Electronic Supplemental Information
Design, development, and evaluation of the Organic chemistry Representational Competence Assessment (ORCA)

Lyniesha Ward,[a] Fridah Rotich,[a] Jeffrey R. Raker,[b] Regis Komperda,[c] Sachin Nedungadi,[d] and Maia Popova*[a]

[a]University of North Carolina at Greensboro, Greensboro, North Carolina, USA
[b]University of South Florida, Tampa, Florida, USA
[c]San Diego State University, San Diego, California, USA
[d]University of Nebraska at Omaha, Omaha, Nebraska, USA
*E-mail: m_popova@uncg.edu

NOTE: If you are interested in using ORCA, please contact the corresponding author.

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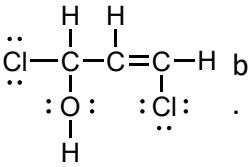
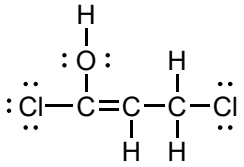
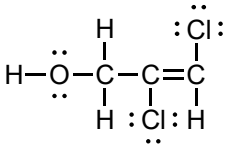
Directions: Identify the choice that best completes the statement or answers the question.

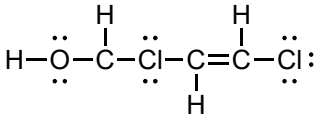
1. Which structure corresponds to the given representation?

HOCHClCH=CHCl

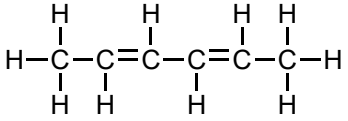
a. 

b. 

c. 

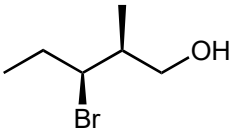
d. 

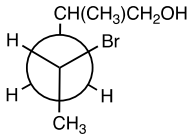
2. Which structure corresponds to the given representation?

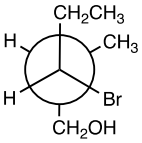


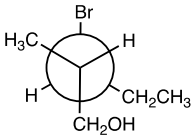
a. $CH_3CH{=}CHCH_2CH_3$ b. $CH_3(CH_2)_2CH_3$ c. $CH_3(CH_2)_4CH_3$ d. $CH_3(CH{=}CH)_2CH_3$

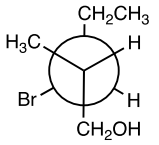
3. Which structure is <u>different</u> from the given representation?



a. 

b. 

c. 

d. 

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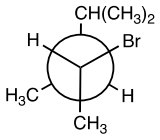
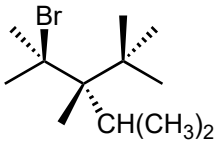
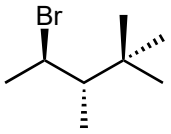
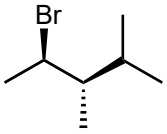
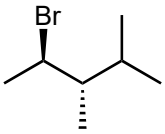
4. Which structure corresponds to the given representation?



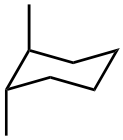
a. 

b. 

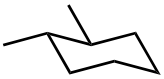
c. 

d. 

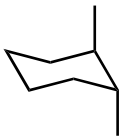
5. Use the given representation below to answer this question.



Select the structure that is the same molecule as the given representation and the statement that best describes what information you focused on to reach your conclusion.



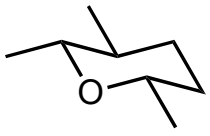
I.

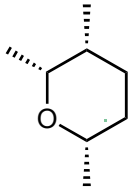


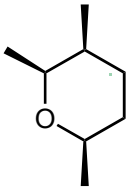
II.

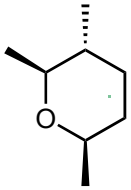
a. I – Whether the groups are on the left side in relation to the ring
b. I – Whether the groups are up versus down in relation to the ring
c. II – Whether the groups are axial versus equatorial in the ring
d. II – Whether the groups are on the outer edges of the ring

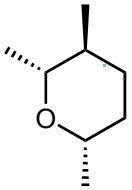
6. Which structure corresponds to the given representation?



a. 

b. 

c. 

d. 

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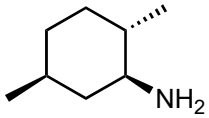
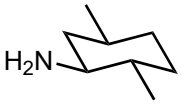
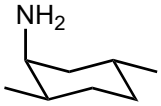
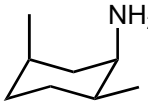
7. Which structure corresponds to the given representation?



a. 

