Fossum

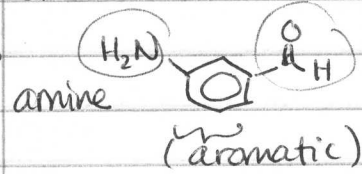
30B Answers to Review Questions for Exam 1

1. a. para-xylene
   b. 3,3-dibromo-1-propyne
   c. 3-bromo-4-methylcyclohexene
   d. cis-6-methyl-3-heptene
   e. cyclopentene
   f. 4-isobutyl-3-methylnonane
   g. 2-methyl-1-butanethiol
   h. 3-ethyl-4-methyl-1-hexanol
   i. 2-methoxybutane
   j. 1-bromo-2-iodocyclohexane

2. a. $CH_3CH(Br)CH(SH)CH(Cl)CH_3$ b. $CH_3CH_2CH(OCH_2CH_3)CH_2CH_3$

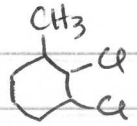
3. a. 1° (alcohol) b. 3° (amine) c. 1° (amine)

4. a. neither - different # H's so diff formula.
   b. identical - both are 2,4,4-trimethylhexane

5. 

6. Most soluble in H_2O: (c) smallest alcohol. can H-bond to water, and has a small hydrocarbon (nonpolar) section. Next: (d) can H-bond to water, but has a longer nonpolar section than c. Next: (b) similar length compared to d. - ~~But b can't H-bond to as~~ b is slightly polar. H_2O can H-bond to b but not as much as to d. (a) least soluble in water. completely nonpolar.

7. Highest bp: (c) a, b, and c have similar molar masses, so similar London forces. (c) can H-bond and will have strongest IMF's overall. Next: (b) slightly polar. Has weak dipole-dipole forces in addition to London forces. Next (a): nonpolar, only London forces, so weaker IMF's than b and c. Last: (d) nonpolar and smaller MM than the others, so weaker London forces than a.

8. a. 

b. $CH_3CH(CH_3)CH_2=CH_2 + H_2O$

c. $CH_3CH_2CH(CH_3)C(=O)H + H_2O \xrightarrow{[O]} CH_3CH_2CH(CH_3)C(=O)OH$

d. $CH_3CH_2CH(OH)CH_2CH_3$ and $CH_3CH_2CH_2CH(OH)CH_3$ (2 products)

e. $CH_3CH=CHCH_2CH_2CH_3$ and $CH_3CH_2CH=CHCH_2CH_3$

(2 products. approx equal amts because same degree of substitution)

9. see lecture notes + text

10. $CH_3-CH(CH_3)-CH_3 + Br_2 \xrightarrow{light} HBr + CH_3-CH(CH_3)-CH_2Br$

$CH_3C(CH_3)(Br)CH_3$ monosubstituted

and $CH_3-C(CH_3)(Br)-CH_2Br$ and $CH_3-CH(CH_2Br)CH_2Br$ and $CH_3-CH(CH_3)CHBr_2$

11. 1° alcohols

$CH_3CH_2CH_2CH_2CH_2OH$

$CH_3-C(CH_3)(CH_3)-CH_2OH$

$CH_3CH_2CH(CH_3)CH_2OH$

$CH_3CH(CH_3)CH_2CH_2OH$

12. a. $CH_3CH(CH_3)CH(OH)CH_2CH_3 \xrightarrow{[O]}$

b. $CH_3-CH(CH_3)-CH=CH_2 + HI \rightarrow$

(can't be $CH_3-C(CH_3)=CHCH_3$ because it would give $CH_3-C(I)(CH_3)-CH_2CH_3$)

13. $CH_3CH(CH_3)CH_2CH_2CH(OH)CH_3 \xrightarrow[\text{heat}]{H_2SO_4} CH_3CH(CH_3)CH_2CH{=}CHCH_3 + H_2O$

5-methyl-2-hexene — major product

$CH_3{-}CH(CH_3)CH_2CH_2CH{=}CH_2$

5-methyl-1-hexene — minor product

14. a. $CH_3CH_2C(CH_3){=}CHCH_2CH_3 + HBr \rightarrow CH_3CH_2C(CH_3)(Br){-}CH_2CH_2CH_3$

3-bromo-3-methyl hexane

b. $CH_3CH(CH_3)CH{=}CHCH_2CH_3 + HBr \rightarrow CH_3CH(CH_3){-}CH(Br)CH_2CH_2CH_3$

3-bromo-2-methyl hexane

and

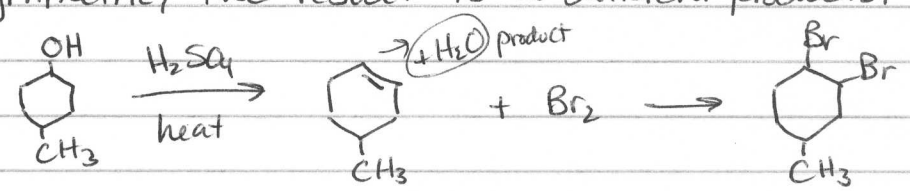
$CH_3CH(CH_3)CH_2CH(Br)CH_2CH_3$

4-bromo-2-methylhexane

Reactant ⓐ is unequally substituted at the double bond. Markovnikov's rule applies, and we get only one product.

