

## ChemHL Alcohols Haloalkane G11

\* 您的姓名：



\* 1. What is the final product formed when  $\text{CH}_3\text{CH}_2\text{OH}$  is refluxed with acidified potassium dichromate(VI)?

- ☐ A.  $\text{CH}_3\text{CHO}$
- ☐ B.  $\text{CH}_2=\text{CH}_2$
- ☐ C.  $\text{CH}_3\text{COOH}$
- ☐ D.  $\text{HCOOCH}_3$

\* 2. What product results from the reaction of  $\text{CH}_2=\text{CH}_2$  with  $\text{Br}_2$ ?

- ☐ A.  $\text{CHBrCHBr}$
- ☐ B.  $\text{CH}_2=\text{CHBr}$
- ☐ C.  $\text{CH}_3\text{CH}_2\text{Br}$
- ☐ D.  $\text{CH}_2\text{BrCH}_2\text{Br}$

\* 3. What is the major carbon-containing products when 2-methylpropan-1-ol is heated with acidified potassium permanganate solution with a distillation setup?

- ☐  $\text{CH}_3\text{CH}_2\text{COOH}$
- ☐  $(\text{CH}_3)_2\text{CHCHO}$
- ☐  $(\text{CH}_3)_2\text{CHCOOH}$
- ☐  $(\text{CH}_3)_2\text{CHCOCH}_3$

\* 4. Which substance(s) could be formed during the incomplete combustion of a hydrocarbon?

I. Carbon II. Hydrogen III. Carbon monoxide

- ☐ A. I only
- ☐ B. I and II only
- ☐ C. I and III only
- ☐ D. II and III only

\* 5. Which formulae represent butane or its isomer?

I.  $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$  II.  $\text{CH}_3\text{CH}(\text{CH}_3)_2$  III.  $(\text{CH}_3)_4\text{C}$

- ☐ A. I and II only
- ☐ B. I and III only
- ☐ C. II and III only
- ☐ D. I, II and III

\* 6. Which compound reacts most readily by a  $\text{S}_{\text{N}}1$  mechanism?

- ☐ A.  $(\text{CH}_3)_3\text{CCl}$
- ☐ B.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$
- ☐ C.  $(\text{CH}_3)_3\text{CI}$
- ☐ D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{I}$

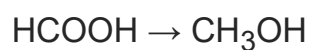
\* 7. How many tertiary isomers does  $\text{C}_7\text{H}_{15}\text{Cl}$  have (excluding stereoisomers)?

- ☐ A. 5
- ☐ B. 6
- ☐ C. 7
- ☐ D. 8

\* 8. Which of the following compounds has the lowest boiling point?

- ☐ A.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- ☐ B.  $\text{CH}_3\text{CH}_2\text{CHO}$
- ☐ C.  $\text{CH}_3\text{CH}_2\text{COOH}$
- ☐ D.  $\text{CH}_3\text{CH}_2\text{COONa}$

\* 9. What type of reaction does the following conversion represent?



- ☐ A. substitution
- ☐ B. oxidation
- ☐ C. reduction
- ☐ D. addition

\* 10. Which compound is a tertiary halogenoalkane?

- ☐ A. 1-chloro-2-methylpropane
- ☐ B. 2-chloro-3-methylbutane
- ☐ C. 2-bromo-2-methylpropane
- ☐ D. 3-chloropentane

\* 11. Which statement about the reactions of halogenoalkanes with aqueous sodium hydroxide is correct?

- ☐ A. Primary halogenoalkanes react mainly by an  $\text{S}_{\text{N}}1$  mechanism.

- ☐ B. Chloroalkanes react faster than iodoalkanes.
- ☐ C. Tertiary halogenoalkanes react faster than primary halogenoalkanes.
- ☐ D. The rate of an SN1 reaction depends on the concentration of aqueous sodium hydroxide.

\* 12. Which of the following solvent is more favored by the substitution reaction between 1-bromobutane and sodium cyanide with heat?

