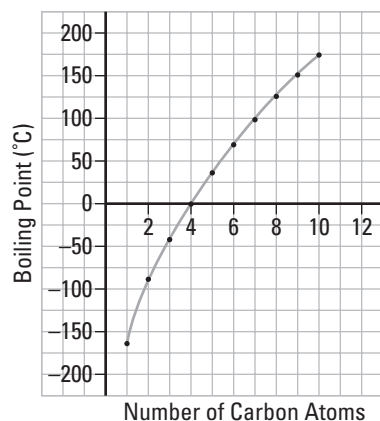


CHAPTER 13 BLM ANSWER KEY

BLM 13-2: Molecular Structure and Physical Properties/Skill Builder

| Name | Number of Carbon Atoms | Molecular Formula | Structural Formula | Boiling Point (°C) |
|---------|------------------------|---------------------------------|--|--------------------|
| Methane | 1 | CH ₄ | CH ₄ | -164 |
| Ethane | 2 | C ₂ H ₆ | CH ₃ -CH ₃ | -88.6 |
| Propane | 3 | C ₃ H ₈ | CH ₃ -CH ₂ -CH ₃ | -42.1 |
| Butane | 4 | C ₄ H ₁₀ | CH ₃ -CH ₂ -CH ₂ -CH ₃ | -0.5 |
| Pentane | 5 | C ₅ H ₁₂ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 36.1 |
| Hexane | 6 | C ₆ H ₁₄ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 69 |
| Heptane | 7 | C ₇ H ₁₆ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 98.4 |
| Octane | 8 | C ₈ H ₁₈ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 125.7 |
| Nonane | 9 | C ₉ H ₂₀ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 150.8 |
| Decane | 10 | C ₁₀ H ₂₂ | CH ₃ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₂ -CH ₃ | 174.1 |



Answers

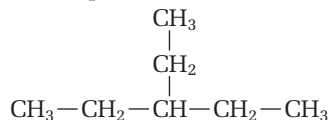
- As the number of carbon atoms increases, so does the boiling point. This is due to an increase in intermolecular forces between molecules. More specifically, there is an increase in the London (dispersion) forces between molecules. Therefore, more energy is required to overcome this force and allow the molecules to go from a liquid state to a gaseous state.
- methane, ethane, propane, butane
- pentane, hexane, heptane, octane, nonane, decane
- A C₁₂ compound will be found in a liquid state (naphtha fuels) while a C₁₈ compound will be in the solid state (paraffin wax, heavy oils).

BLM 13-3: Working with Alkanes, Alkenes and Alkynes/Reinforcement

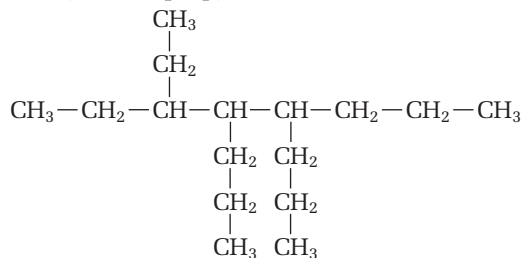
Answers

- 3-ethylpentane
 - 3,5-dimethylheptane
 - 2-methylpropane
 - 4-ethyl-2,3,7-trimethylnonane