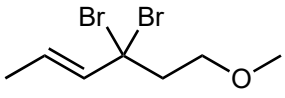
b. 

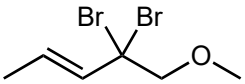
c. 

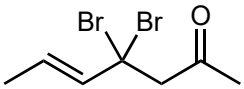
d. 

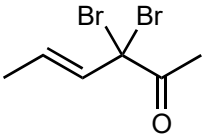
8. Which structure corresponds to the given representation?

$CH_3CH{=}CHCBr_2CH_2COCH_3$

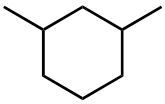
a. 

b. 

c. 

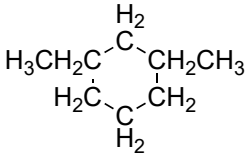
d. 

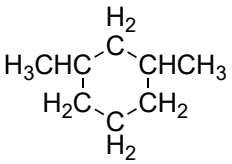
9. Which structure corresponds to the given representation?



a. $CH_3CH_2CH_2CH_2CH_3CH_2CH_2CH_2$

b. $CH_3CHCH_2CHCH_3CH_2CH_2CH_2$

c. 

d. 

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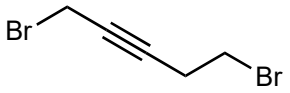
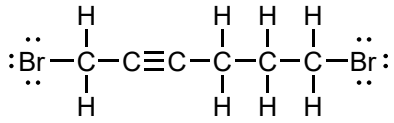
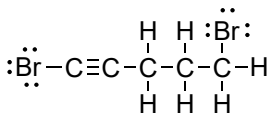
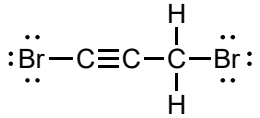
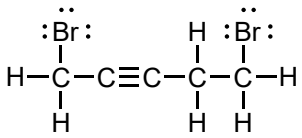
10. Which structure corresponds to the given representation?



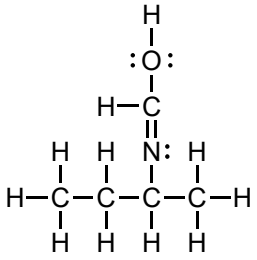
a. 

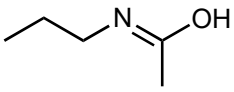
b. 

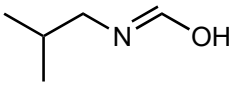
c. 

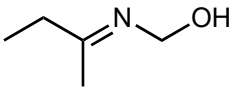
d. 

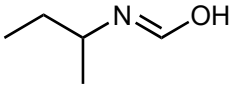
11. Which structure corresponds to the given representation?



a. 

b. 

c. 

d. 

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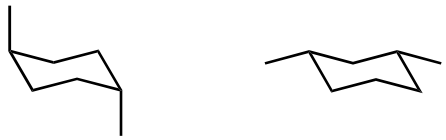
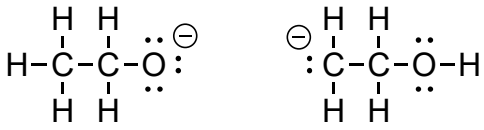
12. Select the structure that is the more stable and the statement that best describes what information you focused on to reach your conclusion.



I. II.

a. I – The amount of space between the groups
b. I – Whether the groups are pointing up or down
c. II – The amount of space between the groups
d. II – Whether the groups are pointing up or down

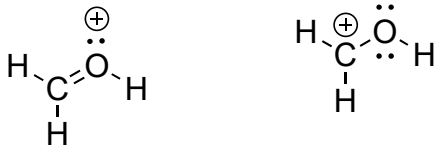
13. Select the structure that is the less stable and the statement that best describes what information you focused on to reach your conclusion.



I. II.

a. I – The electronegativity of the atom with the negative charge
b. I – The absence of a full octet on the atom with the negative charge
c. II – The electronegativity of the atom with the negative charge
d. II – The absence of a full octet on the atom with the negative charge

14. Select the structure that is the more stable and the statement that best describes what information you focused on to reach your conclusion.



I. II.

a. I – Whether the structure has double bonds or single bonds
b. I – Whether or not the atom with the positive charge has a full octet
c. II – Whether the structure has double bonds or single bonds
d. II – Whether or not the atom with the positive charge has a full octet

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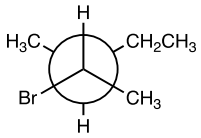
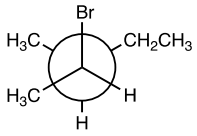
15. Select the structure that is the <u>less</u> stable and the statement that best describes what information you focused on to reach your conclusion.



