Chemistry 2541
Fall 2010; Midterm 3 Exam

This exam has 5 problems on 7 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) Key

Scores:

Problem 1 20

Problem 2 20

Problem 3 24

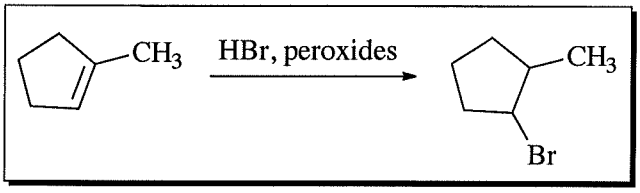
Problem 4 26

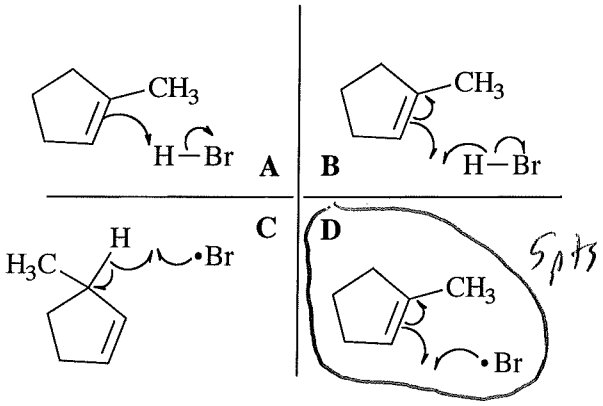
Problem 5 10

Total: 100

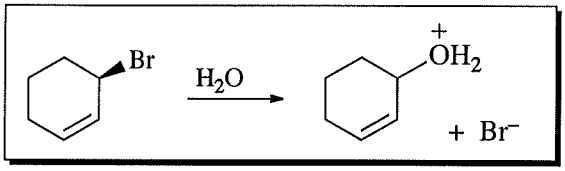
1. (20) Answer the questions on mechanism of the following reactions.

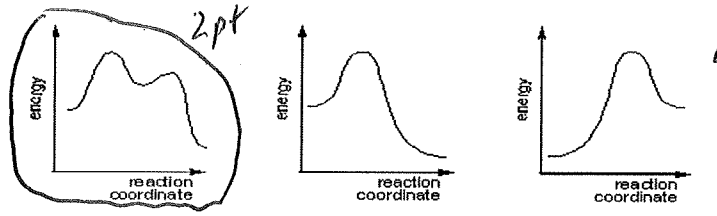
(a) Which one of the following four schemes (**A-D**) represents a **step** in the **mechanism** of the reaction in the box (circle the correct answer; 5 pts):





(b) Circle the **energy diagram** of the reaction in the box (2 pts) and the correct **rate equation** (2 pts):

