

Please write your answers neatly in the spaces provided. You may write in pencil if you decline the option of a re-grade. If you use a blue or black ink pen you retain the option of a re-grade. There are 19 questions. Useful atomic numbers: H=1, C=6, N=7, O=8, F=9, Cl=17, Br=35

Academic Integrity Pledge

During the exam I will

- turn off my cell phone and put it away (out of sight and not on my person)
- close all books, notebooks, etc. and put them under the seat in which I sit
- keep my eyes down and focused on my own paper
- keep my answers covered
- sit in the area assigned to my section

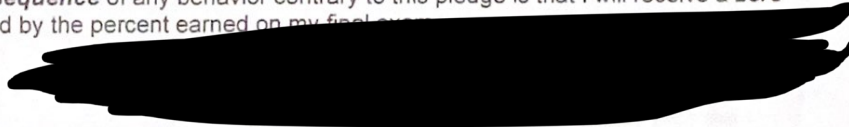
I will stop writing when time is called.

I will hand in my paper when told to do so.

During the exam I will not

- have any papers other than those provided
- have any writing on my clothing or person or desk
- talk to anyone other than the instructor

I understand that the *minimum consequence* of any behavior contrary to this pledge is that I will receive a **zero on this exam** that will not be replaced by the percent earned on my final exam.



Scoring

					VIIIA
13	14	15	16	17	2
IIIA	IVA	VA	VIA	VIIA	He
5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80

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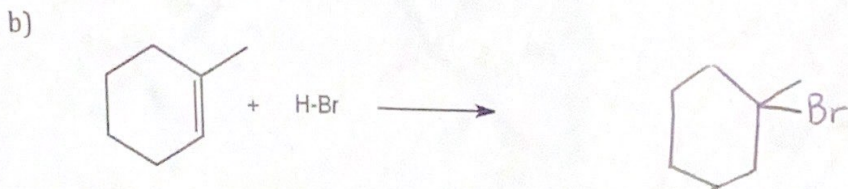
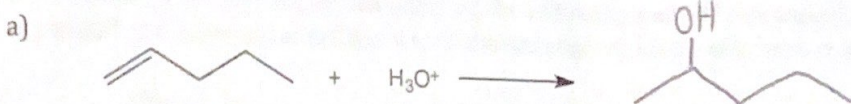
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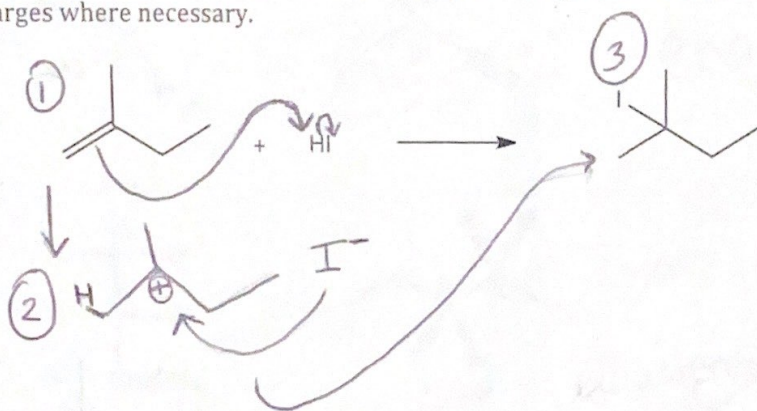
SUM 87 / 100

1. (2 pts each) Write the major product formed in the following reaction.



4

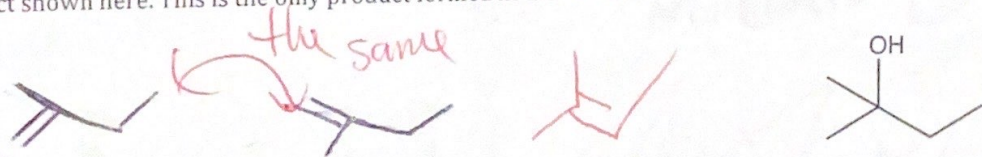
2. (4 pts) Indicate a plausible mechanism for the following reaction. Be sure to show bond making and bond breaking as well as all electron movement. Every arrow counts. Be precise! Don't forget to show charges where necessary.



4

3. (2 pts) Draw **two different** alkene starting materials that when treated with H_3O^+ would give the product shown here. This is the only product formed in the reaction.

