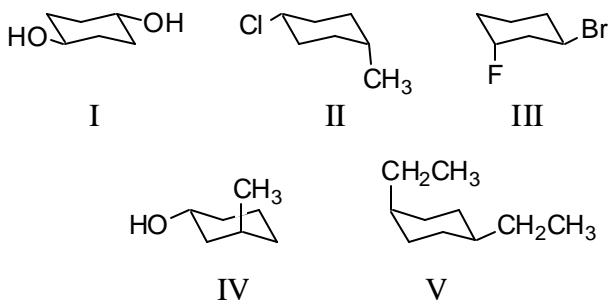


No electronic devices (calculators, cell phones, laptops, etc) may be used or consulted during the exam. All scrap work should be done on the extra page provided; no additional paper may be used. **Your name and Panther ID should be placed in three places;** at the end of this paragraph to indicate acceptance of all policies, on the final page of the exam (Part 2) and on your answer sheet. Be sure to include the form of your exam on the answer sheet.

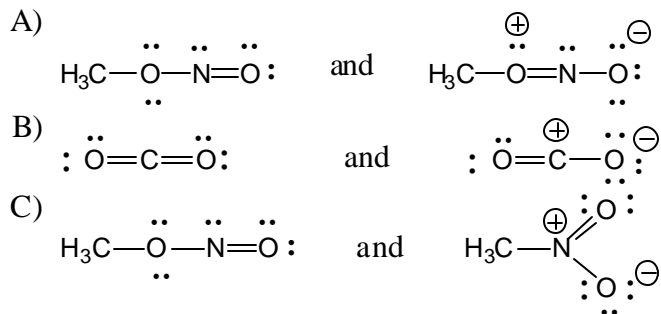
Name _____ Panther ID _____

1. Which of the following will have the same energy after undergoing ring flip?



A) I B) II C) III D) IV E) V.

2. Which of the following pairs are NOT resonance structures?

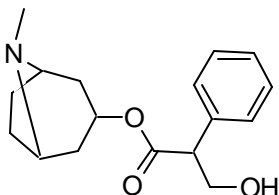


D) Each of these pairs represents resonance structures.
E) None of these pairs represents resonance structures.

3. How many alkanes of formula C_7H_{16} possess a quaternary carbon atom?

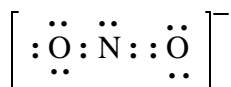
A) 1 B) 2 C) 3 D) 4 E) 5

18. Drawn below is *Atropine*, found in *Atropa belladonna*, sometimes used in dilating pupils during an eye-exam. Which of the following functional groups is NOT in atropine?

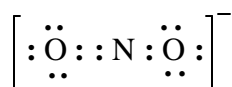


Atropine

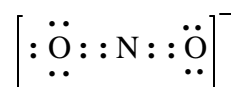
- A) Amine B) Ester C) Alcohol D) Benzene Ring E) Ketone
19. Which of these is a correct electron-dot representation of the nitrite ion, NO_2^- ?



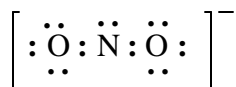
I



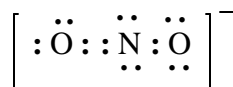
II



III

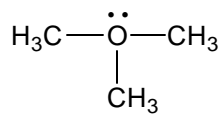


IV



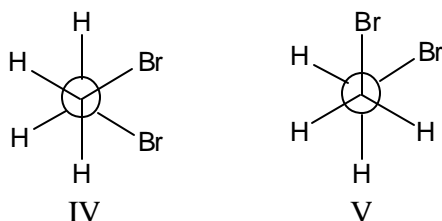
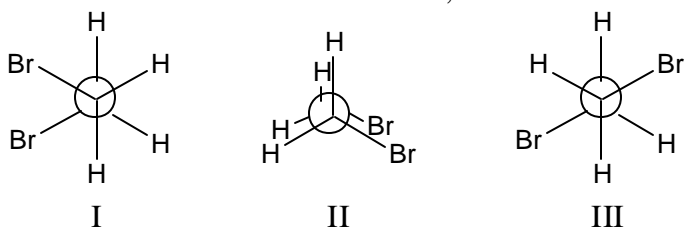
V

- A) I B) II C) III D) IV E) V
20. What is the formal charge on oxygen in the following structure?



- A) +2 B) +1 C) 0 D) -1 E) -2

21. The most stable conformation of 1,2-dibromoethane is:



A) I B) II C) III D) IV E) V

22. Which reaction of these potential acids and bases does not occur to any appreciable degree due to an unfavorable equilibrium?

- A) $\text{NaNH}_2 + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ D) $\text{NaH} + \text{methanol}$
 B) $\text{CH}_3\text{CH}_2\text{CO}_2\text{Na} + \text{HI}$ E) Two of the above will not occur
 C) CH_3Li in hexane + ethyne

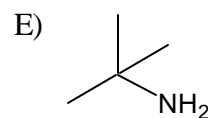
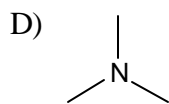
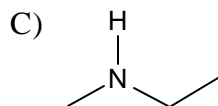
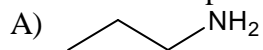
23. What bond angle is associated with a tetrahedral molecule?