I. water   II. propanone   III. diethyl ether   IV. ethanol

- ☐ A. I and IV
- ☐ B. II and III
- ☐ C. All except I
- ☐ D. All of above

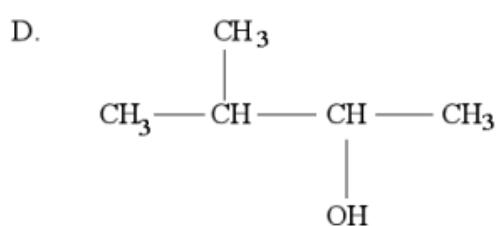
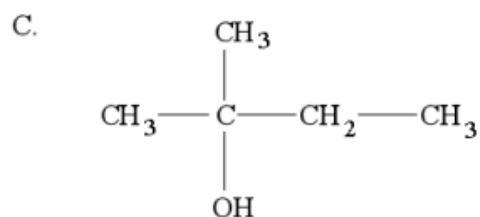
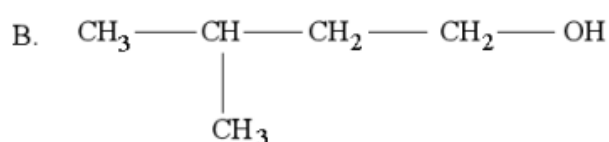
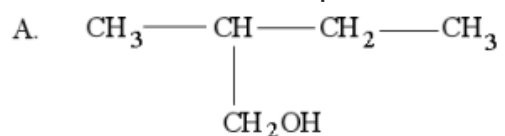
\* 13. Which compound is a member of the aldehyde homologous series?

- ☐ A.  $\text{CH}_3\text{COCH}_3$
- ☐ B.  $\text{HOCH}_2\text{CH}_3$
- ☐ C.  $\text{HOCOCH}_2\text{CH}_3$
- ☐ D.  $\text{OCHCH}_2\text{CH}_3$

\* 14. Which type of compound can be made in one step from a secondary alcohol?

- ☐ A. an aldehyde
- ☐ B. an alkane
- ☐ C. a carboxylic acid
- ☐ D. a ketone

15. Which formula represents a tertiary alcohol?



☐ A

☐ B

☐ C

☐ D

\* 16. Which reaction type is typical for halogenoalkane?

☐ A. nucleophilic substitution

☐ B. electrophilic substitution

☐ C. electrophilic addition

☐ D. nucleophilic addition

\* 17. Which substance is not readily oxidized by acidified potassium dichromate(VI) solution?

☐ A. propan-1-ol

☐ B. propan-2-ol

☐ C. propanal

☐ D. propanone

\* 18. Which pair of compounds can be used to prepare  $\text{CH}_3\text{COOCH}_3$ ?

- ☐ A. Ethanol and methanoic acid
- ☐ B. Methanol and ethanoic acid
- ☐ C. Ethanol and ethanoic acid
- ☐ D. Methanol and methanoic acid

\* 19. When 1 mol of propan-1-ol undergoes combustion with 4 mol of oxygen, which products are most likely to be formed during this reaction?

- ☐ A. Carbon monoxide and water only
- ☐ B. Carbon and water only
- ☐ C. Carbon dioxide, carbon monoxide, and water
- ☐ D. Carbon monoxide, carbon, and water

\* 20. What is/are the major product(s) of the reaction between bromoethane and sodium hydroxide under heat?

- ☐ A.  $\text{CH}_3\text{CH}_2\text{OH}$
- ☐ B.  $\text{CH}_2=\text{CH}_2$  and  $\text{NaBr}$
- ☐ C.  $\text{CH}_2\text{BrCH}_2\text{OH}$  and  $\text{NaH}$
- ☐ D.  $\text{CH}_3\text{CH}_2\text{OH}$  and  $\text{NaBr}$

\* 21. Which are characteristics typical of a free radical?

- I. It has a lone pair of electrons.
- II. It can be formed by the homolytic fission of a covalent bond.
- III. It is uncharged.

- ☐ A. I and II only
- ☐ B. I and III only
- ☐ C. II and III only
- ☐ D. I, II and III

\* 22. Which of the following products could be formed from the oxidation of ethanol?

I. ethanal II. ethanoic acid III. ethane

- ☐ A. I and II only
- ☐ B. I and III only
- ☐ C. II and III only
- ☐ D. I, II and III

\* 23. What is the reaction type when  $(\text{CH}_3)_3\text{CBr}$  reacts with aqueous sodium hydroxide?

- ☐ A. Bimolecular nucleophilic substitution
- ☐ B. Electrophilic substitution
- ☐ C. Free radical substitution
- ☐ D. Unimolecular nucleophilic substitution

\* 24. Which species is a free radical?

