FAMILY NAME _____ FIRST NAME _____
please print please print

SIGNATURE _____ ID NUMBER _____

INDICATE YOUR LECTURE SECTION:

- ❑ Stewart (108 8:00 am MWF)
- ❑ Stewart (110 10:00 am MWF)
- ❑ Withers (103 3:00 pm MWF)
- ❑ Sabarre (199 9:30 am TTh)
- ❑ Sabarre (122 2:00 pm TTh)

THE UNIVERSITY OF BRITISH COLUMBIA

CHEMISTRY 233

(ORGANIC CHEMISTRY)

Midterm Examination One Oct 4 2007

Time: 1 hour

This paper consists of 8 pages including this title page and a periodic table
Ensure that you have a complete examination

Answer the questions ONLY on this examination paper; Do NOT use university examination booklets

1. CANDIDATES SHOULD BE PREPARED TO PRODUCE, UPON REQUEST, THEIR LIBRARY/AMS CARD

2. READ AND OBSERVE THE FOLLOWING ADDITIONAL RULES:

No candidate shall be permitted to enter the examinations room after the expiration of one-half hour, or to leave during the first half-hour of the examination.

Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.

CAUTION – Candidates guilty of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action:

a) Making use of any books, papers or memoranda, calculators, computers, audio or visual cassette players or other memory aid devices, other than those authorized by the examiners.
b) Speaking or communication with other candidates.
c) Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.

3. SMOKING IS NOT PERMITTED DURING EXAMINATIONS

Molecular models may be used during this examination

Calculators may not be used during this examination

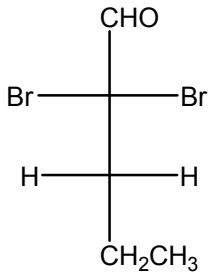
Turn off all pagers and cellular telephones and remove them from your desk

Question	Marks
1	/10
2	/5
3	/12
4	/12
5	/4
6	/12
Total	/55

Question 1 (10 marks)

a) Provide the name for compound A and draw compound B in the spaces provided.

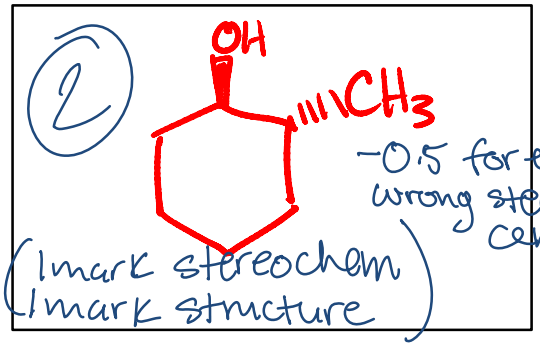
A



2

2,2-dibromopentanal

B



2

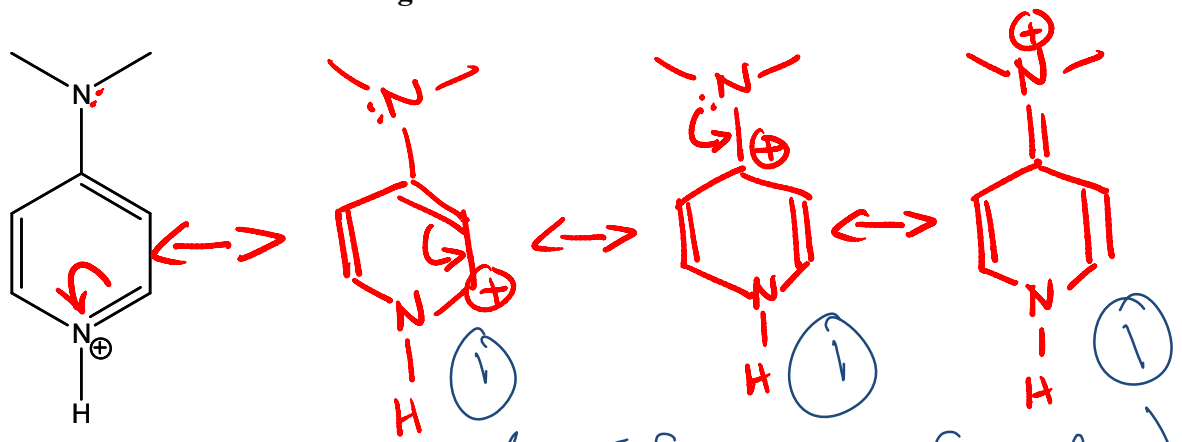
-0.5 for each wrong stereo-centre

(1mark stereochem
1mark structure)

(1R, 2R)-2-methyl-cyclohexanol

b) Draw **3 additional contributing resonance structures** for each of the molecules below.