Reactant ⓑ is equally substituted at the double bond, so the Br could go on either side of the double bond. Since ⓑ is asymmetric, the result is 2 different products.

15. a.



b. $CH_3CH_2CH_2OH \xrightarrow[\text{heat}]{H_2SO_4} CH_3CH{=}CH_2 + H_2O$

$CH_3CH{=}CH_2 + H_2O \xrightarrow{H^+} CH_3CH(OH)CH_3 \xrightarrow{[O]} CH_3C(=O)CH_3$

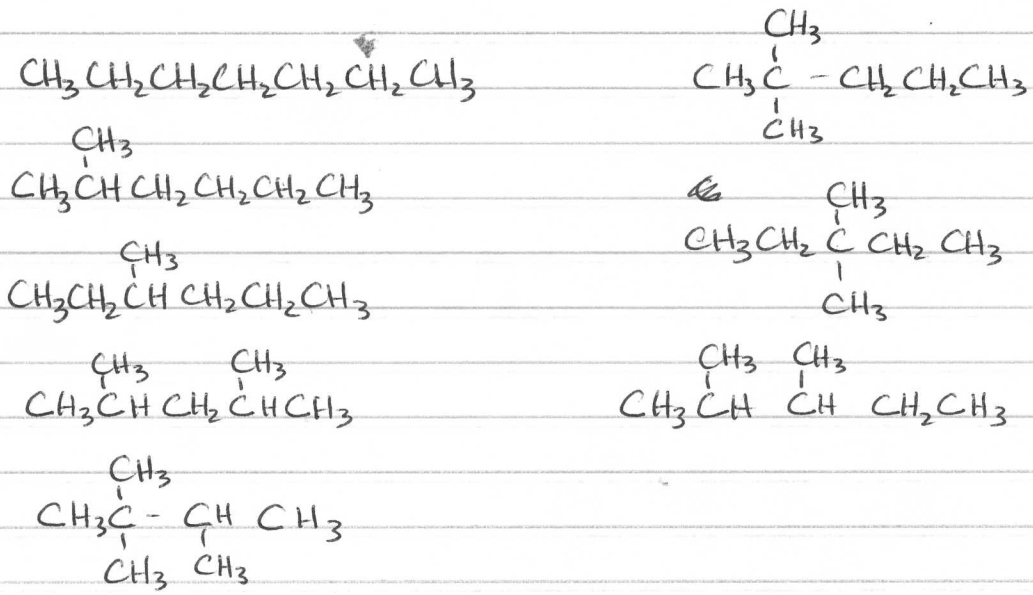
c. $CH_3CH_2CH_2CH_2CH_2OH \xrightarrow[\text{heat}]{H_2SO_4} CH_3CH_2CH_2CH{=}CH_2 + H_2O$

$CH_3CH_2CH_2CH{=}CH_2 + HI \rightarrow CH_3CH_2CH_2CH(I)CH_3$

d. $CH_3CH_2CH_2CH_2OH \xrightarrow[\text{heat}]{H_2SO_4} CH_3CH_2CH{=}CH_2 + H_2O$

$CH_3CH_2CH{=}CH_2 + H_2O \xrightarrow{H^+} CH_3CH_2CH(OH)CH_3$

16.



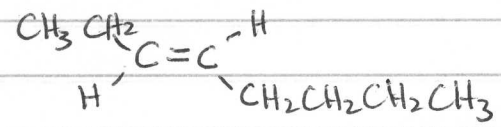
17. a. $CH_3CH_2OH + CH_3CH_2OH \xrightarrow[heat]{H^+} CH_3CH_2OCH_2CH_3 + H_2O$

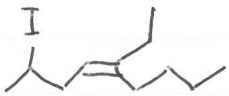
b. $CH_3CH_2CH_2SH + CH_3CH_2CH_2SH \xrightarrow{[O]} CH_3CH_2CH_2S-S-CH_2CH_2CH_3 + H_2O$

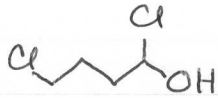
18. a. hydration (of alkenes) H_2O, acid catalyst
b. chlorination of alkenes: Cl_2
of alkanes Cl_2, heat or light
c. dehydration (of alcohols) acid, heat
d. oxidation an oxidizing agent $\xrightarrow{[O]}$
e. ether formation acid, heat
f. hydroiodination (of alkenes) HI
g. hydrogenation H_2, Pt, Pd, Ni
Choose 1 metal catalyst.

