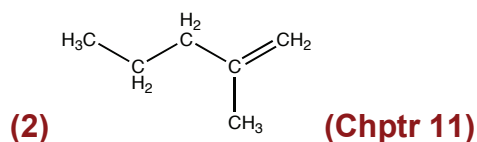


1. (2 points) What is the chemical formula for the molecule at right?

- 1)  $C_6H_{10}$       2)  $C_6H_{12}$       3)  $C_6H_{14}$       4)  $C_6H_{16}$       5)  $C_6H_{18}$

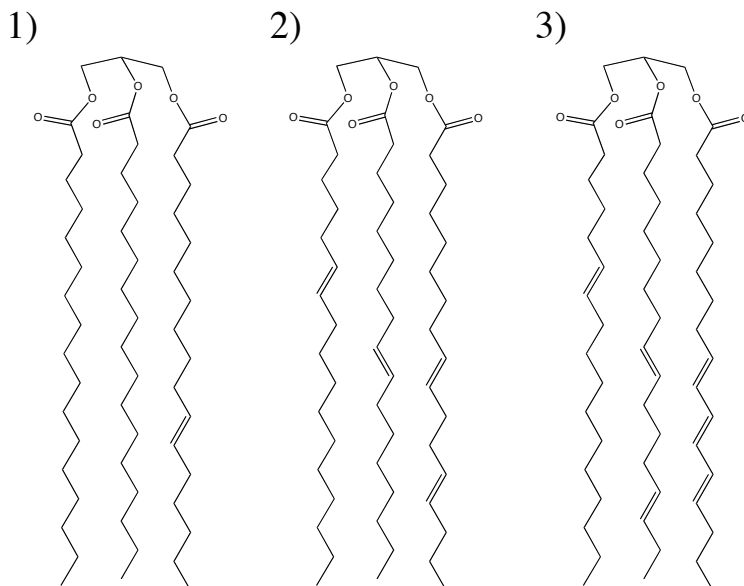


2. (2 points) What is the functional group in  $CH_3COCH_3$ ?

- 1) aldehyde    2) ether      3) alcohol      4) carboxylic acid    5) ketone

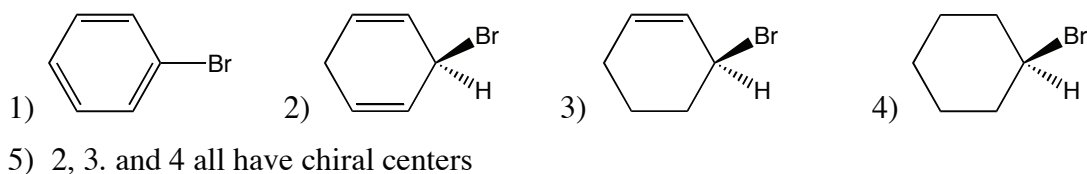
(5) ketone – (Chptr 11)

3. (2 points) Triglycerides are a common form a fat in our bodies. Which of the following triglycerides is *most* likely to be a liquid at room temperature?



(3) It has the most double bonds (Chptrs 12 and 18)

4. (2 points) Which molecule below has a chiral center?

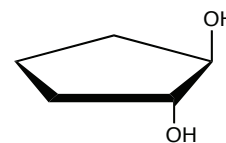


(3) Look at the asymmetry PRS question 3/5 (Chptr 15)

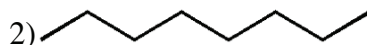
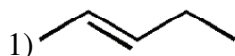
5. (2 points) The molecule at right is

- 1) a cis isomer      2) a trans isomer      3) not an isomer

**(2) trans- with respect to the cyclic ring (Chptr 11)**



6. (2 points) Which molecule below is less reactive, in general?