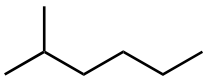
I.



II.

a. I – The size and proximity of the groups to one another
b. I – Whether or not electronegative groups are near other groups
c. II – The size and proximity of the groups to one another
d. II – Whether or not electronegative groups are near other groups

16. Select the structure with a <u>lower</u> boiling point and the statement that best describes the information you focused on to reach your conclusion.



I.

II.

a. I – Whether the molecule has branching
b. I – Whether the molecule is symmetrical or asymmetrical
c. II – Whether the molecule has branching
d. II – Whether the molecule is symmetrical or asymmetrical

17. Which of the following compounds has the <u>highest</u> boiling point?

a. $CH_3CH_2CH_2CH_2OH$

b. $CH_3CH_2CH_2CHO$

c. $CH_3CH_2OCH_2CH_3$

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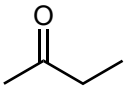
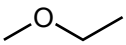
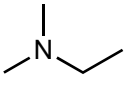
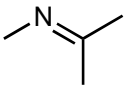
d. $CH_3COCH_2CH_3$

18. Which of the following compounds has the highest boiling point?

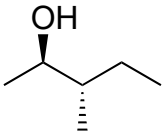
a. 

b. 

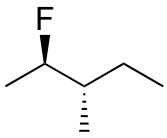
c. 

d. 

19. Select the structure with a higher boiling point and the statement that best describes the information you focused on to reach your conclusion.



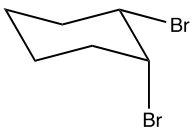
I.



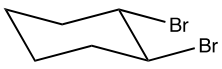
II.

a. I – How strong the bonds are between atoms
b. I – How strong the interactions are between molecules
c. II – How strong the bonds are between atoms
d. II – How strong the interactions are between molecules

20. Select the structure that has bromine atoms on opposite sides in relation to the ring and the statement that best describes what information you focused on to reach your conclusion.



I.



II.

a. I – Whether the bromine atoms are axial versus equatorial in relation to the ring
b. I – Whether the bromine atoms are up versus down in relation to the ring
c. II - Whether the bromine atoms are axial versus equatorial in relation to the ring
d. II - Whether the bromine atoms are up versus down in relation to the ring

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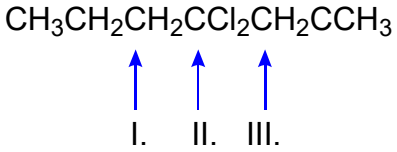
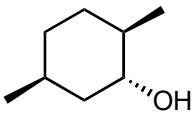
21. To which labeled atom(s) is/are the chlorine atoms connected in the given representation?



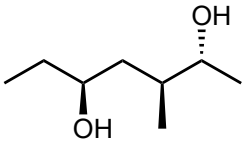
a. Carbon I
b. Carbon II
c. Carbon III
d. Carbons II, III

22. How many hydrogen atoms are in the given representation?



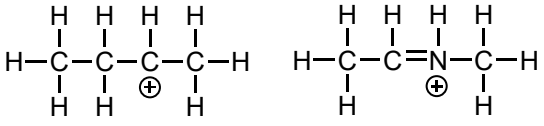
a. 14
b. 15
c. 16
d. 17

23. Which best describes the given representation?



a. The broken dash line is directed out of the page.
b. The bold wedge lines are directed into the page.
c. The thin lines are flat in the plane of the page. The bold wedge and broken dash lines are not.
d. Neither the thin lines, the bold wedge lines, nor the broken dash lines are flat on the plane of the page.

24. Select the structure(s) that has/have an atom with an incomplete octet and the statement that best describes what information you focused on to reach your conclusion.



I.

II.

a. I – It is missing a pair of electrons.
b. II – It is missing a pair of electrons.
c. I, II – They have a positive formal charge.
d. I, II – Their outer shells are not filled.

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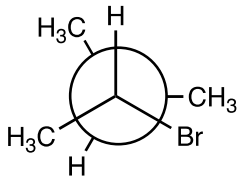
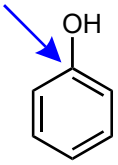
25. How many carbon atoms are in the given representation?



a. 3
b. 4
c. 5
d. 6

26. Which best describes the atom indicated with an arrow in the given representation?



It is connected to…
a. Two carbons and one oxygen.
b. Three carbons and one oxygen.
c. Two carbons, one oxygen, and one hydrogen.
d. Three carbons, one oxygen, and one hydrogen.

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