- 3-ethylpentane



- 3-ethyl-4,5-dipropyloctane

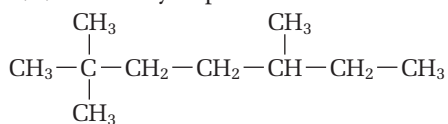


- nonane



CHAPTER 13 BLM ANSWER KEY

(d) 2,2,5-trimethylheptane



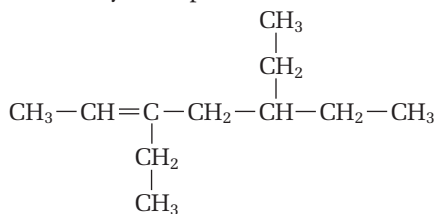
3. (a) propene

(b) 1,4-pentadiene

(c) 2,5-dimethyl-2-hexene

(d) 3,4-diethyl-2-hexene

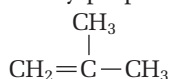
4. (a) 3,5-diethyl-2-heptene



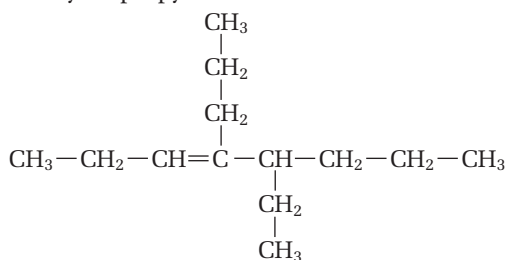
(b) propene



(c) methylpropene



(d) 5-ethyl-4-propyl-3-octene



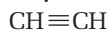
5. (a) propyne

(b) 5-ethyl-2-octyne

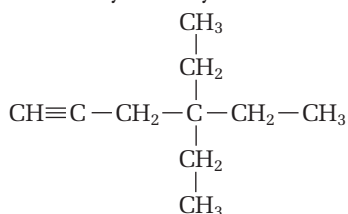
(c) 4-ethyl-2-hexyne

(d) 3-ethyl-2,6-dimethyl-4-octyne

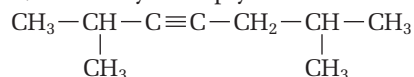
6. (a) ethyne



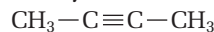
(b) 4,4-diethyl-1-hexyne



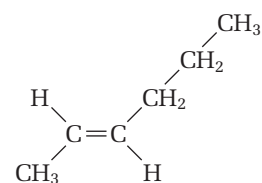
(c) 2,6-dimethyl-3-heptyne



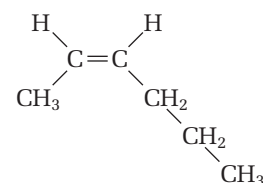
(d) 2-butyne



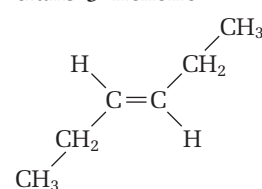
7. trans-2-hexene



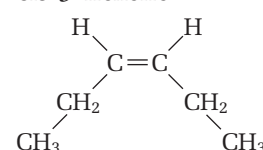
cis-2-hexene



trans-3-hexene



cis-3-hexene



BLM 13-4: Working with Cyclic Compounds/ Reinforcement

Answers

1. Rules for naming cyclic compounds:

- Count the number of carbons in the main ring. (ROOT)
- The carbon containing the first branch is numbered carbon 1, then count around the ring for the remaining branches. (PREFIX)
- If there is a double bond, the carbon where the double bond is located is numbered 1.
- Name the compound using the method: PREFIX-CYCLO-ROOT-SUFFIX.

2. (a) 2,4-diethyl-1-methylcyclobutene

(b) 3,5,7-trimethyl-1-cyclooctene

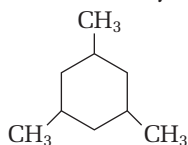
(c) 1,2,3-triethylcyclopropane

3. (a) methylcyclopropane

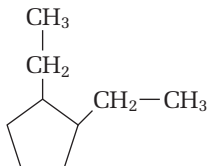


CHAPTER 13 BLM ANSWER KEY

(b) 1,3,5-trimethylcyclohexane



(c) 1,2-diethylcyclopentane



BLM 13-5: Organic Nomenclature Quiz/ Assessment

Answers

1. (a) propyne

(b) 2,2,5,5-tetramethyl-3-hexene

(c) 3,4-dimethylheptane

(d) 2,2,3-trimethylpentane

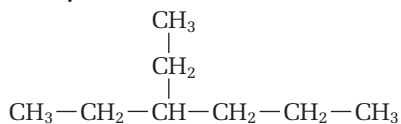
(e) 4,5-dimethyl-1-heptene

(f) 1-methylcyclopentane or methylcyclopentane

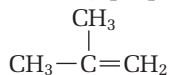
(g) cyclobutene

(h) octane

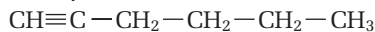
2. (a) 3-ethylhexane



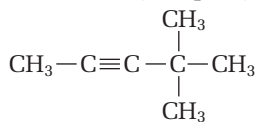
(b) 2-methylpropene



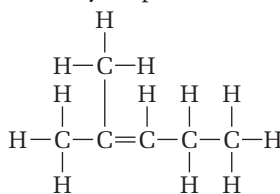
(c) 1-hexyne



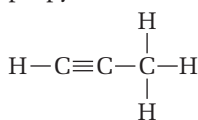
(d) 4, 4-dimethyl-2-pentyne



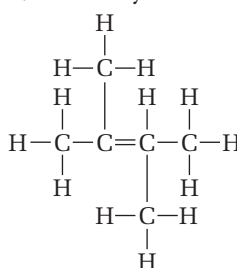
3. (a) 2-methyl-2-pentene



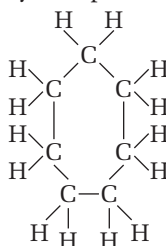
(b) propyne



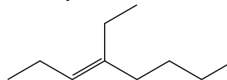
(c) 2,3-dimethyl-2-butene



(d) cycloheptane



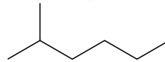
4. (a) 4-ethyl-3-octene



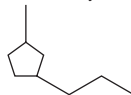
(b) cyclobutane



(c) 2-methylhexane



(d) 1-methyl-3-propylcyclopentane



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BLM 13-6: Separation of a Solution by Distillation/Assessment Inquiry

Answers

1. A plateau occurs when each boiling point is reached. The boiling point of acetone is $\sim 56^{\circ}\text{C}$, the boiling point of ethanol is 78°C , and that of water is 100°C . This plateau occurs because all of the heat is being used for the change of state rather than to increase the kinetic energy (the temperature) of the mixture.
2. The large difference in boiling points between acetone or ethanol and water is due mainly to the difference in London dispersion forces between the two compounds. Water also has an additional intermolecular force due to hydrogen bonds between molecules. This increases its boiling point.

BLM 13-7: Fractional Distillation of Crude Oil/Information Handout

Answers

| Name of Fraction | # of Carbon Atoms | Boiling Point Range ($^{\circ}\text{C}$) | Common Uses |
|------------------------|-------------------|--|--|
| Refining Gases | 1–4 | below 32 | heating/cooling raw materials for chemical reactions |
| Motor Vehicle Gasoline | 5–9 | 32–104 | fuel |
| Naphtha | 10–12 | 104–157 | lighters, lab solvents |
| Kerosene | 12–14 | 157–232 | fuel |
| Gas Oils | 15–18 | 232–426 | heating oils, diesel fuels, |
| Heavy Oils | 18 plus | 426 and higher | lubricating oil, grease, paraffin wax, asphalt |