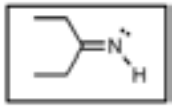
Chem 109a Quiz 2: Complete the Quiz. Put your answers on the scantron sheets. Be sure your perm numbers is on the scantron sheet.

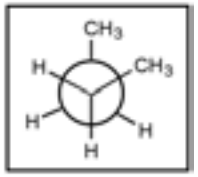
1. The lone-pair of electrons on nitrogen in the following molecule reside in what type of orbital?



A) sp^3

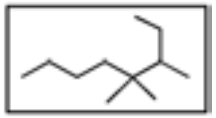
B) sp^2
C) sp
D) $2p$
E) $2s$

2. What is the name given to the Newman projection of the butane conformation shown here?



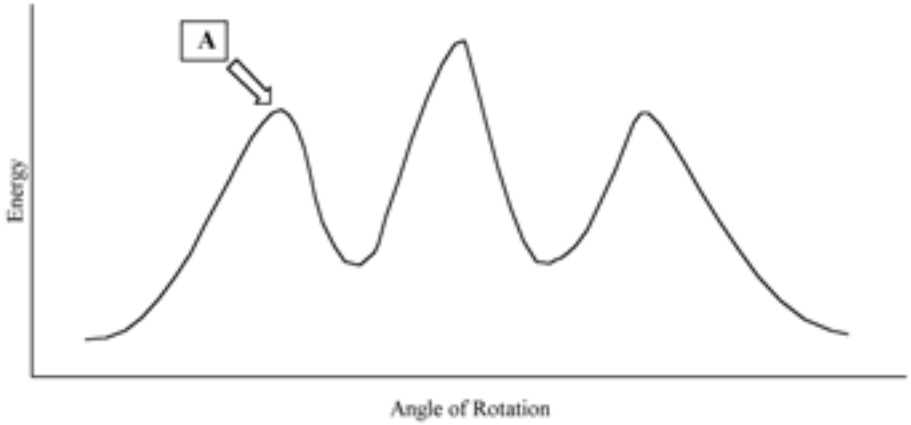
A) anti
B) gauche
C) staggered
D) eclipsed
E) skewed

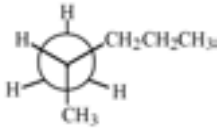
3. The correct name of the following molecule would be

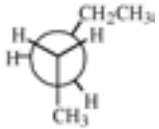


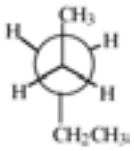
A) 2-ethyl-3,3-dimethylheptane
B) 6-ethyl-5,5-dimethylheptane
C) 3,4,4-trimethyloctane
D) 2-butyl-3-methylpentane
E) 2-sec-butyl-2-methylhexane

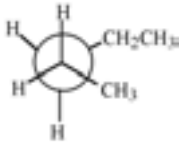
4. Consider the potential energy diagram for rotation about the C2--C3 bond in pentane. The position marked "A" most likely corresponds to which of the following Newman projections?

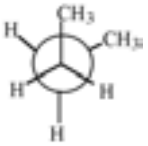


A)


B)


C)


D)


E) 

5. Which of the following is a **propagation** step in the free-radical bromination of methane?

A) $CH_3\cdot + Br\cdot \longrightarrow CH_3Br$

B) $Br_2 \xrightarrow{h\nu} 2\,Br\cdot$

C) $CH_3\cdot + Br_2 \longrightarrow CH_3Br + Br\cdot$

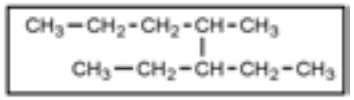
D) $CH_3\cdot + CH_3\cdot \longrightarrow CH_3CH_3$

E) $Br\cdot + Br\cdot \longrightarrow Br_2$

6. The following represents what functional group?

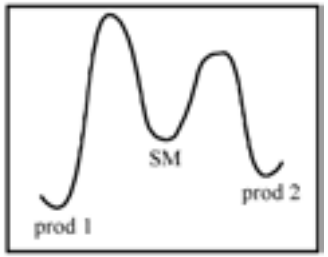
A) ester
B) ether
C) alcohol
D) thiol
E) ketone

7. What would be the correct name of the following?



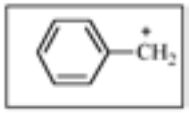
A) 3-(sec-pentyl)pentane
B) 5-ethyl-4-methylheptane
C) 3-(sec-butyl)hexane
D) 3-ethyl-4-methylheptane
E) 3-ethyl-4-propylpentane

8. What statement is true of the following energy diagram?



A) For irreversible reactions, product 1 will dominate.
B) For reversible reactions, product 2 will dominate at equilibrium.
C) For reversible reactions, equal amounts of 1 and 2 will be formed.
D) For irreversible reactions, equal amounts of 1 and 2 will be formed.
E) None of the above are true.