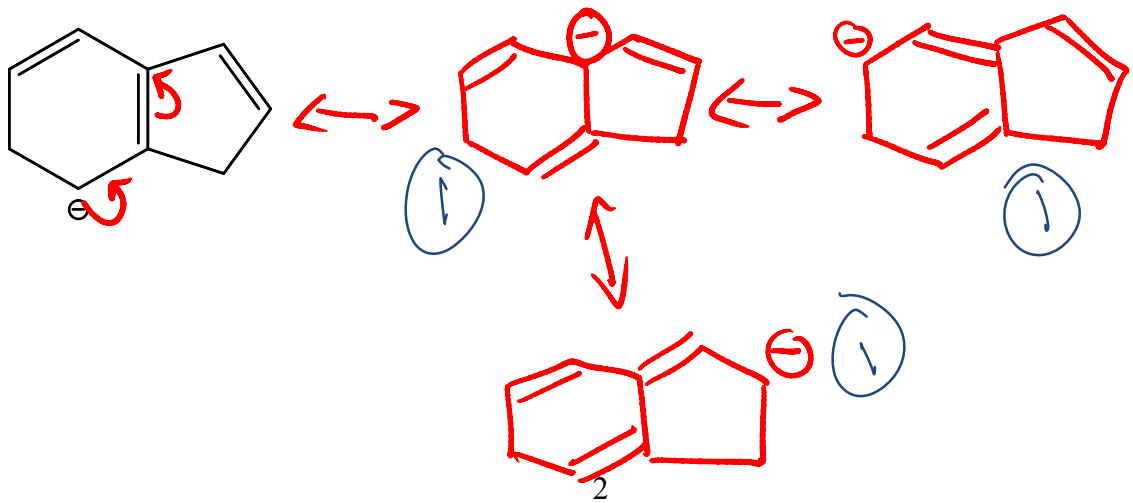
i)



1 1 1

(-0.5 for missing formal charges, octet rule violations etc.)

ii)

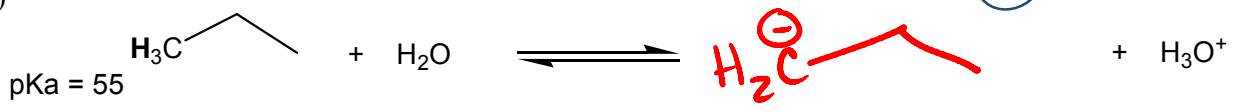


1 1 1

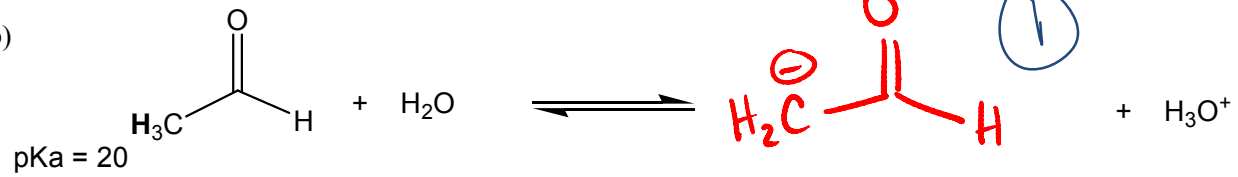
Question 2 (5 marks)

In the space provided, draw the structure of the conjugate base for each acid when ionized in water, wherein the protons indicated in bold are lost.

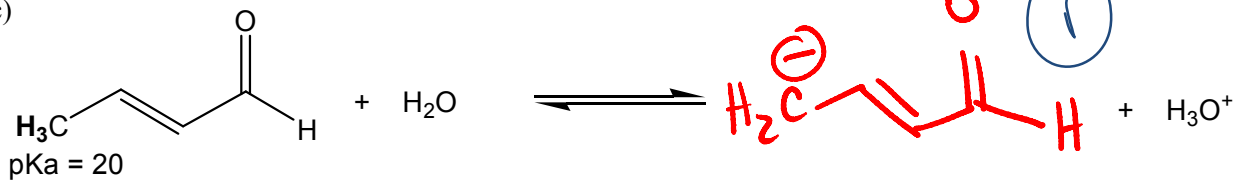
a)



