Name_____Date_____ Period_____

Topic: Organic Chemistry

1. Organic compounds consist of carbon atoms which bond to each other in chains, rings and networks to form a variety of structures.

- ✓ The source of most hydrocarbons (Table Q) is petroleum, which is a mixture of many hydrocarbons.
- ✓ The hydrocarbons in petroleum are separated from each other by distillation in a "cracking tower," on the basis of boiling points.
- ✓ The greater the molar mass, the higher the intermolecular forces of attraction between molecules. As a result, melting points and boiling points are higher. EX: Octane is a liquid at room temperature, whereas propane (the smaller molecule) is a gas, showing that it has weaker forces of attractions.

2. Organic compounds can be named with the IUPAC system.

- ✓ You should know this system! Use Tables P and Q and R for help!

3. Hydrocarbons are compounds that contain only carbon and hydrogen.

- ✓ Saturated hydrocarbons contain only single carbon-carbon bonds.
- ✓ Unsaturated hydrocarbons contain at least one multiple carbon-carbon bond (double or triple bond).
- ✓ Hydrocarbons tend to be nonpolar molecules, and therefore do not dissolve in water.
- ✓ Hydrocarbons are molecular compounds that do not ionize in water, and are therefore "Non-electrolytes."

4. Organic acids, alcohols, esters, aldehydes, ketones, ethers, halides, amines, amides, and amino acids are categories of organic molecules that differ in their structures.

- ✓ Use Table R for help!
- ✓ Esters are the trickiest to name/draw. Review that one especially!

5. Functional groups give organic molecules distinct physical and chemical properties.

6. Isomers of organic compounds have the same molecular formula but different structures and properties.

7. In a multiple covalent bond, more than one pair of electrons are shared between two atoms. Unsaturated organic compounds contain at least one double or triple bond.

8. Types of organic reactions include: addition, substitution, polymerization, esterification, fermentation, saponification, and combustion.

- ✓ You need to memorize the details of these reactions in order to be able to identify them. The Regents exam likes to go after the esterification reaction especially.

9. Empirical formulas express the simplest ration of elements in a comnpound.

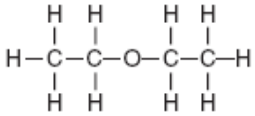
- ✓ EX: Hexane – Molecular formula = C_6H_{14} & has an empirical formula of C_3H_7
  - Propane – Molecular formula = C_3H_8 but has no simpler formula, so C_3H_8 is also its empirical formula

Organic Review – questions from previous Regents exams

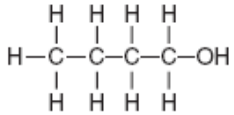
1. What is the total number of carbon atoms in a molecule of ethanoic acid?
   (1) 1 (3) 3
   (2) 2 (4) 4

2. A double carbon-carbon bond is found in a molecule of
   (1) pentane (3) pentyne
   (2) pentene (4) pentanol

3. Given the formulas for two compounds:



and



These compounds differ in
   (1) gram-formula mass
   (2) molecular formula
   (3) percent composition by mass
   (4) physical properties at STP

4. Which pair consists of a molecular formula and its corresponding empirical formula?
   (1) C_2H_2 and CH_3CH_3 (3) P_4O_{10} and P_2O_5
   (2) C_6H_6 and C_2H_2 (4) SO_2 and SO_3

5. The organic compound represented by the condensed structural formula $CH_3CH_2CH_2CHO$ is classified as an
   (1) alcohol (3) ester
   (2) aldehyde (4) ether

6. Which two formulas represent Arrhenius acids?
   (1) CH_3COOH and CH_3CH_2OH
   (2) $HC_2H_3O_2$ and H_3PO_4
   (3) $KHCO_3$ and $KHSO_4$
   (4) NaSCN and $Na_2S_2O_3$

7. Which compound is an unsaturated hydrocarbon?
   (1) hexanal (3) hexanoic acid
   (3) hexane (4) hexene

8. Which formula represents an alkene?
   (1) C_2H_6 (3) C_4H_{10}
   (2) C_3H_6 (4) C_5H_{12}

9. What is the total number of pairs of electrons shared between the carbon atom and the oxygen atom in a molecule of methanal?
   (1) 1 (3) 3
   (2) 2 (4) 4