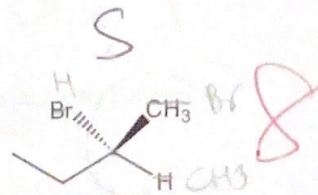
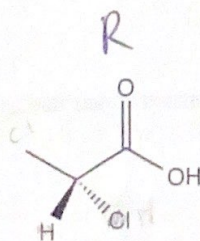
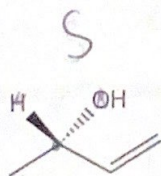
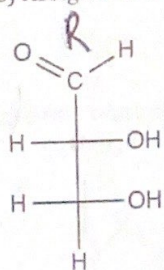
a
b
c
d
e
f



1

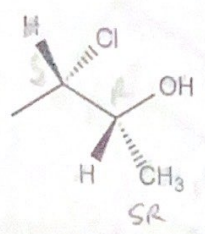
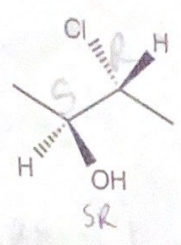
4. (8 pts) Assign R or S to all stereocenters shown.

a
b
c
d

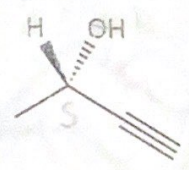
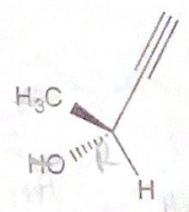


17

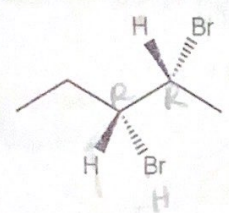
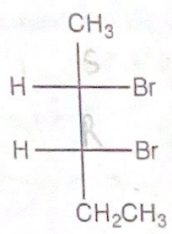
5. (3 pts each) What is the relationship of the following pairs of molecules? Are they identical, constitutional isomers, enantiomers, or diastereomers. Circle any meso compounds in the group.



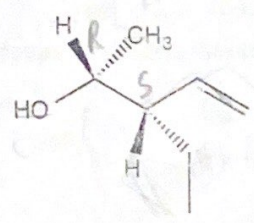
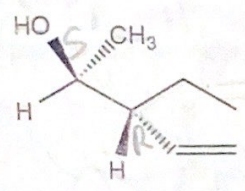
~~Identical~~ (No meso in any)



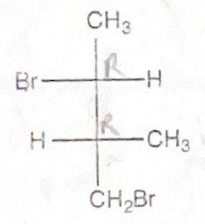
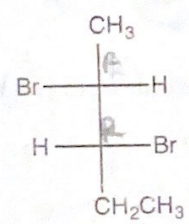
~~enantiomers~~ (3)



~~diastereomers~~ (3)

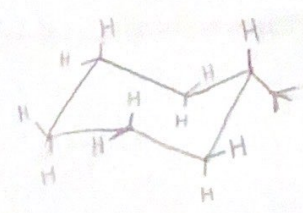
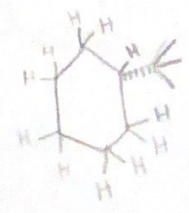


~~diastereomers~~
~~enantiomers~~ (3)



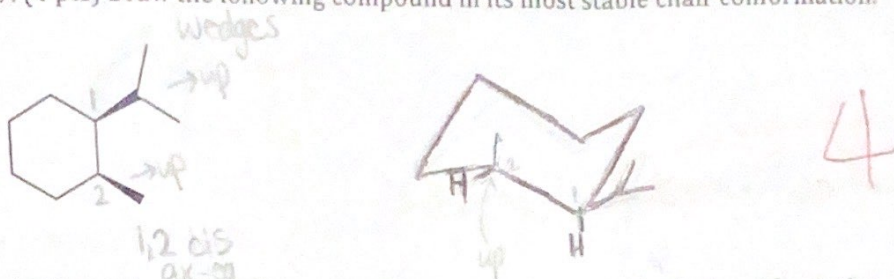
~~Identical~~

6. (4 pts) Draw t-butylcyclohexane in its most stable chair conformation. Show ALL ring hydrogens. (tert-butyl)

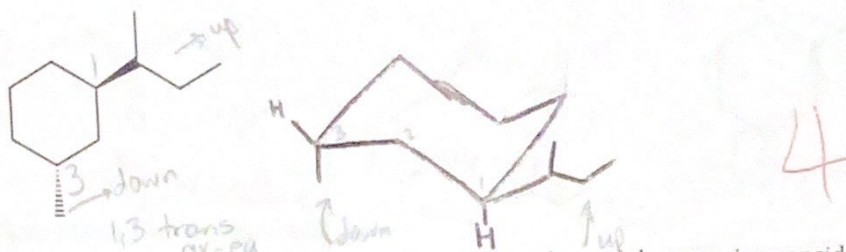


(4)