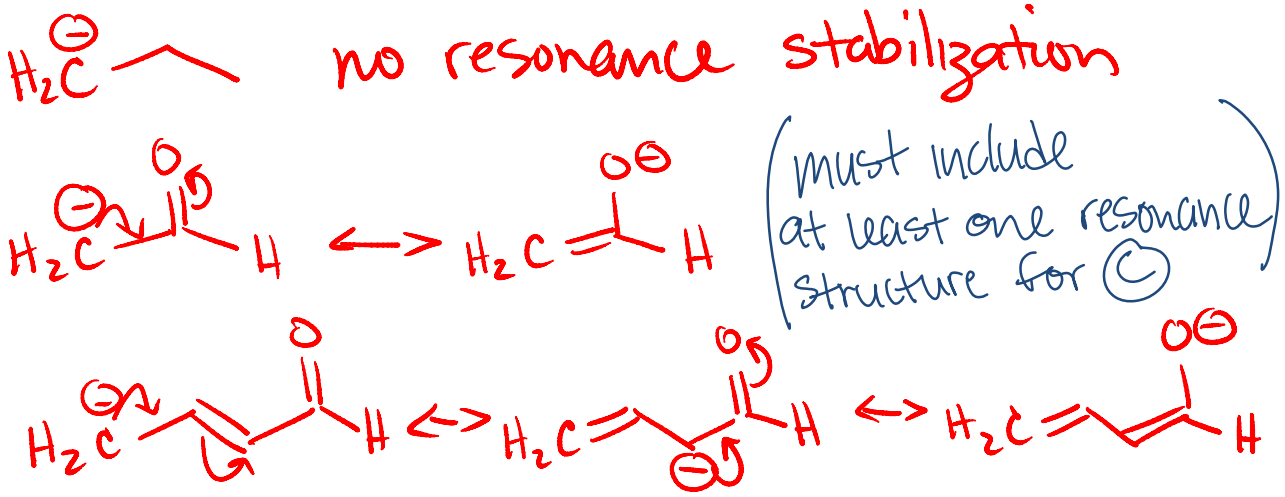
b)



c)



Using appropriate chemical structures, explain **why** the two compounds in questions b and c have pKa values much lower than that of the compound in a.

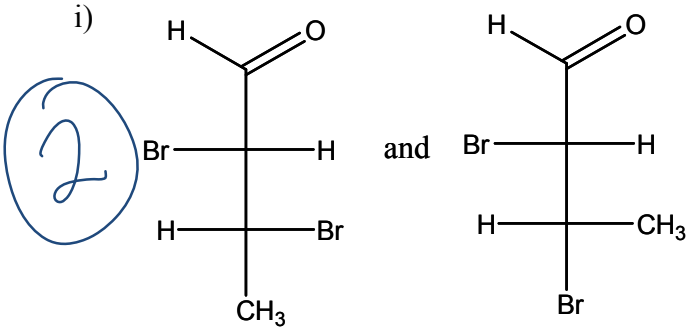


Both B + C have the neg. charge delocalized onto a more electronegative oxygen atom. This resonance stabilization of the neg. charge leads to more stable conjugate base → lower pKa.
(LOGICAL explanations not just "Resonance")

Question 3 (12 marks)

a) Circle the term that describes the stereochemical relationship between each of the pairs of molecules.

i)



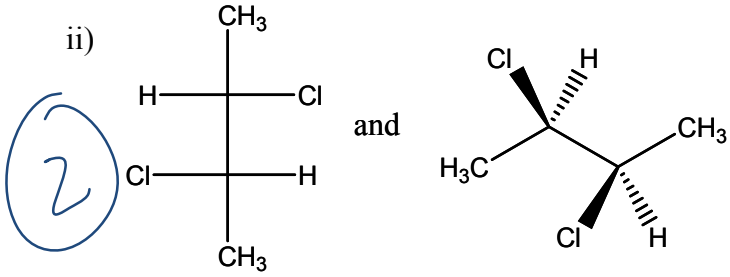
identical molecules

enantiomers

diastereomers

constitutional isomers

ii)