9. How many different resonance structures can be drawn for the benzyl cation (shown below) which place the plus charge on a carbon atom in the ring?



A) 1
B) 2
C) 3
D) 5
E) 6

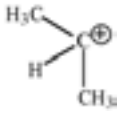
10. Which of the following is considered to be a nucleophile?

A) CH_3Cl

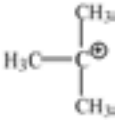
B) CH_3CH_2I

C) NH_3

D) $H^{\oplus}$

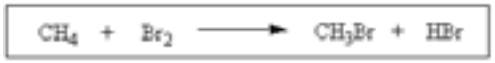
E) 

11. Which of the following is not considered a Lewis acid?

A) 
B) CH_3OH
C) $AlCl_3$
D) 
E) BF_3

12. Which of the following contains the isobutyl group?
A) $(CH_3)_2CHCH_2Cl$
B) $(CH_3)_3CCl$
C) $CH_3CH_2CH(CH_3)Cl$
D) $CH_3CH_2CH_2CH_2Cl$
E) None of these

13. Calculate ΔG^o for the following reaction at 25 °C and $\Delta S=0$



Bond	Ave Strength
C-C	83 (kcal/mol)
C-H	99 (kcal/mol)
C-Br	68 (kcal/mol)
H-Br	87 (kcal/mol)
Br-Br	46 (kcal/mol)

A) -10 kcal/mol
B) 10 kcal/mol
C) 34 kcal/mol
D) -34 kcal/mol
E) None of these

14. Which of the following has the highest pKa?
A) HI
B) NH_3
C) HNO_3
D) CH_3COOH
E) H_2SO_4

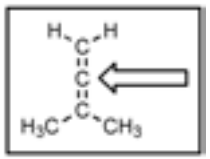
15. Which one of the reactions below will **not** proceed and accounts for why iodine added to a free-radical chlorination or bromination will greatly slow or even stop the reaction?

A) 
B) 
C) 
D) 
E) 

16. Which of the following reaction types are typical of alkanes?
A) addition
B) elimination
C) radical substitution
D) reduction
E) more than one of these is correct.

17. Which of the following is **not** true of free-radical halogenation reactions?
A) Fluorine is more reactive than chlorine in these reactions.
B) Bromine is more selective than chlorine.
C) The reactions require either light or high temperatures to proceed.
D) Brominations are faster than chlorinations.
E) These reactions are irreversible.

18. The following molecule belongs to a class of compounds known as allenes. Based on your knowledge of bonding, predict the hybridization of the carbon atom indicated by the arrow.

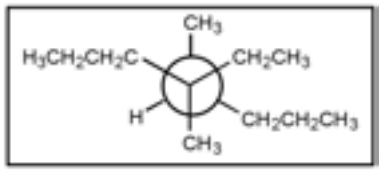


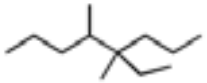
A) *sp*
B) sp^2
C) sp^3
D) *p-p* pi
E) a hypervalent carbon

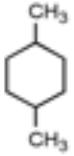
19. The most stable conformation of *cis* 1,3-dimethylcyclohexane has **how many** hydrogen atoms in axial positions?

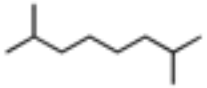
A) 4
B) 5
C) 6
D) 8
E) none of these

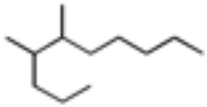
20. The following Newman projection represents which molecule?

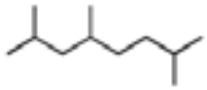


A) 

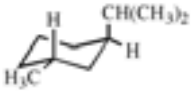
B) 

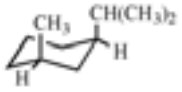
C) 

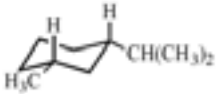
D) 

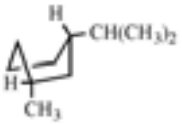
E) 

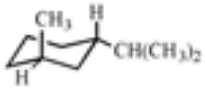
21. Which would be the **most stable** conformation of ***trans***-1-methyl-3-isopropylcyclohexane?