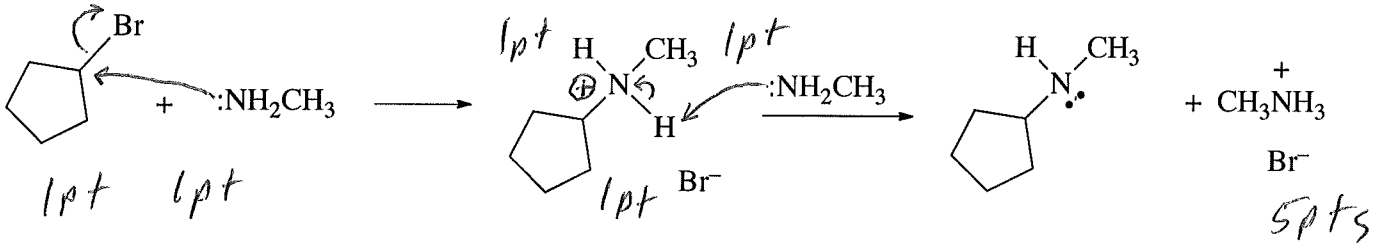




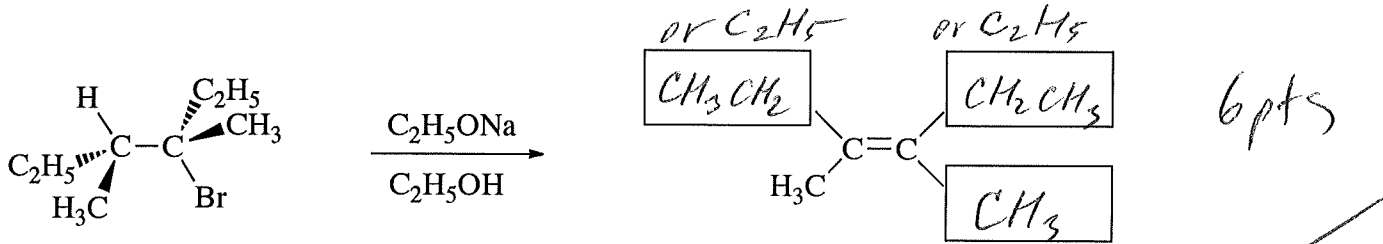
Rate = k [RX][Br⁻] | Rate = k [RX] 2pts

Rate = k [Br⁻] | Rate = k [H₂O]

(c) Show **4** curved **arrows** and a **formal charge** missing in the following mechanism (1 pt each)

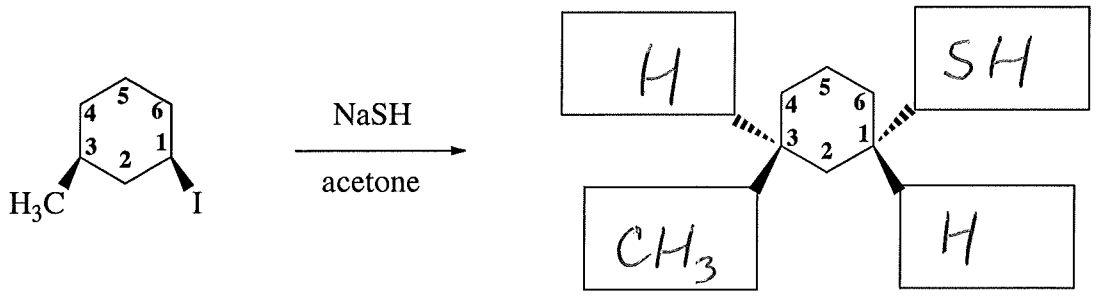


(d) Finish drawing the structure of the major product expected from the following reaction by writing the appropriate substituent in each of the three boxes (2 pts each box, 6 pts total).

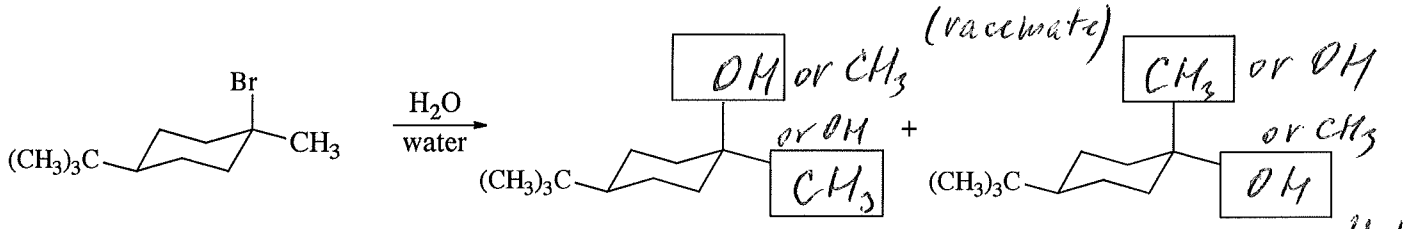


20pts

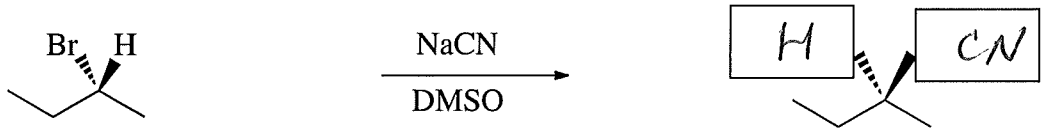
2. (20) Finish drawing the structures of **final products** in these reactions by placing appropriate substituents (including H) in the boxes on the bonds (1 pt each missing part).