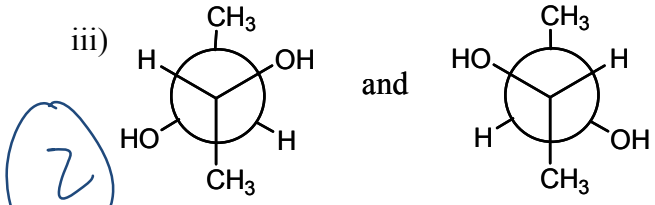
identical molecules

enantiomers

diastereomers

constitutional isomers

iii)



identical molecules

enantiomers

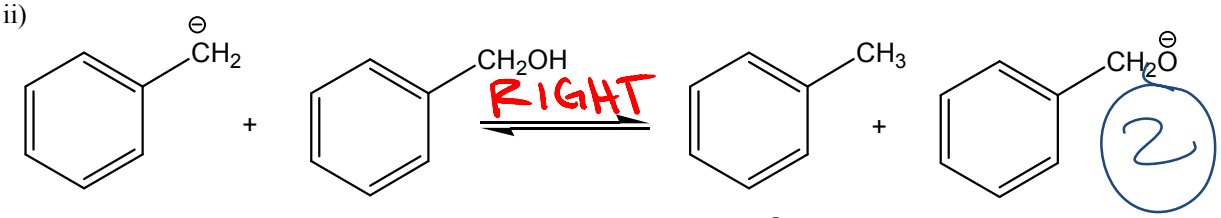
diastereomers

constitutional isomers

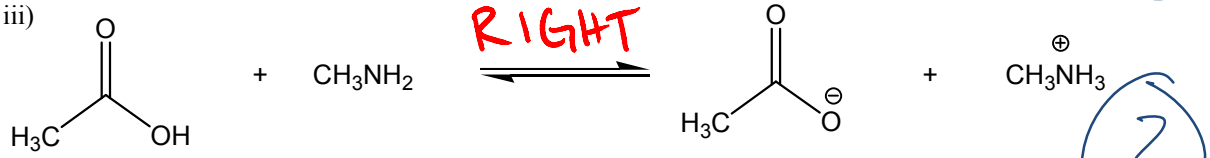
b) For the following equilibria show which side of the equilibrium is favoured by writing the word **LEFT** or **RIGHT** above the equilibrium arrows.

i)

ii)



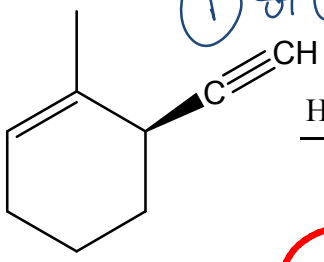
iii)



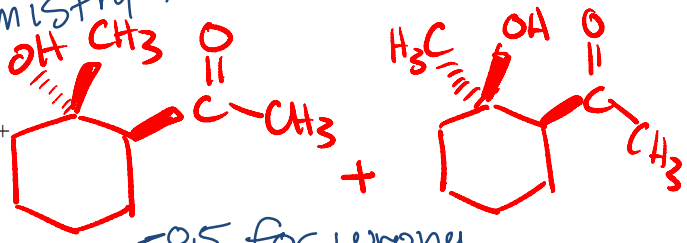
Question 4 (12 marks)

Predict the major product(s) of the following reactions. CLEARLY show stereochemistry where it exists, use the templates where given. For each reaction, **circle** the term that applies to the major product(s) formed.

a)



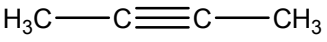
H_2O, H^+, Hg^{2+}



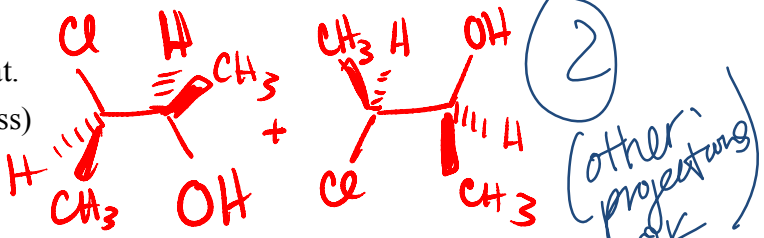
1 for connectivity
1 stereochemistry
-0.5 for wrong stereocentre

enantiomers | diastereomers | one product | structural isomers

b)