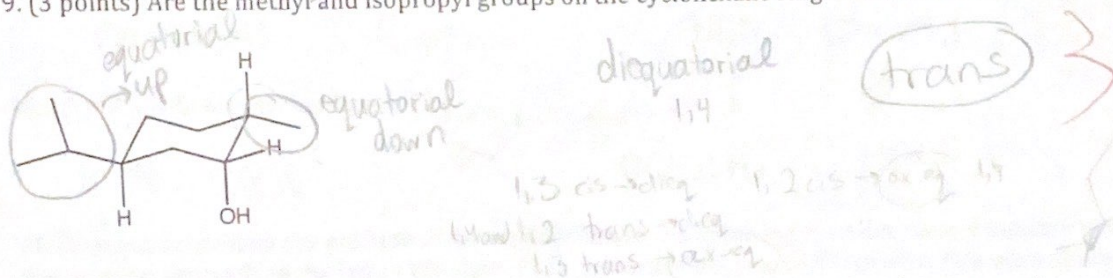
7. (4 pts) Draw the following compound in its most stable chair conformation.



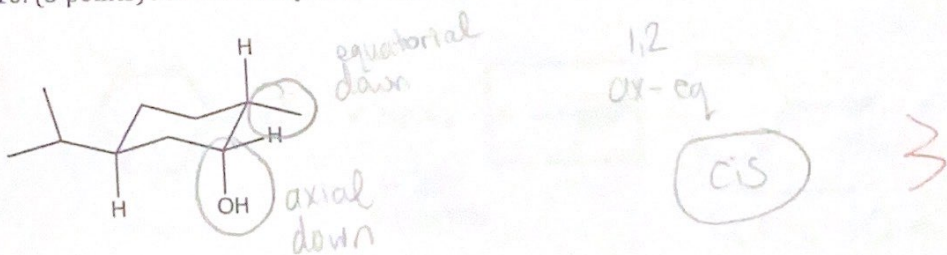
8. (4 pts) Draw the following compound in its most stable chair conformation.



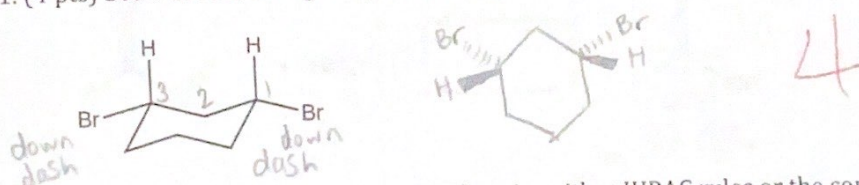
9. (3 points) Are the methyl and isopropyl groups on the cyclohexane ring considered cis or trans?



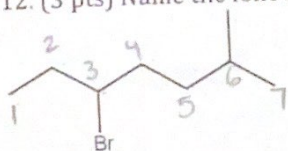
10. (3 points) Are the methyl and OH groups on the cyclohexane ring considered cis or trans?



11. (4 pts) Draw the following compound using the wedge and dash depiction.

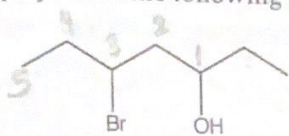


12. (3 pts) Name the following alkylbromide using either IUPAC rules or the common name.



~~3-bromo-6-methylheptane~~ 0 (18)

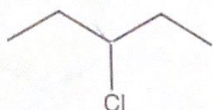
13. (3 pts) Name the following compound using either IUPAC rules or the common name.



+0

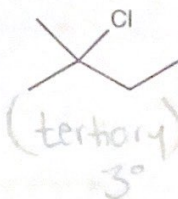
~~3-bromo-1-ethyl-1-pentanol~~

14. (6 pts) Label the following alkyl chlorides as primary (1°), secondary (2°), or tertiary (3°).

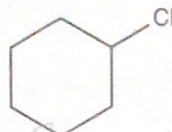


+6

2° (secondary)



(tertiary) 3°



(Secondary) 2°

15. (3 pts) Circle the stronger acid.



15.9 = pKa



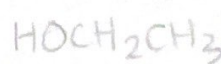
pKa = 9.1

(Smaller pKa = Stronger acid and weaker base)

16. (3 pts) Circle the weaker base.

