

# Chemistry 2541, Fall 2015

## Midterm Exam 1

(100 points)

*Important notes:*

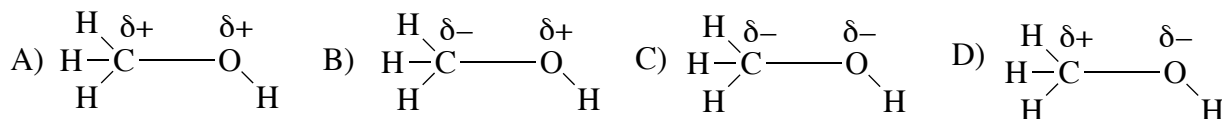
- Please use the provided Scantron form for your answers; you can keep the sheet with the questions and can use it as scratch paper
- Do not forget to write your name on the Scantron form
- You will not receive credit for unmarked answers or for more than one mark on answer line
- Your scores will be posted on eGradebook; graded Scantron forms will not be returned to students.

**Questions 1-28 (84 pts): Please mark the appropriate box on the front of the Scantron form (3 pts each).**

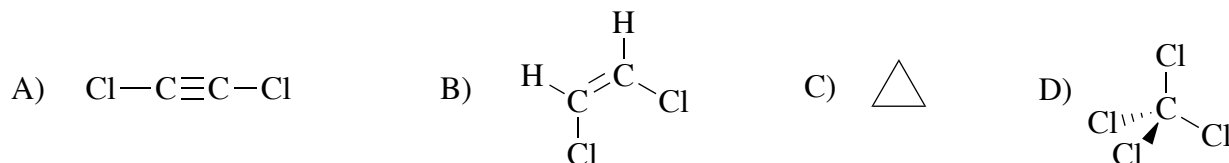
**1.** Which of the following is the ground-state electron configuration of **nitrogen**?

- A)  $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^0$       B)  $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$   
 C)  $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$       D)  $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^1$

**2.** Which of the following correctly describes **bond polarity** in a molecule of alcohol?



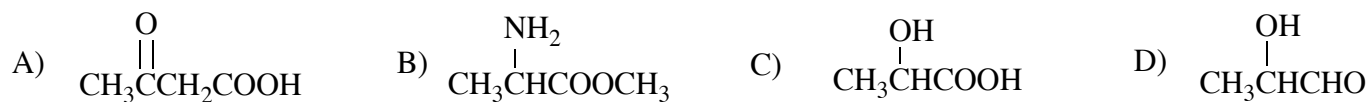
**3.** Which of the following molecules is expected to have **dipole moment  $\mu$**  different from **0 D**?



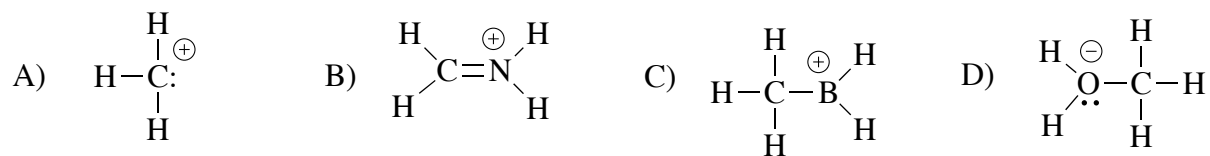
**4.** Which of the following molecules contains a **carboxylic acid** functional group?

- A)  $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OCH}_3$      
 B)  $\text{HOCH}_2\text{CH}_2\text{OH}$      
 C)  $\text{HOCCOOH}$      
 D)  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$

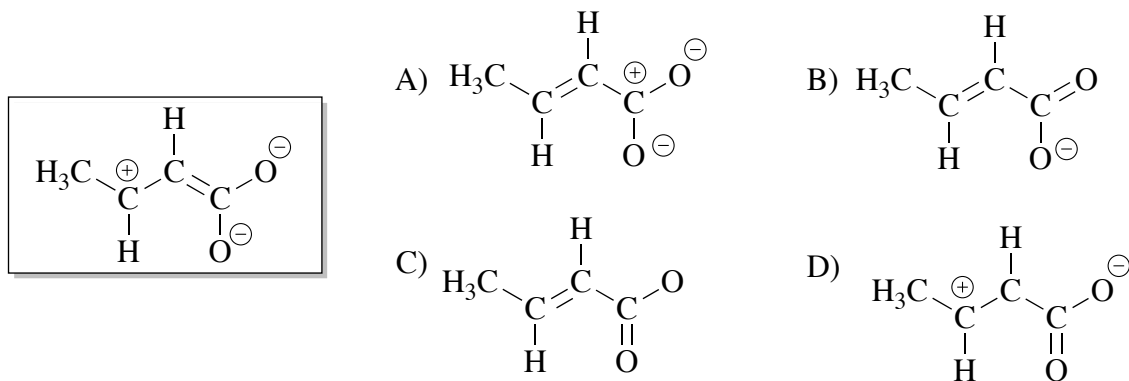
5. Which of the following molecules contains both an **alcohol** functional group AND an **aldehyde** functional group?