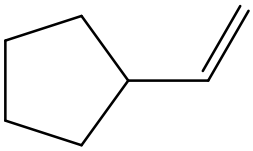


1. H_2, Lindlar's cat.
2. Cl_2, H_2O (excess)

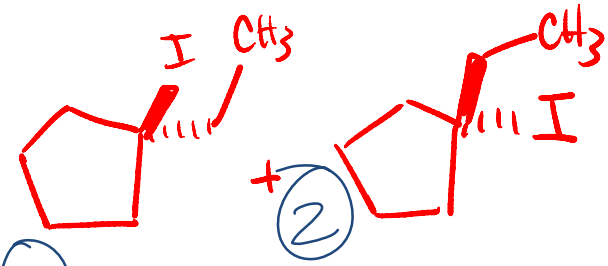


enantiomers | diastereomers | one product | structural isomers

c)



HI

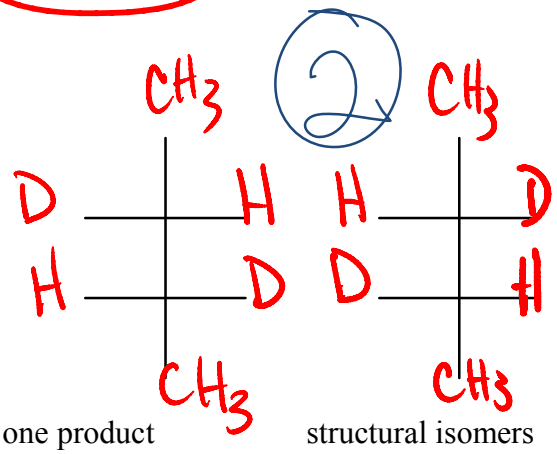


enantiomers | diastereomers | one product | structural isomers

d)

$H_3C-C\equiv C-CH_3$

1. Na, NH_3
2. D_2, Pd/C

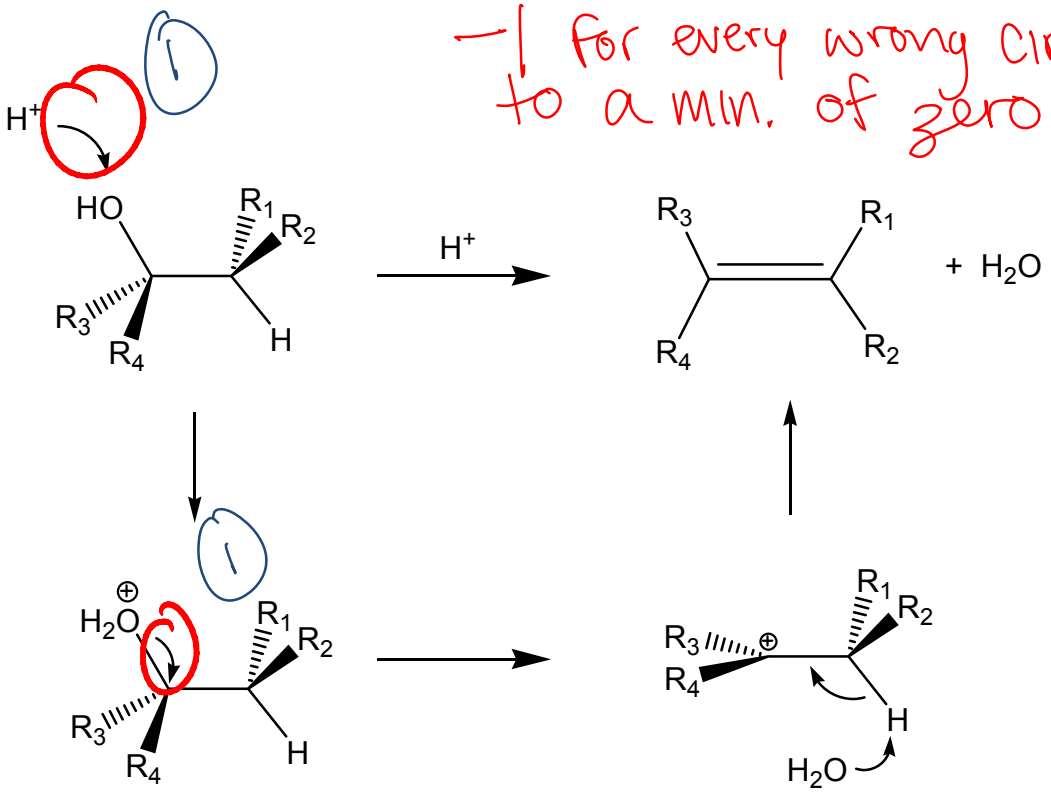


enantiomers | diastereomers | one product | structural isomers

Question 5 (4 marks)

