UNIT 4 – Organic Chemistry –TEST 1
(Assessment of Learning)

Haynes

Chemist: [redacted] od 5

Knowledge: 10 / 11
Thinking & Investigation: 8.5 / 10
Communication: 8 / 8
Application: 8 / 9

(11 marks)

KNOWLEDGE

For each of the following questions, record the ***best*** answer in the answer key provided.

MULTIPLE CHOICE – Answer Key

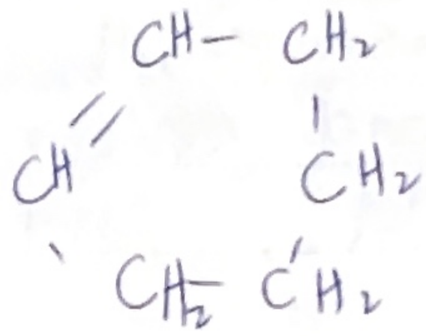
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E

5

2(6) + 2 − 4

C_6H_{10}

1. Which statement about **cyclohexene** and **hex-2-yne** is correct?



A. They are structural isomers
B. They have the different molecular formulas.
C. They could be members of a homologous series
D. They are saturated
E. None above are correct

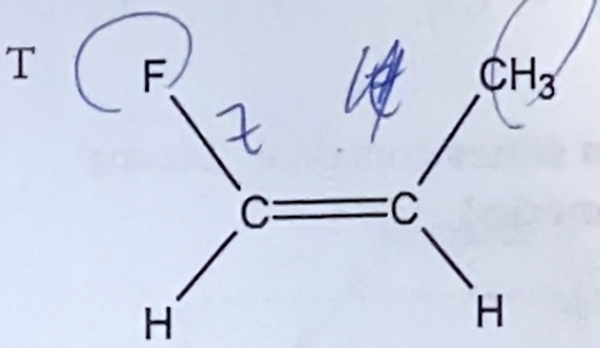
2. Which of the following reactions represents **complete combustion of a hydrocarbon?**

A. $2\ C_3H_8O + 9\ O_2 \rightarrow 6\ CO_2 + 8\ H_2O$
B. $C_3H_8O + 3\ O_2 \rightarrow CO_2 + CO + C + 4\ H_2O$
C. $C_3H_8 + 4\ O_2 \rightarrow CO_2 + 2\ CO + C + 4\ H_2O$
D. $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
E. Two of these answers are correct

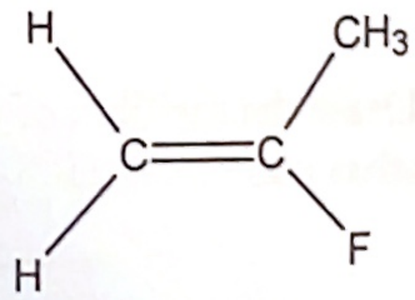
E = trans =
Z = cis =

3. Which two molecules are **E-Zs isomers** of each other?

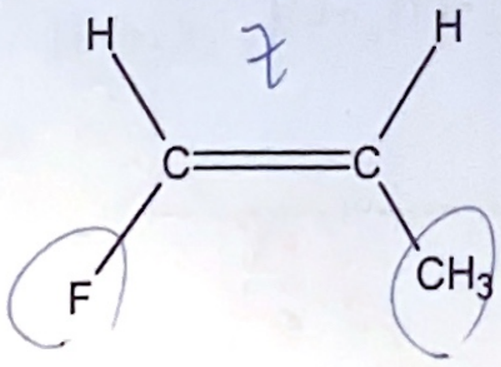
T



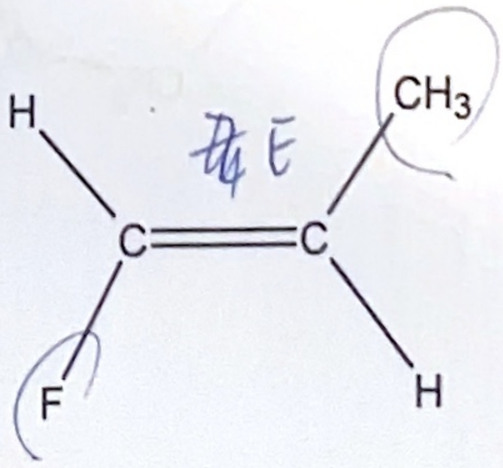
U



V



W



A. T and V
B. V and W
C. U and V
D. U and W
E. T and U

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4. Which of the following is NOT a product of an addition reaction to oct-1-ene?