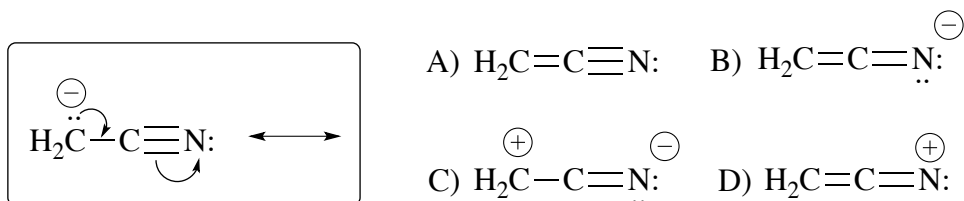
6. Which of the following polyatomic ions is a **correct Lewis structure** with correct formal charge?



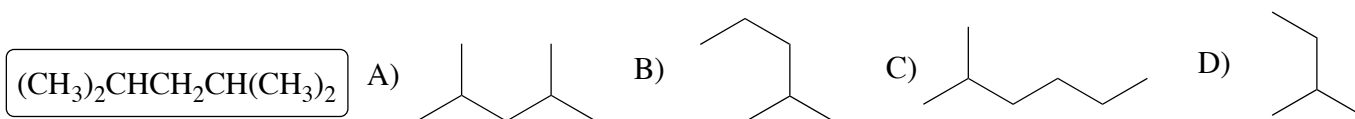
7. Which of the following structures represents the **major** resonance contributor of molecule in the box?



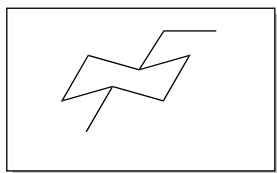
8. Which one of the following structures represents resonance contributor of molecule in the box in agreement with the shown **curved arrows**?



9. Which of the **line-angle formulas** corresponds to the condensed structural formula shown in the box?

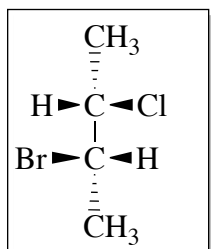


10. What is the **IUPAC name** for the compound shown in the box?



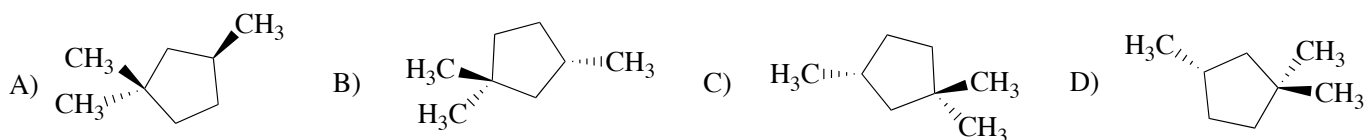
- A) *cis*-1-ethyl-4-methylcyclohexane      B) *trans*-1-ethyl-4-methylcyclohexane  
C) *cis*-1-methyl-4-propylcyclohexane      D) *trans*-1-methyl-4-propylcyclohexane

11. What is the **IUPAC name** for the compound shown in the box?

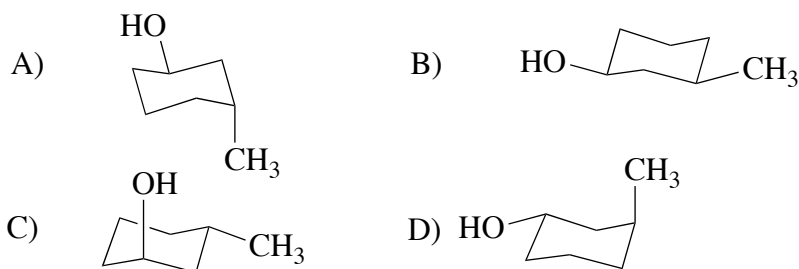
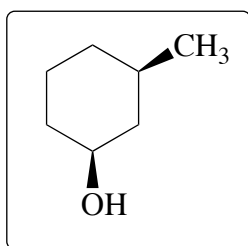