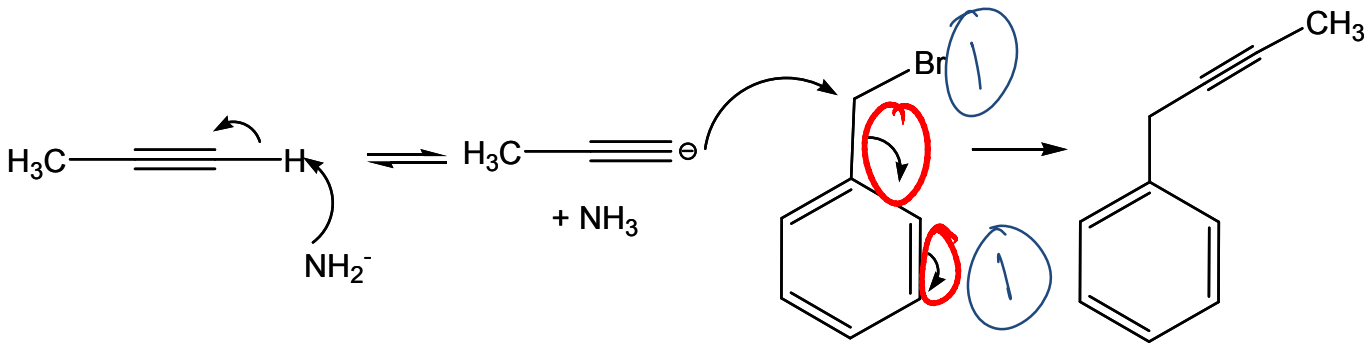
Circle ALL the incorrect parts of the following mechanisms (IF ANY). Marks will be deducted for incorrect circles. Note that all electron movement arrows are 2-electron arrows.

a)



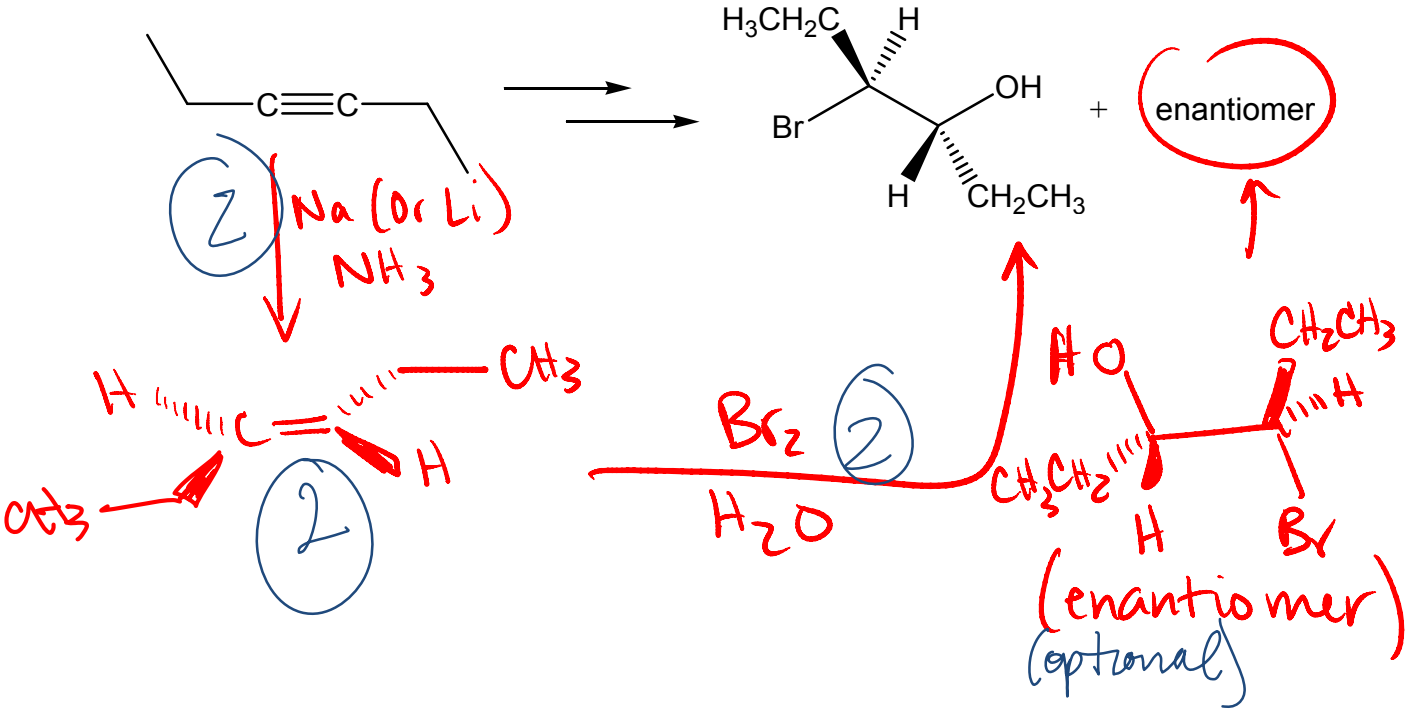
−1 for every wrong circle to a min. of zero