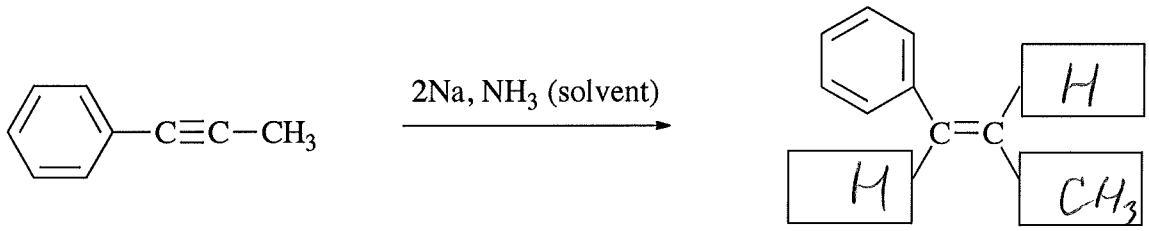
4 pts



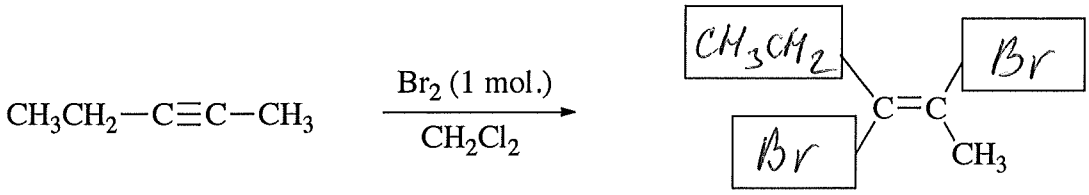
4 pts



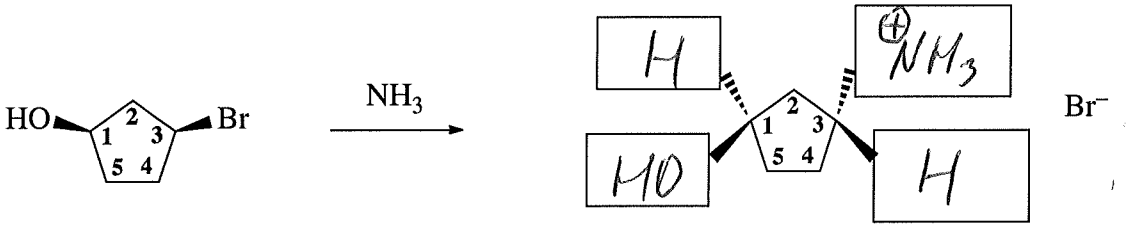
2 pts



3 pts



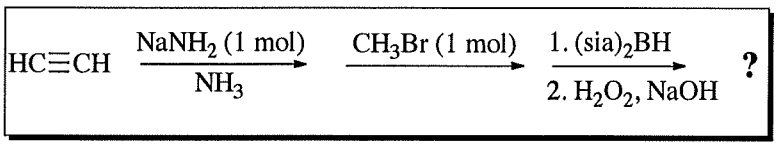
3 pts

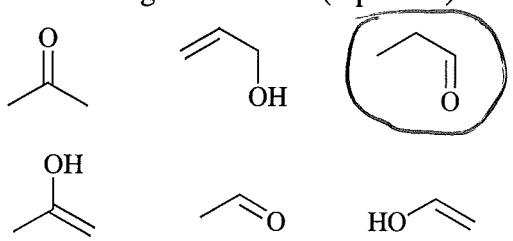


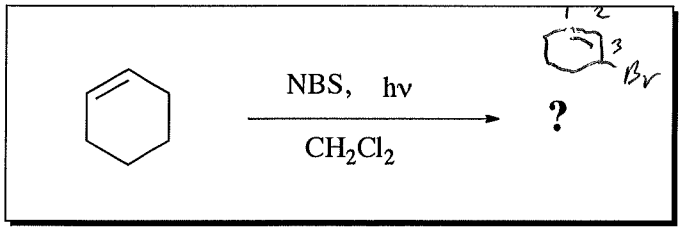
4 pts

20 pts

3. (24) Circle the **major organic product** obtained from each of the following of reactions (4 pt each):