A. octane H_2 $CH_2=CH-C\ C\ C\ C\ C\ C$
B. 2-bromooctane
C. 1,2-dichlorooctane
D. octan-2-ol
E. octan-1-ol

5. Which of the following expanded molecular formulas has **cis-trans isomers**?

A. $CH_3CHCHCH_3$ $-C-C=C-C-$
B. $CH_3C(CH_3)CHCH_3$
C. $CH_3CH(CH_3)CH_2CH_3$
D. $CH_2CHCH_2CH_3$
E. $CH_3CCCH_2CH_3$

6. An acyclic hydrocarbon with 3 double bonds and two (2) triple bonds has 38 hydrogens. How many carbon atoms are in the hydrocarbon? Show your work. **(1 mark)**

$C_nH_{2n+2-2x-4y}$

x = # of double bond

y = # of triple bond

$2n+2-2x-4y=28$

$2n+2-2(3)-4(2)=38$

$n=25$

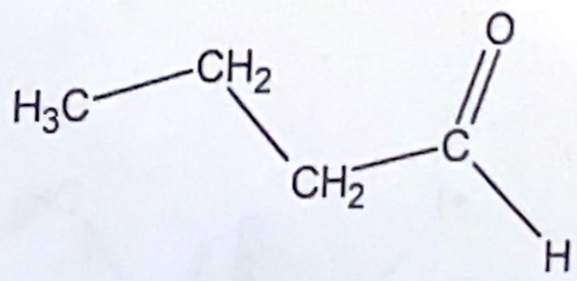
∴ There are 25 carbon atoms.

7. Use condensed structural diagrams or line diagrams to draw three **structural isomers** of C_6H_{14} **(3 marks)**

$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$

changes # hydrogens 2

8. The molecule shown below is butanal. Draw the member of the **homologous series** containing butanal that comes **before** it, and the member that comes **after** it. **(2 marks)**



2

5

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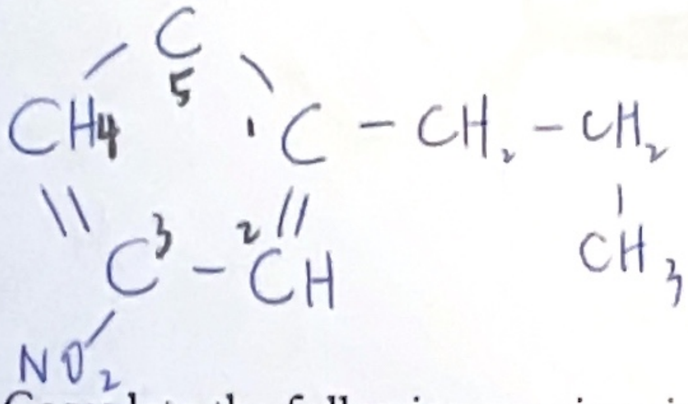
THINKING & INVESTIGATION **(10 marks)**

9. **Determine the error(s)** in the following name and **name the compound correctly.** *Note: show your work*
(1 mark awarded for process and error identification)

no space

1,1-dimethyl-4-nitro-2-propylcyclopenta-2,4-diene **(2 marks)**

CH_3 CH_3 error: double bond not given priority



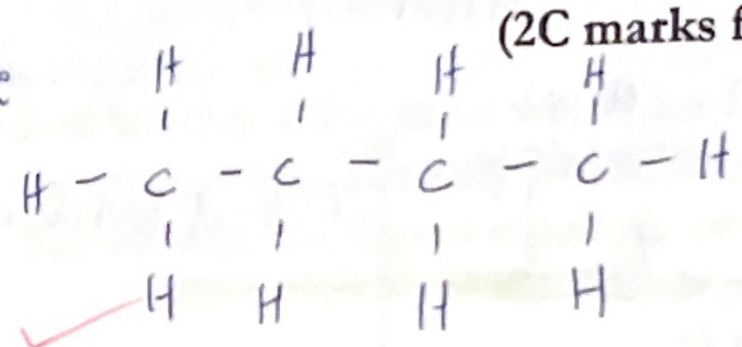
5,5-dimethyl-3-nitro-1-propylcyclopenta-1,3-diene

2

10. Complete the following reactions including **special conditions** (if required) **and inorganic reactants.**
Use **the type of diagram specified.**
Names of structures are **NOT** required.