10. Which compound is a saturated hydrocarbon?
   (1) CH_2CH_2 (3) CH_3CHO
   (2) CH_3CH_3 (4) CH_3CH_2OH

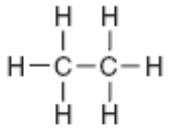
11. A molecule of a compound contains a total of 10 hydrogen atoms and has the general formula C_nH_{2n+2}. Which prefix is used in the name of this compound?
   (1) but- (3) oct-
   (2) dec- (4) pent-

12. A molecule of butane and a molecule of 2-butene both have the same total number of
   (1) carbon atoms (3) single bonds
   (2) hydrogen atoms (4) double bonds

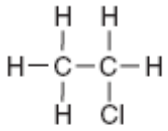
13. Which general formula represents the homologous series of hydrocarbons that includes the compound l-heptyne?
   (1) C_nH_{2n-6} (3) C_nH_{2n}
   (2) C_nH_{2n-2} (4) C_nH_{2n+2}

14. Which two compounds are isomers of each other?
   (1) CH_3CH_2COOH and $CH_3COOCH_2CH_3$
   (2) CH_3CH_2CHO and CH_3COCH_3
   (3) $CH_3CHBrCH_3$ and $CH_2BrCHBrCH_3$
   (4) $CH_3CHOHCH_3$ and $CH_3CHOHCH_2OH$

15. Which formula represents an unsaturated hydrocarbon?



(1)



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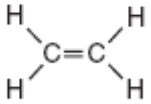

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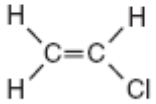
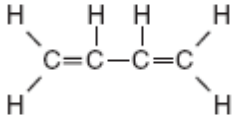


(4)

16. A compound has a molar mass of 90. grams per mole and the empirical formula CH_2O. What is the molecular formula of this compound?

(1) CH_2O (3) $C_3H_6O_3$
(2) $C_2H_4O_2$ (4) $C_4H_8O_4$

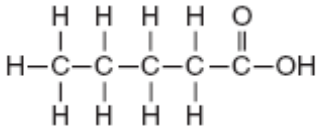
17. Given the formula of a substance:



What is the total number of shared electrons in a molecule of this substance?

(1) 22 (3) 9
(2) 11 (4) 6

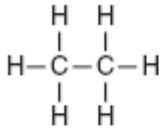
18. Given the structural formula:



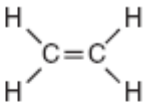
What is the IUPAC name of this compound?

(1) pentanal (3) methyl pentanoate
(2) pentanol (4) pentanoic acid

19. Which structural formula represents an unsaturated hydrocarbon?



(1)



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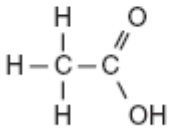

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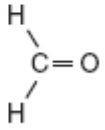


(4)

20. Two substances have different physical and chemical properties. Both substances have molecules that contain two carbon atoms, one oxygen atom, and six hydrogen atoms. These two substances must be

(1) isomers of each other
(2) isotopes of each other
(3) the same compound
(4) the same hydrocarbon

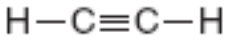
21. Given the balanced equation representing a reaction:

$CH_3CH_2CH_3 + Br_2 \rightarrow CH_3CH_2CH_2Br + HBr$

This organic reaction is best classified as

(1) an addition reaction
(2) an esterification reaction
(3) a polymerization reaction
(4) a substitution reaction

22. Given the structural formula:



What is the total number of electrons shared in the bond between the two carbon atoms?

(1) 6 (3) 3
(2) 2 (4) 4

Base your answers to questions 23 and 24 on the information below.

Ozone gas, O_3, can be used to kill adult insects in storage bins for grain without damaging the grain. The ozone is produced from oxygen gas, O_2, in portable ozone generators located near the storage bins. The concentrations of ozone used are so low that they do not cause any environmental damage. This use of ozone is safer and more environmentally friendly than a method that used bromomethane, CH_3Br. However, bromomethane was more effective than ozone because CH_3Br killed immature insects as well as adult insects.

