Appendix C

ANSWERS TO MODULE ASSIGNMENTS

Module 1

1. a. 5.5×10^{5} b. 6.43×10^{-4}
2. a._0.00000173 b. 4,810
3. grams
4. 100cm / 1m
5. a. 0.525 L b. 19.7 cg
   c. 43.7 cm d. 2.23 in
   e. 59,600 mL f. 49.3 oz
6. 96.6 miles/hr or 97.2 miles/hr
7. 6.0 g/mL
8. 27.6 mL
9. 3.36 kg
10. a. 86.0 ºF b. 10.0 ºC
11. 211 cm
12. 6,810 g, 6.81 Kg
13. 13.6 g/mL
14. 54.5 g
15. 3 tablets
16. –260 ºF

Module 2

1. solution
2. compound
3. heterogeneous
4. liquid
5. a definite, a definite
6. sublimation
7. condensation

8. a. K _potassium__ b. Ag __silver_____ c. Sn __tin_____

   d. Hg _mercury___ e. Mn _manganese____ f. Se _selenium____

9. a. gold _Au_ b. iron _Fe_ c. sodium _Na__
   d. xenon _Xe_ e. fluorine _F__

10. a. Si __metalloid___ b. Ga __metal_____ c. Se _nonmetal____

11. helium, nitrogen, boron, carbon, hydrogen, lithium, iron, arsenic, iodine, tin, beryllium

12.

Isotope	Protons	Neutrons	Electrons
C-14	6	8	6
Cr	24	29	24
Mg	12	12	12
Cl-37	17	20	17
P	15	16	15
K-41	19	22	19
I-131	53	78	53
^{60}Co	27	33	27

13. a. Cs, Ba, Ge, Br, Kr, Be, Li, F, S, Sn, Al
b. Ce, U
c. Al
d. V, Zn, Kr, Fe, Ge, Br
e. V, Zn, Fe
a. Br, F
b. Kr
c. Li, Cs
d. Ba, Be

14. a. S _6__ b. Al _3___ c. Mg _2___d. Si _4__ e. Cl __7__

15.

Symbol for element	Electronic Configuration
N	2-5
Si	2-8-4
Li	2-1
Ca	2-8-8-2
Mg	2-8-2
K	2-8-8-1
P	2-8-5
O	2-6
Ne	2-8
Cl	2-8-7

16.
a. Na 1 e^- lost
b. Al 3 e^- lost
c. P 3 e^- gained
d. S 2 e^- gained
e. Ba 2 e^- lost
f. Br 1 e^- gained

Module 3

ANSWERS

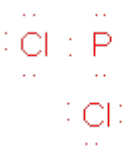
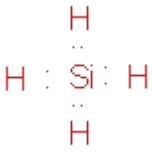
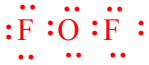
1. 18
2. 2
3. gains
4. ionic
5. – 1
6. +2

7.

8. a. K_2O _ionic_ b. CCl_4 __covalent___ c. $BaCl_2$ __ionic_ d. SO_2 _covalent_

9. a. Li & O _Li_2O__ b. Al & Cl _$AlCl_3$_

c. Ca & N _Ca_3N_2_ _____ d. Mg & S _MgS____

10. a.  b.  c.  d.  e. 

11.
a. ammonium sulfate
b. aluminum bicarbonate
c. magnesium chloride
d. carbon dioxide
e. sodium phosphate
f. potassium nitride
g. dichlorine pentoxide
h. calcium nitrate

12.
a. $Be(CN)_2$
b. NF_3
c. Ba_3P_2
d. $Ca(HCO_3)_2$
e. Li_2S
f. $(NH_4)_2CO_3$
g. $Sr(OH)_2$
h. SF_6

13. a. K & Cl b. Ca & Mg c. S & Cl d. O & F e. Sb & Br f. H & F

14. H-S H-Se H-O H-Te

Module 4

1. a. 30 g/mole b. 148.3 g/mole c. 174 g/mole d. 58 g/mole
2. 0.142 moles C_2H_6
3. 3.71 g $Mg(NO_3)_2$
4. 0.856 moles K_2SO_4
5. 5.17 moles C_4H_{10}

6. a. $C_4H_{10}O + 6\ O_2 \rightarrow 4\ CO_2 + 5\ H_2O$

b. $\underline{3}\ Mg + N_2 \rightarrow Mg_3N_2$

c. $2\ Na + Cl_2 \rightarrow 2\ NaCl$

d. $4\ K + O_2 \rightarrow 2\ K_2O$

e. $2\ Al + 3\ F_2 \rightarrow 2\ AlF_3$

d. $BaO + H_2O \rightarrow Ba(OH)_2$

g. $Fe_2O_3 + 3\ CO_2 \rightarrow Fe_2(CO_3)_3$

h. $P_4O_{10} + 6\ H_2O \rightarrow 4\ H_3PO_4$

7. a. 5.8 moles O_2
   b. 0.977 moles CO_2
   c. 237 g O_2

Module 5

1. polar ionic

2. I_2 $\underline{KCl}$ $\underline{HBr}$ C_6H_6 Kr Cl_2 $\underline{Na_2SO_4}$

3. a. $C_6H_{12}O_6$ nonelectrolyte b. $MgCl_2$ electrolyte c. CH_3OH nonelectrolyte

4.

   a. A supersaturated sugar solution. The sugar crystal will cause the excess sugar to precipitate out of solution.

   b. An unsaturated sugar solution. The additional sugar crystal will dissolve.

   c. A saturated sugar solution. The additional sugar crystal will precipitate out of solution.

5. 4.80 %

6. 200 mL

7. First convert the 50.0 g $C_6H_{12}O_6$ to moles.
   50.0 g $C_6H_{12}O_6$ x (1 mole / 180 g $C_6H_{12}O_6$) = 0.278 moles $C_6H_{12}O_6$

   Then convert the 400 mL of solution to Liters
   400 mL x (1 L / 1000 mL) = 0.400 L

Divide moles by liters of solution.
0.278 moles $C_6H_{12}O_6$ / 0.400 L solution = 0.694 M

8. 0.900 mole

9. 79.8 grams

10. 0.500 %

11. 250 mL solution x (6.0 mL alcohol / 100 mL solution) = 15 mL alcohol

12. 25.0 mL + 50.0 mL = 75.0 mL final volume

$V_1C_1 = V_2C_2$
(50.0 mL) (6.00 M) = (75.0 mL)(C_2)
4.0 M = C_2

13. 12.0 %

14. colloids solutions <u>suspensions</u>

15. hypotonic hemolyse

16. a. 5 % glucose isotonic b. 2 % NaCl hypertonic c. 1 % glucose hypotonic

17. cannot

18. water

Module 6

1. a. base b. acids and bases
   c. base d. acid
   e. acid f. acid
   g. base

2. a. weak acid b. weak base
   c. strong acid d. strong base
   e. strong acid f. weak acid
   g. weak base h. strong base
   i. strong acid j. weak base

3.

pH	pOH	$[H^+]$	$[OH^-]$	acidic, basic or neutral
6	8	1×10^{-6}	1×10^{-8}	acidic
4	10	1×10^{-4}	1×10^{-10}	acidic
9	5	1×10^{-9}	1×10^{-5}	basic
11	3	1×10^{-11}	1×10^{-3}	basic
5	9	1×10^{-5}	1×10^{-9}	acidic
2	12	1×10^{-2}	1×10^{-12}	acidic
7	7	1×10^{-7}	1×10^{-7}	neutral
12	2	1×10^{-12}	1×10^{-2}	basic

4. a) $HBr + NaOH \rightarrow NaBr + HOH$ already balanced

b) $H_2SO_4 + 2\ NH_4OH \rightarrow (NH_4)_2SO_4 + 2\ HOH$

c) $Mg(OH)_2 + 2\ HCl \rightarrow MgCl_2 + 2\ HOH$

d) $Al(OH)_3 + 3\ HCl \rightarrow AlCl_3 + 3\ HOH$

5. a) $HCl + KOH \rightarrow KCl + HOH$ already balanced

b) $H_3PO_4 + 3\ NaOH \rightarrow Na_3PO_4 + 3\ HOH$

c) $Ba(OH)_2 + 2\ HNO_3 \rightarrow Ba(NO_3)_2 + 2\ HOH$

d) $3\ H_2SO_4 + 2\ Mn(OH)_3 \rightarrow Mn_2(SO_4)_3 + 6\ HOH$

6. A weak acid and its salt or a weak base and its salt. A buffer system works by neutralizing both added acid and added base.

7. b, c, and d

8. b

9. a

10. e

11. d

Module 7

1. Least penetrating is alpha, then beta, and gamma radiation is the most penetrating.

2. electrons

3. helium nuclei

4. a. α-radiation __paper or clothing___

   b. β-radiation __heavy clothing_____

   c. γ-radiation __lead or concrete____

5. 16 times

6. a. $^{28}Al \rightarrow {}^{28}Si + \beta$

   b. $^{238}U \rightarrow {}^{234}Th + \alpha$

   c. $^{210}Bi \rightarrow {}^{206}Tl + \alpha$

   d. $^{35}S \rightarrow {}^{35}Cl + \beta$

7. $^{226}Ra \rightarrow {}^{222}Rn + \alpha$

8. $^{60}Co \rightarrow {}^{60}Ni + \beta + \gamma$

9. 15 grams Sr remains

10. 32 days

11. 128 hours;5.3 days

12. 3.13 mg

Module 8

1.
   a. decreases

   b. increases

   c. increases

d. doubled

e. increase, two

f. faster, increases

2. 0.395 atm

3. 570 mm Hg

4. 250 torr

5. a. higher
b. lower
c. higher

6 Treatment for carbon dioxide poisonings, burns, cancer treatments, the bends (nitrogen narcosis).

7. higher

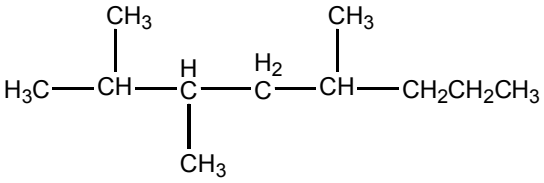
8. increase

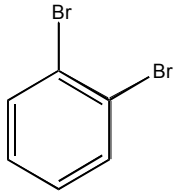
9. higher, lower

Module 9

1. a. 3-methylhexane
b. 5-ethy 3,3-dimethyllnonane
c. 3-bromo-5,5-dimethyloctane
d. 1,1,3-trimethylcylopentane
e. 1,1-dichloro-3-isopropylcyclohexane
f. *trans*-4-methyl-2-pentene
g. 3-methyl-1-propylcyclohexene
h. 1,3-dichlorobenzene or *m*-dichlorobenzene
i. 4-isopropyltoluene or *p*-isopropyltoluene
j. 5,5-dimethyl-1-heptene
k. 1-chloro-2-ethyl-4-bromobenzene
l. 5-methyl-2-hexyne
m. 3-methylcyclopentene
n. 1-ethyl-3-methylcyclopentane
o. 3-isopropyl-4-methyl-2-pentene

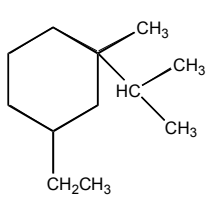
2. a. 2,3,5-trimethyloctane b. o-dibromobenzene

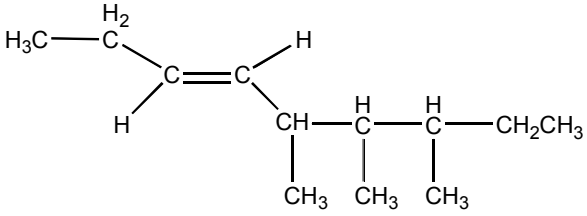




c. 3-ethyl-1-isopropyl-1-methylcyclohexane

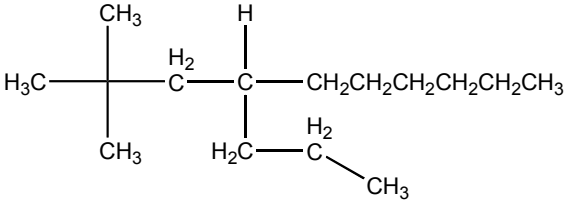
d. trans-5,6,7-trimethyl-3-nonene

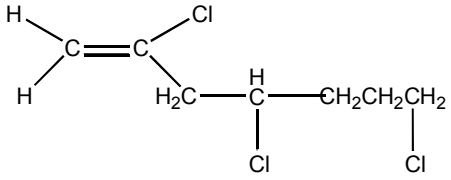




e. 2,2-dimethyl-4-propyldecane

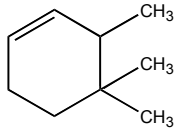
f. 2,4,7-trichloro-1-heptene

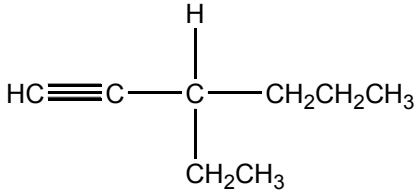




g. 3,4,4-trimethylcyclohexene

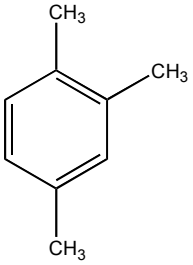
h. 3-ethyl-1-hexyne

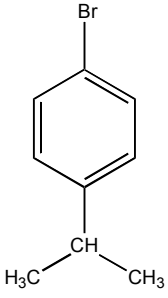




i. 1,2,4-trimethylbenzene

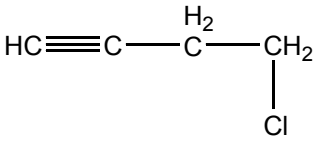
j. p-bromoisopropylbenzene

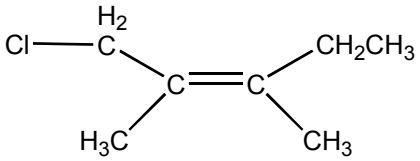




k. 4-chloro-1-butyne

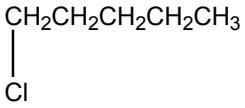
l. cis-1-chloro-2,3-dimethyl-2-pentene



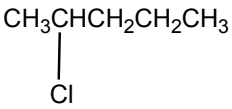


3. Structure # 3, this structure has only 5 carbon atoms

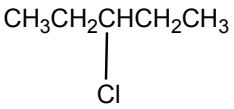
4.



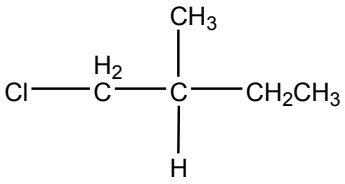
1-chloropentane



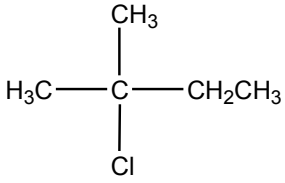
2-chloropentane



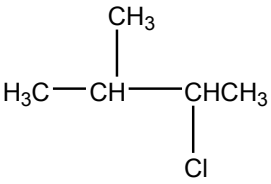
3-chloropentane



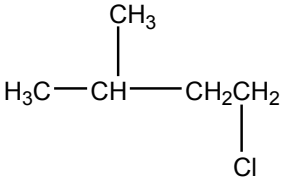
1-chloro-2-methylbutane



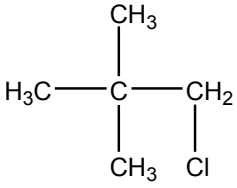
2-chloro-2-methylbutane



2-chloro-3-methylbutane

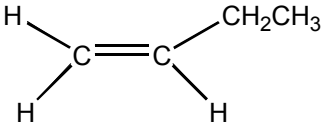


1-chloro-3-methylbutane

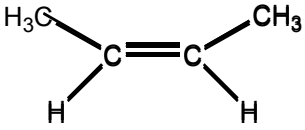


1-chloro-2,2-dimethylpropane

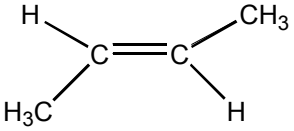
5.



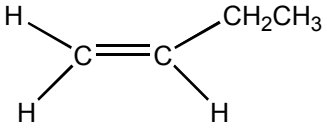
1-butene



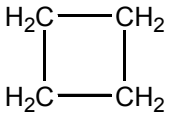
cis-2-butene



trans-2-butene

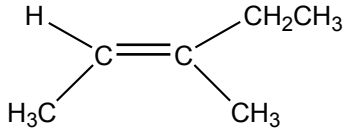


2-methylpropene

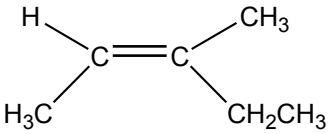


cyclobutane

6. 3-methyl-2-pentene



cis-3-methyl-2-pentene

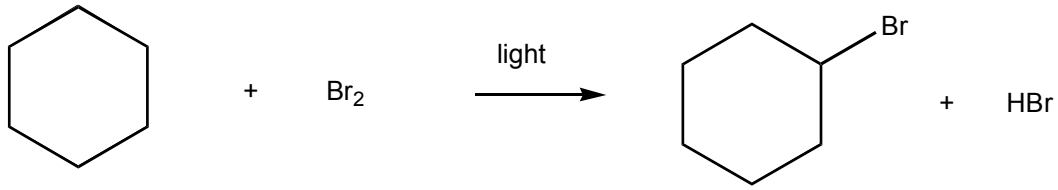


trans-3-methyl-2-pentene

7. a hydration (addition across the double bond)

8.

a.



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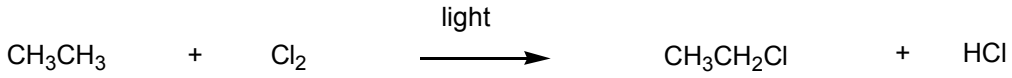
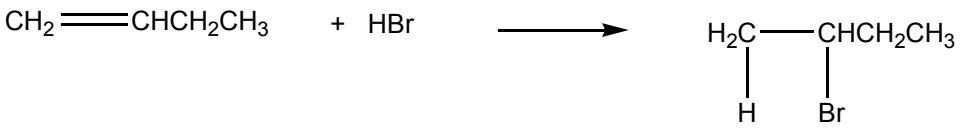
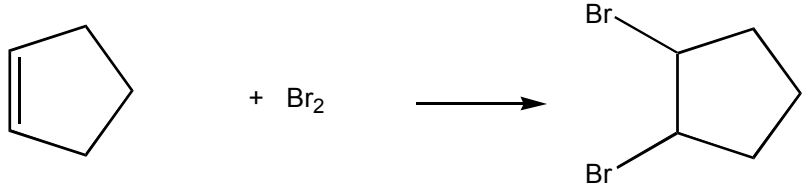


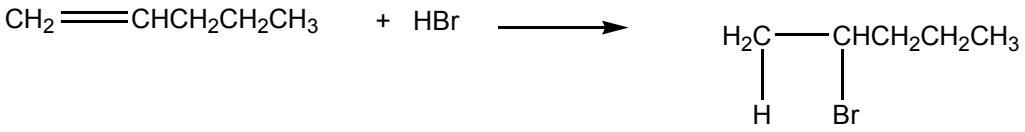
c.



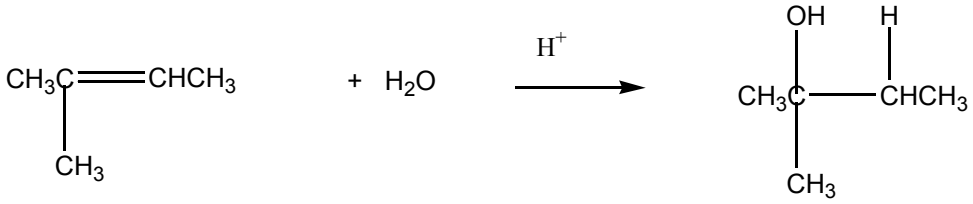
d.



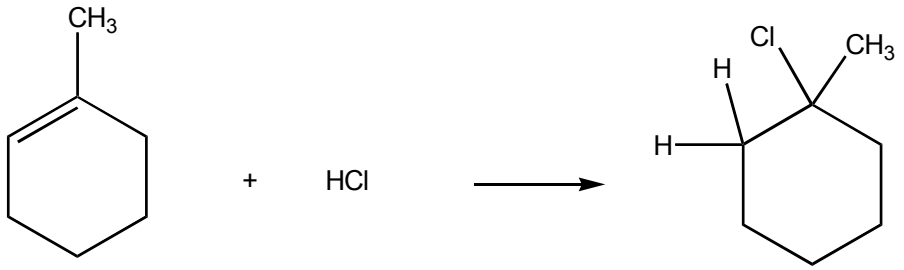
e.



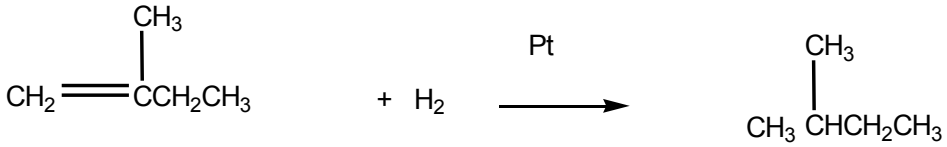
f.



g

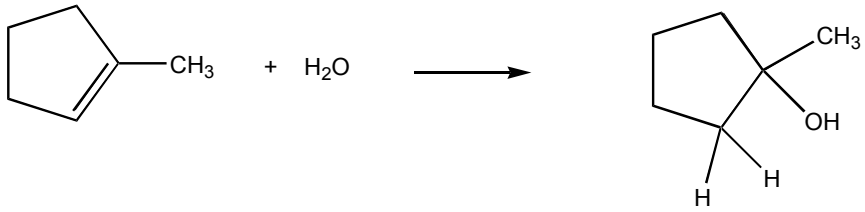


h.



9. Product: chlorocyclobutane

10. Product: 1-methylcyclopentanol



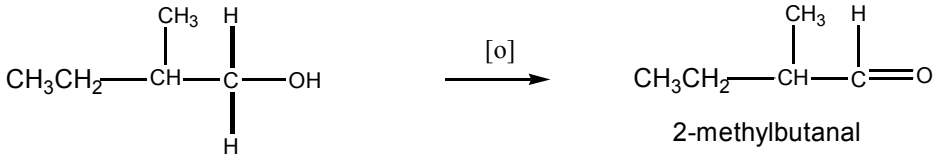
Module 10

1. a. ketone
   b. 3° alcohol
   c. 3° alcohol
   d. 2° alcohol
   e. aldehyde
   f. 3° alcohol
   g. aldehyde
   h. 2° alcohol
   i. ketone
   j. 1° alcohol
   k. aldehyde
   l. 1° alcohol
   m. 2° alcohol
   n. ketone

2. a. cyclopentanone
   b. 1-methylcyclohexanol
   c. 2-methyl-2-pentanol
   d. cyclopentanol
   e. pentanal
   f. 2,4-dimethyl-2-pentanol
   g. propanal
   h. 2-propanol
   i. propanone
   j. 1-propanol
   k. 5-chloro-3,5-dimethylhexanal
   l. 2,2-dimethyl-1-propanol
   m. 2-butanol
   n. 2-methylcyclohexanone

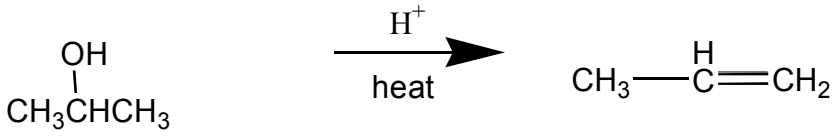
3. ketone
4. carboxylic acid
5. primary alcohol
6. tertiary alcohol

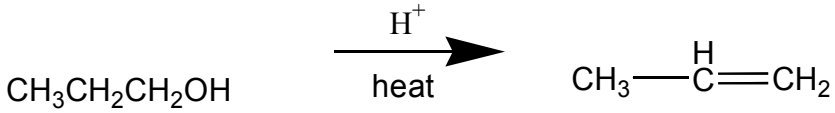
7.

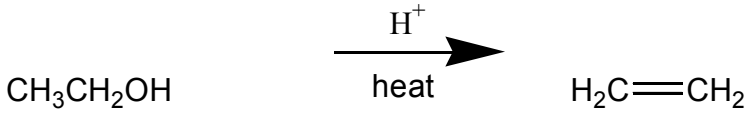


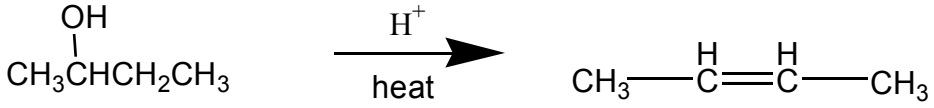
8. $CH_3CH_2OCH_2CH_3$, same type of compounds (ethers)

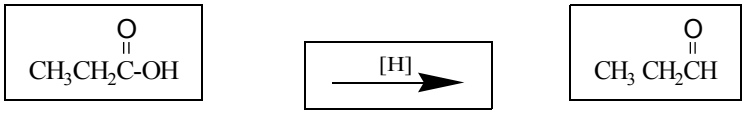
9.

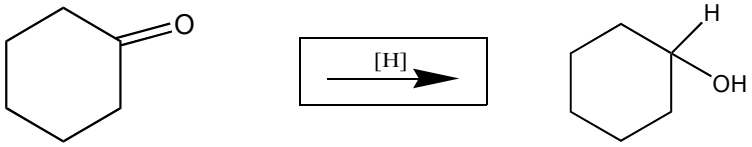
a. 

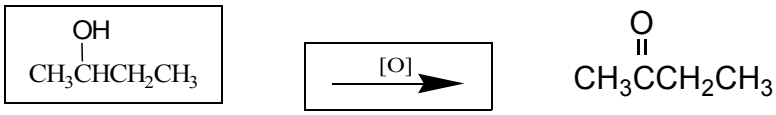
b. 

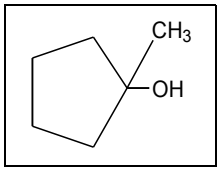
c. 

d. 

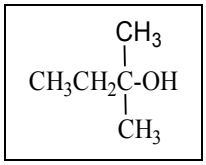
e. 

f. 

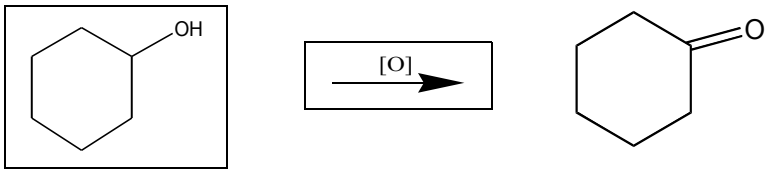
g. 

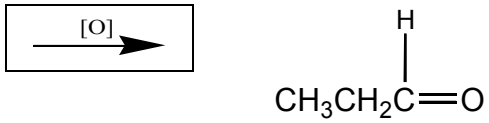
h. 

No reaction

i. 

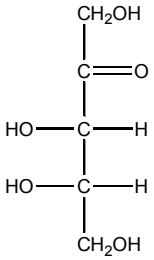
No reaction

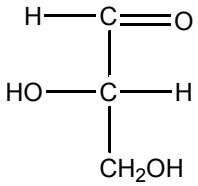
j. 

k. $CH_3CH_2CH_2OH$ 

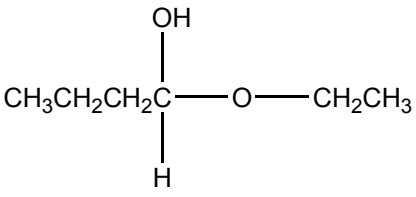
Module 11

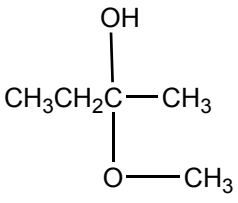
1. tetrose

2. a. 

b. 

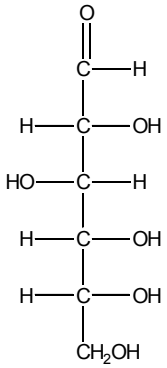
3. aldotetrose
4. fermentation

5. a. 

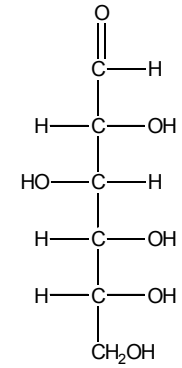
b. 

6. glucose

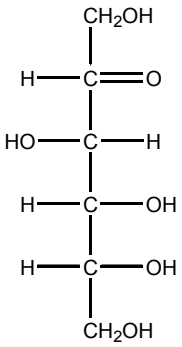
7. D isomer, the OH group in C-5 is on the right side.



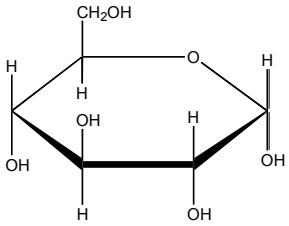
8. a. D-glucose



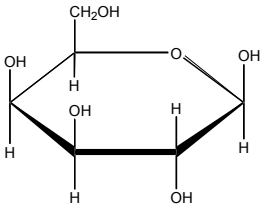
b. D-galactose



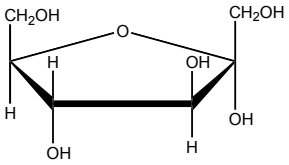
c. D-fructose



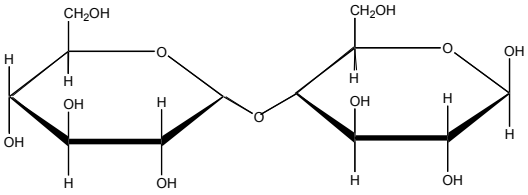
9. a. α-D-glucose



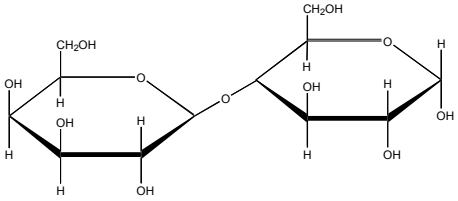
b. β-D-galactose



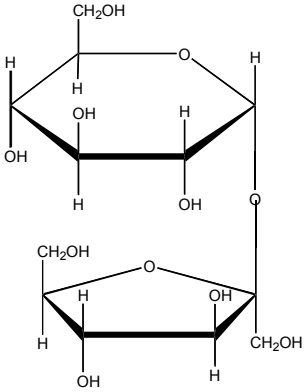
c. α-D-fructose



d. β-maltose



e. α-lactose



f. sucrose

10. two glucose molecules
11. Mutarotation
12. glycogen

13. a. amylose and cellulose –

Both are polysaccharides (polymers of glucose). Amylose has α-1,4-glycosidic linkages while cellulose has β-1,4-glycosidic linkages. They are both straight chains – not branched and both are from plants.

b. amylose and amylopectin
Both are polysaccharides (polymers of glucose) connected by α-1,4-glycosidic linkages. Both are present in starch. Amylopectin has α-1,6- branch points while amylose has no branching.

c. amylopectin and glycogen
Both are polysaccharides (polymers of glucose) connected by α-1,4-glycosidic linkages. Amylopectin is found in plants and glycogen is the polysaccharide found in animals to store excess glucose. Both have α-1,6- branch points, but there is more branching in glycogen.

14. a. The blue solution (Cu^{2+} ions) changes to a brick orange precipitate (Cu_2O).

b. A blue-black iodine/starch complex is produced.

c. For each of the following carbohydrates, indicate whether the Benedict's test is positive or negative and whether the iodine test is positive or negative.

Sugar	**Benedict's test**	Iodine test
sucrose	negative	negative
glucose	positive	negative
fructose	positive	negative
lactose	positive	negative
starch	negative	positive
glycogen	negative	positive

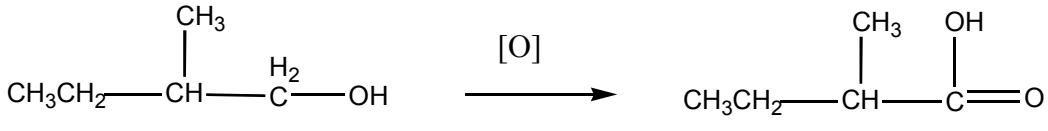
Module 12

1. Classify each of the following as a/an aldehyde, alcohol, carboxylic acid, ester, ether, or ketone.

a. ketone. b. ether. c. ester

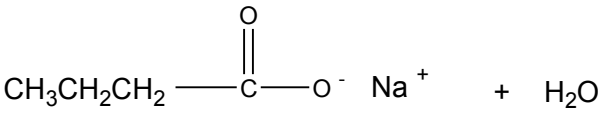
d. aldehyde e. carboxylic acid f. ether

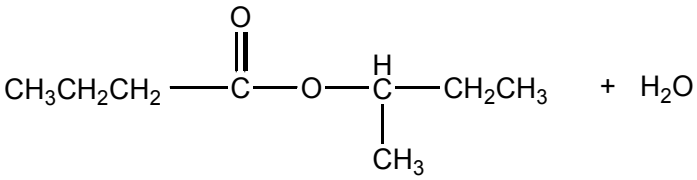
g. ester. h. alcohol

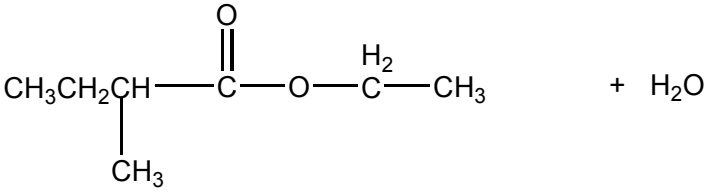
2. 