(2T each - total 8 marks)
(2C marks for diagram type)

a) $H_2C{=}CH{-}CH_2{-}CH_3 + H_2 \xrightarrow[\text{Pt/Pd/Ni}]{\Delta \text{ high pressure}}$

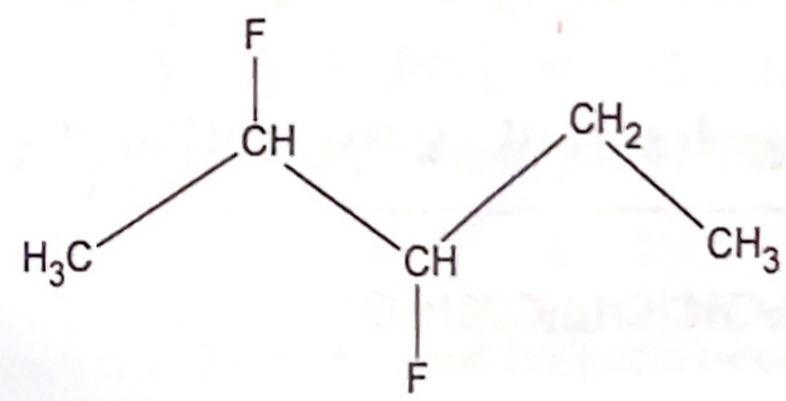


(full structural diagram)

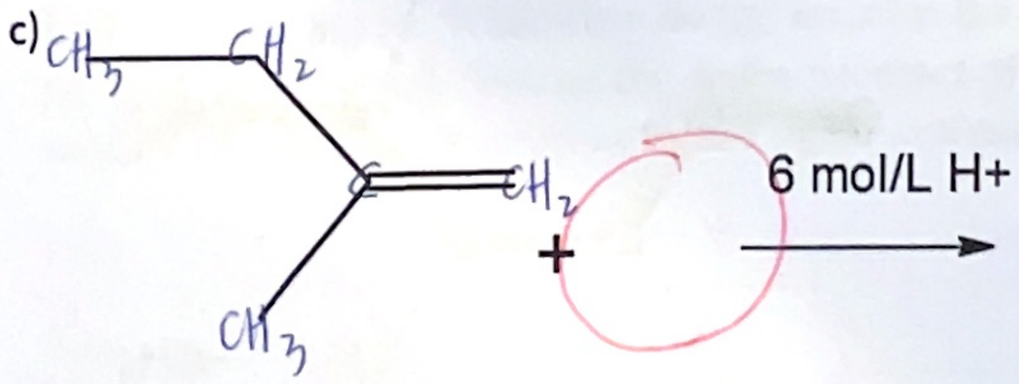
b) $CH_3CHCHCH_2CH_3$ + F_2 $\longrightarrow$

$H_3C-CH=CH-CH_2-CH_3$

(expanded molecular formula)



c)



$\xrightarrow{\text{6 mol/L H+}}$

$CH_3-CH_2-C(OH)(CH_3)-CH_3$

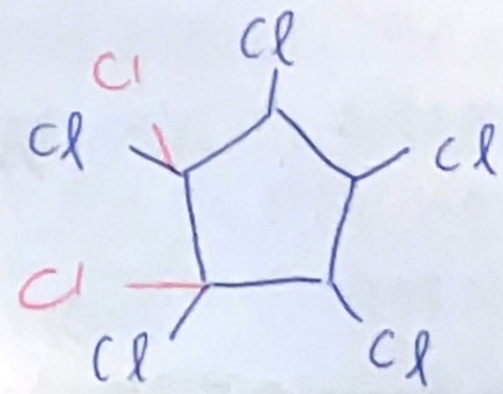
(condensed structural diagram)

