Science 20

Unit A: Chemical Change

Assignment Booklet A3

Alberta
EDUCATION

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Chapter 3 Assignment	65	

Teacher's Comments

Science 20
Unit A: Chemical Change
Assignment Booklet A3
Chapter 3 Assignment

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Education, **http://www.education.gov.ab.ca**
- Learning Technologies Branch, **http://www.education.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.education.gov.ab.ca**

Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

ASSIGNMENT BOOKLET A3
SCIENCE 20: UNIT A
CHAPTER 3 ASSIGNMENT

This Assignment Booklet is worth 65 marks out of the total 186 marks for the assignments in Unit A. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully, and record your answers in the appropriate places. If you have difficulty with an assignment, go back to the textbook and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

65

Chapter 3 Assignment: Organic Chemistry

For questions 1 to 3, read each question carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

1

_____ 1. Which hydrocarbon is most closely associated with the production of plastic polyethylene?

A. butane
B. ethene
C. ethyne
D. propane

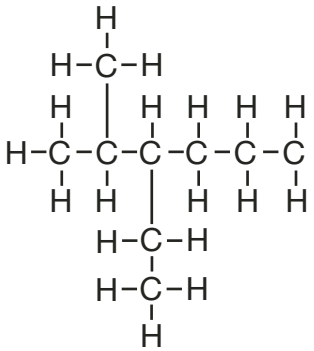
1

_____ 2. What is the chemical name for the liquid fuel component $C_{10}H_{22}(l)$?

A. butane
B. decane
C. nonane
D. methane

1

_____ 3. What is the name of the hydrocarbon on the right?



A. 3-ethyl-2-methylhexane
B. 2-methyl-3-ethylhexane
C. 5-methyl-4-ethylhexane
D. 4-ethyl-5-methylhexane

4. Decide whether each statement is true (T) or false (F). Place your answer in the blank space given.

(½) _____ a. A hydrocarbon contains only atoms of carbon and hydrogen.

(½) _____ b. Alkanes have the general formula C_nH_{2n}.

(½) _____ c. In a condensed structural diagram, the symbol "H" is used to show the position of a hydrogen atom.

(½) _____ d. A continuous-chain alkane has one or more carbon branches attached to the parent chain.

(½) _____ e. In a Lewis dot diagram of a hydrocarbon, each carbon-carbon and carbon-hydrogen bond is represented by a line segment.

(½) _____ f. Any branch within branched alkanes is called an alkyl group.

(2) 5. Explain why there is such a large variety of carbon-based compounds.

_____

_____

_____

_____

(3) 6. Draw the complete structural diagram of the hydrocarbon 3,3-diethylheptane.

Return to page 20 of the Distance Learning Student Guide, and begin Lesson 3.2.

For questions 7 to 15, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 7. The following are steps in the formation of a double-bond hydrocarbon molecule from a single-bond hydrocarbon molecule:

1. The closest thing to bond with is the electron from the other carbon atom.
2. Two hydrogen atoms leave the carbon chain.
3. Twisting occurs to accommodate the double bonds.
4. Both carbons bond with each other to form a double bond.
5. Both carbons have an unbonded electron.

The correct order of the steps in the formation of a double-bond hydrocarbon molecule from a single-bond hydrogen molecule is

A. 2, 4, 1, 3, 5
B. 1, 2, 3, 4, 5
C. 2, 5, 1, 4, 3
D. 5, 1, 4, 2, 3

(1) _____ 8. Why do saturated fats tend to be solid at room temperature, whereas unsaturated fats tend to be liquid?

A. The chains of fatty acid molecules in saturated fats are straight and require more energy to break the bonds between adjacent molecules.

B. The chains of fatty acid molecules in saturated fats are bent and require less energy to break the bonds between adjacent molecules.

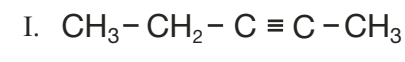
C. The chains of fatty acid molecules in unsaturated fats are straight and require less energy to break the bonds between adjacent molecules.

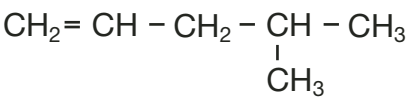
D. The chains of fatty acid molecules in unsaturated fats are bent and require more energy to break the bonds between adjacent molecules.

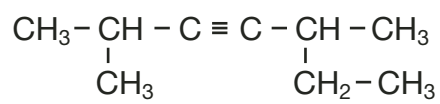
(1) _____ 9. The ending *-yne* is used for hydrocarbons with

A. only single bonds
B. at least one double bond
C. at least one triple bond
D. only double and triple bonds

Use the following information to answer questions 10 to 12.

I. 

II. 

III. 

(1) _____ 10. Compound I is

A. 3-pentene
B. 2-pentene
C. 3-pentyne
D. 2-pentyne

(1) _____ 11. Compound II is

A. 2-methyl-1-pentene
B. 2-methyl-4-pentene
C. 4-methyl-1-pentene
D. 4-methyl-4-pentene

(1) _____ 12. Compound III is

A. 2,5-dimethyl-3-hexyne
B. 2,5-dimethyl-3-heptyne
C. 2-ethyl-5-methyl-3-hexyne
D. 2-ethyl-5-methyl-3-heptyne

(1) _____ 13. Which has the lowest boiling point?

