Time 3 hr April 1991
NAME: $\qquad$
ID \#: $\qquad$
Fill in the blank in the following equations with the correct structural formula. If stereochemical details are important, make sure your drawing shows these. Show any required catalysts over the arrow. [33 points]
(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)

(j)

(k)

2.(a) Pick the word from the following list [enantiomer, diastereomer, identical, positional isomer] which correctly describes the relationship between the pairs of compounds shown in each part. [8 points].
(i)

(ii)



(iii)


(iv)


(b) In the structure below, assign the correct stereochemical descriptor to each of the groups which requires one and give the compound its correct IUPAC name (including stereochemistry). Part of the marks will be for the correct identification of the priorities of groups, so make sure this work is shown. [6 points].

(c) Draw a Fischer projection of (2R,4S) 2-bromo-4-methylhexan-1-ol. [4 points]
(d) Indicate which of the terms [configurations, conformations, positional isomers] correctly describes the relationship between the following pairs of compounds. [4 points]
(i)


(ii)


(e) Draw the Newman projection of the less stable chair configuration of 3-methylcyclohexanol in its less stable conformation and label the substituents as being axial (a) or equatorial (e). [5 points]
(f) Identify which of the eight drawings in question 2(a) represent molecules which, if taken individually, would be optically active. [4 points]
3. For each of the following pairs of reactions, answer the question asked AND GIVE A REASON FOR YOUR CHOICE. [3 points each, total =15]
(a) Which reaction will proceed faster?

$$
\begin{aligned}
& \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{Br}+\mathrm{H}_{2} \mathrm{O} \longrightarrow \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{OH} \\
& \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{Br}+\mathrm{OH}^{-} \longrightarrow \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{OH}
\end{aligned}
$$

(b) Which reaction will be more likely to proceed by a Sn2 mechanism?

$$
\begin{aligned}
& \mathrm{CH}_{3} \mathrm{CH}=\mathrm{CHCH}_{2} \mathrm{Br}+\mathrm{CN}^{-} \longrightarrow \mathrm{CH}_{3} \mathrm{CH}=\mathrm{CHCH}_{2} \mathrm{CN} \\
& \mathrm{CH}_{2}=\mathrm{CHCH}_{2} \mathrm{CH}_{2} \mathrm{Br}+\mathrm{CN}^{-} \longrightarrow \mathrm{CH}_{2}=\mathrm{CHCH}_{2} \mathrm{CH}_{2} \mathrm{CN}
\end{aligned}
$$

(c) Which compound will react faster with the Lucas reagent?

$$
\mathrm{CH}_{3} \mathrm{CH}=\mathrm{CH}_{2} \mathrm{OH} \quad \text { or } \quad \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{OH}
$$

(d) Which compound will react more rapidly with $\mathrm{CH}_{3} \mathrm{OH}$ with $\mathrm{H}+$ catalysis?


(e) Only one of the following materials will function as an ACID when treated with methoxide ion. Which is it and WHY?

$$
\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{Br} \quad \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{3} \quad \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CHF}_{2}
$$

4. Show using equations five (5) ways you could prepare 2,3-dimethyl-2-butanol, each of which uses a different starting material. [5 points]
5. Draw the COMPLETE MECHANISM for the acid-catalyzed reaction of methanol with 3-methyl-1-butene. Show all the steps and make sure you indicate which steps are reversible. Give the IUPAC name for the product and indicate if the product of the reaction will be optically active. [6 points]
6. When methyl 2-methylbutanoate in which the oxygen atom attached to the methyl group is labelled with 180 is reacted with ethylmagnesium bromide and then the mixture is subsequently neutralized with acid, two organic products are formed. What are these and which of them contains the 18 O ? [5 points]
7. The molecule I-CI (iodine monochloride) adds to alkenes via an electrophilic addition mechanism. If 1 -methylcyclohexene is used as the alkene, draw the structure of the product. Your answer should consider stereochemistry and positional isomerism. [5 points]