8.5

d)

+ Cl_2 $\xrightarrow{h\nu}$

(excess)



+ HCl

0.5

(line diagram)

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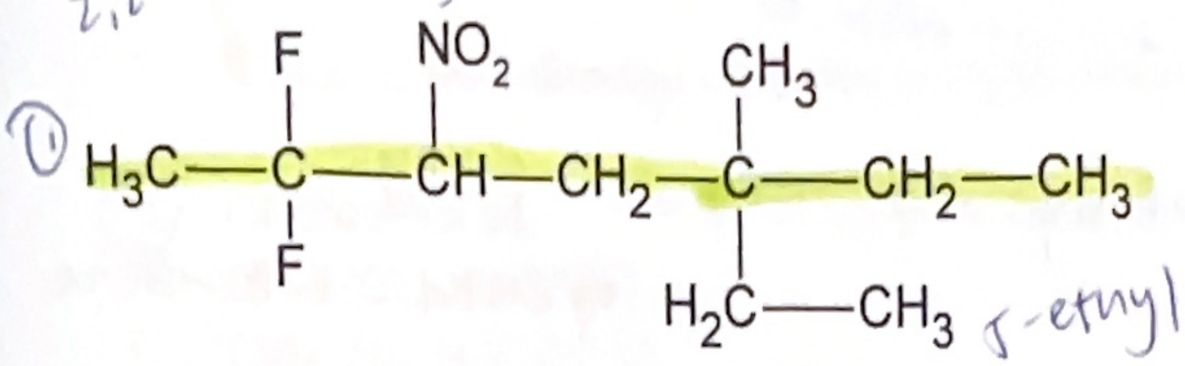
COMMUNICATION **(8 marks)**

11. **Name** the following molecules using their scientific (IUPAC) names and common name where required. **(6 marks maximum)** * *there are 7 marks available – you are allowed up to one mark of "free" error(s)*

a)

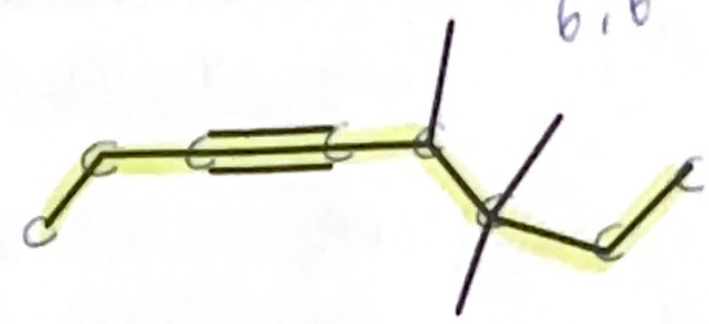
2,2-difluoro 3-nitro 5-methyl



5-ethyl-2,2-difluoro-5-methyl-3-nitroheptane

b)