b)

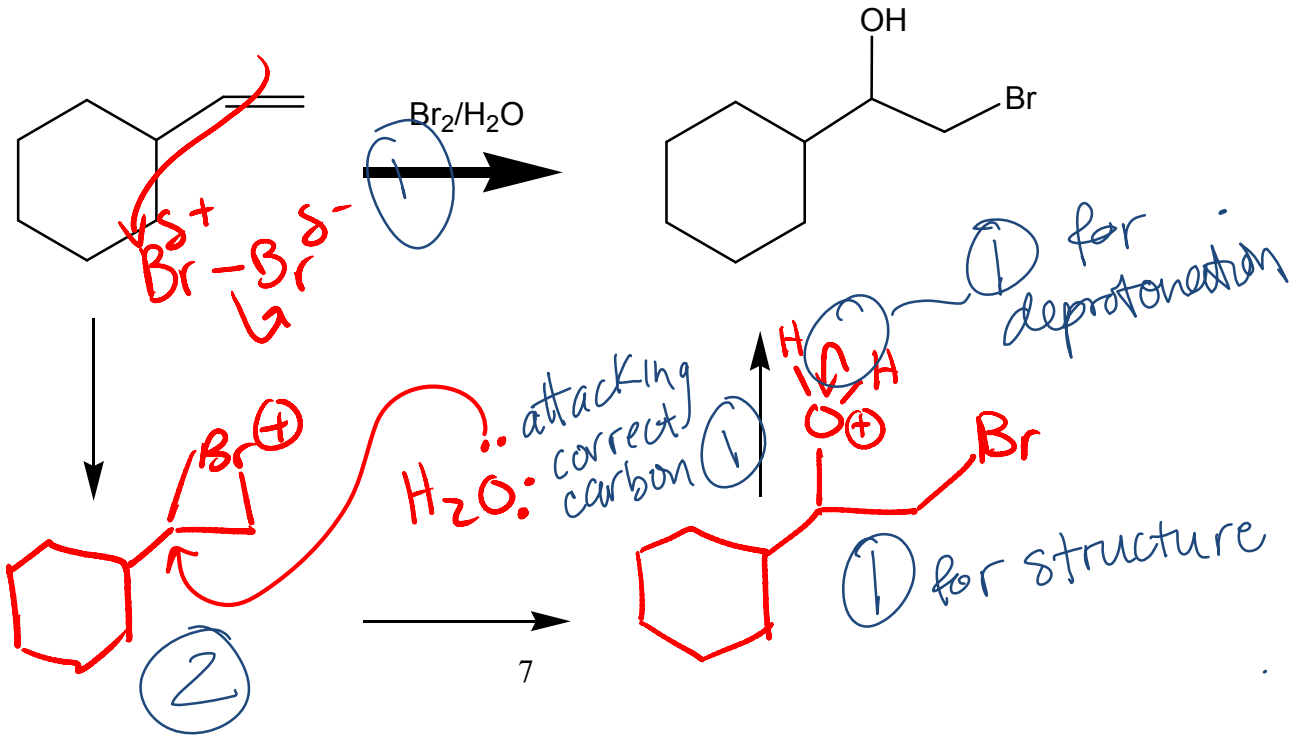


Question 6 (12 marks)

a) Provide the reagents and write out the steps, including the structures of the intermediates in the following multi-step synthetic transformation. You do not need to include mechanistic details of your reactions.



b) Write the mechanism for the following transformation, showing intermediates formed and using curved arrows to indicate electron flow.



Periodic Table of the Elements

1 H																1 H	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110	111	112		114		116		118

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr