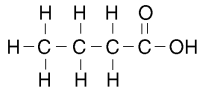
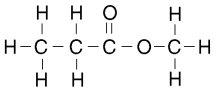
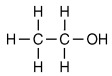
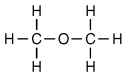
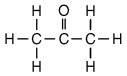
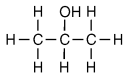
1. Given the structural formulas for two organic compounds:

 and 

The differences in their physical and chemical properties are primarily due to their different
A) number of hydrogen atoms
B) number of carbon atoms
C) molecular masses
D) functional groups

2. Organic compounds that are essentially non-polar and exhibit weak intermolecular forces have
A) low vapor pressure
B) high electrical conductivity in solution
C) low melting points
D) high boiling points

3. Given the structural formulas:

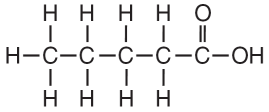
Formula A 
Formula B 
Formula C 
Formula D 

Which two formulas represent compounds that are isomers of each other?
A) *B* and *D*
B) *A* and *C*
C) *A* and *B*
D) *C* and *D*

4. Which compound is an isomer of $CH_3CH_2OH$?
A) $CH_3COOH$
B) $CH_3COCH_3$
C) $CH_3CH_2CH_3$
D) $CH_3OCH_3$

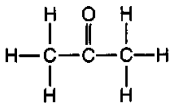
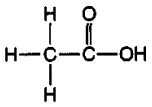
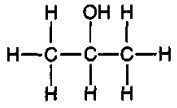
5. What is the total number of carbon atoms in a molecule of ethanoic acid?
A) 1 B) 2 C) 3 D) 4

6. Given the structural formula:



What is the IUPAC name of this compound?
A) methyl pentanoate
B) pentanal
C) pentanol
D) pentanoic acid

7. Given the three organic structural formulas shown below:

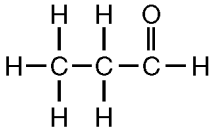
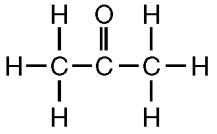
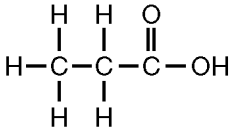
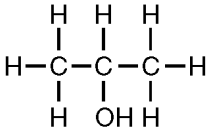
  

Which organic compound classes are represented by these structural formulas, as shown from left to right?
A) ketone, aldehyde, alcohol
B) ester, organic acid, ketone
C) ketone, organic acid, alcohol
D) ester, aldehyde, organic acid

8. Which of these compounds has chemical properties most similar to the chemical properties of ethanoic acid?
A) $C_3H_7COOH$
B) $C_2H5OH$
C) $C_2H_5COOC_2H_5$
D) $C_2H5OC_2H_5$

9. Which compound is an alcohol?
A) methanol
B) ethyne
C) butane
D) propanal

10. Given the formulas of four organic compounds:

(a) 
(c) 
(b) 
(d) 

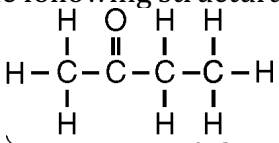
Which pair below contains an alcohol and an acid?
A) *a* and *b*
B) *a* and *c*
C) *c* and *d*
D) *b* and *d*

11. What is the IUPAC name for the compound that has the condensed structural formula CH3CH2CH2CHO?
A) propanol
B) propanal
C) butanal
D) butanol

12. The organic compound represented by the condensed structural formula $CH_3CH_2CH_2CHO$ is classified as an
A) ether
C) alcohol

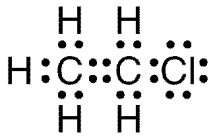
B) ester D) aldehyde

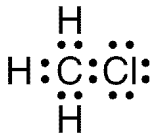
13. What is the IUPAC name of the compound with the following structural formula?

