1. The structure of 3,6-dimethyl-5-(1,2-dimethylpropyl)decane is:

   a) ![Structure a]
   b) ![Structure b]
   c) ![Structure c]
   d) ![Structure d]
   e) ![Structure e]

2. Select the correct IUPAC name for the compounds shown:

   a) 4-propyl-2,5-dimethylhexane  
   b) 4-isobutyl-5-methylhexane  
   c) 2,5-dimethyl-4-propyloctane  
   d) 4,7-dimethyl-5-propyloctane

3. Select the correct IUPAC name for the compounds shown:

   a) 3,3-dichloro-4-(1-chloropentyl)hexane  
   b) 3,5-trichloro-4-ethylnonane  
   c) 5,7,7-trichloro-4-ethylnonane  
   d) 3,3,5-trichloro-4-ethylnonane

4. Select the correct IUPAC name for the compounds shown:

   a) 3-propyl-4-(1-chloropropyl)hexane  
   b) 3-(1-chloropropyl)-4-ethylheptane  
   c) 3-(2-chloro-1-ethylpropyl)hexane  
   d) 3-chloro-4,5-diethyloctane  
   e) 4,5-diethyl-6-chlorooctane

5. Select the correct IUPAC name for the compounds shown:

   a) trans-1-bromo-5-methylcycloheptane
   b) cis-1-bromo-4-methylcycloheptane
   c) trans-1-bromo-4-methylcycloheptane
   d) trans-2-bromo-6-methylcycloheptane
   e) trans-1-bromo-4-methylcyclohexane
Given the following molecule:

6. Of the bonds labeled A-E he weakest bond is:
   a) A  c) C  e) E
   b) B  d) D

7. Carbon-carbon sp²-sp² σ bond(s) is(are):
   a) B only  c) B, C and D  e) C only
   b) C and D  d) A and B

8. How many total π-bonds are in this molecule?
   a) 0  c) 2  e) 4
   b) 1  d) 3

Given the following molecule:

9. Carbon-carbon sp-sp σ bond(s) is(are):
   a) C  c) A  e) A and B
   b) B  d) A and C

10. The weakest C–C bond is:
    a) A  c) B  e) C
     b) D  d) E

11. How many total π-bonds are in this molecule?
    a) 2  c) 4  e) 6
     b) 3  d) 5

12. Which of the following is not a constitutional isomer of the others?

   a) d) 
   b) e) 
   c)  

[Diagrams of molecules and structures]
13. Which of the following are constitutional isomers?

a) A and C  

b) A, B, C and D  

c) A, C and D  

d) A and D  

e) All are constitutional isomers

14. Given the following structure, including bonds, for dimethyl sulfate. The formal charges on the atoms A, B and C are respectively: (Atomic Number of O = 8, S = 16)

- a) –2, +4, –2
- b) –1, 0, +1
- c) 0, 0, 0
- d) –1, +2, –1
- e) +1, –2, +1

15. Given the following structure, including bonds, for trimethylphosphine oxide. The formal charges on atoms A and B are, respectively: (Atomic Numbers are: H = 1, C = 6, O = 8, P = 15)

- a) +1, –1
- b) –1, +1
- c) 0, 0
- d) +2, –2
- e) –2, +2

16. Given the following structures:

The one that is different from the others is:

- a) A
- b) B
- c) C
- d) D
- e) all structures are the same

17. Which of the following shows a staggered conformation?

- a) b) c) d)
- e) both a and d
18. The most stable conformation of those shown is:

a) b) c) d) e) all are equally stable

19. Which of the following is(are) the anti conformation?

a) A only d) C and E
b) B only e) B and D
c) C only

20. Given the following structures:

The one that is different from the others is:

a) A d) D
b) B e) E
c) C

21. The most stable conformation of 2,3-dimethylbutane is:

a) b) c) d) e)
22. In which of the following is the \textit{tert}-butyl group essentially completely axial?

\begin{itemize}
\item A
\item B
\item C
\item both A and C
\item none of them
\end{itemize}

23. The proper Lewis structure for the compound below is: (Atomic number of O = 6 and P = 15)

\begin{itemize}
\item a)
\item b)
\item c)
\item d)
\item e)
\end{itemize}

24. The proper Lewis structure for thioacetamide is:

\begin{itemize}
\item a)
\item b)
\item c)
\item d)
\item e)
\end{itemize}

25. Which of the following molecules has the \textbf{largest} dipole moment?

\begin{itemize}
\item a) CF$_4$
\item b) Br$_2$
\item c) H\text{C} = \text{C} \text{Cl}
\item d) H\text{C} = \text{C} \text{Cl}
\item e) BF$_3$
\end{itemize}

26. Which of the following molecules has the \textbf{smallest} dipole moment?

\begin{itemize}
\item a) (CH$_3$)$_2$O
\item b) BClF$_2$
\item c) H\text{C} = \text{C} \text{F}
\item d) Br$_2$
\item e) CF$_3$--CF$_3$
\end{itemize}
27. When the following isomers are burned in air (or O₂), which will give off the most heat per mole?

a) ![Structure A]

b) ![Structure B]

c) ![Structure C] (CH₂)₉

d) ![Structure D] (CH₂)₂

e) They all produce the same amount of heat since they are constitutional isomers.

28. If the strain energy in cyclobutane is 26 kcal/mole, and its heat of combustion is 656 kcal/mol, calculate the heat of combustion of an unstrained methylene (CH₂) group (in a long alkane chain).

a) 164 kcal  

b) 170.5 kcal  

c) 157.5 kcal  

d) 138 kcal  

e) 190 kcal

29. Draw structural formulas for all structural isomers of C₆H₁₂ which contain a three membered ring. DRAW CLEARLY. If I cannot read or understand it, it will be marked wrong!

30. Name any one of the structures you drew in problem 29.

31. Draw structural formulas for all structural isomers of C₃H₆BrCl. DRAW CLEARLY. If I cannot read or understand it, it will be marked wrong!

32. Draw a Newman projection along the carbon number 3–carbon number 4 bond for the most stable conformation of hexane. DRAW CLEARLY.

33. Draw a Newman projection along the carbon number 3–carbon number 4 bond for the most stable conformation of 2,2,5,5-tetramethylhexane. (Draw Clearly).