- A) (2*S*,3*S*)-2-bromo-3-chlorobutane      B) (2*S*,3*R*)-2-bromo-3-chlorobutane  
C) (2*R*,3*S*)-2-bromo-3-chlorobutane      D) (2*R*,3*R*)-2-bromo-3-chlorobutane

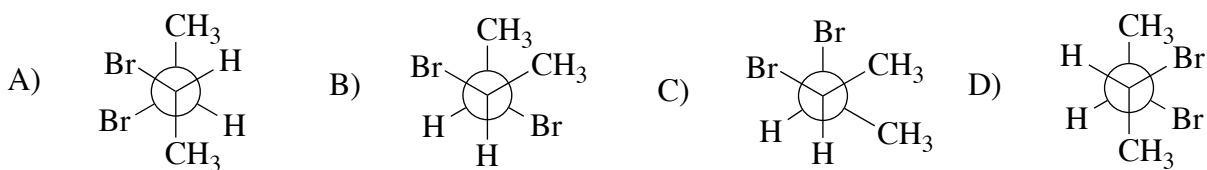
12. Which is the structure of (*R*)-1,1,3-trimethylcyclopentane?



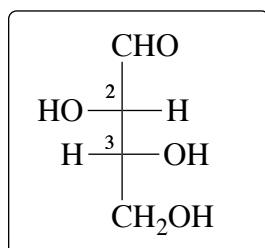
13. Which of the following is the **chair** representation of the compound shown in the box?



14. Which one of following Newman projections represents a **meso** compound?



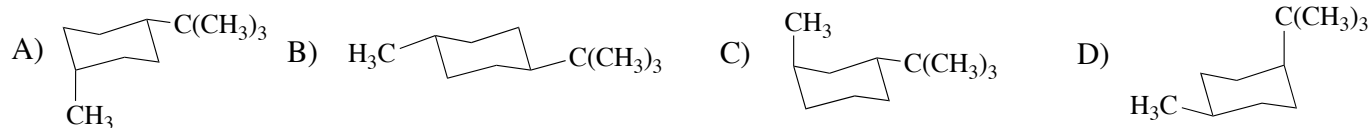
15. What is the **configuration** (*R* or *S*) at the carbon atoms 2 and 3 of the molecule shown in the box?



A) 2*R*,3*R*      B) 2*S*,3*R*

C) 2*R*,3*S*      D) 2*S*,3*S*

16. Which of the following is expected to be **least stable**?



17. Consider the following **orders of priority** (highest to lowest). Which order is **incorrect**?

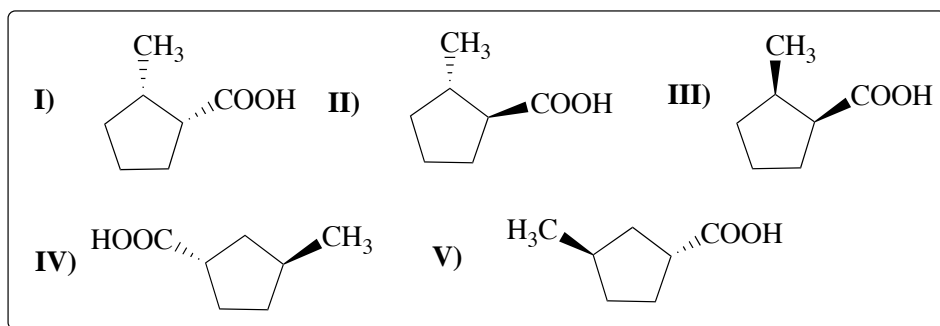
A) OH > CH<sub>2</sub>OH > CHO > CH<sub>3</sub>

