DATE: NAME: CLASS:

ASSESSMENT	Chapter 15 Test	BLM 15.3.1

Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

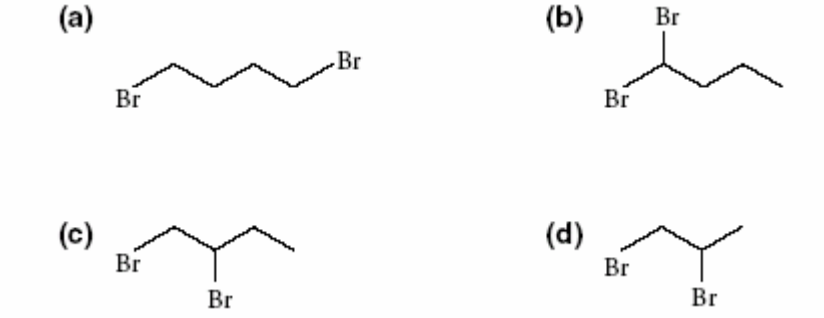
1. Which one of the following statements regarding saturated fatty acids is true?
   a) There are double bonds between the carbon atoms.
   b) They have a higher ratio of hydrogen to carbon than unsaturated fatty acids.
   c) The majority of them are liquid at room temperature.
   d) Manufacturers partially hydrogenate them to produce trans fats.

2. Which one of the following statements best describes an elimination reaction?
   a) Carbon atoms in the organic product are bonded to fewer atoms than the carbon atoms in the organic reactant.
   b) A hydrogen atom or functional group is replaced with a different atom or functional group.
   c) Atoms are added to a double or triple carbon–carbon bond.
   d) Two molecules are combined and a small molecule, such as water, is produced as a second product.

3. The addition of a catalyst is required for the conversion of 2-propanol to propene. An appropriate catalyst for this reaction is
   a) $KMnO_4$
   b) H_2SO_4
   c) NaOH
   d) H_2

4. Which of the following equations best shows the complete combustion of propane?
   a) $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$
   b) $2C_2H_6(g) + 5O_2(g) \rightarrow C(s) + 2CO(g) + CO_2(g) + 6H_2O(g)$
   c) $2C_3H_8(g) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$
   d) $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

5. Which of the following compounds could be formed in the addition reaction of Br_2 and but-1-ene?



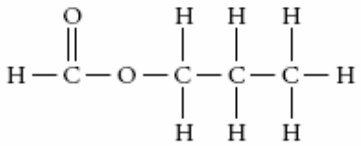
6. What type of reaction is shown below?

$$CH_3CH_2OH + HCl \rightarrow CH_3CH_2Cl + H_2O$$

a) substitution
b) elimination
c) oxidation
d) addition

7. In a reaction between hex-2-ene and hydrochloric acid, which of the following will be the product(s)?
   a) 1-chlorohexane only
   b) 2-chlorohexane only
   c) 3-chlorohexane only
   d) both (b) and (c)

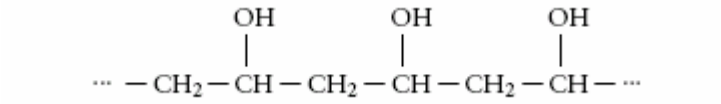
8. What compounds would you need to synthesize the molecule below?



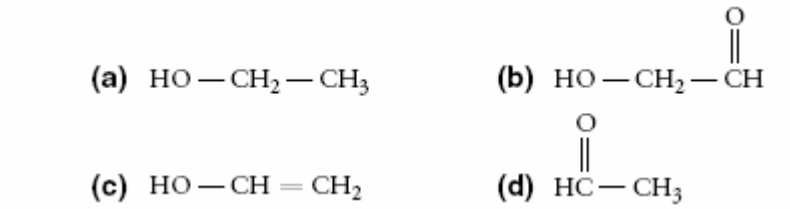
a) propan-1-ol and methanoic acid
b) butan-1-ol and methanoic acid
c) methanol and propanoic acid
d) methanol and butanoic acid