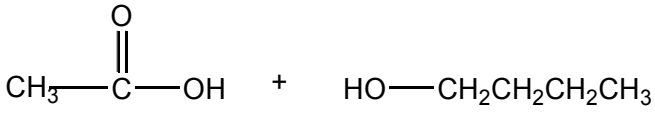
3. ester

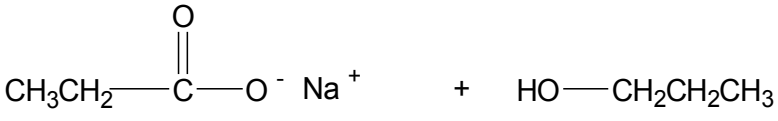
4. carboxylate salt and alcohol

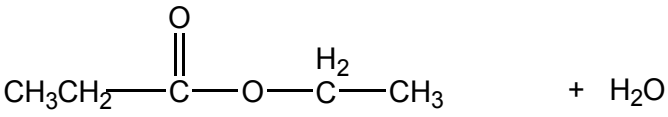
5. a. neutralization 

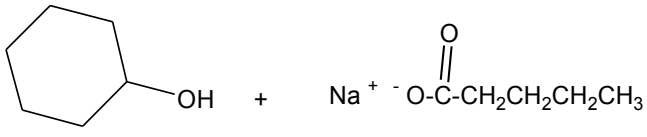
b. esterification 

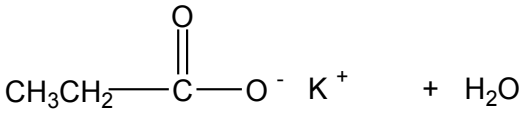
c. esterification 

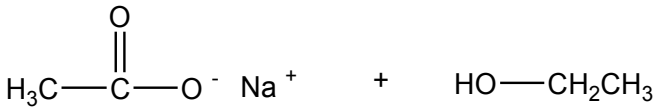
d. acid hydrolysis 

e. basic hydrolysis 

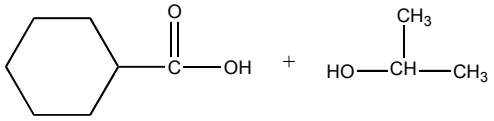
f. esterification 

g. basic hydrolysis 

h. neutralization 

i. basic hydrolysis 

6. The following compound is produced from the reaction of (draw structures)



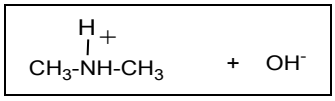
Module 13

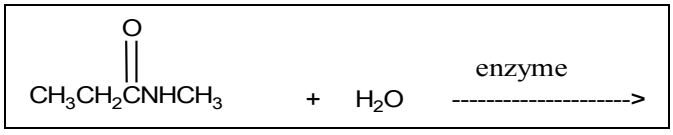
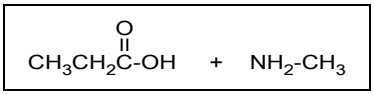
1. a. amide b. primary amine c. secondary amine

d. primary amine e. tertiary amine f. secondary amine g. primary amine

2. Amines react with water to produce hydroxide ions.

3. a. $CH_3\text{-}CH_2\text{-}NH_2 + H_2O \text{ ----------> } CH_3\text{-}CH_2\text{-}NH_3^+ + OH^-$

b. $CH_3\text{-}NH\text{-}CH_3 + H_2O$ ----------> 

c.  

Module 14

1. Waxes, triglycerides, glycerophospholipids and steroids.

2. Saturated fats come from __animal__ sources, and usually are __solids__ at room temperature.

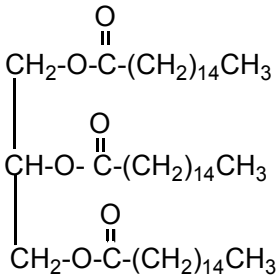
3. Unsaturated fats come from __plant__ sources, and usually are __liquid__ at room temperature.

4. Glycerol, fatty acids, phosphate group and amino alcohol.

5. a. Triacylglycerol b. Esterification
   c. Water in the presence of acid d. Carboxylate salts (soaps) and glycerol

6. A sodium or potassium salt of a fatty acid is commonly called <u>soap</u>.

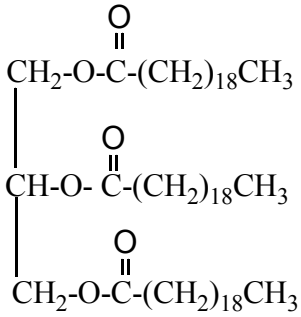
7. a.



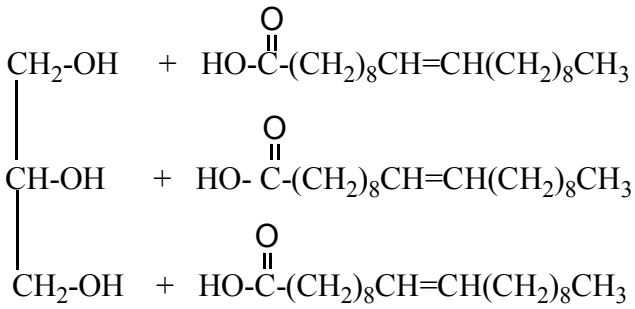
   b. saturated

8. a. unsaturated

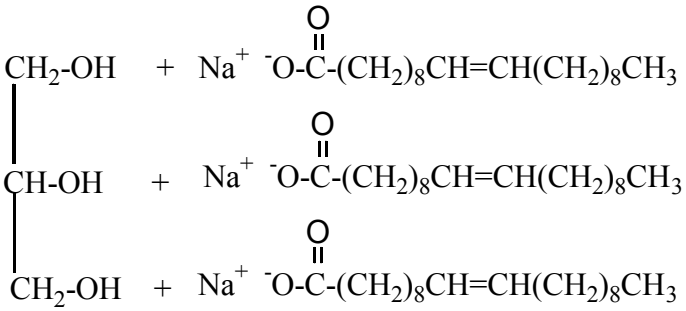
   b. hydrogenation product



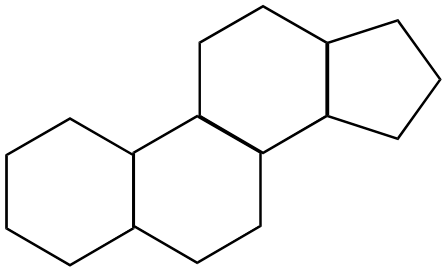
   c. hydrolysis products



   d. saponification products



9. steroid nucleus.