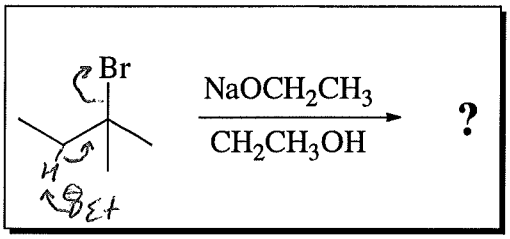


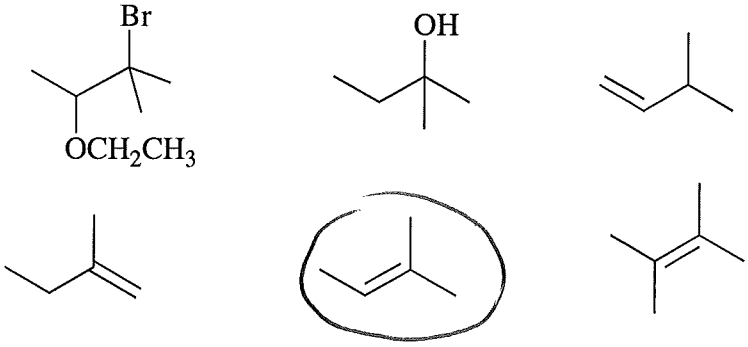


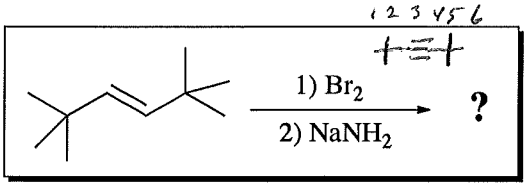
1-bromocyclohexene (3-bromocyclohexene)

cis-1,2-dibromocyclohexane 4-bromocyclohexene

4-chlorocyclohexene bromocyclohexane



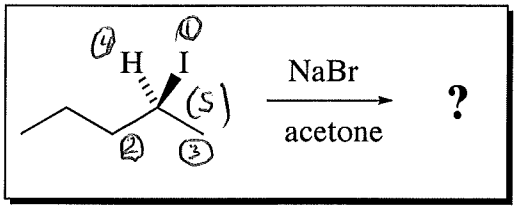




(*E*)-3,4-dimethyl-3-hexen-1-yne (*Z*)-3,4-dimethyl-3-hexen-1-yne

(*Z*)-2,2,5,5-tetramethyl-3-hexene (2,2,5,5-tetramethyl-3-hexyne)