9. The polymerization of propene, $CH_3CH{=}CH_2$, can be classified as
   a) an addition reaction
   b) an elimination reaction
   c) a substitution reaction
   d) a condensation reaction

10. Polyvinyl alcohol has the following structure.

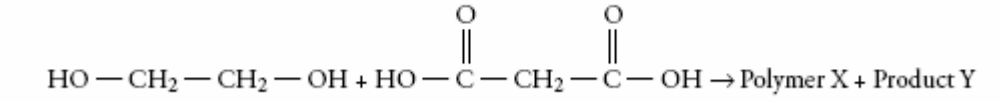


What is the monomer that is used to form this polymer (see the next page)?

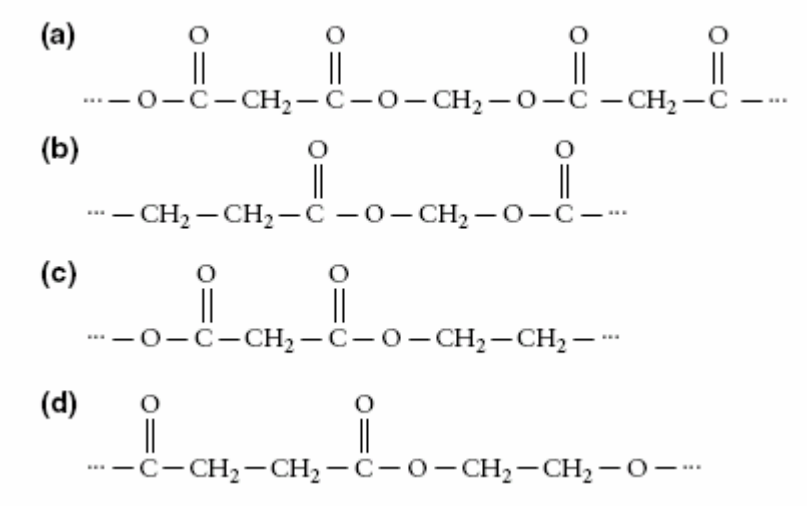


Use the following information to answer questions 11, 12, and 13.

Two organic compounds react together to form a polymer as shown.



11. Which of the following is polymer X?

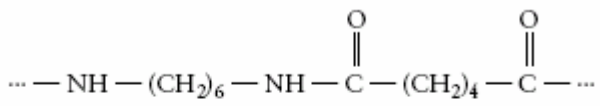


12. Product Y formed in this reaction is
    a) carbon dioxide gas
    b) hydrogen gas
    c) oxygen gas
    d) water

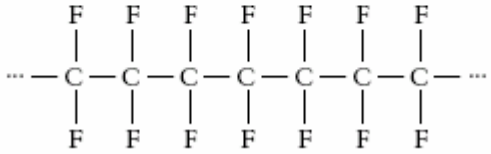
13. What type of polymerization reaction occurs?
    a) condensation polymerization
    b) reformation polymerization
    c) addition polymerization
    d) radical polymerization

14. Nylon 6-6 and Teflon™ are two widely used synthetic polymers. Their structures are shown below.

Nylon 6-6



Teflon™



Which of the following types of reactions are responsible for the formation of these polymers?

	Nylon 6-6	Teflon™
(a)	Addition	Condensation
(b)	Condensation	Substitution
(c)	Condensation	Addition
(d)	Substitution	Condensation

15. DNA is a natural polymer composed of
    a) glucose monomers
    b) nucleotide monomers
    c) amino acid monomers
    d) cellulose monomers

Numerical Response Questions

Record the answers for each numerical response question as indicated.

16. The reaction for the complete combustion of methanol is represented below.

$$\underline{\mathbf{a}}\ CH_3OH(g) + \underline{\mathbf{b}}\ O_2(g) \rightarrow \underline{\mathbf{c}}\ CO_2(g) + \underline{\mathbf{d}}\ H_2O(g)$$

The coefficients **a**, **b**, **c**, and **d** represent integer numbers used to balance this equation. When correctly balanced, the numerical sequence **a,b,c,d** is ___, ___, ___, ___.