A. ethene
B. ethane
C. propane
D. propene

(1) _____ 14. The boiling point of hydrocarbons

A. is higher for alkenes than it is for alkanes
B. is higher for alkynes than it is for alkenes
C. increases as the number of carbon atoms in the chain increases
D. decreases as the number of carbon atoms in the chain increases

(1) _____ 15. Which compounds are in order from most reactive to least reactive?

A. ethane, propene, butane
B. 3-heptyne, propene, ethane
C. 2-hexane, hexene, 3-butyne
D. 2-octane, 4-butene, ethyne

16. Match each description with the appropriate term listed. Place your answer in the blank space given.

i. saturated hydrocarbon	ii. alkene	iii. polyunsaturated fat
iv. unsaturated hydrocarbon	v. fatty acid	vi. monounsaturated fat
vii. hydrogenation	viii. alkyne	

(½) _____ a. an organic molecule consisting of a long chain of carbons with a COOH group at one end and a methyl group at the other end

(½) _____ b. a hydrocarbon that has at least one carbon-carbon double bond

(½) _____ c. a reaction that converts carbon-carbon double and triple bonds in unsaturated compounds into carbon-carbon single bonds of saturated compounds

(½) _____ d. a hydrocarbon containing double or triple covalent bonds between carbon atoms

(½) _____ e. a fat molecule that includes fatty acids having only one double bond

(½) _____ f. a hydrocarbon that has at least one carbon-carbon triple bond

(½) _____ g. a hydrocarbon containing only single covalent bonds between carbon atoms

(½) _____ h. a fat molecule that includes fatty acids having more than one double bond

17. Decide whether each statement is true (T) or false (F). Place your answer in the blank space given.

(½) _____ a. A hydrocarbon molecule with a triple bond is more stable than a hydrocarbon molecule with all single bonds.

(½) _____ b. The difference between butter and corn oil is that the hydrocarbon molecule in butter contains a double carbon-carbon bond.

(½) _____ c. A bent shape is the property that accounts for many of the healthy properties of oleic acid present in corn oil.

(½) _____ d. A diet with no fat is the healthiest.

(½) _____ e. In an industrially produced trans fat, only the relative position of the hydrogen atoms on either side of the double bond is changed.

(½) _____ f. Trans fatty acids have a greater likelihood of clogging up your arteries because they tend to be solids at room temperature.

(2) 18. Draw the complete structural diagram for C_5H_8.

19. Draw the condensed structural diagram for the following compounds.

(2) a. methylpropene

(3) b. 4-ethyl-7-methyl-2-octyne

Return to page 23 of the Distance Learning Student Guide, and begin Lesson 3.3.

For questions 20 to 23, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 20. In fractional distillation, the number of carbons in the different components produced

A. stay the same throughout the distillation tower
B. increase as the vapours move up the distillation tower
C. decrease as the vapours move up the distillation tower
D. increase then decrease as the vapours move up the distillation tower

(1) _____ 21. The purpose of cracking in the production of ethene is to

A. convert large molecules into small molecules
B. convert small molecules into large molecules
C. evaporate the lightest molecules from the mixture
D. condense light molecules into large molecules

Use the following information to answer questions 22 and 23.

The following equation represents the cracking of a 14-carbon hydrocarbon into smaller hydrocarbons:

$$C_{14}H_{30}(g) \rightarrow C_3H_8(g) + C_5H_{10}(g) + C_6H_{12}(g)$$

(1) _____ 22. The reactant hydrocarbon is

A. an alkane
B. an alkene
C. an alkyne
D. none of the above

(1) _____ 23. Which product is an alkane?

A. $C_3H_8(g)$
B. $C_5H_{10}(g)$
C. $C_6H_{12}(g)$
D. $C_8H_{16}(g)$

24. Match each description with the appropriate term listed. Place your answer in the blank space given.

i. petroleum	ii. cracking	iii. fraction
iv. refining	v. naptha	vi. fractional distillation

(½) _____ a. a reaction in which hydrocarbons are broken down into smaller molecules by means of heat or catalysts

(½) _____ b. an industrial process that separates, purifies, and alters raw materials

(½) _____ c. liquid hydrocarbons formed over millions of years from the remains of ancient microscopic marine organisms

(½) _____ d. a group of compounds found in petroleum with similar properties and uses

(½) _____ e. a mixture of hydrocarbons containing between five and ten carbon atoms

(½) _____ f. a process used for the separation of a liquid mixture by vaporizing it and collecting the different components of the mixture as they cool down and condense at their appropriate boiling points

25. Decide whether each statement is true (T) or false (F). Place your answer in the blank space given.

(½) _____ a. Scientific theory states that the atoms in today's plastics were parts of microscopic plants and animals that lived in the oceans millions of years ago.