3) they have the same reactivity

**(2) addition reactions are not possible (Chptr 12)**

7. (2 points) Rank boiling points, highest to lowest:

1)  $\text{CH}_3\text{CH}_3 > \text{CH}_3\text{NH}_2 > \text{CH}_3\text{OH}$

2)  $\text{CH}_3\text{CH}_3 > \text{CH}_3\text{OH} > \text{CH}_3\text{NH}_2$

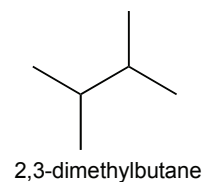
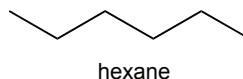
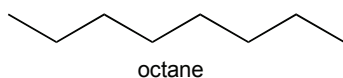
3)  $\text{CH}_3\text{OH} > \text{CH}_3\text{NH}_2 > \text{CH}_3\text{CH}_3$

4)  $\text{CH}_3\text{NH}_2 > \text{CH}_3\text{OH} > \text{CH}_3\text{CH}_3$

5) They are all about the same

**(3) OH hydrogen bonds better than NH2 - PRS 3/5 (Chptr 14)**

8. (2 points) Which molecule below has the highest boiling point?



1) octane

2) hexane

3) 2,3-dimethylbutane

**(1) it's longest & unbranched, so associates with itself best (Chptr 11)**

9. (2 points) In the molecule at right, the ideal bond angle around the 1-carbon is:

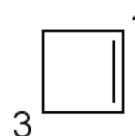
1)  $120^\circ$

2)  $109^\circ$

3)  $90^\circ$

4)  $180^\circ$

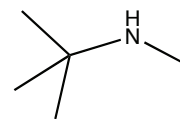
**(1)  $120^\circ$  It's  $\text{sp}^2$  - OWL 12.1a (Chptr 12)**



10. (2 points) In the molecule at right, the amine is classified as:

- 1) primary                      2) secondary                      3) tertiary

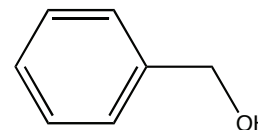
**(2) secondary (Chptr 16)**



11. (2 points) In the molecule at right, the alcohol is classified as:

- 1) primary                      2) secondary                      3) tertiary

**(1) primary (Chptr 14)**



12. (2 points) Ketones are readily oxidized (by oxygen in air) to

- 1) aldehydes      2) alcohols                      3) carboxylic acids                      4) the parent alkanes  
5) ketones are not readily oxidized

**(5) not readily oxidized – see Chapter 17.4.a. OH does not readily replace an alkane off of the ketone.**

13. (2 points) Aldehydes are readily oxidized (by oxygen in air) to

- 1) ketones                      2) alcohols                      3) carboxylic acids                      4) the parent alkanes  
5) aldehydes are not readily oxidized

**(3) carboxylic acids – see Chapter 17.4.a. Note that the C adopts a higher oxidation number in the carboxylic acid. H is replaced by OH**

14. (2 points) Aldehydes are reduced by H<sub>2</sub> and an appropriate catalyst to

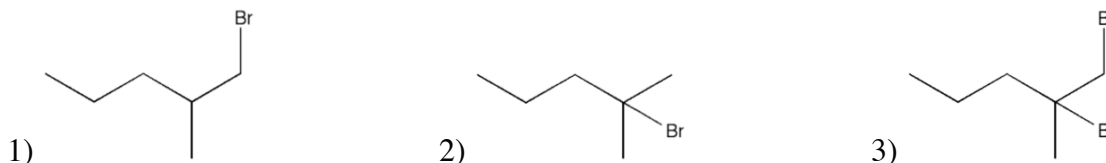
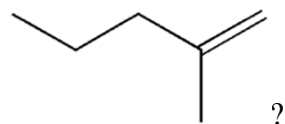
- 1) ketones                      2) alcohols                      3) carboxylic acids                      4) the parent alkanes  
5) aldehydes are not readily reduced

**(2) alcohols – see Chapter 17.4.b. Note that the C adopts a lower oxidation number in the alcohol. You can see that H<sub>2</sub> is “added” across the C=O bond**

15. (2 points) Ketones are reduced by  $H_2$  and an appropriate catalyst to
- 1) aldehydes
  - 2) alcohols
  - 3) carboxylic acids
  - 4) the parent alkanes
  - 5) ketones are not readily reduced