Adapted From: *The Sunday Gazette* (Schenectady, NY) 3/9/03

23. Determine the total number of moles of CH_3Br in 19 grams of CH_3Br (gram-formula mass = 95 grams/mol). [1]

24. Given the balanced equation for producing bromomethane:

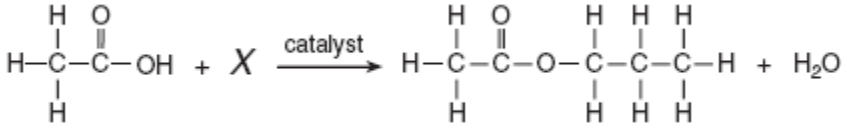
$$Br_2 + CH_4 \rightarrow CH_3Br + HBr$$

Identify the type of organic reaction shown. [1]

25. Write the empirical formula for the compound C_8H_{18}. _____

Base your answers to questions 26 through 28 on the information below.

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



26. On the reaction above, circle the acid functional group.[1]

27. Write an IUPAC name for the reactant represented by its structural formula in this equation. [1]

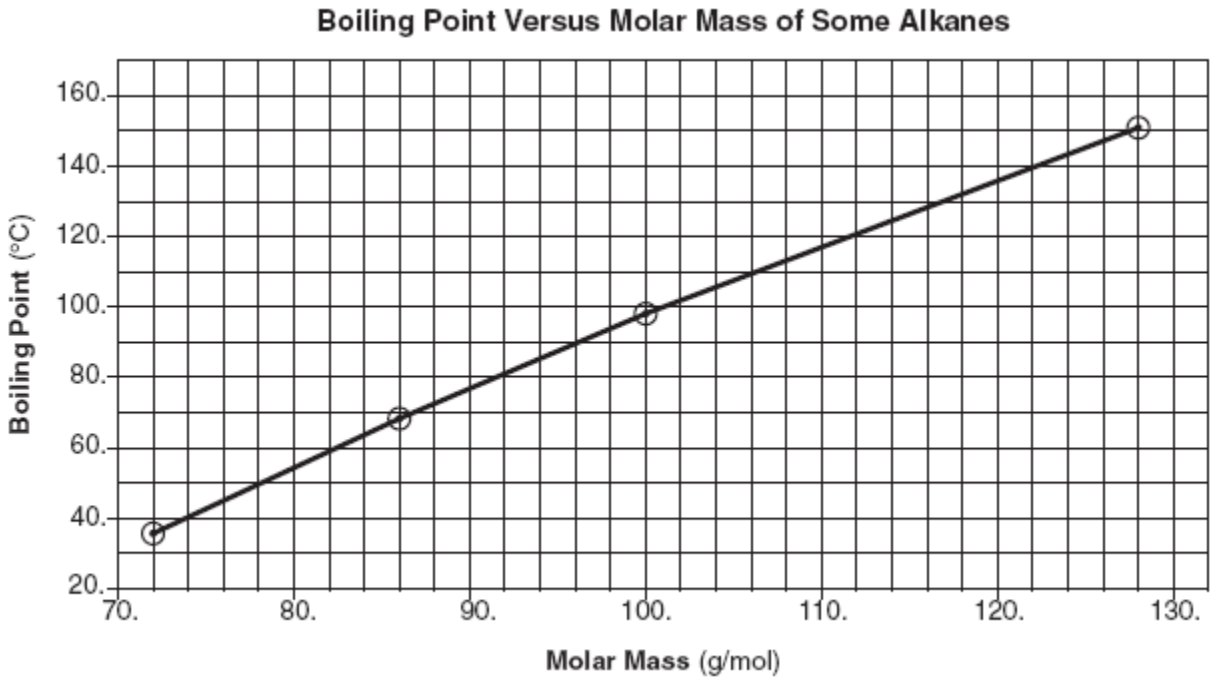
_____

28. Draw the structural formula for the alcohol represented by X.

29.Explain, in terms of molecular structure or distribution of charge, why a molecule of methane is nonpolar. [1]

Base your answers to questions 30 and 31 on the information below.

The graph below shows the relationship between boiling point and molar mass at standard pressure for pentane, hexane, heptane, and nonane.



30.Octane has a molar mass of 114 grams per mole. According to this graph, what is the boiling point of octane at standard pressure? [1]

31.State the relationship between molar mass and the strength of intermolecular forces for the selected alkanes. [1]