17. The following is a list of reactants labelled (a), (b), (c), and (d), and a list of reaction classifications labelled 1, 2, 3, and 4.

a) 2-bromobutane + hydroxide ion →	1. addition
b) propene + hydrochloric acid →	2. elimination
c) ethanoic acid + heptan-3-ol →	3. substitution
d) 2-chlorobutane + sodium ethoxide →	4. esterification

Determine the type of reaction that each combination of reactants will undergo and indicate the type of reaction by number in the order (a), (b), (c), and (d). ___, ___, ___, ___.

18. A student group produces a list of actions necessary to prepare an ester in a laboratory investigation. The instructor informs them that their list includes unnecessary steps and is also incorrectly ordered.

Steps in Incorrect Student Procedure

1. Heat mixture in a hot water bath.
2. Distil mixture and collect fractions.
3. Add four drops of concentrated sulfuric acid to mixture.
4. Add 2 crystals of potassium permanganate to mixture.
5. Add 1.0 mL of ethene.
6. Add 1.0 mL of ethanol.
7. Add 1.0 mL of ethanoic acid.
8. Filter the mixture.
9. Add four drops of bromine water to mixture.

The correct four steps to follow in sequence in preparing an ester would be ___, ___, ___, and ___.

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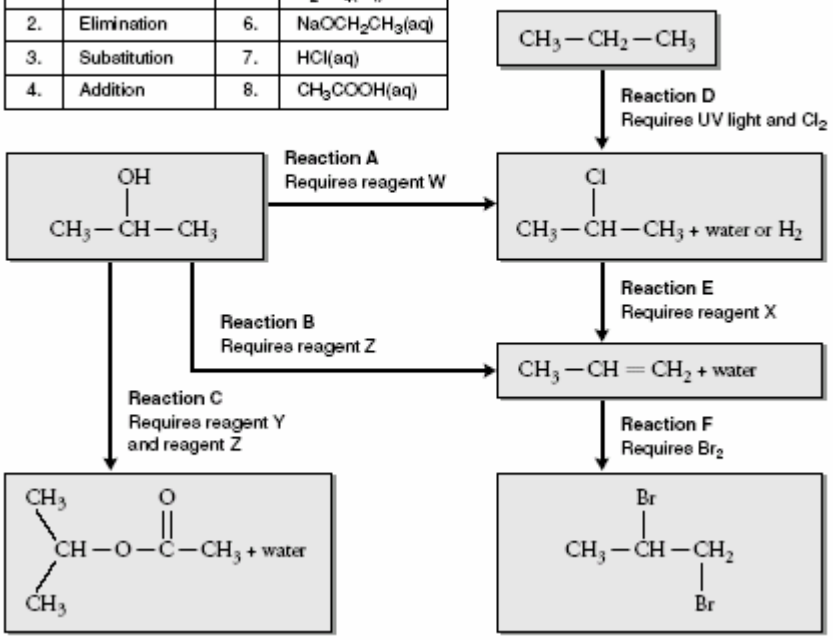
Use the following to answer questions 19, 20, and 21.

Chart 1

Key	Reaction Type	Key	Reagents
1.	Esterification	5.	$H_2SO_4(aq)$
2.	Elimination	6.	$NaOCH_2CH_3(aq)$
3.	Substitution	7.	$HCl(aq)$
4.	Addition	8.	$CH_3COOH(aq)$



19. When Reactions A, B, and C are classified according to the key given in Chart 1, the number sequence that would correspond to ABC is ___, ___, ___.

