

# Materials Science C Key

Science Olympiad North Regional Tournament at the  
University of Florida



Team Name: \_\_\_\_\_

Team Number: \_\_\_\_\_

### **Section 1: Lab Component**

- 1) Obtain a well plate and laminated paper. You will be testing evaporation rates of 5 liquids. You will graph three alcohols, also an alkane and water will be observed for comparison purposes and will not be placed in your graph so data of these will not need to be as precise.
- 2) Place one drop of water in the well plate and note the time it was placed in the well plate on the wall clock. Exact seconds will not need to be recorded as this data will only be used for qualitative comparison.
- 3) Use the well plates as your evaporation surface and only one drop of each alcohol for your data. You may wish to practice dispensing a single drop into the storage container first as obtaining one drop can be a bit challenging if you have not done it before. Time how long it takes each drop to completely evaporate.
- 4) Create a graph of evaporation rates versus molar mass for methanol ( $\text{CH}_3\text{OH}$ ), ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ) and n-propanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ).
- 5) Graph your results. What is the trend you see? ***Molar mass increases, evaporation time increases*** (2 points) Propose a reason for the trend you observed. (4 points)  
***Larger molecules have more London dispersion forces to increase intermolecular interactions.***
- 6) Given what you have graphed, predict the amount of time you expect it should take for butanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ ) to evaporate. Show your work, you are allowed to use linear regression but you must show your work including all values). (6 points)

***Molar mass vs. Time graph***

***Butanol consistent with linear regression of the graph***

- 7) If hexane has the same type of intermolecular attractions as the alcohols you should be able to use your graph to determine the possible evaporation rate of hexane  $\text{C}_6\text{H}_{14}$ . Write the predicted evaporation time for hexane from your alcohol graph. Use a drop of hexane. Explain any differences you observe between the predicted evaporation times from the graph and your actual results. (4 points)

***Hexane consistent with linear regression for prediction***

***Hexane evaporates much faster***

***Explanation: no H-bonding because of lack of an alcohol group, hexane has more London dispersion***

- 8) The water drop may not have evaporated as of yet. Explain any differences you may see between waters predicted evaporation time from the alcohol graph and what you are actually observing. (4 points)

***Prediction consistent with regression line***

***Water has a lot more H-bonding***

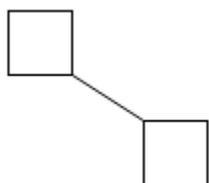
Team Name: \_\_\_\_\_

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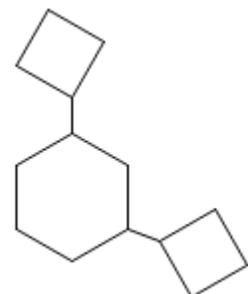
## Answer Booklet

LAB PRACTICAL SCORE: \_\_\_\_\_/20 points

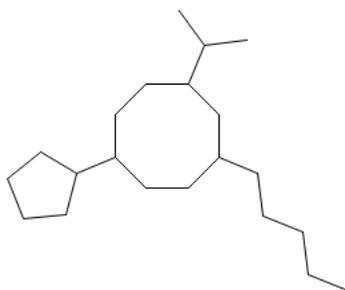
- 1) Hydroxyl/alcohol
- 2) Methyl
- 3) Ketone
- 4) Amide
- 5) Amine



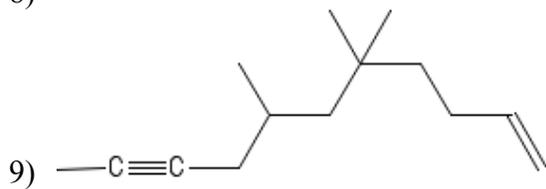
6)



7)



8)



9)



10) either cis or trans alkene OK here

Score: \_\_\_\_/22

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11) B

12) A

13) A

14) A

15)

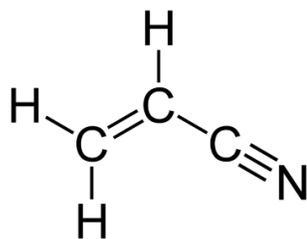
a. HDPE

b. LDPE

16) PVC

17) Polystyrene

18) Polypropylene



19)

For polymer, double bonds go to single bonds and linked at the two carbons that have double bond in monomer.

Score: \_\_\_/20

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20)

- a. Composite
- b. Polymer
- c. Ceramic
- d. Composite
- e. Metal
- f. Polymer

21) C

22) C

23)

- a. Insoluble
- b. Insoluble
- c. Soluble
- d. Soluble
- e. Soluble
- f. Insoluble

24) C

25) A

26) LDPE

27) D

**Score: \_\_\_\_/18**