**(2) alcohols – see Chapter 17.4.b. Note that the C adopts a lower oxidation number in the alcohol. You can see that  $H_2$  is “added” across the  $C=O$  bond**

16. (2 points) What is the product of the reaction of HBr with



**(2) – This was a PRS question for 2/21/08 (Chptr 11)**

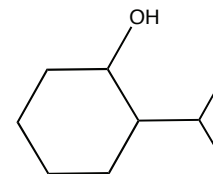
17. (2 points) A racemic mixture
- 1) rotates polarized light to the right
  - 2) rotates polarized light to the left
  - 3) does not rotate polarized light

**(3) half the molecules rotate light to the right, while the other half rotates it to the left, so the mixture has no net rotation. (Chptr 15)**

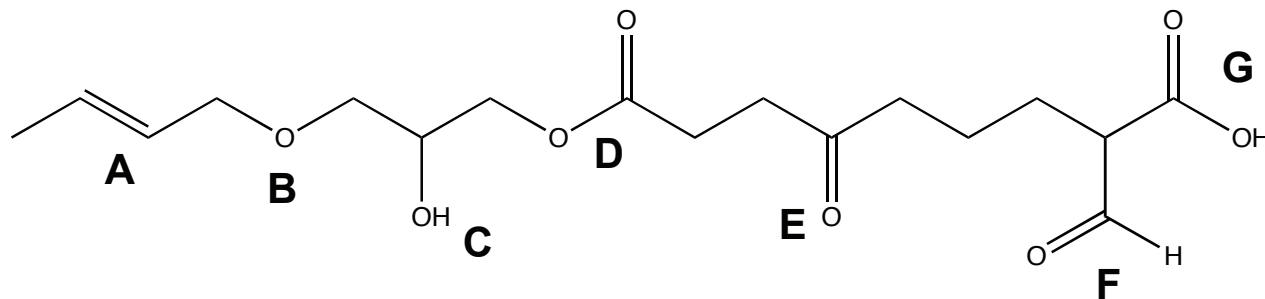
18. How many chiral centers are in the molecule at right?

- 1) 0
- 2) 1
- 3) 2
- 4) 3
- 5) 10

**(3) There are 2 stereocenters (Chptr 15)**



For questions 19 to 23, refer to the molecule below.



19. (2 points) Which of the above represents an aldehyde group?

- 1) B                      2) D                      3) E                      4) F                      5) G

**(4) F (Chptr 17)**

20. (2 points) Which of the above represents a ketone group?

- 1) B                      2) D                      3) E                      4) F                      5) G

**(3) E (Chptr 17)**

21. (2 points) Which of the above represents an ether group?

- 1) B                      2) D                      3) E                      4) F                      5) G

**(1) B (Chptr 14)**

22. (2 points) Which group above is acidic?

- 1) B                      2) D                      3) E                      4) F                      5) G

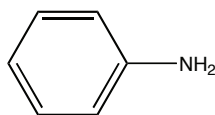
**(5) G – a carboxylic acid (Chptr 14)**

23. (2 points) The functionality at A is:

- 1) cis                      2) trans                      3) neither

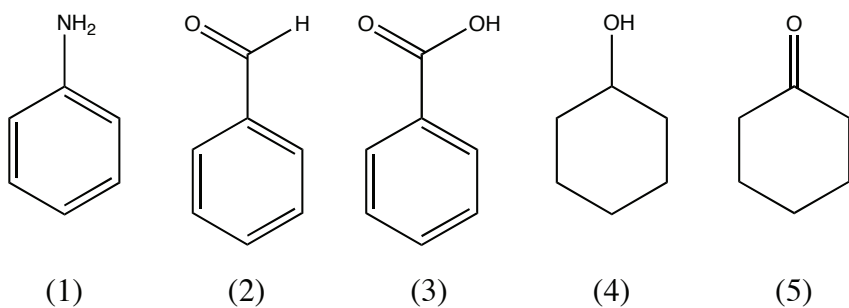
**(2) trans (Chptr 12)**

24. The molecule at right is:



- 1) toluene              2) aniline              3) benzoic acid              4) benzaldehyde              5) cyclohexamine

**(2)**



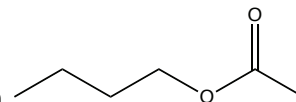
25. (2 points) Which molecule above in a reaction with  $K_2Cr_2O_7$  and  $H_2SO_4$  yields cyclohexanone?