(½) _____ b. Molecules of gasoline have more carbon atoms than do molecules of diesel fuel.

(½) _____ c. It is useful to subject large molecules to cracking because it is easier to manipulate smaller molecules in a reaction and produce a desired product.

(½) _____ d. Unsaturated compounds form during hydrocarbon cracking because there are too many hydrogen atoms for the number of carbon atoms.

(2) 26. In the following equation, three products are produced by cracking.

$$C_8H_{18}(l) \rightarrow 2\ C_2H_4(g) + C_3H_6(g) + CH_4(g)$$

Are these the only possible products from the cracking of this hydrocarbon? Explain.

_____

_____

_____

Return to page 24 of the Distance Learning Student Guide, and begin Lesson 3.4.

For questions 27 to 34, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 27. Which hydrocarbon is the primary component of natural gas?

A. methane
B. propane
C. nonane
D. butane

(1) _____ 28. When a hydrocarbon molecule and an oxygen molecule react chemically, energy breaks molecular bonds of the reactants and forms the new molecular bonds of the products. How is energy involved in bonds forming and breaking during the reaction?

A. Energy is absorbed as bonds form and is absorbed as bonds break.
B. Energy is absorbed as bonds form and is released as bonds break.
C. Energy is released as bonds form and is absorbed as bonds break.
D. Energy is released as bonds form and is released as bonds break.

(1) _____ 29. In the complete combustion of butane, what amount of oxygen is needed for each mole of butane?

A. 4 mol
B. 6.5 mol
C. 8 mol
D. 13 mol

(1) _____ 30. A group of students considered the following statements about the use of vehicles:

I. Vehicles release thermal energy through the exhaust system, braking system, and radiator.
II. Carbon dioxide is an emission from a vehicle's exhaust system.
III. Carbon monoxide is an emission from a vehicle's exhaust system.

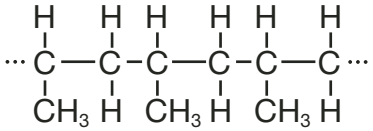
Which statement(s) explains why the use of vehicles contributes to the enhanced greenhouse effect?

A. I
B. I and III
C. II
D. III

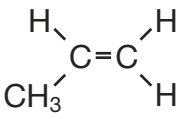
(1) _____ 31. Which hydrocarbon produces the most water vapour when it is burned completely?

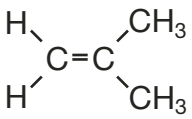
A. 1 mol of octane
B. 1 mol of butane
C. 1 mol of methane
D. 1 mol of 3,3-diethylheptane

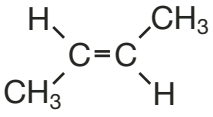
(1) _____ 32. The following polymer is used to make indoor/outdoor carpets, bottles, and even drinking straws.

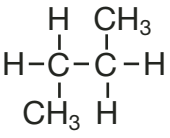


Which is a starting compound for the production of this polymer?

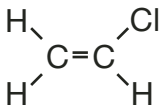
A. 

B. 

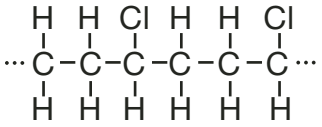
C. 

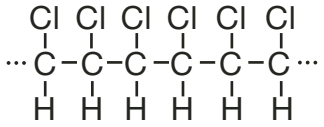
D. 

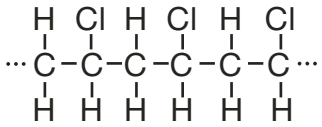
(1) _____ 33. The following short molecule is used as a starting compound in a polymerization reaction.

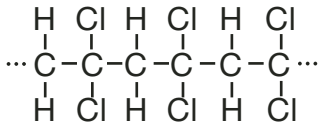


Which polymer is a product of this reaction?

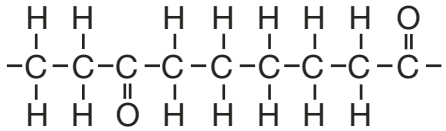
A. 

B. 

C. 

D. 

(1) _____ 34. Biodegradable polyethylene has the following stucture.



Carboxyl groups are inserted into the polyethylene polymer to

A. make the polymer longer lasting
B. improve the strength of the polymer
C. improve the heat resistance of the polymer
D. make the polymer less resistant to sunlight

(4) 35. Imagine riding in a car or bus. Describe four uses of petrochemical products that are related to the manufacture or use of motor vehicles.

(3) 36. Too much heptane is undesirable in gasoline because it causes engine knocking. However, heptane is a significant component of automobile gasoline. Determine the balanced chemical equation for the complete combustion of heptane.

(3) 37. Determine the balanced chemical equation for the complete combustion of 2,2-dimethylhexane.

(2) 38. Give two reasons why people should use petrochemicals wisely.

_____

_____

_____

_____

Submit your completed Assignment Booklet A3 to your teacher for assessment.
Then return to page 26 of the Distance Learning Student Guide,
and begin the Chapter 3 Summary.