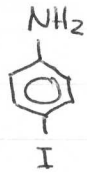
19. applies to addition rxns of alkenes - hydrohalogenation or hydration.
applies if the double bond is unequally substituted.
the halogen or OH will only add to the more highly substituted carbon of the double bond.

20.



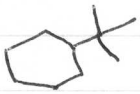
21. a) 

b) 

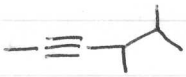
c) 

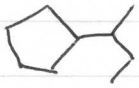
d) 

e) 

f) 

g) 



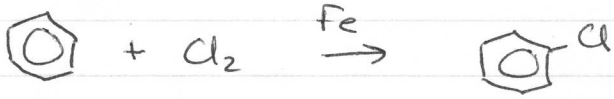
h) 

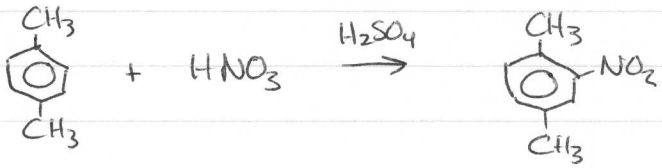
22. a) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{N}}-CH_3 + H_2O \rightleftharpoons CH_3-\overset{\oplus}{\underset{\displaystyle CH_3}{\underset{|}{N}}}H-CH_3 + OH^-$

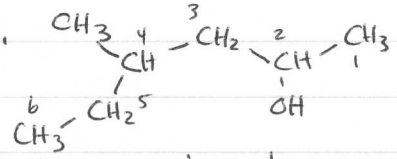
trimethylammonium ion

b) $CH_3CH_2CH_2NH_2 + HBr \longrightarrow CH_3CH_2CH_2NH_3^+ + Br^-$

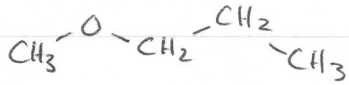
propylammonium bromide

23. a) 

b) 

24. a. 

4-methyl-2-hexanol

b. 

methyl propyl ether

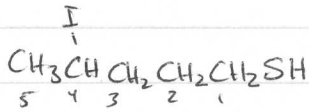
or 1-methoxypropane

c. $CH_3-CH_2-CH_2-NH-CH_2CH_3$

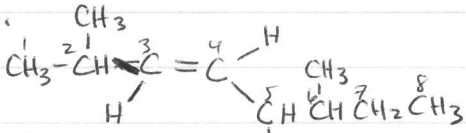
ethyl propylamine OR

N-ethyl propanamine OR

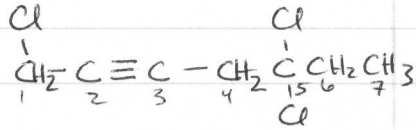
N-ethylpropylamine

d. 

4-iodo-1-pentanethiol

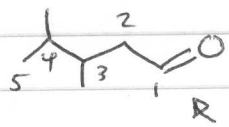
e. 

trans-2,5,6-trimethyl-3-octene

f. 

1,5,5-trichloro-2-heptyne

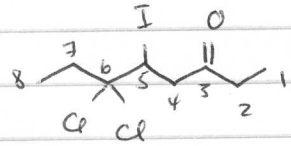
25. a.



R aldehyde

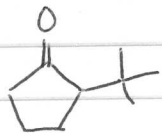
3,4-dimethylpentanal

b.



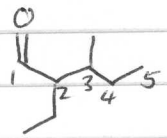
6,6-dichloro-5-iodo-3-octone

c.



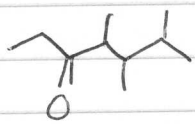
2-tert-butylcyclopentanone

d.

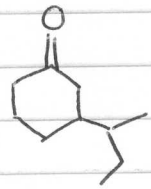


2-ethyl-3-methylpentanal

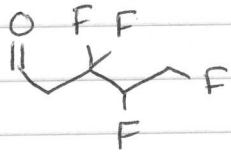
26. a.



b.

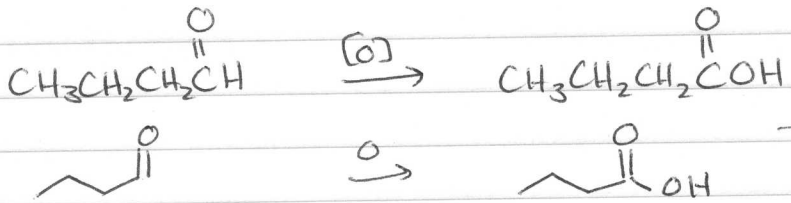


c.