**(4) (Chptr 14)**

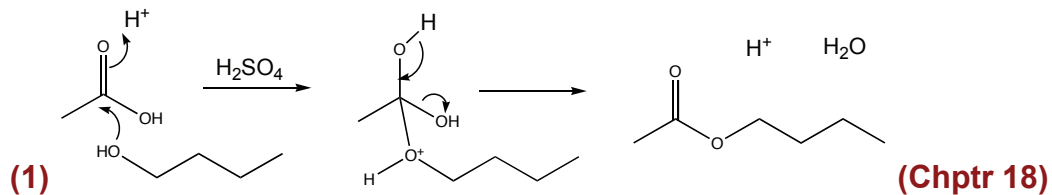
26. (2 points) Which molecule above in a reaction with  $H_2$  and a transition metal catalyst yields cyclohexanol?

**(5) (Chptr 17)**

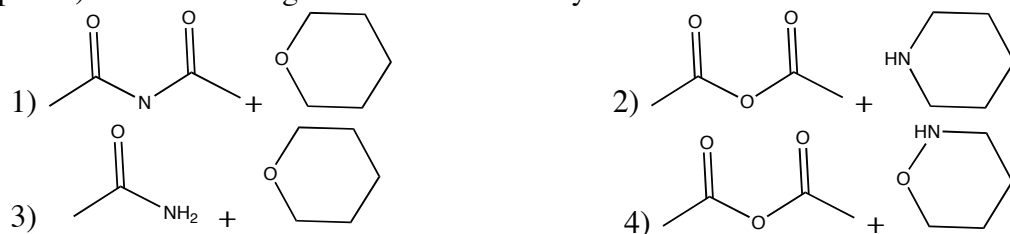
27. (2 points) Which two reagents react in the presence of  $H_2SO_4$  to form



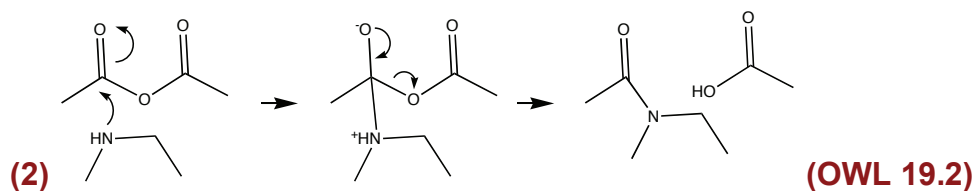
- 1) ethanoic acid and butanol
- 2) butanoic acid and ethene
- 3) butanol and methane
- 4) butanoic acid and ethanol
- 5) none of the above



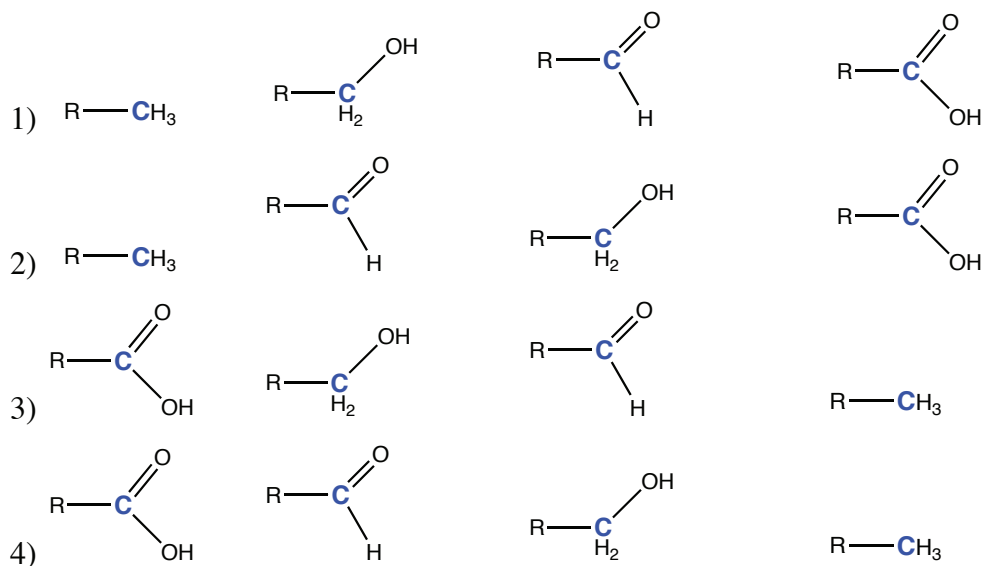
28. (2 points) Which two reagents react most readily to form