B) OH > CH=CH<sub>2</sub> > CH<sub>2</sub>CH<sub>3</sub> > H

C) OH > CH<sub>2</sub>CH<sub>3</sub> > CH<sub>3</sub> > H

D) NH<sub>2</sub> > CH<sub>2</sub>SH > CH<sub>2</sub>OH > CH<sub>3</sub>

18. Consider the structures shown in the box. Which of the following pairs of these structures are **diastereomers**?



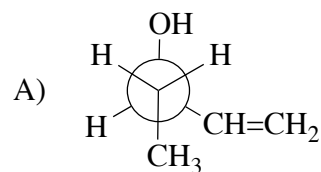
A) I and II

B) I and III

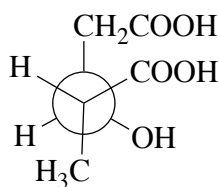
C) I and IV

D) I and V

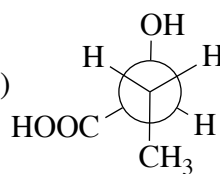
19. Which of the following molecules contains **two chiral centers**?



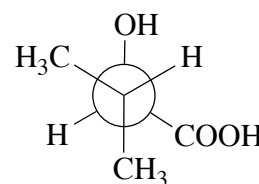
B)



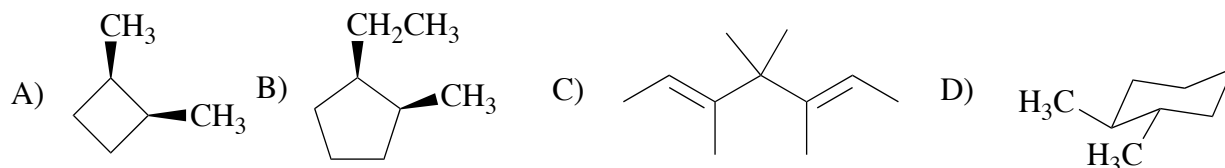
C)



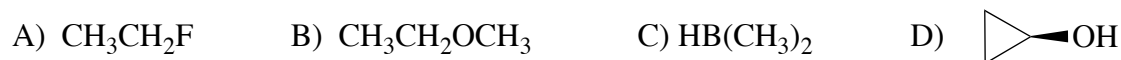
D)



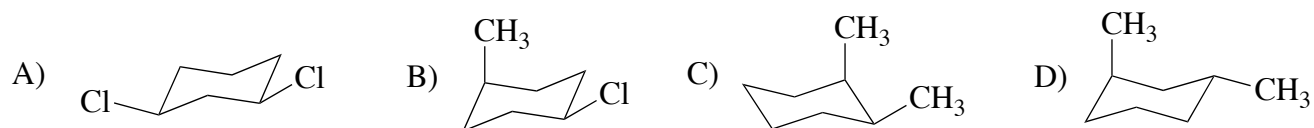
20. Which one of the following molecules is a **meso** compound?



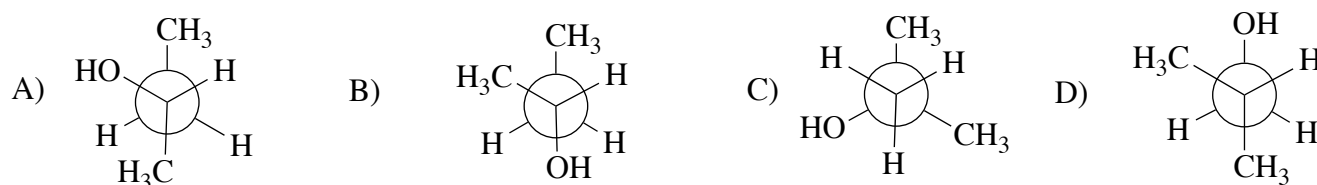
21. Which one of the following compounds has the strongest **intermolecular forces of attraction**?



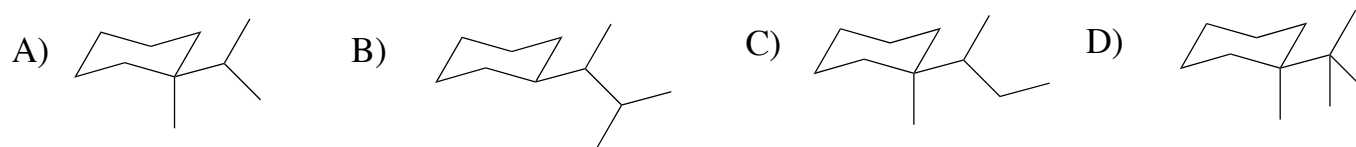
22. Which one of the following molecules is **chiral**?