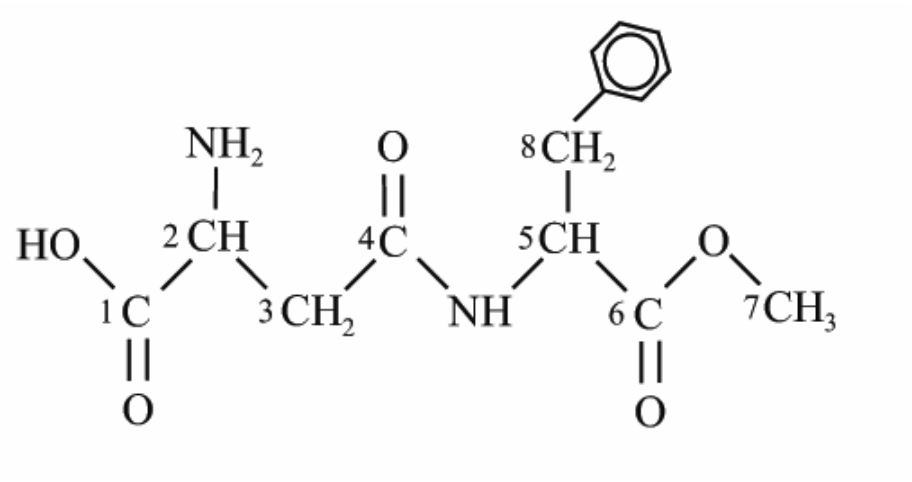
20. When Reactions D, E, and F are classified according to the key given in Chart 1, the number sequence that would correspond to DEF is ___, ___, ___.

21. When the reagents W, X, Y, and Z are classified according to the key given in Chart 1, the number sequence that would correspond to WXYZ is ___, ___, ___, ___.

22. Four numbered reactions are given below. When the reactions are listed in order of addition, substitution, esterification, and elimination, the number sequence that corresponds is ___, ___, ___, ___.

    1. $CH_3CH_2COOH + CH_3OH \rightarrow CH_3CH_2COOCH_3 + H_2O$
    2. $CH_3CH_2OH \rightarrow CH_2CH_2 + H_2O$
    3. $CH_3CCH + HBr \rightarrow CH_3CBrCH_2$
    4. $CH_3CH_2CH_2CH_3 + Br_2 \rightarrow CH_3CH_2CH_2CH_2Br + HBr$

23. The artificial sweetener aspartame is about 180 times as sweet as table sugar. The figure below illustrates the structure of aspartame. The carbons of aspartame are numbered from 1 to 8.



A student identifies four features of the aspartame molecule—a phenyl group attached to a carbon, an amide bond, an ester bond, and a carboxyl group. Match the structural feature to the numbered carbon that it is associated with. Record all four digits of your answer.

Structural Feature	Carbon Number
phenyl group	
amide bond	
ester bond	
carboxyl group	

24. In one stage of the process of forming polyvinylchloride, the vinyl chloride monomer is produced in large amounts by the reaction shown below.

$$\underline{a}\ C_2H_4(g) + \underline{b}\ HCl(g) + O_2(g) \longrightarrow \underline{c}\ C_2H_3Cl\ (g) + \underline{d}\ H_2O(g)$$

The coefficients **a**, **b**, **c**, and **d** represent integer numbers used to balance this equation. When correctly balanced, the numerical sequence **a,b,c,d** is ___, ___, ___, ___.

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Written Response Questions

Answer each question in the space provided. Use complete sentences and diagrams when necessary.

25. The primary component of the gasoline that you purchase to fuel your automobile is 2,2,4–trimethylpentane. The combustion of automobile fuel is one factor linked to the accelerated greenhouse effect.
    a) Provide the condensed structural formula and empirical molecular formula for 2,2,4–trimethylpentane.

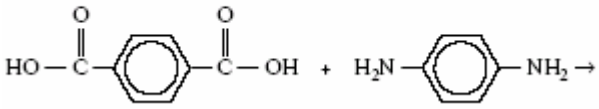
    b) Write a balanced equation for the complete combustion of 2,2,4–trimethylpentane.

    c) Explain how an increased use of fossil fuels such as gasoline is expected to affect global climate.

26. What series of reactions would you carry out to produce ethyl methanoate from chloroethane? Draw condensed structural formulas for all organic reagents and products. Identify any necessary inorganic reagents and indicate the types of reactions that are carried out.

27. Two different polymerization reactions are started below. Draw the product of each polymerization reaction. Include at least two linkages for each product. Classify each polymer as an addition polymer or a condensation polymer.

Reaction I



Reaction II