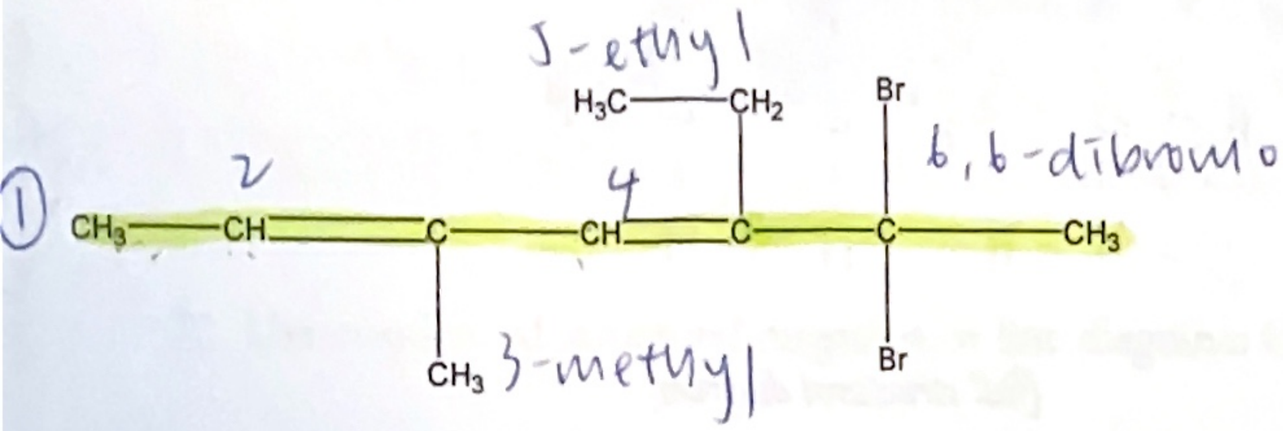
5-methyl 6,6-methyl



5,6,6-trimethyloct-3-yne

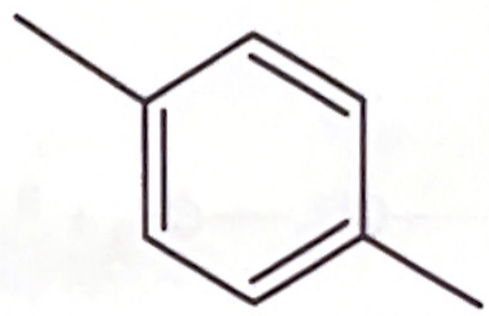
c)

5-ethyl 6,6-dibromo



6,6-dibromo-5-ethyl-3-methylhepta-2,4-diene

d) IUPAC Name: 1,4-dimethylbenzene



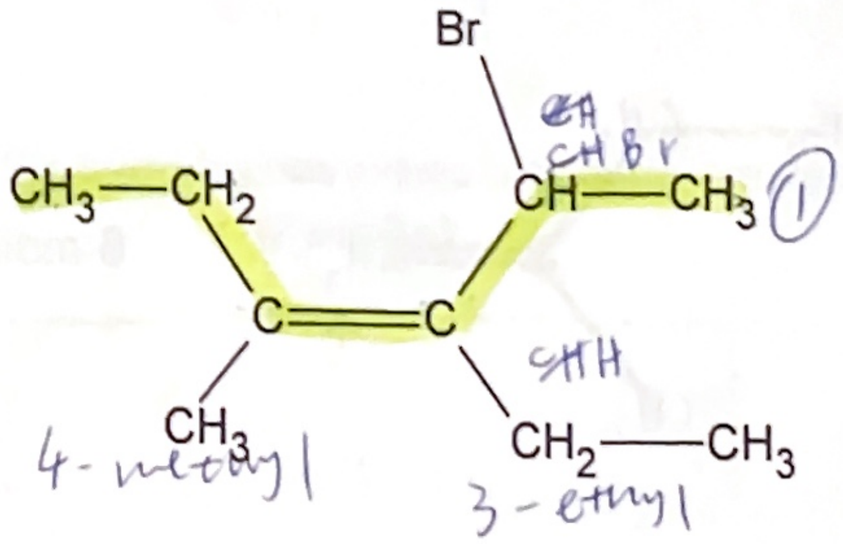
e) Common Name: p-xylene

f) $CH_2CHC(CH_3)_2CCCH_2CH_3$

3,3-dimethylhept-1-en-4-yne

g)

2-bromo



4-methyl 3-ethyl

(3Z)-2-bromo-3-ethyl-4-methylhex-3-ene

8

12. **Correct diagram type** in question #10 reactions 2 _____(2 marks)

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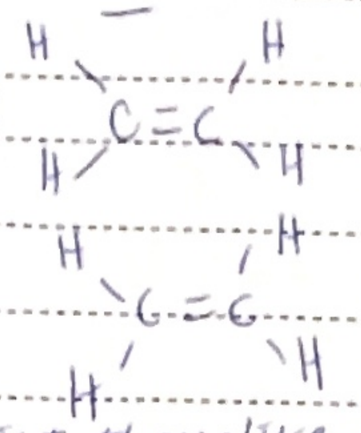
APPLICATION **(9 marks)**

