
OpenCourseWare (2023)

CHEMISTRY II

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EVALUATION TEST 2



1. (3 points) Indicate which of the following statements are TRUE or FALSE, and correct the False one. (Correct answers mark as **+0.25**).

A	Regarding the following Redox pairs, Pb^{2+} is the strongest reducing agent and I_2 is the strongest oxidizing agent. Data: $E^0(\text{MnO}_4^-/\text{Mn}^{2+}) = 1.51 \text{ v}$; $E^0(\text{I}_2/\text{I}^-) = 0.54 \text{ V}$; $E^0(\text{Pb}^{2+}/\text{Pb}) = -0.13 \text{ V}$

B	In a concentration cell, when the concentrations of the electrodes are the same the $E^0_{\text{cell}} = 0 \text{ V}$.

C	Fuel cells are electrical devices which convert chemical energy directly to electrical energy and water.

D	Specimens having rough surfaces display a greater resistance to pitting corrosion.

E	Cis alkenes are less stable than their trans isomers because of steric strain between the two larger substituents on the same side of the double bond.

F	A hydroxyl group deactivates the reactivity of an aromatic ring and orients the substitution on meta.

G	The Williamson ether synthesis consists of the reaction of an alcohol with a primary, rather than secondary, halide.

H	Phenols with an electron-withdrawing substituent, such as a nitro group, are more acidic.

I	Carboxylic acids can be obtained through Grignard reaction from the reaction between a Grignard reagent and an alcohol

J	In a competitive inhibition, the inhibitor can only bind to free enzyme and therefore, inhibition may be reduced by increasing substrate concentration.

K	Triacylglycerols are lipids composed of a glycerol molecule and three fatty acyl residues joined by a glycosidic bond.

L	In a DNA molecule, each of the bases on one strand forms covalent bonds with a base of the opposite strand.

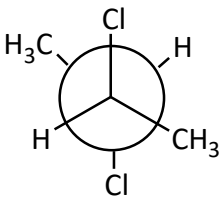
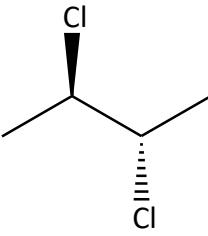
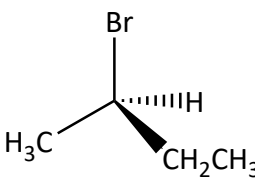
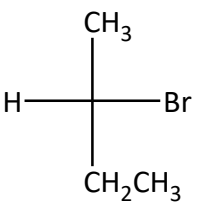
2. (1.5 points) Consider the electrolysis of an aqueous solution of CuBr_2 .

- a) (0.75 p) Write the half-reactions and indicate the products formed at the anode and cathode.
 b) (0.75 p) What volume of bromine gas at 25 °C and 1.00 atm will be produced at the anode by supplying 0.5 A for 30 min?

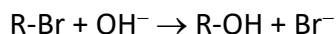
Data: $E^0(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$; $E^0(\text{Br}_2/\text{Br}^-) = +1.07 \text{ V}$; $E^0(\text{O}_2/\text{H}_2\text{O}, \text{H}^+) = +1.23 \text{ V}$; $E^0(\text{H}_2\text{O}/\text{H}_2, \text{OH}^-) = -0.83 \text{ V}$;
 $M(\text{Cu}) = 63.55 \text{ g mol}^{-1}$ and $M(\text{Br}) = 80 \text{ g mol}^{-1}$; $F = 96500 \text{ C mol}^{-1}$.

3. (2 points) Consider the following pairs of compounds A and B.

- a) (0.8 p) Which of the following terms best describe the pair of compounds shown: enantiomers, diastereomers, or the same compound?
 b) (0.8 p) Find the R/S configuration of the chiral carbons for all of them.

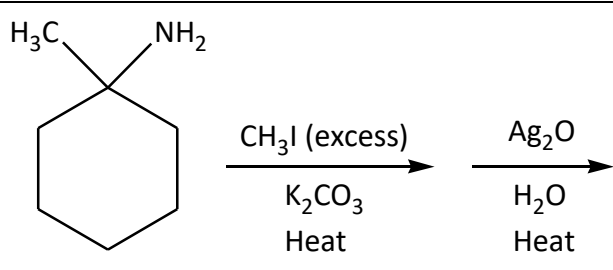
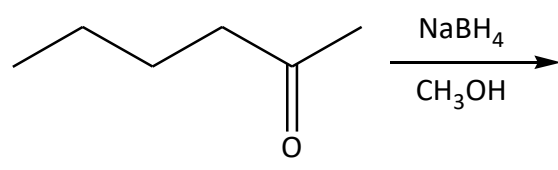
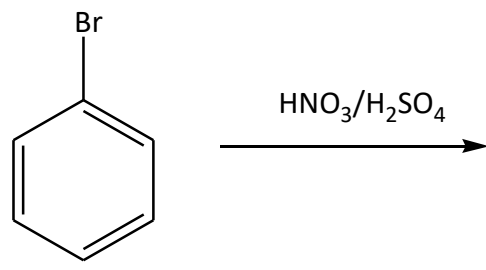
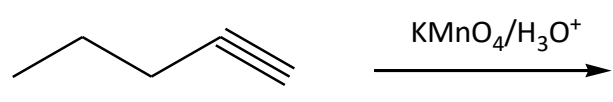
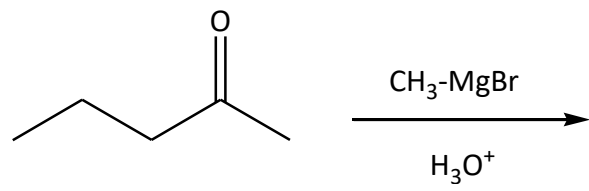
	Compounds A		Compounds B	
				
a)				
b)				

- c) (0.4 p) Alkyl halogenides experience nucleophilic substitution reactions (SN) which are used in the preparation of alcohols from alkyl bromides as depicted in the following scheme:



There are two main reaction mechanisms, S_N1 and S_N2 , which differ in the kinetics and stereochemistry. It has been found that the rate of disappearance of BrE under almost neutral conditions is given by $v_A = k_A[\text{BrE}][\text{OH}^-]$ while the corresponding rate equation for 2BrP is $v_B = k_B[2\text{BrP}]$. Which is the difference in reaction mechanism for both molecules that may explain the difference in the kinetics?

4. (2.5 points) Which product would you expect to result from the following reactions?

a)	
b)	
c)	
d)	
e)	

5. (1 point) (a) (0.5 p) The organic compound $\text{CH}_3\text{C}(\text{CH}_3)(\text{OH})\text{CH}_2\text{CH}_3$ (2-methylbutan-2-ol) shows 4 different peaks in the ^1H NMR spectra. Predict the splitting pattern. (b) (0.5 p) How many different types of carbon would be present in the following molecule?

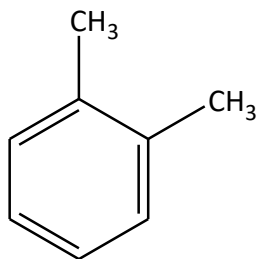


IMAGE CREDITS

- Images were made by authors.