- ☐ A.  $\cdot\text{CH}_3$
- ☐ B.  $+\text{CH}_3$
- ☐ C.  $-\text{CH}_3$
- ☐ D.  $:\text{CH}_3$

\* 25. Which compound is a tertiary halogenoalkane?

- ☐ A.  $(\text{CH}_3\text{CH}_2)_2\text{CHBr}$
- ☐ B.  $\text{CH}_3(\text{CH}_2)_3\text{CH}_2\text{Br}$
- ☐ C.  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{Br}$
- ☐ D.  $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{Br}$

\* 26. Which species reacts most readily with propene?

- ☐ A. Br<sub>2</sub>
- ☐ B. Br•
- ☐ C. Br<sup>-</sup>
- ☐ D. Br<sup>+</sup>

\* 27. An organic compound X reacts with excess acidified potassium dichromate(VI) to form compound Y, which reacts with sodium carbonate to produce CO<sub>2</sub>(g). What is a possible formula for compound X?

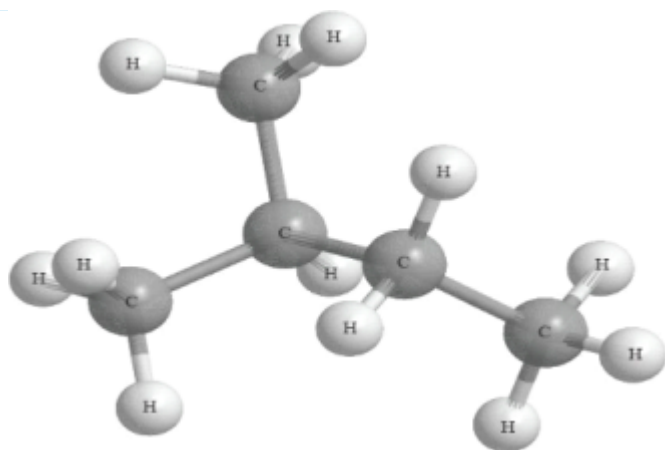
- ☐ A. CH<sub>3</sub>CH<sub>2</sub>COOH
- ☐ B. CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH
- ☐ C. CH<sub>3</sub>CH(OH)CH<sub>3</sub>
- ☐ D. (CH<sub>3</sub>)<sub>3</sub>COH

\* 28. Which statement about successive members of all homologous series is correct?

- ☐ A. They have the same empirical formula.
- ☐ B. They differ by a CH<sub>2</sub> group.
- ☐ C. They have the same physical properties.
- ☐ D. They differ in their degree of unsaturation.

\* 29. The following is a three-dimensional representation of an organic molecule. Which statement is correct?





- ☐ A. The correct IUPAC name of the molecule is 2-methylpentane.
- ☐ B. All the bond angles will be approximately  $90^\circ$ .
- ☐ C. One isomer of this molecule is pentane.
- ☐ D. The boiling point of this compound would be higher than that of pentane.

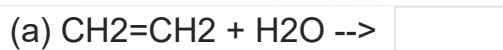
\* 30. Which is the major product forms when hydrogen bromide is added to but-2-ene?

- ☐ A. 2-bromobutane
- ☐ B. 2,3-dibromobutane
- ☐ C. 1-bromobutane
- ☐ D. 1,2-dibromobutane

\* 31. Which of the following combinations would undergo  $S_N1$  mechanism when heated with aqueous NaOH with the fastest rate?

- ☐ A.  $\text{CH}_3\text{CH}_2\text{I}$  reacts with NaOH in ethanol solvent
- ☐ B.  $\text{CH}_3\text{CHICH}_3$  reacts with  $\text{NH}_3$  in dimethyl ether solvent
- ☐ C.  $(\text{CH}_3)_2\text{CClCH}_2\text{CH}_3$  reacts with NaCN in propanone solvent
- ☐ D.  $(\text{CH}_3)_3\text{CI}$  reacts with NaOH in ethanol solvent

\* 32. Fill in the blanks to complete the following reactions (fill in with chemical/condensed structural formulae rather than names when a chemical is needed to be filled in).



The catalyst used is concentrated  with the condition of .