5) none of the above react to form that product

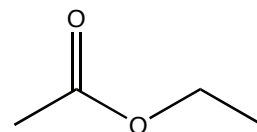


29. (2 points) Which listing portrays the carbons in increasing oxidation state



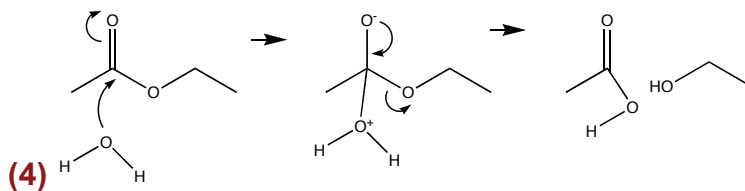
(1) See our discussion in class



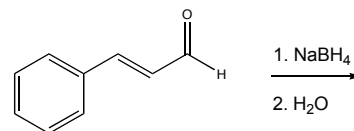


30. (2 points) Hydrolysis of the compound at right would yield

- |  |  |
|--|--|
| 1) Propanoic acid and methanol               | 2) Propanol and methanoic(formic) acid |
| 3) Ethanoic (acetic) acid and methanol       | 4) Ethanol and ethanoic (acetic) acid  |
| 5) This compound does not undergo hydrolysis |  |



31. (2 points) The products of the reaction of cinnamaldehyde with  $\text{NaBH}_4$  (see scheme at right) are:



- |                           |               |
|---------------------------|---------------|
| 1) a carboxylic acid      | 2) an alcohol |
| 3) sodium boroester       | 4) a diol     |
| 5) no reaction will occur |               |

**(2) see p 441 of text (Chptr 17)**

32. (2 points) Which do you think is more acidic: benzoic acid or acetic acid?

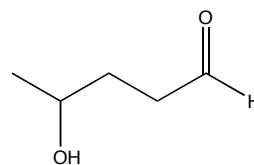
- |                 |                |
|-----------------|----------------|
| 1) benzoic acid | 2) acetic acid |
|-----------------|----------------|

**(1) benzoic acid can delocalize the deprotonated charge (Chptr18 and 13)**

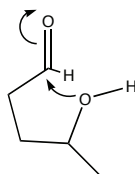
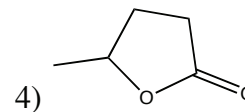
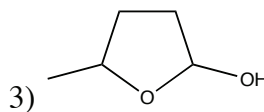
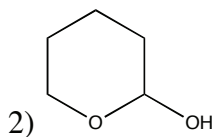
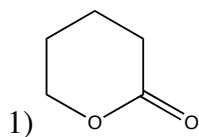
33. (2 points) Which do you think is more acidic: acetic acid or trichloroacetic acid?

- |                |                         |
|----------------|-------------------------|
| 1) acetic acid | 2) trichloroacetic acid |
|----------------|-------------------------|

**(2) in trichloroacetic acid, the Cl's pull  $e^-$  density away (Chptr18 and 13)**



34. (2 points) The molecule at right can cyclize to form:



**(3) Formation of hemiacetals**

**See p 443 (Chptr 17)**

35. (2 points) Roger Clemens needs your help. Someone has given him only one of the possible stereoisomers of androstenedione. What are the odds (assuming a random grabbing of bottles) that he has the correct stereoisomer?