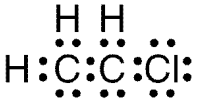


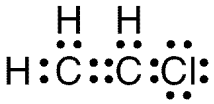
A) propanone C) butanone
B) butanal D) propanal

14. Which Lewis electron-dot diagram represents chloroethene?

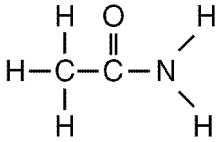
A) 

C) 

B) 

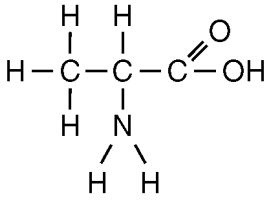
D) 

15. Given the structural formula:



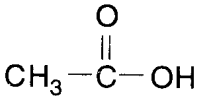
This compound is classified as an
A) aldehyde C) alcohol
B) amide D) amine

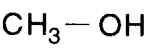
16. Given the structural formula:

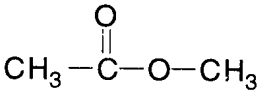


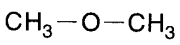
This structural formula represents a molecule of
A) a ketone C) an aldehyde
B) an ester D) an amino acid

17. Which formula represents an ether?

A) 

C) 

B) 

D) 

18. Given the balanced equation for an organic reaction:



This reaction is best classified as
A) fermentation C) esterification
B) substitution D) addition

19. Given the incomplete equation representing an organic addition reaction:



Which compound could be represented by X?
A) $C_3H_8$ C) $C_4H_{10}$
B) $CH_4$ D) $C_2H_4$

20. Given the equation:

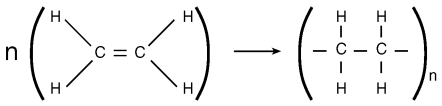


Which type of reaction does this equation represent?
A) substitution C) polymerization
B) addition D) hydrogenation

21. Which organic reaction produces rubber and plastics?
A) polymerization C) fermentation
B) esterification D) saponification

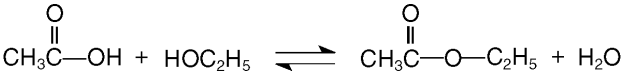
22. Which type of reaction is represented by the equation below?

Note: n and n are very large numbers equal to about 2000.



A) saponification C) esterification
B) fermentation D) polymerization

23. Given the reaction:



This reaction is an example of
A) hydrogenation C) fermentation
B) saponification D) esterification

24. When butane burns in an excess of oxygen,

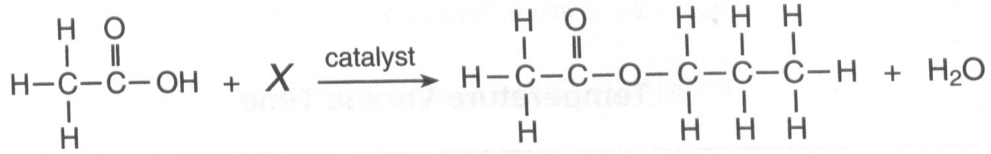
the principal products are
A) CO and $H_2O$ C) $CO_2$ and $H_2O$
B) $CO_2$ and $H_2$ D) CO and $H_2$

25. In which reaction is soap a product?
A) saponification C) polymerization
B) addition D) substitution

26. What are the two main products of a fermentation reaction?
A) ethanol and water
B) ethanol and carbon dioxide
C) sugar and water
D) sugar and carbon dioxide

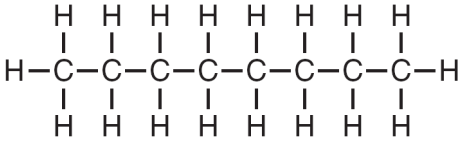
27. Base your answer to the following question on the information below.

The incomplete equation below represents an esterification reaction. The alcohol reactant is represented by X.




Draw the structural formula for the alcohol represented by X.

28. A gasoline engine burns gasoline in the presence of excess oxygen to form carbon dioxide and water. The main components of gasoline are isomers of octane. A structural formula of octane is shown below.