A) 

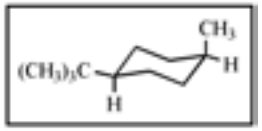
B) 

C) 

D) 

E) 

22. What would be the proper name of the following:



A) *cis*-1-tert-butyl-4-methylcyclohexane
B) *trans*-1-tert-butyl-4-methylcyclohexane
C) axial,equatorial-1-tert-butyl-4-methylcyclohexane
D) *cis*-1-isopropyl-4-methylcyclohexane
E) *trans*-1-isopropyl-4-methylcyclohexane

23. Hyperconjugation is MOST useful for stabilizing which of the following:

A) neopentyl radical
B) *tert*-butyl radical
C) isopropyl radical
D) ethyl radical
E) methyl radical

24. Which of the following disubstituted cyclohexanes could exist in a conformation which has both groups equatorial?

A) *cis*-1,3-dimethylcyclohexane
B) *cis*-1,4-dimethylcyclohexane
C) *trans*-1,3-dimethylcyclohexane
D) *cis*-1,2-dimethylcyclohexane
E) all or none can have both groups equatorial.

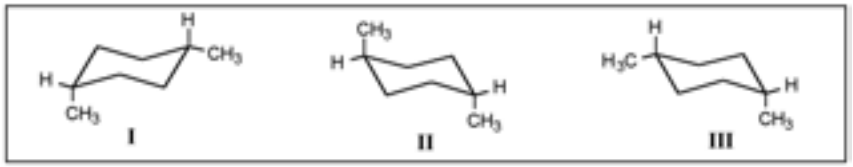
25. In a carbon radical, the carbon possesses how many valence electrons?

A) 4
B) 5
C) 6
D) 7
E) 8

26. Give the relative reactivity in decreasing order for free radical halogenation of $(CH_3)_3CH$.

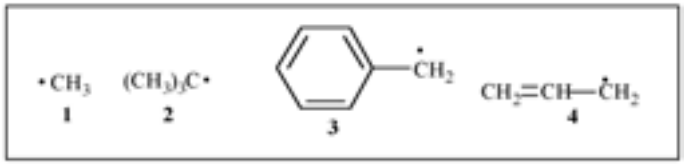
A) F > Cl >Br
B) Cl > Br > F
C) Br > F > Cl
D) Br > Cl > F
E) I > F > Cl

27. Which of the following structures represent *cis*-1,4-dimethylcyclohexane?



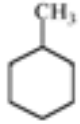
A) I & II
B) I & III
C) II & III
D) All of these
E) None of these

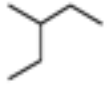
28. Rank the following radicals in decreasing order of stability.



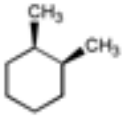
A) 3 > 4 > 2 > 1
B) 3 > 2 > 4 > 1
C) 2 > 3 > 4 > 1
D) 2 > 4 > 3 > 1
E) 1 > 2 > 3 > 4

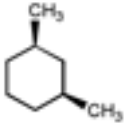
29. Which of the following hydrocarbons would yield only a single mono-chloro derivative under free radical chlorination conditions? (Cl_2/hv)

A) 
B) 
C) 
D) 

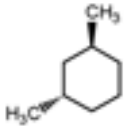
E) 

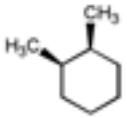
30. Which of the following could have **both** methyl groups in an **equatorial** orientation?

A) 

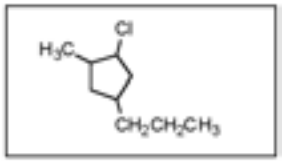
B) 

C) 

D) 

E) 

31. What is the correct name for the following molecule?



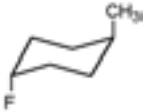
A) 1-chloro-2-methyl-4-propylcyclopentane
B) 2-chloro-1-methyl-4-propylcyclopentane
C) 1-chloro-5-methyl-3-propylcyclopentane
D) 5-methyl-1-chloro-3-propylcylopentane
E) 1-chloro-3-propyl-5-methylcyclopentane

32. Which, if either, of the two isomers of the compound shown below would be the more stable?

A) *Cis* is more stable.
B) *Trans* is more stable.
C) Both are equally stable.
D) Neither is stable.
E) There is no way to predict this.