23. Which of the following depicts a **primary ( $1^\circ$ ) alcohol**?



24. Which of the molecules shown below contains a **tert-butyl** group?



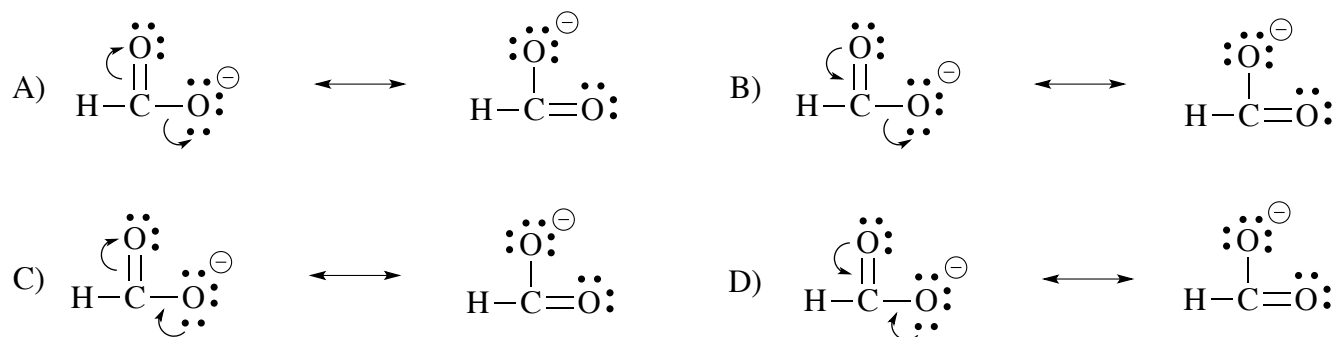
25. Which of the statements below is NOT true about **stereoisomers**?

- A. They have the same molecular formula      B. They have the same orientation of atoms in space  
C. They have the same molecular weight      D. They have the same connectivity of atoms

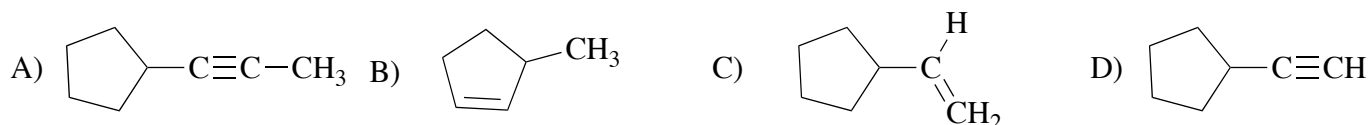
26. How many **aldehydes** have a molecular formula of  $\text{C}_3\text{H}_6\text{O}$ ?

- A) 1      B) 2      C) 3      D) 4

27. Which sets of **curved arrows** correctly describes the flow of electrons in the resonance contributors?

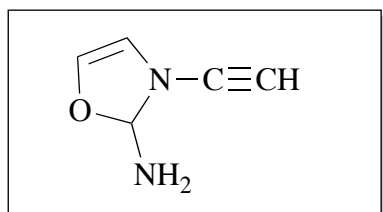


28. Which of the following compounds has the **shortest carbon-hydrogen bond**?



**Question 29 (16 pts): Please mark your answers in the appropriate box on the back of the Scantron form (2 pts each)**

29. Consider the molecule shown below and answers the following questions. Indicate your answers by marking the appropriate number in the boxes on the back of the Scantron form.



**Box 51:** Number of  $\sigma$  bonds formed by overlap of  $sp^2$  and  $sp^3$  orbitals

**Box 52:** Number of  $\sigma$  bonds formed by overlap of  $sp$  and  $sp$  orbitals

**Box 53:** Number of  $\sigma$  bonds formed by overlap of  $sp^3$  and  $sp$  orbitals

**Box 54:** Number of  $\sigma$  bonds formed by overlap of  $s$  and  $sp^3$  orbitals

**Box 55:** Number of  $\sigma$  bonds formed by overlap of  $sp^2$  and  $sp^2$  orbitals

**Box 56:** Total number of  $\sigma$  bonds

**Box 57:** Total number of  $\pi$  bonds

**Box 58:** Total number of **non-bonding electrons** in this molecule