13. Both olive oil and butter consist mainly of fats with hydrocarbon chains that are 18-20 carbons long. However, olive oil is a liquid at room temperature, and butter is a solid. Use your knowledge of the properties of hydrocarbons to explain **this difference**. *You may include a diagram as part of your explanation if you wish to.* **(3 marks)**

alkane:

alkyne:

alkene



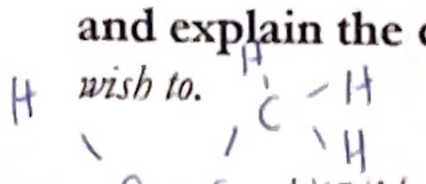
Among 3 ~~types~~ cases of hydrocarbon, the alkene has the lowest melting point, followed by alkane, and alkyne has the highest melting point ~~a~~ relatively. Due to the structure of double bond (~~the~~ bending) ~~causes~~ in the alkenes, alkenes cannot be packed closely, thus, the London Dispersion force of alkenes are weak, and does not require high energy to ~~be~~ overcome it, which can explain why olive oil is a liquid at room temperature (low melting point). While alkynes and alkanes can pack closer than alkenes as shown as the diagram, as there is no bent, which can explain why butter has higher melting point than olive oil, even though they are both hydrocarbon, as olive oil might be alkenes while

3

14. A scientist has samples of **propan-2-ol and of octan-2-ol** but they don't know which one is which. They determine that one compound is soluble in water and the other is not. **Identify which compound is soluble, and explain the difference in solubility observed.** *You may include a diagram as part of your explanation if you wish to.* **(3 marks)** (cont. on last pg)

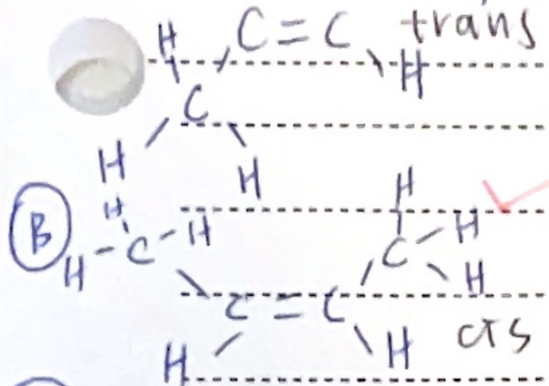
3

(A)



trans

(B)



cis

(C) $CH_3-CH=CH-CH_3$

As there are cis-trans isomers for pent-2-ene. ~~Structural diagram C,~~ Diagram C is the condensed ~~&~~ structural diagram for both diagram A ~~and~~, B and pent-2-ene, where A and B is ~~a~~ the full structural diagram for cis-pent-2-ene and trans-pent-2-ene. Since "pent-2-ene" did not specify which isomer ~~it~~ is talking about, ~~the~~ the 2 students drew the same condensed ~~or compressed~~ structural diagram for pent-2-ene but one drew full structural diagram for cis-pent-2-ene, one for trans-pent-2-en

15. A scientist wishes to make **1-bromo-2-methylpentane and they decide to use 2-methylpent-1-ene and $HBr_{(g)}$** as reactants. When they do the reaction the find out that most of the product produced <u>is not the product they wanted</u>. **Name the main product of the reaction and explain the error that the scientist made.** *You may include a diagram as part of your explanation if you wish to.* **(3 marks)**

2

$C_1H_2 = C_2(CH_3) - CH_2 - CH_2 - CH_3 + HBr \longrightarrow C_1H_3 - C_2(CH_3)(Br) - CH_2 - CH_2 - CH_3$

2-methyl pent-1-ene

Due to Markovnikov's rule, hydrogen would bond to the carbon that originally has more hydrogen. In 2-methyl pent-1-ene, C_1 ~~has more~~ bonded to more hydrogen than C_2, thus, the hydrogen ion in HBr would bonded to C_1 instead of C_2, and thus he couldn't produce what he want, as it requires the hydrogen ion to bond with C_2. ~~Instead, he produced~~

END OF QUESTIONS

8

Extra space for continuations and corrections

#13) butter ~~might~~ would be alkanes or alkynes.