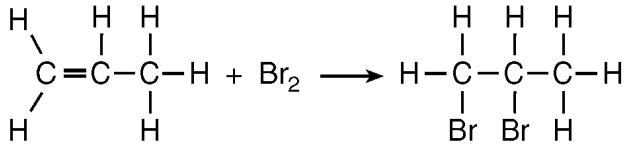
Draw a structural formula for 2,2,4-trimethylpentane.

**Base your answers to questions 29 and 30 on the information below.**

Many esters have distinctive odors, which lead to their widespread use as artificial flavorings and fragrances. For example, methyl butanoate has an odor like pineapple and ethyl methanoate has an odor like raspberry.

29. What is a chemical name for the alcohol that reacts with methanoic acid to produce the ester that has an odor like raspberry?
30. Draw a structural formula for the ester that has an odor like pineapple.

**Base your answers to questions 31 through 33 on the equation below, which represents an organic compound reacting with bromine.**



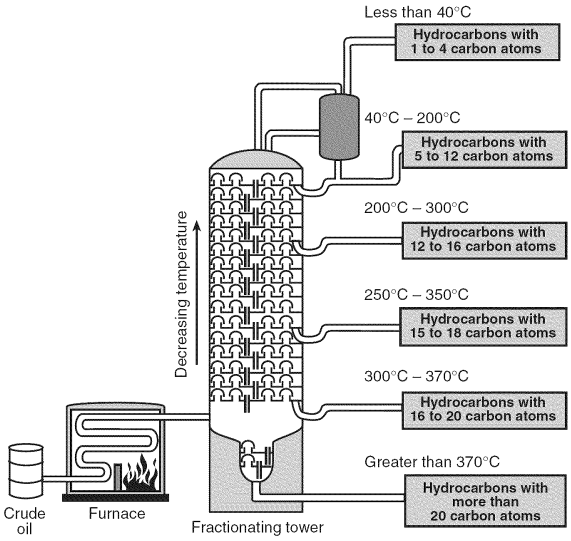
31. What is the gram-formula mass of the product in this reaction?

32. What type of organic reaction is represented by this equation?

33. What is the IUPAC name for the organic compound that reacts with Br2?

**Base your answers to questions 34 through 37 on the information and diagram below and on your knowledge of chemistry.**

Crude oil is a mixture of many hydrocarbons that have different numbers of carbon atoms. The use of a fractionating tower allows the separation of this mixture based on the boiling points of the hydrocarbons. To begin the separation process, the crude oil is heated to about 400°C in a furnace, causing many of the hydrocarbons of the crude oil to vaporize. The vaporized mixture is pumped into a fractionating tower that is usually more than 30 meters tall. The temperature of the tower is highest at the bottom. As vaporized samples of hydrocarbons travel up the tower, they cool and condense. The liquid hydrocarbons are collected on trays and removed from the tower. The diagram below illustrates the fractional distillation of the crude oil and the temperature ranges in which the different hydrocarbons condense.




34. How many hydrogen atoms are present in one molecule of octane?

35. Write an IUPAC name of *one* saturated hydrocarbon that leaves the fractionating tower at *less than* 40°C.

36. Describe the relationship between the strength of the intermolecular forces and the number of carbon atoms in the different hydrocarbon molecules.

37. State the trend between the boiling point of the hydrocarbons contained in the crude oil and the number of carbon atoms in these molecules.

**Base your answers to questions 38 and 39 on the information below. Given the reaction between 1-butene and chlorine gas:**

$$C_4H_8 + Cl_2 \longrightarrow C_4H_8Cl_2$$

38. Draw the structural formula of the product 1,2-dichlorobutane

39. Which type of chemical reaction is represented by this equation?

**Base your answers to questions 40 and 41 on the information below.**

Diethyl ether is widely used as a solvent.

40. Draw the structural formula for an alcohol that is an isomer of diethyl ether.

41. In the space provided draw the structural formula for diethyl ether.

42. How is the bonding between carbon atoms different in unsaturated hydrocarbons and saturated hydrocarbons?