutral form using buffers. What HPLC technique should you use for the analysis?

- a. normal phase HPLC
- b. ion chromatography
- c. reverse phase HPLC with ion-pairing reagents
- d. size exclusion chromatography

7. (10 pts) Your sample to be analyzed by reverse phase HPLC contains an analyte that is an acid (HA) with a pKa of 4.46. To what pH should you buffer your aqueous eluent in order to have an HA to A<sup>-</sup> ratio of 100:1 in the aqueous phase?

2.46