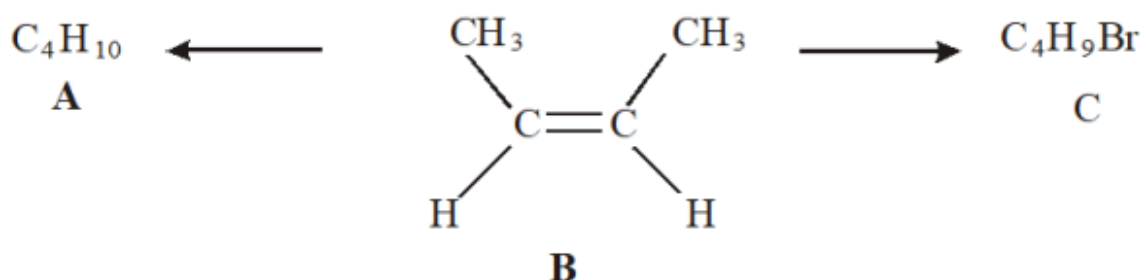


The oxidizing agent used is  (fill in with the condition of this agent)  
 (fill in with the chemical formula of a chromium-containing reagent)  
and the color change of this reaction would be  to .

Heating with  setup is used to obtain  (fill in with the name of the product) because it has  (fill in with "lower" or "higher") boiling point than the other two organic compounds in the reaction mixture and so it can escape from the reaction mixture.

Heating with  setup is used to obtain the other organic product. The cooling water is filled in from  (fill in with "bottom" or "top") opening into the condenser.

\* 33. Two reactions of an alkene, B, are shown below.



(a) State the IUPAC name of B

(b) Complete the complete combustion equation of A:   $\text{C}_4\text{H}_{10} +$   
  $\text{O}_2 \rightarrow$    +   $\text{H}_2\text{O}$

(c)  (aq) (fill in the chemical formula) can be used to distinguish compound A and B. If B is present, then the color of the mixture would change from  to , and the mixture liquid would be separated into two layers, where the organic product is in the  (fill in with "upper" or "lower") layer.

(d) The reaction  $\text{B} \rightarrow \text{A}$  requires  as the other reagent and  as catalyst.

(e) The type of the reaction  $B \rightarrow C$  is .

(f) The IUPAC name of C is .

(g) C can react with sodium hydroxide to form organic compound D. The type of this reaction is  and the IUPAC name of D is .

(h) C is a  (fill with primary, secondary, or tertiary) bromoalkane. It undergoes  (fill in with "mostly SN1", "mostly SN2" or "both SN1 and SN2") reaction with NaOH. The organic products would be  (fill in with "one enantiomer", "a pair of two enantiomers", or "racemic mixture"). One of the organic products would take up 40%. It can be deduced that SN1 would have  (fill in with percentage) in this case.

(i) D can be oxidized by acidified potassium permanganate to form organic compound E. The setup of this reaction would be heat and  and the IUPAC name of E is . The color change of this reaction would be  to .

(j) The IUPAC name of the isomer of D that does not react with acidified potassium dichromate is .

(k) D can react with  $\text{CH}_3\text{CH}_2\text{COOH}$  under the catalysis of  with heat to form organic compound F and water. The specific reaction type of this reaction is called  and the name of the functional group of F is .

(l) The reaction between D and  $\text{CH}_3\text{CH}_2\text{COOH}$  has a positive enthalpy change. The addition of water into the reaction mixture at the beginning of the reaction would result in a  (fill in with "higher" or "lower") reaction rate and a  (fill in with "higher" or "lower") yield of the organic product.


A higher temperature would lead to a  (fill in with "higher" or "lower") reaction rate, a  (fill in with "higher" or "lower") yield of the organic product, and a  (fill in with "higher" or "lower") value of  $K_c$ .

The addition of NaOH solid into the equilibrium mixture of this reaction would result in a  (fill in with "higher" or "lower") yield of the organic product.


Sodium metal can react with all the substances in the reaction mixture except  (fill in with "acid", "alcohol", "ester", "water", or "catalyst").

- \* 34. Draw the reaction mechanism of the reaction between 2-bromobutane and sodium cyanide using curly arrows to show the movements of electron pairs. 3D shapes of reatants, products, intermediates and transition states in your drawing need to be shown clearly.

(a) via SN1  
mechanism;

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(b) via SN2  
mechanism.

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