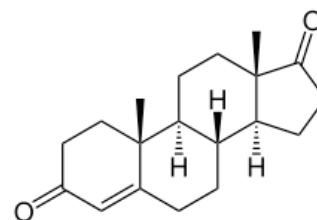
1) 1 in 8

2) 1 in 32

3) 1 in 64

4) 1 in 100

5) I don't know, but he should retire



**(2) There are 5 chiral centers.  $2^5 = 32$  (Chptr 15)**

36. (2 points) Androstenedione (see above) is expected to have what kind of geometry?

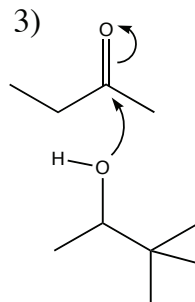
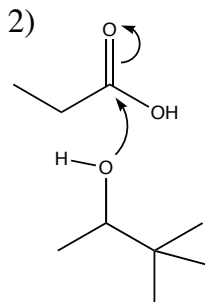
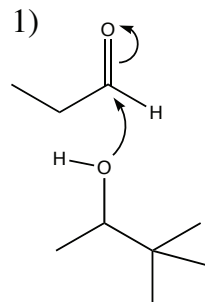
1) absolutely flat

2) almost flat

3) very distorted

**(3) Lots of  $sp^3$  centers!**

37. (2 points) The following represent initial steps in a reaction. Which is most favorable?



**(2) The extra OH group stabilizes the resulting negative charge (Chptr 18)**

38. (2 points) Which are you most likely to find as a flavoring added to your favorite candy?

- 1) a long, branched alkane      2) an aldehyde      3) a carboxylic acid

**(2) aldehydes have low vapor pressures, so your nose can smell them.  
Candies that smell good, taste good. see p 439 (Chptr 17)**

39. (2 points) Which is more polar?

- 1) an alcohol      2) a thiol

**(1) alcohol – compare electronegativities of O and S (Chptr 14)**

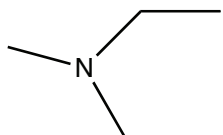
40. (2 points) What is the catalog number for this class?

- 1) 250      2) 111      3) 86      4) 3.14159      5) 68.6 g

**(1)**

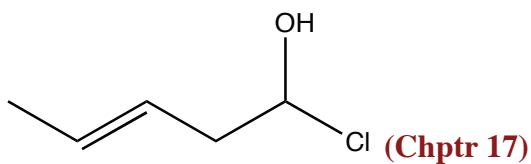
**Turn this page in, along with your OpScan Sheet (be sure your name is on both!)**

41. (5 points) Draw the structure for dimethylethylamine:



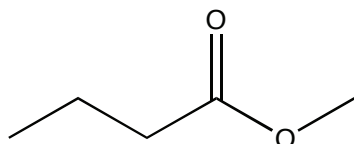
**(Chptr 16)**

42. (5 points) Draw the structure for 1-chloro-3-pentenol:



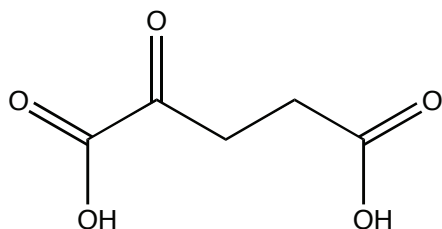
**(Chptr 17)**

43. (5 points) Draw the structure for apple flavor: methyl butanoate



**(Chptr 18)**

44. (5 points) Draw the structure for ~~2-ketopentanoic~~ 2-ketopentanedioic acid



$\alpha$ -ketoglutarate (Chptr 18)

**The name provided on the original exam does not conform to IUPAC formalism – my apologies. If you get close to the right answer, you'll get credit (or partial credit)**

**Turn this page in, along with your OpScan Sheet (be sure your name is on both!)**