33. What is the most stable conformation of *trans*-1-fluoro-4-methylcyclohexane?

A) 

B) 

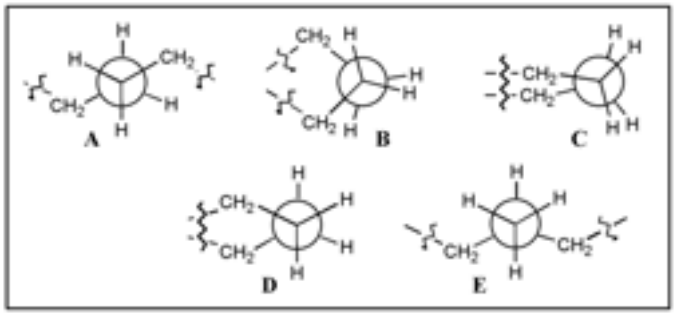
C) 

D) 

E) 

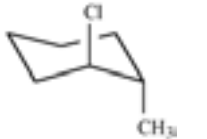
34. Although five- and six-membered rings are generally the most stable, why is cyclopentane less stable than cyclohexane?
A) The angles in cyclopentane deviate significantly from the tetrahedral angle.
B) Five-membered rings have trans annular interactions.
C) Five-membered rings have eclipsing hydrogens.
D) Planar cyclohexane has bond angles closer to 109°.
E) Larger rings are always more stable than smaller rings.

35. Which of the following correctly shows the Newman projection along a C-C bond in cyclohexane? (the squiggles indicate where the rest of the ring is attached)



A) A
B) B
C) C
D) D
E) E

36. Which of the following is NOT in its most stable conformation?

A) 

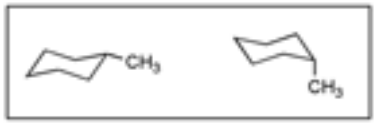
B) 

C) 

D) 

E) All of these are in their most stable conformation

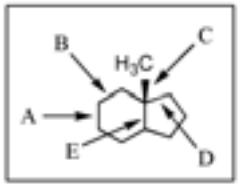
37. Which of the following statements about conformations of methylcyclohexane is true?



A) The energy barrier to interconvert these is too high to be achieved at room temperature.
B) The two forms are in equilibrium and are present in equal amounts at room temperature.
C) The two forms are not in equilibrium but **are** present in equal amounts at room temperature.
D) The two forms are in equilibrium but are **not** present in equal amounts at room temperature.
E) The two forms are not in equilibrium and are **not** present in equal amounts at room temperature.

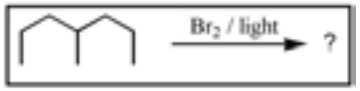
38. Which of the following is TRUE for an early transition state:
A) The starting materials resemble the products.
B) The reaction proceeds very slowly.
C) The transition state resembles the reactants.
D) The transition state resembles the products.
E) Both B and C.

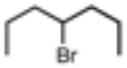
39. Which of the carbon-carbon bonds indicated would be the weakest?

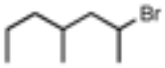


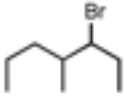
A) A
B) B
C) C
D) D
E) E

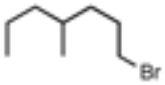
40. Predict the MAJOR Product of the following reaction:

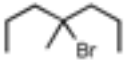


A) 

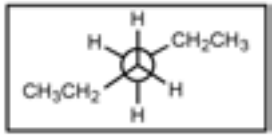
B) 

C) 

D) 

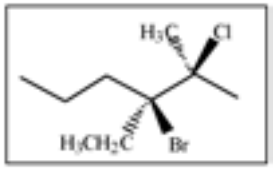
E) 

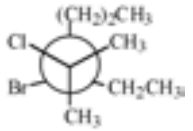
41. The following Newman projection corresponds to which molecule?

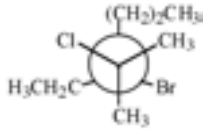


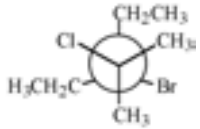
A) pentane
B) butane
C) 3-ethylbutane
D) hexane
E) 3-methylpentane

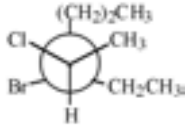
42. What is the correct Newman projection for the following molecule?



A) 

B) 

C) 

D) 

E) None of these

43. Which of the following compounds has the **highest** heat of combustion **per CH_2 group**?
A) cyclopropane
B) cyclobutane
C) cyclopentane
D) cyclohexane
E) all have equal $\Delta H_{combustion}$

44. In a free radical termination step:
A) an initiator starts a chain reaction.
B) free radicals recombine with one another.
C) a radical reacts to form another radical.
D) the activation energy is high.
E) a reactive intermediate is formed.

Answer Key - Ferret:Exam:Quiz2.qf.ef

1. B
2. B
3. C
4. B
5. C
6. B
7. D
8. E
9. C
10. C
11. B
12. A
13. A
14. B
15. D
16. C
17. D
18. A
19. C
20. A
21. E
22. A
23. B
24. A
25. D
26. A
27. B
28. A
29. A
30. B
31. A
32. B
33. E
34. C
35. D
36. A
37. D
38. C
39. E
40. E

41. D
42. A
43. A
44. B