10. Controls the movement of particles in and out of the cell.
11. Vitamins A, D, E and K.
12. 124 Calories

16 g carbohydrate X 4 cal/g = 64 cal from carbohydrates
6 g proteins X 4 cal/g = 24 cal from proteins
4 g fat X 9 cal/g = 36 cal from fat

Total calories = 124 calories

13. The label for a granola bar gives the following: Fat, 6 grams; carbohydrates, 29 grams; protein, 4 grams. Calculate the total calories. What percentage of the total calories are fat calories?

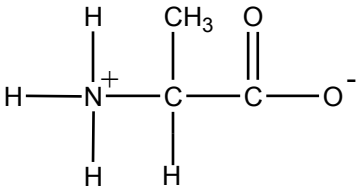
6 g fat X 9 cal/g = 54 cal from fat
29 g carbohydrate X 4 cal/g= 116 cal from carbohydrates
4 g proteins X 4 cal/g = 16 cal
Total calories = 186 cal

% cal from fat = 54/186 X 100 = 29.0 %

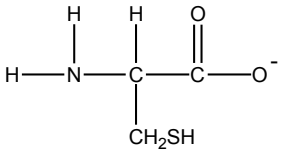
Module 15

1.Enzymatic catalysis; transport and storage; coordinated motion; structural; immune protection; hormones; generation and transmission of nerve impulses.

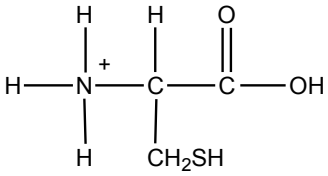
2.



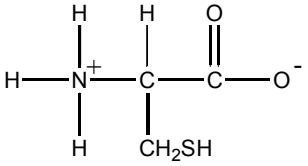
1. a.



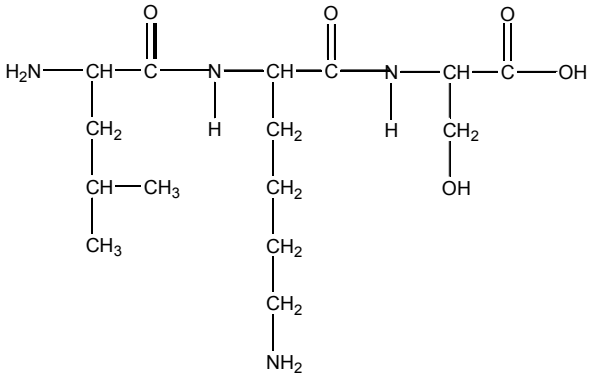
b.



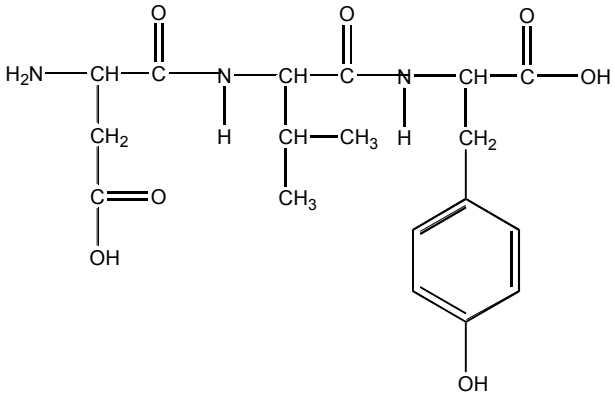
c.



4. a.



b.



5. secondary

6. quaternary

7. tertiary

1. primary

9. secondary

10. secondary

11. tertiary

12. H-bond; disulfide linkage; hydrophobic region; salt bridge.

13. amino acids

14. negatively charged

15. glycine; alanine; valine; leucine; isoleucine; phenylalanine; methionine; praline; trytophan.

16. serine; threonine; tyrosine; cysteine; asparagines; glutamine.

17. The loss of biological activity.

18. Heat and ultraviolet radiation; alcohol and other organic solvents; reducing agents; pH changes; heavy metals.

19. a. glucose b. glucose c. glycerol + 3 fatty acids
d. no change e. amino acids

20. $E + S \rightarrow ES \rightarrow E\,P \rightarrow E + P$

21. "ase", substrate

22. a. conjugated, Mg^{2+}
b. conjugated, vitamin E
c. simple
d. conjugated, carbohydrate

23. cofactor

24. a. isomerase b. transferase
c. decarboxylase d. hydrolase

25. a. remain the same
b. increase

26. a. noncompetitive

b. competitive
c. noncompetitive

27. Changes the overall shape of the enzyme, thereby changing the shape of the active site.

28. An increase in temperature will generally speed up the rate of an enzyme-catalyzed reaction; however, if the temperature increase starts to denature the enzyme, then the reaction is slowed down.

Module 16

1. a. DNA
b. RNA
c. RNA
d. Both RNA and DNA
e. DNA
f. RNA

2. a. deoxyribose and guanine
b. ribose and cytosine
c. deoxyribose, adenine, and phosphate
d. ribose, uracil, and phosphate
e. deoxyribose, thymine, and phosphate

3. a. adenine
b. guanine
c. adenine
d. cytosine

4. a. A---T---T---A---G---C---G---C---T

b. G---A---A---C---T---G---G---C---A

c. C---A---C---T---G---A---G---G---C

5. a. 2
b. 3
c. 1

6. a. 3
b. 1
c. 2

7.

a. The step within protein synthesis creates the template for the amino acid sequence in a protein molecule.

b. The step within protein synthesis where the tRNA matches a codon in the mRNA that specifies a particular amino acid.

c. The step within protein synthesis that ends the production of a protein molecule.

8. a. C---U---G---A---G---U---G---C---G

b. G---A---C---C---U---A---G---U---A

c. C---U---G---U---G---C---G---G---C

9. a) A---C---C b) U---G---C c) C---A---G