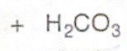
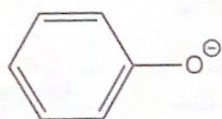


9.1 = pKa

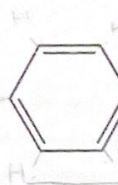


pKa = 15.9

17. (3 pts each) Predict the position of the equilibrium in the following reaction. Clearly indicate whether the reaction proceeds to the left or the right. Place arrows in the box. HINT: Use the pKa table at the end of the exam.

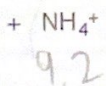
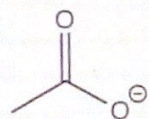


6.35 = pKa

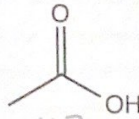
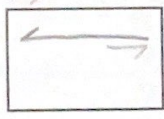


pKa = 10

C₆H₆ C₆H₅OH

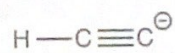


9.2

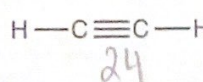
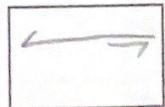


4.7

C₂O₂H₄
C₂H₃COOH

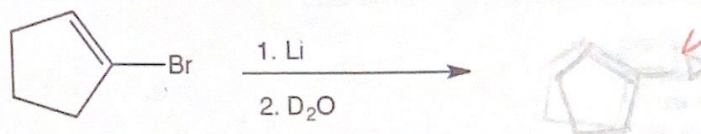
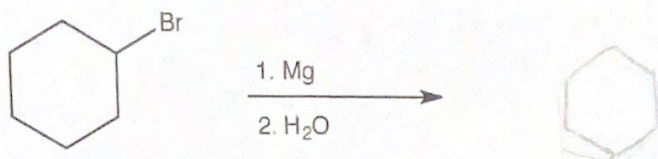
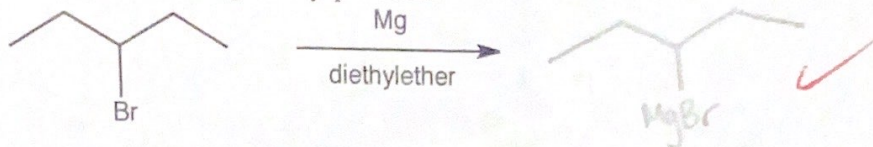


36

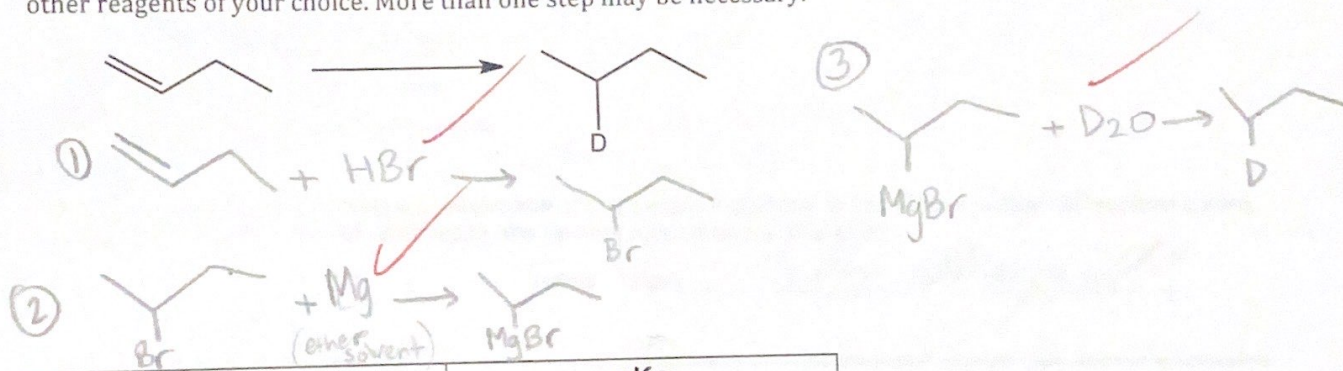


24
C₂H₂

18. (3 pts each) Complete the following reaction showing the major organic product formed. You do not need to worry about inorganic by-products.



19. (6 pts) Propose a synthesis of the following compound using the indicated starting material and any other reagents of your choice. More than one step may be necessary.



Compound	pKa
H ₃ O ⁺	- 1.7
HNO ₃	- 1.4
HF	3.1
CH ₃ COOH	4.7
H ₂ CO ₃	6.35
HCN	9.1
NH ₄ ⁺	9.2
(CH ₃) ₂ NH ₂ ⁺	9.8
C ₆ H ₅ OH	10
H ₂ O	15.7
CH ₃ CH ₂ OH	15.9
HC≡CH	24
NH ₃	36
(CH ₃) ₂ NH	36
CH ₄	60