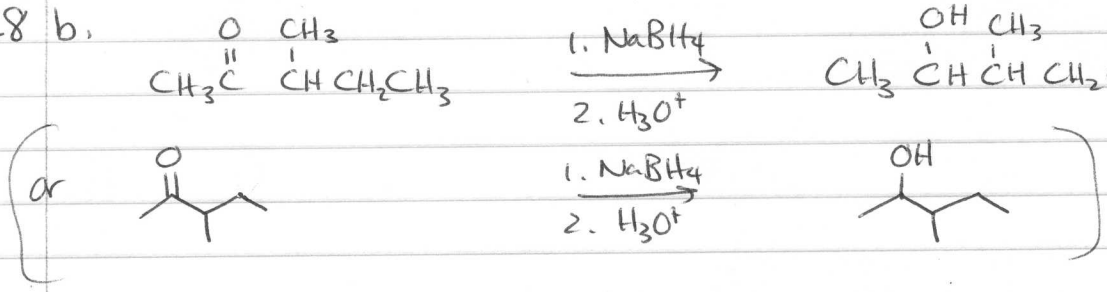


27.
- they are polar, but can't Hbond (to each other - no H on O)
- higher bps than alkanes + ethers of the same size, lower bps than alcohols of the same size.
- small aldehydes + ketones are soluble in water
- all are soluble in organic solvents
- ketones are good solvents
- aldehydes smell good in general.

28 a.



28 b.



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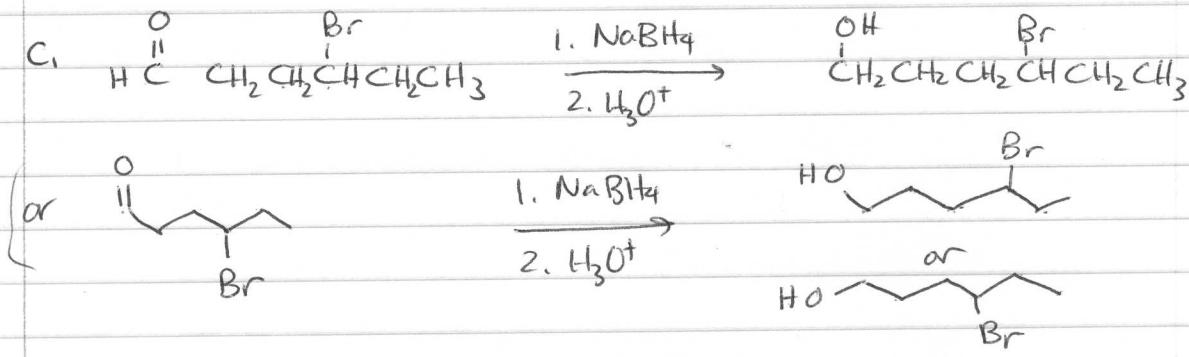
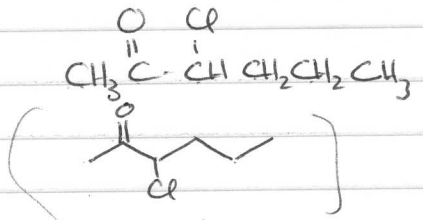
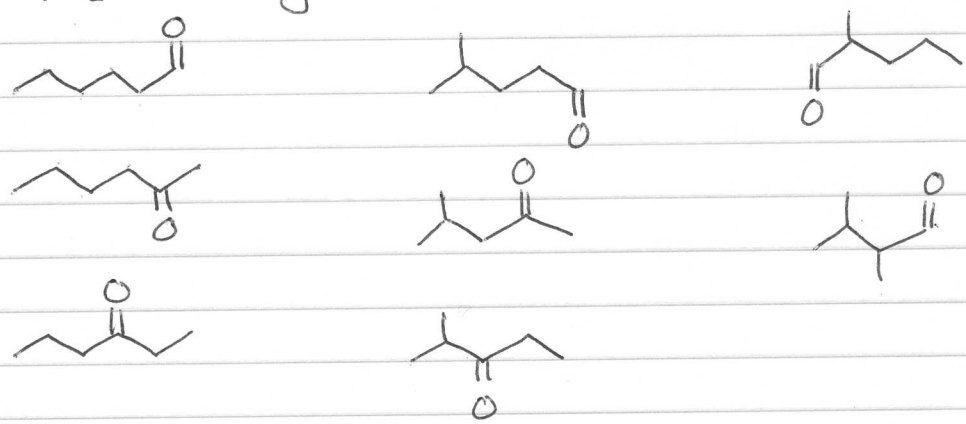


d.



No Rxn

29. $C_6H_{12}O$ aldehydes + Ketones



(others are duplicates)