(*E*)-3,4-dibromo-2,2,5,5-tetramethyl-3-hexene *tert*-butylacetylene

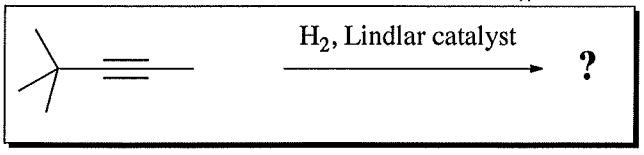


Inversion

(*R*)-2-bromopentane (*S*)-2-bromopentane

(*E*)-2-pentene (*Z*)-2-pentene

(*S*)-2-pentanol (*R*)-2-pentanol



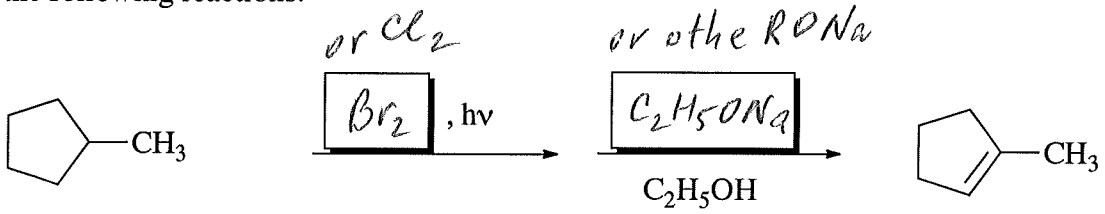
(*E*)-4,4-dimethyl-2-pentene (*Z*)-4,4-dimethyl-2-pentene

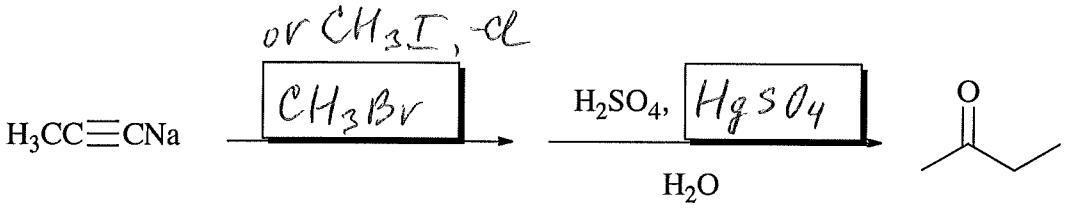
(*E*)-2,2-dimethyl-3-pentene (*Z*)-2,2-dimethyl-3-pentene

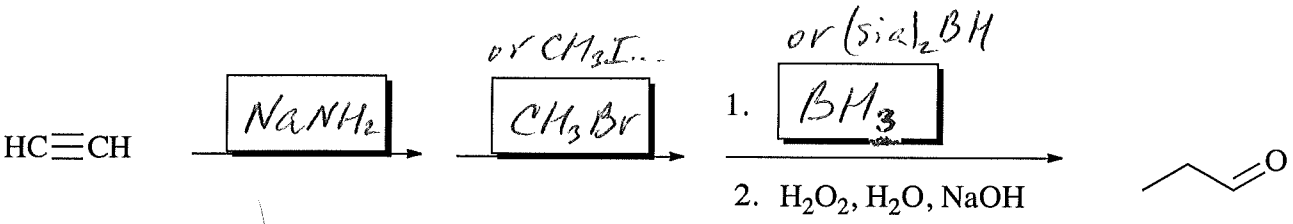
4,4-dimethyl-2-pentyne 2,2-dimethylpentane

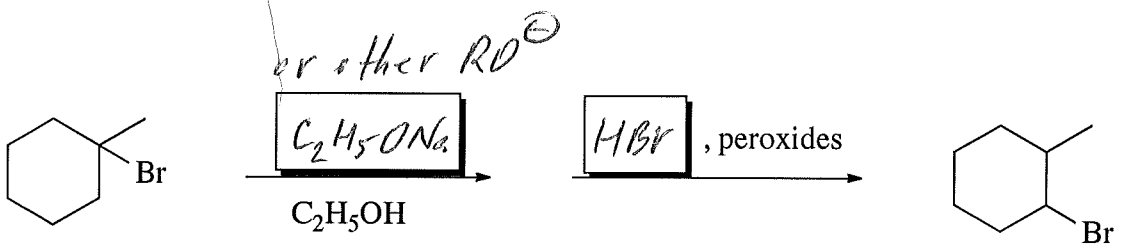
24 pts

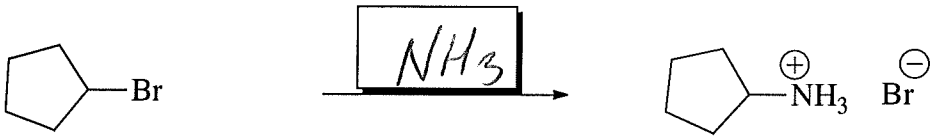
4. (26, 2 pts each box) Place in each box the molecule of a **reagent** that is required to perform each of the following reactions:

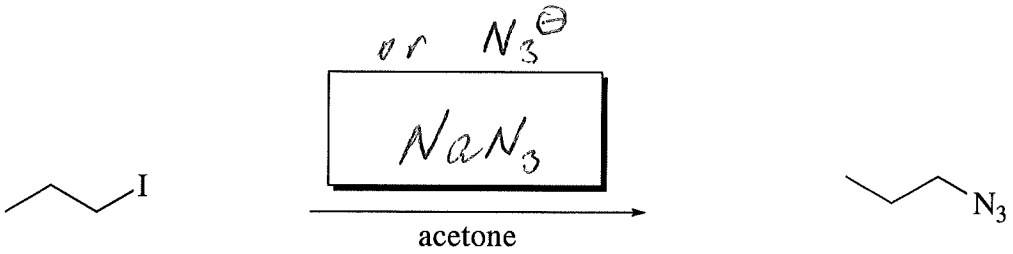


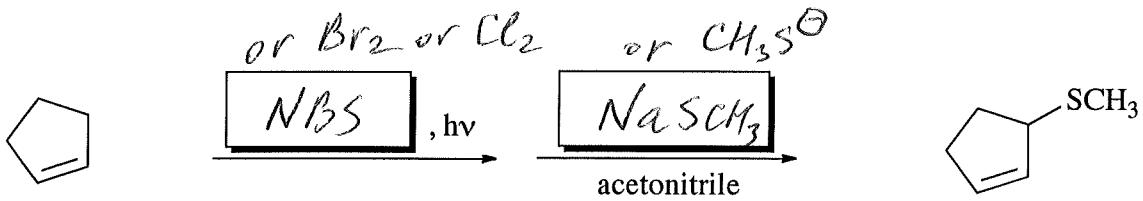












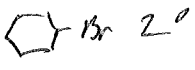
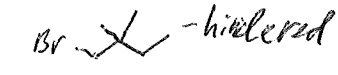
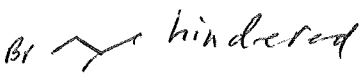
26 pts

5. (10, 2 pts each) For each of the following questions (a)-(e) **circle** the item that is the correct answer.

(a) In which of the following **solvents** would the reaction of **1-bromobutane** with sodium fluoride, NaF, proceed the **fastest**? (S_N2)

diethyl ether	methylene chloride	chloroform	ethanol	
methanol	(dimethylsulfoxide)	water	acetic acid	hexane

(b) Which of the following bromoalkanes reacts the **fastest** with sodium cyanide, NaCN, in acetone?

 bromocyclohexane	 1-bromo-2,2-dimethylbutane	 1-bromo-2-methylbutane
2-bromobutane	1-bromo-1-methylcyclohexane	(1-bromobutane)

(c) Which one of the following compounds has the **best leaving group**?

(2-bromobutane)	3-methylcyclohexanol	1-methylcyclohexanol	chlorocyclohexane
methylamine	chloroform	fluorocyclohexane	ethanol	cyclohexanol

(d) Which one of the following compounds is the **best** choice as a **reagent** for an **E2** reaction?

H_2O	*t*-BuCl	KI	NaN_3	$C_2H_5OCH_3$	NaI	HI	HCl	(C_2H_5ONa)	*t*-BuOH	KBr

(e) Which of the following compounds is **<u>not</u> a nucleophile**?

water	methanol	(methane)	sodium chloride	ammonia	acetic acid

10 pts