- A) 120° B) 109.5° C) 180° D) 90° E) 45°

24. Which is the strongest acid?

- A) $\text{CH}_3\text{CH}_2\text{OH}$ B) $\text{CH}_3\text{CO}_2\text{H}$ C) $\text{HC}\equiv\text{CH}$ D) $\text{CH}_2=\text{CH}_2$ E) CH_3CH_3

25. Which compound would you expect to have the lowest boiling point?



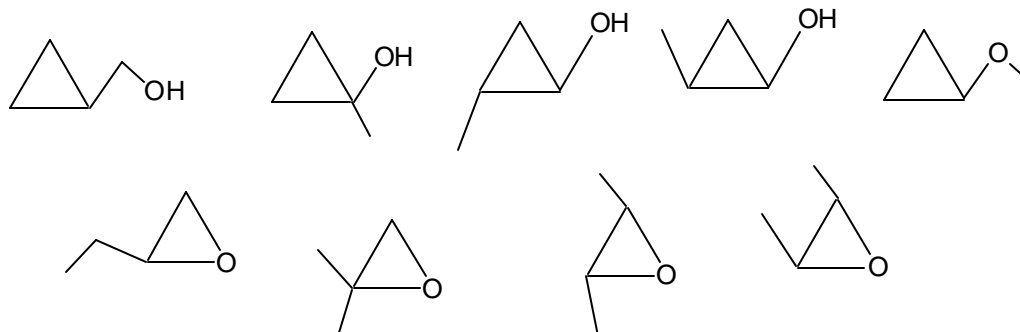
Answer Key

1. E
2. C
3. C
4. C
5. D
6. A
7. A
8. C
9. A
10. B
11. E
12. C
13. C
14. C
15. A
16. C
17. A
18. E
19. A
20. B
21. C
22. A
23. B
24. B
25. D

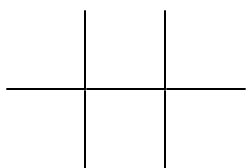
1. (5 points) Draw an energy diagram that depicts the energy of each species in one complete 360° rotation around the C₂-C₃ bond of butane. Estimate the height of energy barriers, label the various forms and use Newman projections to show the geometry of each species.

See Solomon's Figure 4.8, p. 152

2. (5 points) There are 9 isomers of the formula C₄H₈O that contain a three membered ring. Give their structures.

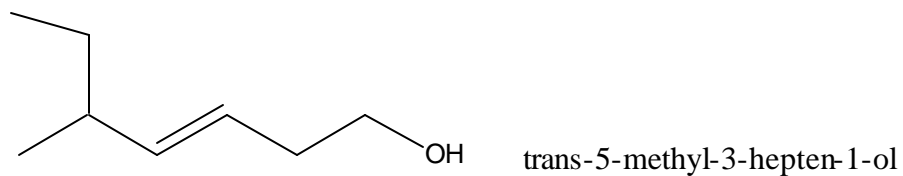


3. (4 points) Of the 18 configurational isomers of octane (C₈H₁₈), there is one which contains only primary hydrogens. Draw the structure and name the compound.

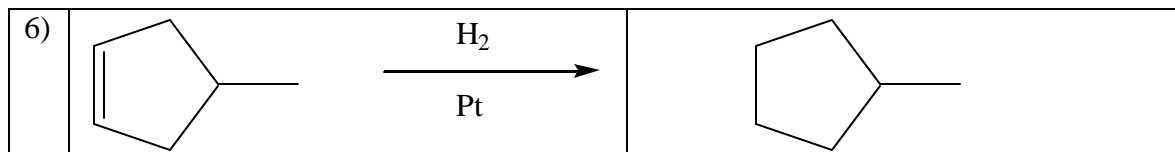
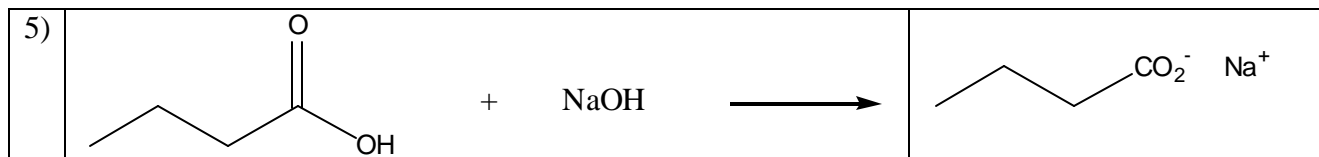


2,2,3,3-tetramethylbutane

4. (4 points) Give the IUPAC name for this compound, including stereochemistry if appropriate.



5 and 6 (4 points each) Give the major organic product of the following reactions, including stereochemistry if appropriate.



Bonus (2 points): A compound $\text{C}_5\text{H}_8\text{O}$ shows a very strong infrared absorption at 1730 cm^{-1} and shows 3 unique signals in its carbon 13 NMR spectrum. Give a structure which fits this information.

